

**SUCCESSFUL POLLUTION CONTROL
THROUGH CLEANER PRODUCTION:
MYTH OR REALITY?**

By

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CERTIFICATION

This Thesis is submitted in fulfilment of the requirement of the degree of PhD in the Centre of Environmental Law, Division of Law, Macquarie University. This represents the original work and contribution of the author, except as acknowledged by the general and specific references.

I hereby certify that it has not been submitted for a higher degree to any other university or institution.

I further declare that opinions and ideas expressed in this thesis are my personal opinions and ideas, and do not reflect in anyway the official and unofficial positions, opinions and policies of present and previous employers.

Ely Anthony R Ouano

DEDICATION

This work is dedicated to my wife Rosalie V Ouano and to our four daughters, Evariz, Ellirose, Eunice Abigail and Edelyn Pia.

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ABSTRACT

Although wastes minimisation was a standard component in industrial pollution textbooks as early as 1965¹, acceptance of the concept was limited to the specialised field of sanitary engineering and, later, environmental engineering. It was not until the 1985 when Royston² published the book *Pollution Control Pays* that the concept caught the attention of a broad range of decision-makers including politicians, business managers, bankers, and journalists. The popularity of Royston's book was facilitated by the simplicity of the presentation and the increasing cost of pollution control. By 1990, "pollution prevention" was incorporated into environmental laws and policies and promoted by international organizations. As more research was devoted to pollution prevention, the scope of analysis was broadened beyond the technology aspect to include management practices, interrelationships of industries, consumer preferences, and various economic incentives and disincentives. Pollution prevention is considered the solution to environmental degradation that at the same time improves product quality, market competitiveness and share.

In competing for public and private funding, each organization started to coin and promote variations of the "pollution prevention" concept. "Wastes minimisation", "clean technology", "cleaner production", "environmentally sound technology", "green technology", "zero wastes" and "industrial ecology" are some of the most common variations of the concept that entered into the public domain. Among the "pollution prevention" variants, "cleaner production" is the most common in developing countries due to the promotion by the United Nations Environment Programme, the World Bank and other regional financial

¹ Wesley Eckenfelder Jr. (1966) *Industrial Pollution Control*, McGraw Hill Book Co., New York

² Michael Royston (1979) *Pollution Prevention Pays*, Pergamon Press, London

organizations like the Asian Development Bank, African Development Bank and the Inter-American Development Bank.

The promotion of cleaner production and its variants consists of:

- (i) demonstration projects;
- (ii) information dissemination through seminars, international conferences and technology transfer centres;
- (iii) loans with low interest and long repayment periods; and
- (iv) environmental laws and policies providing incentives.

Demonstration projects have shown that cleaner production is a very attractive investment with financial rates of return ranging from 20 to more than 100 per cent. However, venture capitals are not competing for cleaner production projects. Soft loans provided by development banks and bilateral development assistance agencies have low utilisation. Decision-makers' psychology and resistance to change, the limited number of demonstration projects and technology transfer centres, and inadequate legislation providing incentives and disincentives are some of the suggested reasons for poor implementation of cleaner production.

Yet in the whole of human history, inventions are closely protected by law or brute force. Nevertheless, inventions are pirated, copied, modified and improved by people other than the original inventor. On the other hand, cleaner production and its variants are not utilised effectively in spite of all the financial incentives, promotions through conferences, seminars, ministerial declarations, technology transfer centres, and demonstration projects.

This thesis examines the domestic and international legal constraints to the use of cleaner production and its variants. The domestic legal constraints are the labour laws, industrial incentives to less developed regions, protection of existing industries from

competition, “grandfather” clauses in environmental legislation to existing industries, and national security. The international legal constraints are treaties distorting the market, thereby eroding the benefits of cleaner production – together with the wide range of non-operational concepts attached to cleaner production, thereby creating apathy and confusion in the potential users. This thesis examines the sugar industry in the Philippines as a case study to illustrate the impacts of domestic and international legal constraints on the use of cleaner production.

ABBREVIATIONS

ACCA21	Administrative Centre for China Agenda 21
ADB	Asian Development Bank
APEC	Asia Pacific Economic Cooperation
APO	Asian Productivity Organization
ASEAN	Association of South East Asian Nations
BAT	Best Available Technology
BOD	Biochemical Oxygen Demand
CDM	Clean Development Mechanism
CITES	Convention on International Trade in Endangered Species
COP	Conference of Parties
CP	Cleaner Production
DENR	Department of Environment and Natural Resources (Philippines)
EC	European Commission
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMB	Environment Management Bureau of the Philippines
ESCAP	Economic and Social Commission for Asia Pacific
ESTTC	Environmentally Sound Technology Transfer Centre
EU	European Union
FIRR	Financial Rate of Return
GATT	General Agreement on Tariff and Trade
GDP	Gross Domestic Product
GEF	Global Environment Facility
GNP	Gross National Product

GTZ	Gesellschaft für Technische Zusammenarbeit (German Aid Agency)
G7	Group Seven Industrialised Nations
IBRD	International Bank for Reconstruction and Development
IETC	International Environmental Technology Centre
IFC	International Finance Corporation
IMF	International Monetary Fund
IPO	International Productivity Organization
ISO	International Standard Organization also International Sugar Organization
JBIC	Japan Bank for International Cooperation
LIBOR	London Interbank Ordinary Rate
Ltd	Limited
MIGA	Multinational Insurance and Guarantee Association
NAFTA	North American Free Trade Agreement
NGO	Non-Governmental Organization
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
PHILSUCOM	Philippine Sugar Commission
PP	Purchasing Power Parity
PPP	Policy, Plans and Programs
SA	South Australia
SEA	Strategic Environmental Assessment
SIEEA	System of Integrated Environmental and Economic Accounts
SIFI	Sugar Industry Foundation Incorporated
UK	United Kingdom

UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
US	United States of America
USAID	United States Agency for International Development
US-AEP	United States ASEAN Environment Partnership
US-EIP	United States Environmental Improvement Partnership
USEPA	United States Environmental Protection Agency
WTO	World Trade Organization

MEASUREMENT

cum	cubic meter
hr	hour
kg	kilogram
kw	kilowatts
kw-hr	kilowatt hour
l	litre
mg	milligram

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CHAPTER I

INTRODUCTION

The waste from one human activity may be a useful by-product for other activities but most often the waste is discharged into the environment where it is degraded, neutralized or diluted, and absorbed into one of nature's chemical cycles. In the early days of human civilization, when the intensity of human activities was very low, the waste discharge was very small and spread out over large areas. Consequently, this waste discharge was readily assimilated into the natural cycles.

The natural cycles convert the waste either into other chemicals for use by other living organisms or to simpler and stable chemicals.³ The most common chemical cycles in nature are the carbon, sulphur, nitrogen, oxygen, and water cycles. The carbon cycle to which the food chain belongs is the main energy cycle in nature. In the presence of sunlight, a plant's chlorophyll converts water and carbon dioxide to carbohydrate. The carbohydrate is consumed by animals and converted back to carbon dioxide and water for the cycle to continue.⁴

The waste discharged into the environment could have both beneficial and negative impacts, depending on the nature of the wastes and the receiving environment. For example,

³ Eugene Odum (1971) *Principles of Ecology*, W.B. Saunders Company, Philadelphia, Pennsylvania, at p. 8

⁴ The carbon cycle is more complex than this simple illustration. Under warm conditions and high atmospheric carbon dioxide concentrations, plant growth is very high and a large portion of the plant tissues are deposited on the ground and swamps. The dead plant tissues accumulate in the surrounding areas forming peat. Geological forces compress the peat and convert it to coal and in some instances to crude oil. This reduces the carbon dioxide concentration in the atmosphere and removes the carbon from the natural cycles. The food chain passes the organic material containing carbon and water from one predator to another before converting it back to carbon dioxide and water.

degraded organic solid wastes or compost, when disposed of on land, improve the soil's ability to hold moisture and nutrients and provide a medium for various micro-organism and nematodes that form a symbiotic relationship with the higher species of plants. As a general rule, nature operates under very low or suboptimal concentration of essential nutrients. In response, living organisms tend to hoard in their living tissues the essential nutrients for future use. The survival of a species is highly dependent on its ability to store the essential nutrients for consumption during periods of scarcity induced by natural events such as drought, fire, very cold winters and very hot summers. However, when in excessive quantities, the stored essential nutrients could be detrimental to a living organism.⁵ For example, fat is stored to provide energy in times of famine, but excess fat or obesity triggers a wide range of diseases especially in a mature organism. The toxicity of excessive consumption or storage of essential nutrients and the prey/predator relationship prevent a particular species from monopolizing all the essential nutrients and hence act to sustain the wide range of biodiversity.

Wastes, especially those that form part of a natural cycle, may have a beneficial impact on the environment when discharged in diluted concentration and low quantities, but in large quantities or high concentration the wastes could be destructive to the environment.⁶ For example, in nature, fluoride compounds are very rare and as a result, most water supplies have very low fluoride concentrations. Fluoride is therefore added to the water supply to strengthen the teeth and prevent tooth decay. On the other hand, the human body has a

⁵ Eugene Odum (1971) *Principles of Ecology*, W.B. Saunders Company, Philadelphia, Pennsylvania. at p. 74

⁶ Kenneth Watt (1973) *Principles of Environmental Science*, McGraw Hill Book Co. New York, New York, at p. 26

tendency to store excess fluoride in the bones and teeth. Excess fluoride concentration in drinking water can cause teeth mottling and brittle bones.⁷

The quantity of wastes that could be assimilated into the environment without causing any detrimental effect is known as the “assimilative capacity”. The assimilative capacity is determined by the chemical properties of the wastes, the stability of the ecosystem, the sensitivity to those wastes of the species comprising the ecosystem, the uses of that environmental resource and the variations in the ecosystem profile with changes in season, weather and climate. The ecosystem is dynamic and even without human intervention, some species gain predominance over others. The assimilative capacity defines the boundary line between the beneficial and destructive impact of the waste discharge.⁸

The concept of assimilative capacity of the environment is very controversial in environmental science. When an essential nutrient is introduced into the environment it may not be in a chemical form appropriate to all the existing organisms. As a result, the existing ecological structure will be altered.⁹ The essential nutrients could be in a form more suitable to a particular organism which as a result experiences higher biomass growth compared to other species in the ecosystem. For example, a very small quantity of a nitrogenous compound may be discharged into a river, where it may cause insignificant oxygen depletion from algal respiration at night. Nevertheless, the nitrogenous compound will result in an initial increase in algal biomass compared to the other living organisms in the ecosystem, as algae could

⁷ Gordon Maskew Fair, John Charles Geyer. and Daniel Alexander Okun (1968) *Water and Wastewater Engineering*, John Wiley and Sons, New York,., at pp. 19-11 to 19-12. (p. 19-11 is page 11 in chapter 19)

⁸ Michael Overcash, and Dhiraj Pal (1979) *Design of Land Treatment Systems for Industrial Wastes- Theory and Practice*, Ann Arbor Science. at p. 8 and pp.14 to 20

⁹ Kenneth Watt (1973) *Principles of Environmental Science*, McGraw Hill Book Co., New York, New York. at p. 56-57

utilize nitrates. Fish and other higher organisms could not utilize the nitrates directly and their population will not increase immediately, although given some time, the population of the fish and other species in the ecosystem will increase in response to higher food availability in the food chain, based on the increased algal mass. The ecosystem is thus disrupted to a certain extent by the waste discharge.

As John Kinney¹⁰ puts it:

“Underlying the situation is the difference in philosophy¹¹ of two schools of thought:

Whether water and air resource utilisation will be directed by engineering studies of fact and economic studies of costs and benefits or whether direction will be administrative fiat and legal contract

Whether assimilative capacity of the resource (air or water) is a physical and economic capacity to be utilized or whether the requirement shall simply demand the maximum treatment available.

Actually, the second is the more often stated argument, but it really acts as a screen for the first. The decision determines whether engineering or law, data or compromise, specific objectives or constantly changing goals will be our way of life. Doubt about this is dispelled by comparison of progress in achieving control in areas strictly under state dominance with areas where federal conferences have been adjusting objectives.

Viewpoint makes the difference, but exaggeration often excites vocal support. For example, one frequently offered by proponents of clean streams is that sanitary engineers advocate using assimilative capacity in order to keep a stream as dirty as possible while those interested in clean streams propose keeping it as clean as possible. Making it either black or white is an easy way to confuse the issue.”

To the ecological purist, however, there is no such thing as an assimilative capacity of the environment. From the environmental management perspective, assimilative capacity is defined as the quantity of wastes that could be discharged to the environment without dislocating its present or intended use. To the environmental economist, the assimilative capacity of the environment is the quantity of wastes discharged to the environment such that

¹⁰ John Kinney (1971) The Industrial Pollution Problem. Herbert Lund. (Ed.) *Industrial Pollution Control Handbook*. New York, McGraw Hill Book Co., New York, New York. at pp. 1-12

¹¹ Kinney was referring to the difference between engineering and economics in defining “assimilative capacity”.

the marginal benefit and the marginal cost associated with the change are equal. As John Kinney¹² further emphasised:

“Utilizing the assimilative capacity means to treat wastes before discharge and/or to control the discharge so as to remove any material or polluting property which would cause an impairment of quality in the receiving water such as to interfere with the other uses determined in the public interest. But treatment beyond that actually benefits no one, adds greatly to the costs, and really is unwarranted. It is definitely not a case of allowing the water to be as dirty as possible. That would mean no treatment at all”

The debate on the use of the assimilative capacity was settled in the 1970s but in recent years the debate has reopened with the emergence of the precautionary principle as an emerging principle in international environmental law.

Charmain Barton summarised¹³ the deficiencies of the assimilative capacity concept as follows:

“The assimilative capacity concept, which has been applied primarily to air and water pollution, is based on the following assumptions: (1) A certain level of some contaminants may not produce any undesirable effect on the environment and its various uses (2) Each environment has a finite capacity to accommodate some wastes without unacceptable consequences and (3) Such capacity can be quantified, apportioned for a certain activity and utilized.”

In applied science, a factor of safety is commonly applied to the results of the scientific experiments. The factor of safety could vary from a low of two to a high of 10,000. A very high factor of safety is used if the pollutant has only been recently identified and the potential impact on the environment or human health is very high or unknown. For example, dioxins, a group of chlorinated hydrocarbons with similar chemical structure to Agent Orange used in Vietnam, were noted in flue gas of incinerators. As Agent Orange is known to cause deformities in unborn children and is potentially a carcinogenic substance, a very high factor

¹² John Kinney (1971) The Industrial Pollution Problem. Herbert Lund (Ed.) *Industrial Pollution Control Handbook*. McGraw Hill Book Co., New York. at p. 1-12

¹³ Charmain Barton. (1998) The Status of the Precautionary Principle in Australia: Its Emergence in Legislation and as a Common Law Doctrine. *Harvard Environmental Law Review*, 22, 509-554. at p. 512

of safety was applied to the results of the Ames test.¹⁴ As more scientific results became available the decision maker gradually reduced the factor of safety. The reduction of the factor of safety depends on a wide range of social, economic, and political factors in addition to the scientific data and will vary from one country to another. Even for a traditional poison such as arsenic, the factor of safety in environmental standard is ten.¹⁵

As science interacts with the legal profession, one of the main misconceptions in the legal profession is the direct application of the scarce scientific information into environmental standards or calculations of the assimilative capacity. Charmain Barton is very critical concerning the use of the assimilative capacity. To quote Barton:

“Scientific uncertainty, an inherent part of all scientific predictions, has received significant attention in both the theory and practice of environmental decision making. One response has been the development and application of the precautionary principle, as an alternative to the assimilative capacity approach when the level of uncertainty is high.”¹⁶

Barton further added:

“In scientific methodology, a complex system is commonly studied by isolating its components. This reductionist approach means that a small number of variables can be studied with a high degree of precision, but indirect and cumulative effects may go unnoticed. Uncertainty, resulting from inadequate data, ignorance, and indeterminacy, is an inherent part of science.”¹⁷

When Barton made this statement he must have been unaware of the difference between applied science and pure science. Pure science tries to establish the basic relationship between cause and effect so that phenomena are studied by reductionist approach as he mentioned. On the other hand, applied science calls for an integrated approach and in fact

¹⁴ Ames test is a laboratory procedure to determine the mutagenic effect of a chemical.

¹⁵ It is for this reason that environmental standards, especially those related to human health, are often criticised as being too stringent and impractical by industry and/or potential violators.

¹⁶ Charmain Barton (1998) *The Status of the Precautionary Principle in Australia: Its Emergence in Legislation and as a Common Law Doctrine*. *Harvard Environmental Law Review*, 22, 509-554. at p. 510

¹⁷ *Ibid.* at p. 510

with the complex and urgent nature of engineering activities during the World War II, a new branch of engineering called “systems engineering” has evolved.¹⁸ The environmental modelling used in climate debate is just one example of the integrative approaches of systems engineering to address complex problems. As such, Barton¹⁹ found the concept of assimilative capacity unjustified and he preferred to use the precautionary principle when he stated:

“The assimilative capacity approach assumes that science can provide policymakers with the information and means necessary to avoid encroaching upon the capacity of the environment to assimilate impacts. It also presumes that the relevant technical expertise is available when environmental harm is predicted and that there is sufficient time to act in order to avoid such harm. Proponents of the assimilative capacity approach maintain that scarce financial resources are not wasted if action is taken only when proof of harm exists, because it is difficult to justify high initial expenditure for uncertain environmental gains.

The precautionary principle has emerged in international law due to the inadequacy of environmental policies based on the assimilative capacity approach to avoid environmental impacts. The precautionary principle advises decision makers to err on the side of caution where the effects of an activity on the natural resource could not be predicted with confidence, where the activity would have adverse implications for future generations, or where there are no substitutes for the resource being used.”

Barton’s observation has one fundamental oversight- it failed to recognise that the factor of safety is the rational application of the precautionary principle in a systematic and methodological way. Applied science, especially the engineering profession, has been using the factor of safety for hundreds of years. As more information become available and the risk of uncertainty declines the factor of safety is correspondingly adjusted.²⁰ Society, including

¹⁸ Robert Machol, Wilson Tanner, and Samuel Alexander (1965) *Systems Engineering Handbook*, McGraw Hill, New York. The handbook provides a comprehensive review of the development, and scope of systems engineering.

¹⁹ Charmain Barton (1998) The Status of the Precautionary Principle in Australia: Its Emergence in Legislation and as a Common Law Doctrine. *Harvard Environmental Law Review*, 22, 509-554. at p. 512

²⁰ World Health Organization (2006) First Addendum to the 3rd Edition Guidelines for Drinking Water Quality, vol. 1 Recommendations. World Health Organization, Geneva, Switzerland. at page 35. This is a good example of the action taken under uncertainty and the corresponding adjustment to the factor of safety as more scientific information is available. In this particular case, the guideline for Barium was adjusted. Barium is a common chemical found in water. Barium sulphate a white and opaque substance is taken internally during medical X-rays to determine if the patient has stomach ulcer. To quote the WHO publication “The guidelines value for barium is based on an epidemiological study in which no adverse effects were observed, although the study population was relatively small and the power of the study was limited. As a consequence, an uncertainty factor of 10 was applied to the level of barium in the drinking water of the study population. However, the level at which effects would be seen may be significantly greater than this concentration, so the guideline value for barium may be highly conservative and the margin of safety is likely to be high”

the courts, could adjust their decisions to account in a rational manner for the changes in risks, potential damage and, in the case of scarce resources, the availability of alternative resources or technology. Instead, in the application of the precautionary principle, the decision maker is very often influenced by public emotions, fear, apprehension, and doubts. The significance of the factor of safety in decision making seems to be overlooked in environmental law as lawyers get carried away with the concept of the precautionary principle as a pillar of sustainable development. This issue will be discussed further in Chapter V, in relation to the concept of sustainable development. In reviewing the legal literature, there seems to be little appreciation in the legal profession of the differences between pure science and applied science.²¹

Margaret Maxey's²² cited scientific results are distorted and misinterpreted in the mass media and attempts to correct the distortions and misinterpretations even by the original source have been very difficult, especially if the public is distrustful of the sector when implicated by bad publicity. Maxey cited the case of John Higginson's cancer theory of which she wrote:

“Thirty years ago John Higginson formulated a complex theory which through misrepresentation and distortion has led ordinary citizens to believe that some cancer-causing agent lurks in everything we eat, drink, or breathe. He has attempted to correct the distortions of his theory by pointing out that, when he ascribed the incidence of chance in industrialised societies to “environmental causes”, he meant the total environment—cultural components of life-style such as diet and behaviour, agricultural practices, social pressures—and not merely or exclusively physical chemicals or other toxic elements”

²¹ Dinah Shelton (1983) The Impact of Scientific Uncertainty on Environmental Law and Policy in the United States, Chapter 12 of the book *The Precautionary Principle and International Law*, Freestone, D. and Hey, E. (eds), Kluwer Law International, The Hague

²² Margaret Maxey (1983) Managing Toxic Materials: A bioethical Perspective. Neal Armstrong and Akira Kudo (Ed.) *Toxic Materials Methods for Control*. The University of Texas at Austin, Centre for Research in Water Resources. at p. 154

On the other hand, public perception or misconception or preference on what is good and bad may go completely against scientific findings. For example, in densely populated cities, a number of oxygen bars cater to the public to provide relief from the polluted air in the city. As Maxey²³ quoted from the work of Totter: “Totter suggests that the culprit is oxygen. ‘It is a recognized mutagen, experiments have shown that it causes tumours in fruit flies, in the Ames assay test for screening carcinogens, it shows positive.’” Another common public misconception is the superiority of pure substances such as drinking water. Kurita Water Industries of Japan manufactured and sold reverse osmosis systems to produce ultra-pure water from seawater for seafaring vessels. The system was very popular as it increases the ship’s cargo capacity and reduces contamination of stored water. However, after a year various forms of heart and kidney diseases were noted among the crew. At first, they ignored the problem as most of the elements in drinking water are also found in solid food and often in excess quantity. When the problem persisted, they carried out animal tests which showed that continuous consumption of pure water is dangerous to health.²⁴ Alfred Hoadley²⁵ reported similar results. To quote Hoadley:

“An analysis has been undertaken at the University of Florida to determine the benefits that might accrue from improvements in drinking water quality i.e. decreases in cardiovascular heart diseases attributable to increases in total dissolved solids. In their crude analysis of Standard Metropolitan Statistical Areas, an increase in total solids by the addition of 20 mg/l of lime would reduce the mortality rate from cardiovascular heart diseases by 0.5 %, and assuming similar reduction in morbidity the benefit-cost ratios of from 3.04 in 1962 to 5.61 in 1971 were derived.”

If public policy is made primarily to satisfy what the public wants, and in the absence of scientific information or in the presence of distorted and misinterpreted scientific information, the precautionary principle is a handy policy making tool. The review and

²³ Ibid. at p. 154

²⁴ Kurita Water Industries Limited (1985) *Kurita Handbook of Water Treatment*, Kurita Water Industries Ltd., Tokyo at pp. 347-351

²⁵ Alfred Hoadley (1978) *Water Treatment Plant Design- For the Practising Engineer*, Ann Arbor Science, Ann Arbor. at p. 29

updating of public policy based on the precautionary principle will go up and down with public perceptions of the problem which most often will be intensified by gossip, public meetings, and the mass media. Once the public policy has been established, it is difficult for scientists to obtain reasonable research funding for research that goes against the accepted public policy. When using the factor of safety there is a rational basis for adjusting the risks as more information becomes available. Decision makers have an indicator for allocation of research funds to areas with high risks and high level of uncertainty.

Human physiology, basic needs and instincts are similar to those of other zoological members of the ecosystem. Humans need food to build their biomass and energy to move around. Their basic instinct is focused on self preservation and perpetuation of the species. Human physiology and instincts are inferior compared to those of some zoological species in the ecosystem when it comes to survival in the wilderness by brute force. Humans have, nevertheless, evolved the capacity to transmit and use the knowledge and skills developed from one generation to the succeeding generation, such that the latter do not have to re-invent the knowledge and skills needed for survival and perpetuation of the species. As the knowledge and skills inventory grew and its application became more complex, humans learned to organize their activities, allowing members to contribute voluntarily or forcibly to the collective needs of the group.

Initially, human efforts were directed primarily at maintaining food and fertility in adverse environmental conditions and natural phenomena. However, as human knowledge and skills became more sophisticated, their efforts were directed at controlling natural phenomena and changing the environment to suit their needs.²⁶ Human needs also became more complex. These have gone beyond the immediate need for self-preservation and the

²⁶ Edmonds Stahl, and John Letty (1968), *Environmental Administration*, John Wiley, New York. at p. 3

continuity of the species. They have expanded to include aesthetics, security, leisure, longevity and freedom from pain. Mankind started to express desires as “quality of life” rather than basic “human needs”. Taming nature has become a major human pursuit. Today, human activities are centred on urbanization, industrialization, and commercialism on the expectation of developing and delivering the products efficiently to meet the expanded needs for a better and higher quality of life.

With urbanization, human activity is concentrated in a smaller area, and subsequently, the wastes generated are not able to be assimilated into the natural cycles. In fact, the waste discharge disrupts and destroys the natural cycles, causing environmental pollution or damage. Industries discharge synthetic chemicals that are not found in nature and are difficult to integrate into the natural cycles.²⁷ Synthetic chemicals have often unpredictable reactions with the biochemical processes in living organisms, resulting in abnormal cellular growth, reduction and defects in the transmittal of genetic material from one generation to the next and the early deterioration of the living tissues. Commercialisation and fierce competition to develop and supply the services and materials required by ever-changing and more complex human needs have resulted in a higher degree of urbanization and industrialization.

During the initial years of the industrial era, the wastes generated and the environmental degradation were considered with pride by society as a symbol of power, dynamism, and progress. Whitman and Sandburg were typical of the poets in the early industrial era exhorting the growth of cities and their industries. Myths and legends such as that of Paul Bunyan were woven around the wanton destruction of the North American forest: the hunting skills of Buffalo Bill were praised, almost resulting in the extinction of the North

²⁷ Gordon Maskew Fair, John Charles Geyer, and Daniel Alexander Okun (1968) *Water and Wastewater Engineering*, John Wiley and Sons, New York. at page 20-17. The page numbering for the book is quite unusual. Page 20-17 refers to page 17 of chapter 20.

American bison. In Sydney, at the end of the 19th century, people were paying a premium to live close to the Australian Gas Limited coal gasification plant in Parramatta, and those who could not afford the premium spent their leisure time in nearby parks, especially if they had colds and coughs. The humidity and smell of organic compounds from the gasification plant were considered healthy.

By the middle of the 1950s, social thinkers started to realize that the quantity and chemical properties of the waste discharge from human activities were negating the improvement in the quality of life. Carson's²⁸ book published in 1962, *Silent Spring*, reviewed the potential negative impacts of waste discharge from human activities on the quality of life and long term sustainability of the human species and other living organisms. While the book was dependent on research reports published in scientific journals, it was written in simple language for wide readership. It crystallized public opinion and brought the environmental degradation debate into the public domain. Incidentally, Carson died in 1964 of cancer, a painful degenerative disease often stimulated or caused by environmental pollutants.

The initial social response to the ever-increasing waste discharge to the environment could be classified into three groups, namely: (i) alternative lifestyle, (ii) waste treatment or "end of pipe", and (iii) self-denial or "do nothing".²⁹ The 1960s and early 1970s were a period of youth protest against the US-led involvement in the Vietnam War. The protest movement considered the industry-military alliance in the US and other western developed

²⁸ Rachel Carson (1962) *Silent Spring*, Houghton Mifflin, Boston.

²⁹ Eugene Odum (1971) *Principles of Ecology*, W.B. Saunders Company, Philadelphia, Pennsylvania. at p. 438 had different but similar approaches. To quote Odum "Man has three basic options in dealing with wastes materials (i) dump them untreated into the nearest convenient environment such as the air, a river, lake, soil, well or ocean (ii) contain and treat them within a delimited environmental wastes management park where engineered semi-natural ecosystem such as oxidation ponds, spray-irrigated forest and landfills do most of the work of decomposition and recycle and (iii) treat them in artificial chemo-mechanical regeneration systems". Odum's first option is similar to the "do nothing" approach described above; (ii) and (iii) are basically treating the wastes.

countries as the main proponent of the war as well as of a host of other moral problems including environmental degradation. To undermine the industrial-military alliance, the protest movement tried to undermine industry by boycotting its products. In lieu of the industrial products, the protest movement wanted a simpler lifestyle integrated with nature rather than taming it. It was the lifestyle of the past two to three hundred years. With the end of the Vietnam War, however, the protest movement lost its prime reason for existence. While the alternative lifestyle to environmental degradation continued to attract new adherents, a large number of practitioners went back to the mainstream lifestyle with some former protesters even leading the growth of major industrial complexes by the end of the 20th century.

Since environmental degradation is caused by waste discharge, the obvious solution is to treat the wastes by transforming them into simpler substances that could be easily assimilated into the environment. The wastes treatment processes are often a synthesis of the natural biological stabilization of the wastes taking place in the environment. Micro-organisms such as bacteria and fungi excrete a wide range of enzymes to break down the organic compounds and even some synthetic compounds into simpler substances. Activated sludge, trickling filters, aerated and facultative lagoons are examples of biological waste treatment processes. To hasten the biological stabilization of the wastes and to prevent odour formation, oxygen is introduced into the wastewater and a high concentration of micro-organisms is built up in the wastewater treatment plant. For inorganic wastes and complex synthetic chemical wastes, more complex waste treatment processes are used. These include incineration, ion exchange, coagulation and flocculation.³⁰ While there is a noticeable improvement in the environmental quality in the immediate vicinity of the waste discharge,

³⁰ Walter Weber Jr. (1972), *Physiochemical Processes for Water Pollution Control*, Wiley Interscience, New York, at p.1-59. P.1-59 refers to page 59 of chapter 1.

there is also an increase in pollutant discharge elsewhere from power generation and the production of waste-treatment chemicals.³¹

“Self-denial” or the “do nothing” option was more common in the early 1960s although it is still used by some governments today in the climate change debate. Some common self-denial strategies are:

- (i) the waste discharge is improving the productivity of the environment rather than degrading it since the discharge is very small and the waste is an essential nutrient that is deficient in the environment;
- (ii) there is a need for more scientific evidence to prove that the waste is destructive to the environment;
- (iii) it was somebody else’s waste upstream or upwind causing the problem; and
- (iv) the cost of waste treatment is prohibitive and could cause the closure of factories and mass unemployment.

Waste from any anthropogenic activity comes from the raw material and energy inputs to the activity. For a given quantity of raw material and energy, the quantity of useful products generated by the activity is inversely proportional to the wastes generated. Raw material and energy inputs compose a large portion of the economic cost of the activity. Economic cost, theoretically, should be equal to the utility value of the resource or the value of the resource in an ideal market. However, in the real world, the market is so distorted by various political, social, and financial practices, policies and legislation that the market valuation or financial cost of a resource became much lower than the economic cost. Similarly, the economic benefits may differ from the financial benefits because of market distortions. Reducing the waste generation reduces production cost through corresponding reduction in cost of waste

³¹ Ely Anthony Ouano (1990), Environmental Pollution Due to Environmental Protection, *Asian Environment*, 12, 20-29. at p. 24

treatment, raw material and energy inputs. Profitability will increase, and at the same time, environmental degradation is minimized or prevented.

The 3M Corporation was the first major industrial conglomerate to implement this strategy of wastewater reduction and document the financial and environmental benefits.³² It was a “win-win” strategy for the waste generator and the environment. The corporation named the strategy “Pollution Prevention” to emphasize the focus in reducing environmental pollution rather than in improving productivity and competitiveness.³³

Commonly used waste reduction strategies include recycling and reuse, process modification to improve the raw material and energy conversion efficiency, the use of less polluting raw material substitutes and changes in the final product specification. “Recycling” refers to the recovery of the wastes after some form of reprocessing or treatment. “Reuse” is the recovery of the wastes for the same or similar purpose after minor reprocessing or treatment. For example, glass is recycled as cutlet in a glass factory, but glass is reused for decoration or refilling. Hot water is recycled after cooling in a power plant, and grey water is reused for plant watering. In non-technical literature, the two terms are used interchangeably.

Changes in product specification are dependent on consumers’ attitudes and this is the most difficult aspect of waste reduction strategy. For example, until recently greyish paper was considered inferior to glossy white paper, and this attitude was a major constraint in reducing the quantity and type of bleaching chemicals in paper production as well as the use

³² Michael Royston (1979) *Pollution Prevention Pays*, Pergamon Press, Oxford

³³ Wesley Eckenfelder Jr.(1966) *Industrial Pollution Control*, McGraw Hill Book Co. New York, at pp. 21-26. Professor Eckenfelder used the term “water reuse and in plant wastes control”.

of recycled paper. However, with increased environmental awareness, consumer preference especially in Europe has shifted to greyish paper, shunning white glossy paper.

Waste reduction strategies have been used mainly in times of scarcity and emergency such as during a war, but have been largely ignored until the 1980s. Among the first to embrace a waste reduction strategy are international organizations such as the United Nations Environment Programme (UNEP), the United Nations Industrial Development Organization (UNIDO), and International Productivity Organizations (IPO), and the bilateral and multilateral financial institutions.³⁴

The waste reduction strategy was labelled “clean technology” to improve its market appeal and acceptance. By the 1990s, the waste reduction strategy was expanded to include the marketing, product life cycle analysis, and corporate environmental policies and objectives in addition to technology. The expanded nature of this strategy is now commonly called “Cleaner Production”. Hereafter in this thesis, the term “cleaner production” is used. In Chapter III, the variations in the cleaner production strategy are briefly reviewed and described.

Emerging from a status of apparent neglect, waste reduction policies and programs were developed and implemented in the 1980s, often without consideration for the technical constraints. The United States Environmental Protection Agency (USEPA) had a “zero waste

³⁴ Ralph Luken, Richard Stevenson, and Rene van Berkel (2004), Introduction To The Special Issue On Building Institutional Capacity For Cleaner Production In Developing and Transition Economies, *Journal of Cleaner Production*, 12, 189-194. at p. 189

discharge” program in 1985,³⁵ that for all purposes and intent requires conversion of the liquid wastes to solid or gaseous wastes.

While “zero waste discharge” is an ideal catch phrase for generating public interest, the longer-term impact will be public apathy, as “zero waste discharge” is technically impossible. All natural and man-made processes operate in accordance with the laws of science. While matter and energy cannot be created or destroyed (first law of thermodynamics – conservation of matter and energy), the quality of matter and energy is continuously degraded (second law of thermodynamics – entropy). “Zero waste discharge” is based on the assumption of the application of the law of conservation of matter and energy without consideration for the law of entropy. Surprisingly, the law of entropy caps the efficiency of all processes with the Carnot cycle³⁶ defining the ideal engine or maximum efficiency. A number of processes commonly in use, such as the gasoline engine, have very low efficiency in the range of less than 20 per cent.³⁷ However, the invention of a perpetual motion machine is one of mankind’s oldest ambitions. The World Bank environmental program, through its publication *World Without End*,³⁸ offers a good example of the unrealistic expectations of the extent to which wastes could be reduced. The book based its analysis on the first law of thermodynamics that matter and energy could neither be created nor destroyed, but neglected

³⁵ United States Environmental Protection Agency (2006) History- Water, at <http://www.epa.gov/history/topics/fwpc/05.htm>, accessed on August 1, 2006

³⁶ Entropy is mathematically defined as the ratio of the reversible energy to temperature. The lower the entropy, the higher is the quality of the energy. For example, if a hot and a cold substance are placed side by side, energy will spontaneously move from the hot substance to the cold substance. However, it is not possible for energy from the cold substance to move to the hot substance, making the hot substance hotter. Energy at the ambient temperature is at the lowest quality and for this reason the ambient temperature is also known as the sink temperature. The Carnot cycle is an ideal or theoretical engine that abstracts the maximum heat energy from a source as it generates the work at constant entropy or isotropic phase. Work of the Carnot cycle is defined as the product of the entropy and the temperature difference between the sink and the energy source. The Carnot cycle was developed by Nicolas Leonard Said Carnot in the late 19th century.

³⁷ Virgil Moring Faires (1969) *Thermodynamics*, Collier Macmillan, New York. at p. 162

³⁸ David Pearce (1986) *World Without End: Economics, Environment and Sustainable Development*, Oxford University Press and World Bank.

to analyse the impact of the second law that during transformation the energy quality is continuously degraded.

Cleaner Production

While Michael Royston ³⁹ documented the successful implementation of the waste reduction strategy at 3M, there were some doubts on the transfer of technology to other companies with fewer financial and technical capabilities than 3M. The insufficient financial and technical capabilities, in addition to low public perception and awareness of environmental issues, were more critical in developing countries.

The paradigm for the successful implementation of a cleaner production program was conceptualized to involve the following steps:

- (i) research and development;
- (ii) demonstration projects to initiate practical experience, data and information;
- (iii) database and information management to systematically collect, collate and disseminate the data and information gathered in the demonstration projects, and full-scale implementation;
- (iv) technology verification to eliminate spurious information and data;
- (v) technology matching to determine the most appropriate cleaner production technique that could be applied; and
- (vi) financing.

The information generated from research and demonstration projects on cleaner production is so huge that a potential user will be overwhelmed. A cleaner production centre or clearing

³⁹ Michael Royston (1979) *Pollution Prevention Pays* , Pergamon Press, Oxford.

house for cleaner production not only on the national level but also at the regional and international levels has been established to provide assistance to potential users at various stages of implementation.

For example, as of 2004, in the Peoples' Republic of China, three regional centers for cleaner production were established in Taijin, Chengdu and Xian, with eight other regional centers programmed for implementation. The national center in Beijing under the Administrative Center for China Agenda 21 supports the regional centers on problems that are beyond the technical and financial capacity of the regional centers. This center, which was established in 1997, is officially named the Environmental Sound Technology Transfer Center (ESTTC).

ESTTC has linked up with the Cleaner Production Center in Delhi, India, established by the Economic and Social Commission for Asia and the Pacific (ESCAP) to serve the Asia-Pacific region, the United Nations Environment Program Regional Center for Cleaner Production in Kyoto, Japan, and the UNIDO Cleaner Production Center in Vienna, Austria. ESTTC and the three regional centers in the People's Republic of China were established under a technical assistance grant from the Asian Development Bank. I was the project administrator who designed the technical assistance in 1997 and supervised its implementation until 2002.

Bilateral and international organizations sponsored demonstration projects in developing countries to provide examples wherein management and personnel of major polluting industries could participate in the evaluation, design, and implementation of cleaner production projects. Aside from providing technical experience, the demonstration projects provided assistance in financial evaluation and documentation for financial assistance and

loan application. Most often the demonstration project involved the local communities and civic and social organizations, as well as the local government institutions, providing the participating companies an excellent platform for public relations and production promotion.

International organizations such as the UNIDO, United Nations Environment Programme (UNEP), Asian Productivity Organization (APO), Asian Development Bank (ADB), and United States Agency for International Development (USAID) have sponsored the development of regional and national databases on cleaner production. These enable companies to access information on technology, financing, results of demonstration projects, patent applications of new technology, technology assessment and contacts.⁴⁰ The databases are often supplemented with newsletters, pamphlets, and internet and email subscription. International, regional and local seminars, conferences and meetings are held to disseminate the results of the demonstration projects and the successful implementation of cleaner production technologies. The demonstration projects, publications, seminars, websites, and other initiatives to promote cleaner production are too many for a comprehensive literature survey and listing in this thesis.

In general, the demonstration projects and the successful implementation of Cleaner Production projects showed that cleaner production could reduce the waste discharge from 50 to 90 per cent, almost equivalent to the standard waste treatment processes. The cost of designing, implementing and operating cleaner production procedures is normally recovered within one year, through the generation of additional income from the sales of better quality products and the reduction in the cost of raw materials and waste treatment. Rarely does it take more than three years to recover the cost of cleaner production. In financial terms,

⁴⁰ Ralph Luken, Richard Stevenson, and Rene Van Berkel (2004), Introduction in the Special Issue: On Building Institutional Capacity For Cleaner Production In Developing And Transition Economies, *Journal of Cleaner Production*, 12, 189-194. at p. 189

implementing cleaner production will usually result in a financial internal rate of returns ranging from 100 per cent per annum down to a low of 20 per cent per annum.⁴¹ The financial rate of return (FIRR) is the discounting rate applicable to balance the monetary or financial cost and benefit of a project to the present time. Roughly, it is equivalent to the interest earned if the money is invested. For example, an FIRR of 100 per cent means that the investment in a project will be recovered in one year, or the project earns in one year a sum equivalent to the investment. The investor practically doubles their money as they effectively holds the investment, plus an income equal to the investment. The economic internal rate of return (EIRR) is the discounting rate applicable to balance the economic cost and benefit of the project. Generally, EIRR is higher than FIRR, especially on environment and social projects as a large number of benefits could not be priced and included in the FIRR analysis.⁴² The economic internal rate of return for a cleaner production project is even higher, considering the wide range of non-quantifiable benefits such as feeling good in a clean environment, conservation of biodiversity, improved recreational use, that are realized from the removal of the wastes from the environment during the manufacturing process, as well as the easier disposal of the manufactured products once they have passed their useful life.

The financial rate of return of using cleaner production is normally higher in heavy industries using obsolete technologies, where wastage of the raw materials is very high. For example, studies carried out by the ADB on the power sector in the Philippines in 1996 showed that a number of power plants were operating with thermal efficiencies of 15 to 20 per cent compared to an efficiency of 38 to 40 per cent for a well operated and maintained

⁴¹ Kenneth Mulholland (2006) *Identification of Cleaner Production Improvement Opportunities*, Wiley, New York. This book provides a good review of the waste reduction and high financial rate of return for cleaner production projects.

⁴² Jones, P. M. S. (1973) The Use of Cost Benefit Analysis as an Aid to Allocating Government Resources for Research and Development. in Wolfe, J. N. (Ed.) *Cost Benefit and Cost Effectiveness -Studies and Analysis*, Oxford, Alden and Mowbray Ltd. at p. 165

power plant. This means that the inefficient power plants with 15 per cent efficiency were using 2.5 times more fuel than the power plant with 38 per cent efficiency. Worse, the efficiency was the result of poor combustion of the fuel, resulting in a higher discharge of polluting substances to the environment.⁴³

Cleaner production applied in industries can be as simple as metering and control of water wastage or can involve the redesign and construction of new industrial complexes. It has been used in cottage industries such as leather tanning through the reuse and recovery of chromium compounds. In the electroplating industry, cleaner production through streamlining of the plating baths reduces the toxic and hazardous chemicals spillage as well as losses when the substances being plated are moved around. It has also been used in large complex industries such as petroleum refineries, steel mills and power generation. As mentioned earlier, cleaner production is a “win-win” solution to environmental problems caused by industry. It lowers the cost of production by reducing wastage and the need for waste treatment, and in a number of instances by increasing the product value.⁴⁴

Cleaner production normally includes an analysis of the product life cycle. The life cycle analysis looks at the operation and maintenance of the product, its reuse, recycling and ultimate disposal once it has exceeded its utility. Although many products may have a life cycle analysis carried out, there are large numbers of commercial constraints preventing the manufacturer from adopting the most environmentally-friendly option. This is discussed in detail in Chapters IV and V.

⁴³ Sinclair, Knight, Merz (1997) *Review of Environmental Standards and Performance in Selected Industrial Sectors in the Philippines*. Asian Development Bank, Manila, Philippines. at p. 2-9

⁴⁴ Kenneth, Mulholland (2006) *Identification of Cleaner Production Improvement Opportunities*, Wiley, New York. Mulholland's book provides a good review of the various industrial sectors covered by cleaner production.

The life cycle analysis of the product includes an analysis of the disposal and potential recycling and reuse of essential parts. The increase in product value is not only realized at the initial point of sale of the new product, but extends to the operation and maintenance phase, and ultimately to the scrapping or decommissioning phase. For example, the HP computer has a “replace and revitalize” service. Malfunctioning parts are replaced with new parts, but the defective parts are then sent back to the factory for revitalization. Revitalization is the replacement of all the major parts, including the defective part, and subjecting it to thorough quality control. The normal alternative is for computer owners to retain the defective parts being replaced and to dispose of them, as often they have no use for them. The cost of the “replace and revitalize” service is only 25 per cent of the normal procedure wherein the owner retain ownership of the defective parts. The options are explained to computer owners for them to decide.⁴⁵

Retaining the defective part is still common practice in car repair shops to assure the car owner that it has really been replaced. Car parts, like computer parts, however, often contain toxic and hazardous substances that should not be normally discarded with the ordinary solid wastes or household garbage. Toxic and hazardous substances require special disposal methods such as a secured landfill. Computers may contain lead, chromium, selenium and other toxic heavy metals used in the circuitry. Likewise used car parts such as brake linings may contain asbestos and oil contaminated with heavy metals found in the fuel.

The Cleaner Production Enigma

⁴⁵ This episode is based on my personal experience in replacing my computer’s graphic card.

Provision of financial support for industry to adopt cleaner production is considered the last major component in designing cleaner production programs after completion of the demonstration projects, the operation of the database and technology transfer centres, and a public awareness campaign. Financial support from multilateral financial institutions varies from soft loans with interest rates of one per cent per annum, payable over a period of 25 years for very poor countries, to six to seven per cent per annum, payable over 25 years for developing countries with per capita incomes above US\$1,000 per annum. Multilateral financial institutions float bonds in the major financial markets such as New York, London, Tokyo, Frankfurt and Singapore. The multilateral financial institutions borrowings are guaranteed by the governments owning the institutions. The G7 countries own a sizeable portion of the existing multilateral financial institutions. With the guarantees of the G7 countries, the multilateral financial institutions bonds are given the highest ratings such as AAA by Moody, allowing them to borrow with the minimum interest rates. For example, if the London Interbank ordinary rate is 1 per cent, the multilateral financial institutions with their AAA rating could borrow at 1.5 per cent, whereas a developing country with a BB rating will have to pay an interest rate of 8 per cent. Loans given to least developed countries at very low rates are often a mix of donor assistance and profit. The Asian Development Bank and the World Bank are the major multilateral financial institutions providing financing for cleaner production in Asia.

Bilateral financial organizations often offer more advantageous financial arrangements, depending on various treaties and agreements the financiers have with the borrowing country. A bilateral development assistance organization normally operates from the donor government budgetary allocation. A bilateral agreement between the donor and the receiver country is affected by a wide range of economic, political and social factors. For example, a developing country with a large trade deficit may be able to negotiate loans with a

lower interest rate as part of a bilateral trade agreement compared to another developing country with a much lower per capita income. The Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) of Germany, the Japan Bank for International Cooperation (JBIC), the Commonwealth Development Corporation of the United Kingdom, and the US Agency for International Development (USAID) are the major bilateral financial institutions involved in financing cleaner production in Asia.⁴⁶ The financing from the multilateral and bilateral financial institutions is channelled to local banks, commonly called conduit banks, for re-lending to industries with specific criteria and guidelines to prevent the use of the funds for purposes other than cleaner production. In a number of instances, the lending criteria and guidelines may include social constraints or focus on a particular sector such as labour-intensive industries where the adoption of cleaner production will have the most impact in improving the workers' health. In the initial years of financing cleaner production, government-owned banks were given priority in selecting the conduit banks. In recent years, however, privately owned and other types of financing organizations such as cooperatives and non-governmental organizations have been considered eligible on the behest of the lending institutions and often over the objections of the borrowing countries.⁴⁷

The bilateral and multilateral financial institutions are interested in expanding the involvement of private financial institutions as the funds provided for cleaner production often lie idle for long periods, and after several extensions a large portion of the funds is cancelled.⁴⁸ A number of reasons have been cited for the poor performance of funds provided

⁴⁶ Ralph Luken, Richard Stevenson, Rene Van Berkel (2004) Introduction To The Special Issue On Building Institutional Capacity For Cleaner Production In Developing And Transition Economies. *Journal of Cleaner Production*, 12, 189-194. at p. 189

⁴⁷ Official development assistance (ODA) is often included in the government's budget estimates and the government normally insists on using government owned financial institutions as depositories of the funds to maximise its control on the multiplier effects of the assistance.

⁴⁸ Clean Air Initiatives (2006) *Country Synthesis Reports on Urban Air Quality Management in the Philippines. Clean Air Initiatives*, Ateneo De Manila. at paragraph 78. On December 29, 2003, the Air Pollution Control

for cleaner production, ranging from the apparent lack of incentives in government-owned banks to aggressively market the funds to potential users. While government-owned banks have their own charter and operate in a quasi-private sector environment, they are still subject to some public rules especially in accounting, bonuses and other incentives programs to employees. However, the experience with the private sector banks and institutions as conduits for the re-lending or retailing of the funds to the potential users has been marginally better than the government-owned banks.

When I was working for the Asian Development Bank, I was involved in the processing of loans for cleaner production to the People's Republic of China, Bangladesh, India and the Philippines. In the internal discussions during the loan processing, I questioned the need for bilateral and multilateral financial institutions to provide funds for cleaner production. If the financial rate of returns for cleaner production projects are in the range of 20 per cent to more than 100 per cent per annum and the interest rates for one-year term deposits even in the local market are in the range of 5 to 7 per cent, investors should be running around the country looking for cleaner production projects in which to invest.

The interest rates in the international market are often much lower than the interest rates in developing countries. For example, in 2004, the interest rates in the Philippines for the local currency were fluctuating between 5 and 7 per cent per annum, while London Inter-Bank Ordinary Rate (LIBOR) was fluctuating from 1.5 to 2.7 per cent for the US dollar. Even if the cleaner production project would require foreign exchange which may not be readily available using the local currency, certainly international venture capitals will be interested to

Facility component of the MetroManila Air Quality Improvement loan of the Asian Development Bank was cancelled because of low availment. During loan processing our team approached the Development Bank of the Philippines to serve as conduit bank for the loan and was politely turned down as it has a number of cleaner production loans from various bilateral agencies with low availment. The Land Bank of the Philippines is more oriented towards financing the agricultural sector and the land reform program.

invest in cleaner production projects – especially in export industries where remittance of the investment and profit in currency of choice are assured. In most developing countries today, investment uncertainty due to foreign exchange control has been removed on the initiatives of the International Monetary Fund and the multilateral banks. However, uncertainties from devaluation and currency exchange fluctuations do still exist.

Bilateral and multilateral financial organizations justify their continued involvement in providing funds for cleaner production, citing the need for a catalyst to start the investment boom in cleaner production. This is based on the premise that the private sector is risk-averse even to potentially very high rates of return if the investment is in a new and uncharted sector such as cleaner production and that the bilateral and multilateral financial institutions involvement will provide security and tangible example to hesitant investors. In my opinion, this is contrary to the realities of the real world. Private investors do take considerable risks even in ventures which are more uncertain than cleaner production such as the various “bubble and burst” investments in the stock market or pyramid investment schemes. As the latest stock market “bubble and burst” has shown, investors were fighting to invest in technology stocks whose business plans were vaguely defined and with minimal assets to show for the money raised. On the other hand, cleaner production projects are often backed by demonstration projects and the investment takes place in an existing and operating industry. Technology verification, information exchange and public awareness are funded and implemented by respectable international organizations without any potential conflict of interest in promoting cleaner production – whose investment risk is much lower than that in some stocks listed in the stock market. The need for a financial catalyst to initiate investment in cleaner production is questionable, considering the public information programs carried out by the cleaner production centres worldwide, as well as the practical and hands-on training provided by demonstration projects.

Since industries adopting cleaner production have better products and lower production cost than their competitors, it would be advantageous for industries to initiate cleaner production. The industry taking the lead will be in a position to capture a bigger market share and enjoy higher profitability than its competitors. In an ideal market, the high profitability from cleaner production will be eroded as competitors reduce their profit margins in order to gain a higher market share. The reduction in profit margin goes on until it equals the marginal cost. The last industry adopting cleaner production will have difficulty in capturing a market share from its competitor without sacrificing profitability in the short term. Even in an imperfect market, there is every advantage for a company to lead in introducing cleaner production. But this has not happened. Industries, especially in developing countries, are not rushing to adopt cleaner production in spite of all the demonstration projects, free in-service training of personnel, public awareness campaigns and even amnesty from previous violations of environmental regulations.

An environmental audit is normally an integral part of the cleaner production process. It will point to areas with high wastage or low manufacturing efficiency which discharge the highest quantities of pollutants. As incentive for industry to adopt cleaner production, the cleaner production centre or program provides free consultancy to leaders signing in. In the case of the United States Agency for International Development (USAID) cleaner production program, a lack of interest for industry to participate was traced to potential legal problems if during the environmental audit, it would be shown that the participant was violating the environmental standards.⁴⁹

⁴⁹ Richard Stevenson (2004b) Impact of the ASEAN Environmental Improvement Project (ASEAN-EIP) on the Adoption of Waste Minimization Practices in the Philippines. *Journal of Cleaner Production*, 12, 297-303. at p. 302

The Missing Link

Engineers believe in the absoluteness of the laws of science. Technical advantages of cleaner production technologies as shown and documented by the demonstration projects to engineers are the most important considerations and should be sufficient rationale for industry to adopt them. The most efficient technology will render the least efficient technology obsolete in a phenomenon commonly called “technological obsolescence”. For example, the DVD has driven the VCR into technological obsolescence. Ten years ago, it was the VCR that drove the Betamax into technological obsolescence, and earlier, the Betamax drove out the home movie projector. All these changes took place as users realized the advantages of the more efficient and convenient technology. People do not have to carry around heavy and bulky movie projectors. The disc or tapes in a new digital DVD are renewable and available a few minutes after the picture is taken. The process of recording and replaying the event no longer generates toxic wastes such as silver nitrate, sodium hyposulphite solution and acid bath as when celluloid films were developed. To engineers, a successful demonstration project should be sufficient for industry to adopt cleaner production.

Economists and financial experts believe in the invisible hand of the market to guide the consumer and provider of goods and service. Consumers and providers interact to maximize their benefits from the transactions. Users of “win-win” strategies such as cleaner production will drive into bankruptcy the users of more polluting and inefficient processes.

In an ideal market, there is no need for cleaner production centres. The technology providers, will search for the cleaner production processes to move ahead of their competitors. The former will advertise their products and convince the user of the advantages not only in terms of pricing, but also in terms of social and cultural benefits such as protection

of the environment. If the cleaner production centre provides information, technological verification and public awareness campaigns, these are forms of incidental assistance. Survival in the market should be a sufficient driving force for industry to adopt cleaner production.

From the perspective of the engineers, economists, and financial experts, cleaner production has a comparative advantage⁵⁰ over polluting and inefficient processes. Natural resources and the quality of the labour force also affect the comparative advantage of an industry. The mere fact that the industry is already in existence and operating, means that the availability of natural resources and labour to operate and manage it is presumed to exist as well. However in the real world, comparative advantage is not solely determined by technological, financial and marketing efficiency, natural resources and labour. First and foremost, the market and the national economy are fuelled by money. Money is printed by the central bank to settle public and private obligations. In simple terms, money is printed by the central bank for the citizens to accept it for settlement of goods and services that the citizen has rendered to the government and other citizens, as well as to pay for goods and services received from the government and other citizens.

Traditionally, money was supported by valuable commodities such as gold and silver. Currency printed by the central bank used to include a statement that the money could be exchanged for a specified quantity of gold or silver on demand. As the economy expanded the demand for currency also expanded. As the supply of gold and silver is determined by geology, it becomes impossible for the central bank to satisfy the increased demand for currency if the currency is fully backed by gold and silver. Except in times of economic or political turmoil, the currency circulates without being redeemed. Central banks print more

⁵⁰ Sometimes comparative advantage is referred to as “competitive advantage”.

currency than they could redeem which leads to serious and often uncontrollable problems as people lose trust in the former. The gold standard was abandoned in 1974 when the US dollar was freed from any equivalence with gold, although gold and silver continues to form part of the reserve for most central banks. The value of the money or currency is determined by public perception of the current and future strength of the local economy, the public budget and deficit, and various monetary policies used by the central bank to control money supply, inflation and possible economic depression. Theoretically, a strong currency signifies a strong public and even international trust in the economy of a country, but often the central bank will depress the value of the currency to improve the comparative advantage of its products in the world market without necessarily improving production efficiency. For example, Japan and the People's Republic of China are under international pressure to revalue their currencies to correct their trade surplus. The countries experiencing large trade deficits with China and Japan claim that Chinese and Japanese exports are highly competitive in the world market because the undervaluation of their currencies artificially depresses the cost of the local production components. Monetary policy is just one example of a wide range of economic, legal and political legislation, policies and programs to improve the comparative advantages of industries other than improving production efficiency or using cleaner production.

In the competitive world market, governments passed legislation to protect their industrial, financial and service sectors from external competition and at the same time assist them in exporting the goods and services. Wasteful and inefficient industries could remain competitive in both domestic and international markets. As economic and trade supremacy results in higher employment, social satisfaction and standard of living, countries try all possible measures to protect their industries from external competition. These measures are often considered illegal by their competitors, although the latter may be applying similar measures to protect their own industries. Often trade competition results in armed conflicts.

After World War II, the victorious Western powers aimed to minimise if not prevent armed conflict resulting from trade competition. While important gains have been made in negotiating reduction in quantifiable trade protection measures such as monetary policy, taxation and tariff, contentious problems still exist on non-quantifiable or difficult to quantify trade measures such as environmental protection. In fact, as described in Chapter IV, environmental protection legislation and procedures are used by polluting and inefficient industries to inhibit competition and introduction of cleaner production.

Research Objectives

The main objective of the current research is to analyse the legislation, policies and programs which impede or discourage industries in developing countries from adopting cleaner production to simultaneously address environmental degradation and at the same time improve their comparative advantage in the domestic and international markets.

The secondary objective of the research is to analyse the dynamic interactions of various sectors in society promoting and impeding changes in legislation to promote cleaner production, through a case study. While promotion of comparative advantage and environmental protection are key objectives of all governments today, society is a complex interaction of various vested interests promoted by the different sectors. Any change will have negative impacts on some social groups, altering the balance of power or social structure. Some negatively affected social groups could adjust to the change and even take advantage of it to promote their social power and prestige while others face the difficulty and risk of being marginalized. As previously discussed, one of the major shortcomings of the cleaner production program as it is formulated today is the naive assumption that it is a “win-win”

proposition for society as a whole without considering the realities that society is not a monolithic structure and the benefits and cost of even a “win-win” proposition such as cleaner production are not evenly distributed in society. Governments, in formulating legislation and policies, will have to contend with the reality that while the legislation and policies may promote the welfare of the majority, there are groups which will be adversely affected. In a number of instances, the political influence of the adversely affected group is much higher than their numbers warrants such that the legislation and policies will not be to the best interest of the society as a whole, but rather to the vested interest of this group. Under these circumstances, it is not unusual to find legislation and policies crafted to protect the polluters; or to see environmental legislation, policies and practices crafted for propaganda purposes to satisfy the environmental movement without any possibility of success.

Research Outline

This thesis is divided into seven chapters. The first chapter gives a short background of the problem, the objectives of the research and its organization.

Chapter II is a brief review of environmental management techniques from the perspective of environmental science, economics, and technology. This chapter provides background information on the different options for addressing environmental degradation and conserving natural resources. The background information is an introduction to the principles behind the cleaner production concepts.

Chapter III is an analysis of the rationale behind cleaner production, its evolution from “pollution prevention” and later from clean technology. Chapter III also briefly reviews the

different environmental management techniques that are similar to cleaner production such as pollution prevention, environmentally sound technology, and industrial ecology. Chapter III also includes a critical review of the various national and international policies, rules, regulations, declarations and programs on cleaner production. Chapter III closes with a short review of the failures and sluggish implementation of cleaner production.

Chapter IV is an analysis of national legislation, regulations and practices affecting cleaner production that are ignored in the design and implementation of cleaner production programs. The constraints in national legislation with significant impacts on the design and implementation of these programs are:

- (i) labour laws;
- (ii) national security;
- (iii) balanced regional development;
- (iv) industrial and trade promotion laws; and
- (v) environmental laws.

Chapter V is a short analysis of the international economic and trading practices, declarations, and programs affecting the implementation of cleaner production. It also includes a review and critical analysis of the international practices of pricing environmental and natural resources, and the incorporation of cleaner production into international agreements with vague and non-operational concepts, thereby restraining its implementation. Chapter V closes with a short commentary on the evolution of “post-normal science” in environmental management and policies and the resulting confusion and public apathy to environmental issues. On the part of the engineers and business decision makers, the apathy is reflected in their attitude towards cleaner production.

Chapter VI is a case study on the interactive dynamics between the various laws, regulations and programs to promote cleaner production and the existing legal, economic, and technical practices negating its promotion. The case study uses the sugar industry in the Philippines.

Chapter VI discusses the interactions of various social groups in promoting their vested interests, the resistance to change especially to cleaner production by existing beneficiaries, the rationale for resisting the change, the impact of international competition and the trade policies adopted by competitors and consumers in both the domestic and international markets.

Chapter VII is the conclusion and recommendations.

CHAPTER II

ENVIRONMENTAL MANAGEMENT AND CLEANER PRODUCTION

The previous chapter briefly reviewed the environmental management leading to the development of cleaner production as a “win-win” solution to improve product quality and at the same time to protect the environment. The discussion focused on the promises resulting from cleaner production and the need to establish the legal and institutional framework in order for cleaner production to live up to its potential. There are a number of important environmental management principles and techniques which have to be examined in relation to the development of environmental legislation, policies and implementing rules and regulations in order to facilitate cleaner production. The main purpose of this chapter is to provide the necessary background information for the analysis of the existing international and domestic legislation, policies and implementing rules and regulations as they affect the adoption of cleaner production to simultaneously address environmental degradation and decline in comparative advantage.

Some of those environmental management principles and techniques were mentioned in the previous chapter. However, to discuss these in a more detailed manner would divert the focus of the research in the context of its importance and objectives.

Environmental legislation, policies and implementing rules and regulations are not merely the result of a scientific analysis but rather of the complex interactions and compromises of economic, financial, social and political factors. By precedent, the courts

defer to the expertise of the agency implementing the environmental legislation and will similarly concentrate on the procedural aspects of the implementation and enforcement of the legislation.⁵¹ Similarly, the legislative branch delegates to the environmental agencies in the executive branch the development of standards, rules and regulations which often have “law making” aspects, in deference to the technical expertise of the agencies. To maintain its authority, the environmental agency tends to present and resolve environmental issues exclusively on scientific and technical aspects unless the authorizing legislation specifically calls for economic, financial or social analysis. The courts and legislative branches of government find it more difficult to reach consensus without the expertise of the environmental agencies as more sophisticated scientific and technical techniques are used in resolving environmental issues. To break this trend, the public is demanding more openness in the decision-making and dissemination of information, commonly called the “right to know”. Today, the public is not satisfied with the “right to know” but demands and seeks active participation in the actual decision making process itself.⁵²

Objectives of Environmental Management

Pollution is said to take place if the wastes discharged into the environment dislocate the existing legitimate uses and users of the environmental resource.⁵³ Long before

⁵¹ Steven Ferrey (2004) *Environmental Law*, Aspen Publishers, New York.

⁵² United Nations Economic Commission for Europe (1998), Aarhus Convention -"Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters" Signed on June 25, 1998 and entered into force on October 30, 2001, United Nations Treaty Series, v. 2161, p.447. While the Aarhus Convention was signed and ratified by the European member countries of UNECE, it has been used as a model for public participation globally. As a large number of UNECE member countries are donors in bilateral and multilateral development institutions, the provisions of the Aarhus Convention is often cited or required in projects financed by those countries.

⁵³ Anon (1971) Glossary. Herbert Lund (Ed.), *Industrial Pollution Control Handbook*. McGraw Hill Book Co., New York. At p. 37. In this book Water Pollution is defined as “ the introduction into a body of water of

environmental management was on the public agenda, conflicts arising from the deterioration of the quality and quantity of an environmental resource were resolved using the principles of nuisance, negligence and trespass. In almost all instances, the environmental problem was related to the use of water resources – the discharge of waste into a water body or diversion of the wastes from a water body resulting in damage to the other users or neighbouring properties. Considering the dynamic nature of human settlements and the strong impact of land-use planning and later, of environmental planning on environmental management, pollution was redefined to include the “future intended uses of environmental resources” in addition to the existing uses of the environmental resource. This definition is more in line with the concept of “sustainable development” and “sustainability”. The Bruntland Commission Report in 1987⁵⁴ defined sustainable development as “development that meets the needs of the present without compromising the capability of the future generations to meet their needs”. The same report further defined “needs” to mean the essential needs of the world’s poor to which an overriding priority should be given. The term “without compromising the capability of future generations to meet their needs” essentially imposes a limitation on the use of the resource. The Bruntland Report further defined the limitations as those imposed by the state of technology and social organizations on the government’s ability to meet present and future needs.

substances of such character and of such quantity that its natural quality is altered as to impair its usefulness or render it offensive to sight, tastes or smell.” R. D. Ross (1972b) Defining the Problem. R. D. Ross (Ed.), *Air Pollution and Industry*, Van Nostrand Reinhold Company. New York. at p. 1, defines air pollution as “it is the addition to our atmosphere of any material which will have deleterious effect to life in our planet.” Considering that low concentration of sulfur dioxide and even carbon dioxide has long term and cumulative impacts on irreplaceable work of arts using marble or particulates and spoils the paint on buildings, air pollution has broader impacts than on life in this planet. Extending Lund’s definition of water pollution to air pollution is appropriate.

⁵⁴ World Commission on Environment and Development (1987) *Our Common Future*, United Nations, New York (commonly called the Bruntland Report after the head of the commission, G Bruntland).

In 1998, the International Court of Justice expanded the definition and rationale of sustainable development in its decision on the Gabčíkovo-Nagymaros Project.⁵⁵ The court considered the principle of sustainable development as the principle reconciling the conflicting needs of development and the necessity to protect the environment.⁵⁶ However, as Professor Douglas Fisher⁵⁷ analysed it, the legal system under its traditional mandate has difficulty in imposing the implementation of sustainable development. To quote Fisher,

“Where does the law fit? It is the particular nature of ecologically sustainable development that has created the major challenge of the law. Ecologically sustainable development is essentially an outcome or a result. In this sense, it is impossible to know if the development is ecologically sustainable until it has actually taken place. If this is transposed into a legal context, it is not possible to be sure whether an activity is lawful or not until it has actually taken place. Certainly, much effort goes into predicting whether actions, and activities and decisions are lawful or not. But this is speculation. Events may not work out as planned. Not all the risks might have been foreseen.

The function of the law has been, at least in the traditional sense, to set standards for human behaviour. It does so by prescribing rules that govern the activities and decisions of individual persons and their corporate entities. Those standards are for the most part enforced after the event by application of the range of liability rules already discussed. Ecologically sustainable development is not, however, about the past. It is about the future. If ecologically sustainable development, like any other outcome, were to become a rule of law, how would it be enforced?”

Commentators on environmental law in the United States such as Professor Ferrey⁵⁸ completely ignored the relevance of sustainable development in American jurisprudence. Australia, the member countries of the European Commission and a number of developing countries have included the concept of sustainable development in their environmental

⁵⁵ Judgement in the case concerning the (1998) Gabčíkovo-Nagymaros Project. 37ILM 162 p.205. ICJ.

⁵⁶ To quote the ICJ: “The problem of steering a course between the needs of development and the necessity to protect the environment is a problem alike of the law of development and the law of the environment. Both these vital and developing areas of law require, and indeed assume, the existence of a principle which harmonizes both needs.

To hold that no such principles exist in the law is to hold that current law recognizes the juxtaposition of two principles which could operate in collision with each other, without providing the necessary basis of principles for their reconciliation. The untenability of the supposition that the law sanctions such a state of normative anarchy suffices to condemn a hypothesis that leads to so unsatisfactory a result.

Each principle cannot be given a free rein, regardless of the other. The law necessarily contains within itself the principle of reconciliation. That principle is the principle of sustainable development.”

⁵⁷ Douglas Edgar Fisher (2003) *Australian Environmental Law*, Lawbook Company, Sydney. at pp. 349-352

⁵⁸ Steven Ferrey (2004) *Environmental Law*, Aspen Publishers, New York.

legislation.⁵⁹ Although the concept is internationally accepted and included in environmental legislation, it has remained an abstract concept to administrators and legislators. As Fisher pointed out, there are a number of practical issues that current political process is unable to resolve in implementing sustainable development. Fisher stated⁶⁰

“In this sense, sustainability is a condition attached to the achievement of development. If it is the environment that is the resource that is being developed, then sustainability in this sense means that the resources that are taken out of the environment for development purposes must not be exhausted. To make decisions based upon sustainability in this sense is difficult. What is the context for making a decision based upon sustainability? Is it the need of the local community, the regional community, the national or the international community? Is it their perceived needs over five years, ten years, one hundred years or longer? If the resources are renewable, how long does it take for them to recover their productivity? If they are non-renewable, should they be developed at all? Those are complex political and economic issues. Although sustainability is part of the legal system, it does not, in terms, address questions such as these – at least not yet.”

Sustainable development is also difficult to attain under current and existing understanding of the laws of nature and the state of technology.⁶¹ Every action, no matter how small and low-level, for example meditating, has an impact on the environment. The person meditating generates heat from their body metabolism, inhales oxygen and discharges carbon dioxide, water and a wide range of organic compounds such as methane, ammonia, hydrogen sulphide, etc. The wastes generated enter the environment and are integrated, sooner or later, into one of the natural cycles. While the natural cycles are often expressed in terms of the basic chemicals responsible for life, all the natural cycles involve the storage of high quality energy which is continuously degraded as the chemicals are converted from one form to another. Wastes are the substances with the lowest quality and often quantity of energy that it is in equilibrium with its surroundings. Plants convert carbon dioxide and water to

⁵⁹ Environmental Protection Act (ACT), 1997, The Commonwealth Government Printer, Canberra, Australia, and Environmental Protection and Biodiversity Conservation Act of 1999 (Cth), The Commonwealth Government Printer, Canberra, Australia. and Department of Environment and Heritage (1992) National Strategy for Ecologically Sustainable Development, Department of Environment and Heritage, Canberra, Australia .

⁶⁰ Douglas Edgar Fisher (2003), *Australian Environmental Law*, Lawbook Company, Sydney at p. 352

⁶¹ More detailed discussions on the problems created by vague definitions such as sustainable development in the implementation of environmental management programs such as cleaner production are presented in Chapter V

carbohydrates using solar energy. Carbon dioxide and water, the waste material from the oxidation of carbohydrates, exist in nature for a long time as they are very stable or in equilibrium with its surroundings, whereas carbohydrates will easily decompose releasing the stored energy.⁶² The same could even be said about the non-living materials used in our modern day civilization. For example, iron releases energy as it is oxidized and forms iron oxide. Iron oxide is stable, and for this reason it is the most common iron mineral mined. The iron oxide is converted to iron by extreme heating, using coal or any suitable fuel, so that oxygen is released and metallic iron is again formed.

Solar energy is the most common energy which drives natural cycles, converting wastes to other compounds that other members of the ecosystem could use – including the meditating person.⁶³ The same person jogging generates more heat and wastes into the environment. In addition to natural heat and wastes generated from body metabolism, people use work animals, machines and equipment in their workplace, in their houses and even for recreation. When our ancestors were hunter-gatherers, their basic needs – food, clothing and shelter – were taken from nature and what nature could not provide in time of droughts, floods and other events, limited the quantity that people could use. Humans were completely dependent on and were part of their environment. One of the major changes that has taken place since the advent of agriculture was people's transition away from the environment – even evolving to a confrontational stage on the need to control nature. Mankind started to domesticate work animals, to build granaries, holding ponds, irrigation systems and simple engines and to use energy stored underground for millions of years. More detailed analysis of

⁶² Eugene Odum (1971) *Principles of Ecology*, W.B. Saunders Company, Philadelphia, Pennsylvania,. at page 96-98

⁶³ Long and sustained supply of energy such as in geothermal vents is able to establish a micro-environment with its own unique ecosystems, food chain and natural cycles independent or with minimal dependence on solar energy.

the impact of terminologies and phrases used in international agreements on environmental management including implementation of cleaner production is discussed in Chapter V.

Ecologists have developed the concept of ecological footprints or environmental footprints to visualize the impact of human existence on the environment. For societies such as the developed countries of the US and Europe, the environmental footprint is estimated to be 48.95 hectares per year per person while in a primitive South American society that remains in the hunting-gathering stages, the footprint is still at a low of two hectares per year.⁶⁴

Today, even the hunter-gatherers of South America are using steel tools and rudimentary hunting equipment that are no longer an integral part of, or dependent on what their environment could provide. They are hunting the wild animals and plants at a rate faster than the natural replacement rate, thereby altering the balance of the ecosystem. With higher hunting efficiencies, the human population has also expanded, thus accelerating the ecological imbalance. The environmental footprints for even the average lifestyle in a developing country have shown that the environmental resources required are much higher than the capacity of the natural cycle to sustain. Non-renewable resources, especially coal and hydrocarbon resources, are consumed in ever-increasing quantities to power the equipment and machinery that artificially supplement the natural cycle. For example, agriculture in 1800 was highly dependent on nature. The energy value from an average North American wheat farm was approximately 2,000 times the energy input from the resident farm animals and the farmer. The wheat farm was fixing large quantities of solar energy. To increase the farm yield per unit area, fertilizers and pesticides were added, heavy equipment was used to cultivate, harvest and process the crop, and water was supplied from distant sources through irrigation

⁶⁴ World Wildlife Fund for Nature (2004) *Living Planet Report 2004* United Nations Environment Programme, Nairobi, Kenya, at p. 10

channels and pumping systems. An average North American wheat farm today fixes 30 per cent less energy from the sun than the energy required to produce it. The energy runs the equipment and manages the irrigation system. Energy used in the farms is non-renewable.⁶⁵ Today, American farms account for 25 per cent of the carbon dioxide emission from fuel combustion in the country.

Under the existing developmental paradigm, agriculture – the human production activity most closely related to nature – uses large quantities of non-renewable energy. To be competitive, agricultural practices, even in the least developed countries, are evolving towards the American model of intensive use of fertilizers, pesticides and mechanical equipment.

Utilization of non-renewable energy is more intensive in other production activities like manufacturing, transportation and commerce. With a civilization and technology built around the intensive utilization of non-renewable energy, there is serious doubt as to the applicability of the concept of sustainable development. As will be discussed later under the concepts of ecological footprints, humanity today needs an equivalent of one and a quarter planet earths to effectively provide the resources to support the existing energy and material needs as well as to effectively assimilate the wastes generated.⁶⁶

Tremendous technological strides are being made in the field of solar energy harvesting and fixation. However, the international environmental movement is being waylaid by high-powered advertisements and public relations campaigning for the hydrogen fuel cell and the so-called hydrogen economy. Hydrogen cells do have higher energy conversion

⁶⁵ David Pimentel and T. Patzek (2005) Ethanol and Biodiesel from Crops not Worth the Energy, *Natural Resources Research*, 14, 65-76. at page. 75

⁶⁶ World Wildlife Fund International, Zoological Society of London, and Global Footprints Network, (2006) Living Planet Report 2006, World Wildlife Fund International, Gland, Switzerland . at page 1 -3.

efficiencies than power plants fired by fossil fuels. The former have efficiencies of 70 to 80 per cent ⁶⁷ and these may go up to 90 per cent. However, hydrogen, as it exists in the atmosphere, is too dilute to be of any use. Hydrogen has to be extracted from water by hydrolysis which requires intensive electricity input. The electricity has to be generated first before the hydrogen for the fuel cell is available. When the energy efficiency and pollution required to fuel and generate the electricity to generate the hydrogen is considered, the energy conversion of non-renewable fossil fuel turns out to be lower by 10 per cent. Thus, the hydrogen fuel cell or the hydrogen economy is highly polluting and wasteful of energy. ⁶⁸

Solar energy fixation in ancient biomass is the main source of non-renewable energy today, followed by radioactive materials. The release of stored solar energy also releases carbon dioxide with still unquantified potential ecological damage.

The Organization for Economic Cooperation and Development (OECD), an organization of developed economies, recently released the review of the implementation of the sustainable development strategy. The OECD countries have the most advanced environmental accounting, resource utilization planning and even technological forecasting. Although the report was specifically titled “Implementing Sustainable Development”⁶⁹, it failed to analyse the basic definition of sustainable development to determine the implementation activities required to assure that environmental resources needed by future generations are met. The report merely considered all types of environmental protection activities and resource conservation as implementation of sustainable development.⁷⁰ It did

⁶⁷ Virgil Moring Faires (1969) *Thermodynamics*, New York, Collier Macmillan at pp. 155-157

⁶⁸ Ulf Bossel (2005) Does Hydrogen Economy Makes Sense. *European Fuel Cell Forum*, at p. 6

⁶⁹ Organization for Economic Cooperation and Development (2005) *Implementing Sustainable Development, Key Results 2001-2004*. OECD Department of Agriculture, Fisheries and Forestry

⁷⁰ Ibid.

not address the questions Fisher⁷¹ raised to determine the needs of the future generations, the number of generations, the location or domicile of the generations being addressed, and the necessary legal framework to assure that the outcome of a development is sustainable. The National Strategy for Ecologically Sustainable Development 1992⁷² in Australia followed the same approach as the OECD and the Agenda 21 reports. The report identified major environmental management principles and activities without tackling the issue of the needs of future generations and the resources required to meet those needs.

After the United Nations Conference on Environment and Development in 1992, each of the developing countries established a national commission on sustainable development. With the assistance of the United Nations Development Programme and various bilateral and multilateral financial institutions, these commissions developed their national Agenda 21 in order to promote and implement sustainable development. The Agenda 21 reports followed the same pattern as that of the OECD. The reports never attempted to define the needs of the future generations and the resources needed to meet those needs. It could be argued that as the Agenda 21 are national reports, then the generational domicile is limited to the national territory except on global or regional issues that the reports may have specifically identified.

For practical purposes, the protection of an environmental resource for its existing and/or intended future uses is an objective that is difficult to implement. The existing use could be quantified and measured. The intended uses are normally covered in the short-term, medium-term and long-term plans. The short-term plan is normally of three to five years. The medium-term plan is normally twice as long as the short-term plan and the long-term plan

⁷¹ Douglas Edgar Fisher (2003) *Australian Environmental Law*, Lawbook Company, Sydney. at pp. 349-352

⁷² Department of the Environment and Heritage (1992) *The National Strategy for Ecologically Sustainable Development*, Department of the Environment and Heritage, Canberra, Australia.

covers 20 to 30 years. Plans longer than 30 years are considered a “vision” rather than a plan because of the difficulty in determining the various factors affecting it.

I went to great lengths to examine and explain the difficulty of interpreting and implementing some of the concepts that have evolved in environmental international law using “sustainable development” as an example. The difficulty in translating those concepts will have serious implications in developing sound environmental management practices at the domestic level, contrary to the intent and purpose the international drafters may have had, as discussed in subsequent chapters in this thesis.

In 1986, after the People’s Power Revolution in the Philippines, I was appointed member of the technical committee of the Pollution Adjudication Board of the defunct Ministry of Environment and Natural Resources⁷³ (Department Order No.1). Part of the technical committee responsibility was to set the environmental standards, and to be practical, we used a time frame of 10 years as the standards would have to be reviewed and amended with changes in technology, knowledge of the impact of the pollutants, and the uses of the environment. In 1988, the proposed standards were discussed in public meetings where the formulators were criticized and turned down as these did not take into account the resources to meet the needs of future generations – or simply, the standards did not conform to the concept of sustainable development. To satisfy the critics, the final standards included levels and procedures that looked good on paper but could not be implemented in the field. For example, a number of parameters in the effluent standard were more stringent than the drinking water standard, i.e. the effluent is suitable for drinking, but not for discharge to a polluted river. From my observation, environmental laws or regulations that cannot be reasonably enforced and implemented are worse than having no environmental law at all. A

⁷³ Creation of Legal and Technical Standard Committee to Assist the Pollution Adjudication Board. issued on April 7, 1988. Department of Environment and Natural Resources, Manila, Philippines.

badly crafted environmental law will only lead to corruption. The regulated parties either resort to corruption or close down.

International agreements are primarily implemented by domestic legislation. In instances where nations are bound by strong regional organizations such as the European Union, the organizations may pass directives or legislation which have the force of domestic legislation in the member countries. There are a wide range of vested interests and concerns among the member countries involved in the development of international agreements. This means that if these have very specific requirements for implementation, the nations involved may never come to an agreement or if they do sign them, the governments may fail to ratify them. In a number of instances, governments may sign and ratify the international agreement but fail to pass domestic legislation to enforce it. For example, the Philippines has signed and ratified the Montreal Protocol on the control of Ozone-Depleting Substances⁷⁴ but has not passed the necessary domestic legislation to enforce the agreement within the Philippine Territory. In 1999, chloro-flouro hydrocarbons were found imported in excess of the amount allowed under the Protocol. The case is still pending in court in Zamboanga City for smuggling.⁷⁵

On the other hand, the environment-conscious public and environment-oriented non-government organizations have very high expectations for the international community to

⁷⁴ Montreal Protocol on Ozone Depleting Substances implementing the Vienna Convention on Ozone Depleting Substances. Opened for signature on September 16, 1985 and went into force on January 1, 1987, United Nations, Treaty Series, v. 1522, p.3 The Montreal Protocol was amended in London in 1990 with the amendment entering into force on August 10, 1992, Copenhagen in 1992 with this amendment entering into force on June 14, 1994, Montreal in 1997 with this amendment entering into force on November 10, 1999 and Beijing in 1999 with this amendment entering into force on February 22, 2002.

⁷⁵ The Environment Management Bureau (EMB) of the Department of Environment and Natural Resources will carry out public consultations in February and March 2007 to establish the guidelines and imposition of penalties for importations that it did not clear. At present all importation requires clearance from EMB but there is no specific penalty and disciplinary measures.

craft agreements with far-reaching consequences. Hence, it is not unusual for international agreements and reports to include concepts and principles which are difficult to implement if the statements and phrases are thoroughly analysed and scrutinized for implementation. For example, the phrase in Sec. 102(c) of the National Environmental Policy Act of 1969 states, “major federal actions significantly affecting the quality of human environment” which triggers the requirement of an environmental impact statement preparation by a federal agency, generates the majority of the cases related to the Act.⁷⁶ In fact, most of the international agreements on the environment are classified as “soft laws”, i.e. while the agreement may form part of international law, its enforcement and implementation are non-binding to the parties or countries that have ratified the agreement.

Environmental Standards

The environmental standard translates the environmental management objective into quantifiable sets of requirements and delineates enforcement procedures. When I was seating in the WHO committee on the development of indoor air quality criteria, the major considerations in establishing for establishing the environmental criteria are:

- (i) protection of public health;
- (ii) protection of irreplaceable flora and fauna, natural formations and man-made structures or works of art;
- (iii) protection of a resource;
- (iv) prevention of nuisance or irritants; and
- (v) aesthetics.

⁷⁶ See also Steven Ferrey (2004) *Environmental Law*, New York, Aspen Publishers. at pp. 77

The concentration of various chemical species and physical properties of an environmental resource is compiled from toxicological and epidemiological data to establish the maximum permissible level to protect public health and protected flora and fauna. For recently synthesized chemicals, toxicological tests are carried out on related species. Even for well-established chemicals such as lead, mercury, and other heavy metals, the trend has been toward more stringent standards as more information become available. Considering the level of uncertainty and potential large-scale negative impacts, the standard-setting committees normally divide by 10 the minimum toxic level reported in literature for common and established chemical pollutants. For newly-introduced chemicals, the factor of safety could range from 50 to 100 depending on the class of chemicals and the relative toxicity of its precursors, by-products and related chemical compounds.

For an environmental resource whose usage is common and difficult to contain or control, such as air, the protection of public health is used as the basis of the environmental standard. However, more stringent standards may be justified based on the economic benefit cost analysis. For example, a more stringent air quality standard may be justified if the cost of attaining the standard is lower than the costs associated with premature deterioration from corrosion and abrasion rates of protected man-made and natural monuments. In fact, when the standard of living is so high, such that a very stringent air quality standard is affordable and desired by the community, factors such as aesthetics are important considerations in standard setting.

Normally, a benefit-cost analysis is carried out to determine the appropriate level of pollutants allowed when the environment is treated purely as a resource. For example, the cost of removing or treating the pollutant at its source is compared with the cost of removing it by the user or for the user to find an alternative source. Generally, the cost of treatment at the

source is much cheaper than treatment at the point of usage. However, there are instances when the consumption at the point of usage is so small and isolated that it is cheaper for the polluter to pay the user and for the latter to treat the resource to its required quality rather than for the polluter to treat its wastes at a substantially higher cost. While this practice may look unconventional and contrary to commonly accepted environmental management paradigms, in reality the practice is common.

A typical example is the water supply system. Conventional practice would be for the waste discharger to a river used downstream for the municipal water supply to discharge effluent of quality close to the drinking water standard in order to minimize the cost of treating the river water for drinking or consumptive purposes.⁷⁷ The waste dischargers add the cost of treating their wastes to meet the stringent standards to the product cost. Ultimately, it is the consumer who absorbs the additional cost of the waste dischargers. However, most of the water treated and delivered by the municipal water supply system is for non-consumptive uses such as laundry, gardening, car washing etc. Approximately 20 litres per person only are used for consumptive purposes such as drinking and cooking. In instances where the concentration of dischargers upstream from the municipal water supply intake is too high, such that the cost is prohibitive or the technology is non-existent to treat the waste discharges to the desired effluent quality, the municipal water supply may be of doubtful quality for consumptive uses. Instead of demanding a higher quality from the municipal water supply, which consumers often do not wholeheartedly trust, consumers would prefer to buy bottled water. The proliferation of bottled water in the market is often an indication of this practice.

⁷⁷ Richard Joel Frankel (1965), Cost-Quality Relationship in an Engineering Economic Modelling for Municipal Wastes Disposal, *Water Resources Engineering Conference*, Mobile, Alabama, American Society of Civil Engineers. at p.20

While this practice may be contrary to the accepted “polluter-pays” principle⁷⁸ since the consumer is paying more for the use of the environmental resource which in this case is the river water, some economist will argue that the practice may sometimes result in more efficient allocation and use of environmental resources.⁷⁹ The waste dischargers do not incur an extremely high cost of waste treatment in order to minimize the water treatment cost incurred by the municipal water supply system. Neither does the municipal water supply system incur an additional or higher water treatment cost, as the water quality supplied is primarily for non-consumptive uses. The consumer is actually paying an incremental amount for the small volume of water used for consumptive purposes.⁸⁰

The irritant or nuisance values are determined by the standard of living and local customs. For example, iron imparts a reddish brown coloration which does not have significant impact on health. However, the reddish coloration is often interpreted as contamination and users are forced to resort to alternative sources which might be clear but contaminated. Aesthetic values are also determined by the standard of living, cultural and social preferences.

⁷⁸ Pollution is considered an “externality”. Externality is cost caused by the polluter and paid by persons other than the polluter. Externality distorts the price of the polluter’s product. Pollution control will remove the externality with the cost of pollution control added to the internal cost of production. The catch phrase in the 1970s when I was doing my graduate studies was “internalizing the externalities” rather than the “polluter pays”. In most instances, the person paying for the externality is not really the polluter but the consumer. The polluter merely passes the cost of pollution control to the consumer.

⁷⁹ Richard Joel Frankel (1965) Cost-Quality Relationship in an Engineering Economic Modelling for Municipal Wastes Disposal. *Water Resources Engineering Conference*. Mobile, Alabama, American Society of Civil Engineers. at page 18. This concept was also explored by other researches in the Resources for the Future. The reference section of Frankel’s paper gave a list of related articles on this subject.

⁸⁰ If the polluter has a very strong social and economic value to the community it has a very strong bargaining power especially if it is in adverse financial situation. See Hua Wang, Nlandu Maming, Benoit Laplante and Susmita Dasgupta, (2003), Incomplete Enforcement of Pollution Regulation: bargaining Power of Chinese Factories, *Environmental and Resource Economics*, v. 24, n.3, pp 245-262 China with its large trade surplus and foreign exchange reserve is a major donor country in Africa and Asia, but it accounts for 25 to 30 per cent of the borrowings from the Asian Development Bank and is the biggest borrower from the World Bank after the western powers constrained its influence in both institutions. Similarly, Argentina in its last financial crisis found out it has a large influence in the International Monetary Fund being a major borrower.

For this reason, within the same country or even region, the environmental standards could vary as the standard of living, local customs, the users or the resource, and protected monuments, flora and fauna differ. In a number of instances, the political boundaries of the region may differ from the environmental region, in which case the development of appropriate environmental standards could be difficult, especially for the area receiving the pollutant. This problem is common in cases of trans-boundary pollution problems such as acid rain, greenhouse gas emissions or in management of environmental resources across political boundaries such as coastal and marine waters and international rivers, and also large underground aquifers. A common mistake by standard-setting authorities, non-governmental organizations and the public at large is to make a comparative review of standards adopted in other countries and advocate for the most stringent value as the appropriate standard. This practice is common in developing countries where the research budget and expertise to carry out detailed benefit cost analysis, toxicity and deterioration rates of protected flora and fauna are very limited. Governance and corruption issues create public distrust in recommended values lower than the most stringent value and any accompanying justification by authorities. An environmental standard that is too stringent, so that its implementation is beyond the financial capacity of the waste discharger and/or beyond the administrative capacity of the authorities to enforce, will result in a chaotic situation. The polluters will bribe officials or completely ignore the environmental standards so as to remain in business or will close down and move elsewhere resulting in serious economic losses and social dislocation.

In this thesis, distinction is made between waste discharger and polluter. A waste discharger is not necessarily a polluter if the quality/quantity of wastes discharged is within the assimilative capacity of the environment. In some instances, waste discharged to the environment is one of the methods of recycling, or even enhancing the fertility and productivity of the environment. For example, discharge of sewage in marine outfall increases

the biodiversity and productivity of the sea in the vicinity.⁸¹ Most environmental management laws such as those in NSW allow the authorities to issue discharge permits which basically means that the authorities consider the quantity of waste discharge to be within the assimilative capacity of the environment to cause pollution.⁸²

In most instances, there are a number of waste sources discharging to a particular environment. Having defined the quality of the environment to protect its existing and/or potential uses, the next step will be to allocate the quantity of wastes among the users. The techniques of allocating the allowable quantity of waste discharged among the users have evolved rapidly in the last 50 years in tandem with rapid technological development in communication, instrumental methods of detection and analysis, development of economic and technical databases, weather forecasting, computation and modelling techniques. These will be reviewed in the following sections. This review is focused on the administrative aspects, specifically those that affect the introduction of cleaner production.⁸³

Implementing Environmental Standards

⁸¹ A. J. O. Sullivan (1971) Ecological Effects of Sewage Discharge in the Marine Environment. *Proceedings of the Royal Society Series B, Biological Sciences*, 177, 331-351. at pp. 333- 335

⁸² It is important to link the discharge permit with the assimilative capacity of the environment otherwise the discharge permit is effectively a permit to pollute the environment.

⁸³ For detailed discussion, textbooks on environmental management such as Allen Bower and Blair Kneese (1968) *Managing Water Quality*, Resources for the Future Inc., Washington DC,. may be consulted. While this book is somewhat outdated, it has a number of futuristic and novel methods of efficient allocation of the assimilative capacity. Some of the methods discussed such as emission trading and growth of emission futures have only been practised in recent years.

In almost all countries the initial concern has been on water pollution.⁸⁴ The first response of the environmental management authorities was to enforce the riparian rights of the users under common law. The upstream user has the right to use the water, and it has the obligation to return the water to the river with a quality that will not affect its proper use by the downstream users. As a general rule, the water quality has to be maintained at the highest possible use, which is often for drinking purposes. Some of the downstream users may not need water of the quality required for drinking, such as those using the river for navigation or industrial purposes. This means that the river could have taken additional waste without affecting the existing uses if nobody was using it for drinking purposes. Just as in urban land use planning, the environmental management authorities classify the water body for various uses such as drinking water, fishing, irrigation, industrial, navigation, and sometimes even for waste disposal. The section classified for drinking water is usually the most upstream section of the river with navigation at the downstream. Authorities control the establishment of new users through the permit system. For example, a new industry will only be given a permit to operate if it is located in the industrial section of the river. For water pollution control, the standard is often called the “receiving water standard” and for air pollution, it is called the “ambient air quality standard”.

Within the same classification, the upstream user could discharge a larger quantity of wastes than the downstream users. In fact, the upstream user could completely use the assimilative capacity, leaving nothing for the downstream users. The upstream user may not even need any waste treatment process at all. As waste treatment processes operate with less than 100 per cent removal efficiency, with the cost of treatment increasing exponentially above 95 per cent, the downstream users will have to close down. If the downstream user is

⁸⁴ For example, the first water pollution law in the United States was passed in the Water Pollution Control Act of 1948 (US) PL 80-845, 62 Stat 155., while it was not until 1955 that the first air pollution act was legislated Air Pollution Control Act of 1955 (US) PL 88-206, 77Stat 392

expanding production or building a new plant, it will try to relocate as closely as possible to the upstream section boundary in order to maximize its use of the assimilative capacity. Otherwise, it will just operate the waste treatment facility at a reasonable level, ignoring the consequences of its waste discharge to the river. As all the users ignore the consequences of their waste discharge, the water quality in the river deteriorates to less than that required in the environmental standard, leading to the failure of the environmental management system. For example, the industrial developments in Manila were clustered close to the estuary of Pasig River. As the assimilative capacity of the river was used up, industries were required to treat the wastewater to efficiencies close to 100 per cent. Industries moved up to upstream tributaries like the Marikina River and readily used up the upstream assimilative capacity.

Discharge Standard

To prevent the upstream user from monopolizing the assimilative capacity of the environmental resources, the quality or concentration of the waste discharge is controlled per discharger.⁸⁵ For water bodies, the discharge standard is commonly called “effluent standard” and for air, it is called “emission standard”. The main considerations in setting the effluent standards are

- (i) the receiving water quality standard to be met;
- (ii) the total waste discharge from various users; and
- (iii) fluctuations in the environmental resource’s characteristics, affecting its ability to assimilate the waste discharge. This includes river flows, lake water circulation and mixing, wind direction and atmospheric turbulence.

⁸⁵ The quality of the wastes is defined by the concentration of the impurities, i.e. 30 mg/l (milligrams per liter) nitrogen, 250 mg/l of biochemical oxygen demand (BOD). The quantity of a particular waste component is the product of the volume of wastes and the concentration of the particular species. For example, 100 cum of wastewater containing 30 mg/l of nitrogen contains 3 kg of nitrogen. In some instances, the wastes flow continuously and instead of volume, the flow rate is given. If the waste flow rate is 100 cum/hr and it contains 30 mg/l of nitrogen, the waste discharge rate is 3 kg/hr of nitrogen.

With the discharge standard, the authorities monitor the quality of the waste stream discharge to the environment. It is the responsibility of the waste discharger to discharge a waste stream with a quality better than or equal to that required in the discharge standard. Different users have different waste characteristics, and depending on the waste characteristics, the ease of treating the wastes also varies. Some waste dischargers could easily meet the effluent or emission standards with low waste treatment cost, while others will incur a high waste treatment cost. Users facing high waste treatment costs will encourage wastage of the environmental resource to dilute the waste stream rather than treat or remove the pollutant to meet the emission or effluent standard. For example, an industry may have difficulty in treating its wastes to discharge a BOD of 15 mg/l from 150 mg/l. The industry will not repair leaking pipes or else just pumps more water from the river than necessary in order to dilute the wastes to concentration within the standard. In this particular example, the industry will dilute the waste stream to 15 mg/l of BOD with the leaking water and excessive water consumption. The industry will then satisfy the effluent standard without any form of treatment.

Waste Load Standard

Based on the best practices and the best available technology, the minimum quantity of waste discharge has been collated from various industries.⁸⁶ The waste load standard is based on the production capacity of the user. Using information on the extent to which the waste could be treated economically, a waste discharge rate or the quantity of waste discharge could be assigned to a particular user. The waste could have a very high concentration of

⁸⁶ World Bank (1999) *Pollution Prevention and Abatement Handbook: Towards Cleaner Production*, World Bank, Washington DC .

potential pollutants, but if the volume is very small, the untreated waste could be discharged to the environment. The user will be encouraged to conserve the environmental resource such as water, to discount potential dilution. In fact, dilution will only increase the waste treatment cost, as normally it is easier to remove the initial 70 to 90 per cent of the wastes than the remaining 1 or 0.5 per cent. For example, 90 per cent of 1000 mg/l is 900 mg/l whereas 90 per cent of 100 mg/l is 90 mg/l. If the volume is 1000 cum, then the strong wastes treated to 90 per cent removes 900 kg, whereas the weak wastes of 100 mg/l will remove only 90 kg. For strong organic wastes, it might even be possible to recover energy using anaerobic processes to recover methane gas. For non-organic wastes, such as heavy metals it is also easier to treat strong wastes. Weak concentrations of heavy metals are difficult to flocculate as the hydroxides may simply form colloids. Additional metallic hydroxide is added to destroy the colloids and induce swift flocculation to remove the metallic hydroxide in suspension.

While the allocation of the assimilative capacity based on the waste load is more efficient than the use of the discharge standard and/or the environmental standard, it raises a number of implementation issues. Should the assimilative capacity be allocated in accordance with the social value of the industry? For example, should an alcohol distillery receive a lower allocation than a cheese factory? The alcohol distillery may be viewed as having a lower social value than a cheese factory.

How about variations of social values within the same industry? For example, a factory producing luxury cars may have lower social values as it caters primarily to satisfy the egos of the rich rather than provide a means of transportation compared to one producing cars for the masses. Should the factory producing luxury cars have a lower allocation of the assimilative capacity compared to the factory producing cars for the masses? How would the assimilative capacity be allocated if the factory produces both luxury cars and cars for the

masses with the production levels varying from time to time depending on the market demand for a particular model? The social valuation of an industry is highly subjective. Some ecologists would condemn the whole car industry, and if given the option, will not allocate any assimilative capacity to it.

The quantity of the environmental resource could vary from time to time. Changes such as the wind velocity, direction and turbulence could take place within a few minutes. In other instances, the change is gradual – such as the change in outflow from a lake.

The assimilative capacity also changes with changes in the quantity of environmental resources. During a drought, the river flow could be very low, with fish and other aquatic life under serious stress. Waste discharged to the river during a drought will have a more significant impact on a river ecosystem than during a flood.

Variation in the assimilative capacity was a major constraint in the application of waste load standards. However, with improvements in modelling and computational techniques, it is possible to give advance notice to the waste discharger regarding the changes in assimilative capacity and their allocation.

Aside from allocating the assimilative capacity, it is important for the authorities to monitor compliance. Chemical techniques, such as the conventional biochemical oxygen demand test where the results are available five to six days after the waste has been discharged, will be of little use. The consequences of any waste discharge above the assimilative capacity have occurred long before the quantification of the excess effect is available for corrective action to be made.

On-line and real-time waste analysis and reporting are more suitable than titration methods commonly used in quantitative chemical analysis. However, the cost of on-line and real-time waste analysis and reporting is so high that it is difficult for small-and medium-scale industries to install the system. The instrumentation and reporting system initial cost ranges from \$500,000 to a million dollars for each factory.

Guidelines

To simplify the discussion of the legal and administrative implications of the technical nature of environmental management, the last sections were devoted almost entirely to managing and allocating the assimilative capacity of the environment to the existing users. As discussed earlier, the objective of environmental management is to protect the quantity and quality of the environment for the existing and/or future user. As a general rule, most equipment has a seven to ten year useful or economic life span before it is replaced for reasons of technological obsolescence, loss of tax benefits and the additional cost of operating and maintaining the system due to frequent breakdowns. Most industries expand in line with an expanding economy, replacing old equipment and introducing new products. In a stagnant or declining economy, businesses continue using the existing machinery, deplete goods in storage and even close down factories.⁸⁷ For this reason, the business cycle and refurbishment of factories, households, and even agricultural demand conform closely to the seven-to ten-year cycles. In a number of instances, economic recovery is initiated by the introduction of new technologies.

⁸⁷ It is a common practice to dismantle factories and ship it to subsidiaries or to new emerging industries in developing countries.

As discussed earlier, it is very difficult to predict the profile of the users and the quality and quantity of environment resources needed by future users. The factors affecting the environmental resources needed by future users even in the next 10 to 20 years are also dependent on a wide range of factors ranging from:

- (i) natural phenomena such as droughts, earthquakes;
- (ii) social perceptions of wide-ranging issues from politics to job security to religion;
- (iii) technological development;
- (iv) dynamics of world trade; and
- (v) the environment, itself

Instead of just waiting for events to unfold, environmental authorities often try to influence the future outcome within their policy-making prerogatives.

If the changes are highly probable, environmental authorities promulgate guidelines. The purpose of the guidelines is to ensure that the existing industry will use the proper technology when they phase out and replace existing equipment as well as to guide the direction of current research and development. The existing users are most likely to complain that the guidelines promulgated are unreasonable and difficult to attain.⁸⁸ However, if one or more of the competitors is able to implement the technology suggested by the guidelines, that competitor will monopolize the market or at least capture a major market share. Hence, the users, while complaining, will also devote resources to research and development in order to remain competitive.⁸⁹ Once established, the guidelines are then converted to an industry standard and implemented as waste load standards.

⁸⁸ The use of guidelines is common in the automotive industry where targets are specified on fuel consumption efficiency, emission of common pollutants such as carbon monoxide, nitrogen oxides and particulates.

⁸⁹ It should be noted that environmental guidelines work if there is market competition. Otherwise, the user will just ignore the guidelines. A more detailed discussion on this aspect is made in Chapter IV.

While equipment and appliances may meet the guidelines as they leave the factories, the operation and maintenance will have a very significant impact on the actual waste generation rates. For example, two cars of the same model and manufacturer could have different fuel efficiencies and waste emissions a few years after use. One car could be as good as junk two to three years later while the other car could be operating like new depending on the care, driving habits of the user, and compliance with the operation and maintenance schedule. In the case of New South Wales, emission and safety check-up and certification are mandatory before a car older than three years could be registered. In addition, the police may fine smoke-belching vehicles on the road. Similarly, for factories, the emissions and effluents are monitored and evaluated regularly to check continuous compliance notwithstanding that the emissions and effluents conform to the standards at the start.

Local and Global Environmental Management

During an economic depression, the government urges its citizens to spend their savings, and if their savings are used up, to borrow money to spend in order to pull the economy out of the depression. The government advice is the logical economic policy to pursue on the macro-economic level. However, to the housewife operating on the micro-economic level, the government advice is damaging to the family's economic well-being. Jobs are scarce, and even if a person has a job, there is no security. Businesses go bankrupt, including established banks and financial institutions. Families save their money and even keep it away from the banks for fear of losing it if the bank closes down. Families forego new clothes, shoes, vacations and even cut down on expenses for essentials such as food. People who lose their jobs and have no savings are rendered homeless and destitute.

The contrary holds true in time of hyperinflation. The macro-economic policy to curtail hyperinflation is to reduce spending and increase savings by increasing interest rates, cutting down budget deficits, and increasing taxes or foregoing public infrastructure development. To the household operating in the micro-economic environment, the sensible activity is to spend the money before it loses its value.⁹⁰

The contradiction between macro- and micro-policies is not limited to economic policies but is also evident in environmental policies. Environmental policies developed to solve a particular local environmental problem may be effective, but from the perspective of regional or global environmental problems, the environmental policies may create a bigger, longer-term and often irreversible environmental problem. The reverse holds true where some environmental policies deemed benign to the global or macro-environment could have detrimental impacts on the micro-environment. The environmental damage on the macro-environment is facilitated by technology transfer, improved communication and often by technical assistance or demonstration projects. For instance the use of tall smokestacks is well documented in literature⁹¹. They address local air pollution problems caused by coal fired power plants and the subsequent acid rain impact and damage on the regional scale, which are bigger and extended for a longer term than the local environmental impact

Unlike the subject of economics where the art of analysing causes and effects is well-established, environmental science is a new field of knowledge and the methodologies for policy development are still undergoing revolutionary changes. In a number of instances,

⁹⁰ Paul Samuelson and William Norhaus (1989) *Economics*, McGraw Hill, New York. at page 309-311. This section gives a brief description of the cause and effects of monetary policy on economic inflation and depression.

⁹¹ R. D. Ross (1972a) *Air Pollution and Industry*, New York, Van Nostrand and Reinhold. at pp. 423-428

environmental policy-makers have to address issues less than 20 years old without any precedent, unlike in economics where a large number of economic cycles have been so thoroughly studied and analysed that for almost 70 years that now the “boom and bust” cycle can be avoided. It is not unusual for environmental policy-makers even to grapple with the definition of new terminology such as “sustainable development”, “joint implementation”, “clean development mechanism”, “zero waste discharge” and the like. While the delineation between macro-economics and micro-economics is defined, the difference between macro-environment and micro-environment is so vague that often the environmental decision-maker does not bother to differentiate between the macro-environment and micro-environment. For analysing causes and effects, the environmental decision-maker finds it more convenient to use an imaginary boundary covering the region of interest. This imaginary boundary, referred to as system boundary, could be as large as the whole solar system when analysing the impacts of the sun on the earth or of microscopic size when analysing the impact of a particular pollutant on micro organisms. Basically, the environmental decision-maker divides the environment into the environment analysed (environment within the system boundary) and the external environment (environment outside the system boundary). Politicians, lawyers, and environmental economists involved in the development of environmental policies and legislation do not even bother to define the boundaries in analysing the impacts of their policies and legislation. They presume that the environmental policies will have general applicability and beneficial impacts on both the macro and the microenvironment.⁹²

The concept of system boundary may not come up during the deliberation on environmental legislation in parliament or congress, but it is a basic concept that the technical committee members use formally or informally in developing the scientific aspects of the

⁹² Ely Anthony Ouano (1990) Environmental Pollution Due to Environmental Protection. *Asian Environment*, 12, 20-29.

draft environmental legislation or policy. In almost all instances, the environmental scientist limits the analysis to the environment within the system boundary. It is important, however, to analyse the external environment in order to foresee apparent contradictory impacts of the environmental legislation and policy being developed. The policy-maker or lawmaker, being aware of the potential contradictory impacts of the proposed environmental law or policy, will be in a better position to decide on the ultimate provisions of the law and policy.

In the analysis of complex systems like the environment, it is important to define the scope of analysis and the region affected; otherwise, the analysis will bog down on minor details that have little relevance. In order to define the scope of analysis and the affected region, it is important to isolate them so that their behaviour could be studied thoroughly. Basically, the researcher focuses their attention on the phenomena within the system boundary and considers the phenomena outside it as sink or background. The decision-maker may try to influence the output of the various phenomena within the system boundary by various economic and legislative policies, which in the scientific community are commonly called the “control variables”. The system boundary is equivalent to the agenda in a meeting, or legislative program in parliament, or decision framework in management. Without an agenda, the meeting could aimlessly move from one topic to another, and at the time of adjournment, the body could not come up with a useful outcome or recommendations. While the scientific community would like to quantify the outcomes of the various phenomena within the system boundary, a number of factors, especially those related to the environment, are unknown and often very difficult to quantify.

Qualitative methods of analysis such as past experience, perception or gut feel, precautionary principle, expert opinion, social acceptability, consensus and majority decision are often used in developing the economic and legislative policies to protect and improve the

environment. In adopting qualitative methods, the system boundary becomes less defined, as the analysis will depend on the breadth and depth of the decision-makers' past experience, their capacity to take risks and their interactions with the other decision-makers. Nevertheless, in order to arrive at a useful and enforceable policy, the decision-maker has to define the scope and region to apply.

As environmental concern and knowledge expands, the system boundary for decision-making also expands. The system boundary has been expanding for most disciplines. For example, in environmental health, when Pasteur discovered the relationship between micro-organisms and diseases, the system boundary was the person's body and concern was directed towards personal hygiene. After the great typhoid and cholera epidemics of the late 19th century, the system boundary was expanded to cover the community, and concern was focused on community health and environmental sanitation. When R. Carson published her book in 1962,⁹³ "Silent Spring", the system boundary was expanded to the regional and continental levels.

In a number of environmental issues, the system boundary covers the global environment, although in developing policies, decision-makers continue to limit their concerns to localized issues, often of concern to their electorate. As a result, policies are developed at local levels which often have contradictory results on the global scale.

As the system boundary expands, the limitations of the original environmental policy and laws become more evident. For example, in addressing stream pollution, water pollution laws, effluent and receiving water standards are developed and enforced. The decision-

⁹³ Rachel Carson (1962) *Silent Spring*, Houghton Mifflin, Boston.

maker's response is to install wastewater treatment plants to remove the impurities from the wastewater prior to discharge into the water body. The environmental laws and policies requiring wastewater treatment plants are effective in solving the water pollution problem. However, in expanding the system boundary to simultaneously consider land, air and groundwater pollution, the decision-maker may find that the wastewater treatment plants merely increase the air and land pollutant load by concentrating the pollutants in the wastewater in the sludge or air pollutant when the sludge is incinerated. Today, decision-makers are calling for multi-media pollution control rather than media-specific pollution control such as water, air and land pollution.

While the system boundary method facilitates the technical analysis and the deliberations that ultimately result in the development of environmental laws and policies, the impacts of those policies on the region outside the system boundary are often ignored; and if ever the impacts are considered, they are looked at as a background or phenomenon outside the system boundary. The environmental laws and policies developed often focus on a particular problem and region as defined by the system boundary. In a number of instances, this boundary is defined by the organizational structure of the institution developing the environmental laws and policies. For example, the Ministries of Environment are traditionally divided into water, air, land, environmental assessment and administrative support. In addressing the water pollution problem, the water pollution control department automatically defines the system boundary to exclude air and land – where it has no authority and expertise. Subsequently, the water pollution control laws and policies developed will not consider the potential negative impacts on air and land, but will only highlight the positive impact on the water resources. Even when the draft water pollution law is discussed in the cabinet and parliament, the discussion is strongly influenced by the technical report and will seldom

deviate to consider the potential negative impact of the decision on other environmental resources.⁹⁴

The negative environmental impacts of environmental laws and policies, which could exceed the positive impacts of well-meaning regulations, are widely recognized today. In recent years, the concept and methodology of Strategic Environmental Assessment (SEA) is being adopted by a number of governments, specifically Australia, and the member countries of the European Union⁹⁵, to systematically analyse the potential negative impacts of policies, plans and programs on the region outside the system boundary. We are currently witnessing the evolution of two distinct levels of environmental policy in response to the potential environmental impacts. The environmental impact assessment (EIA) is project-specific and tends to define the rules governing the science or art of the micro-environment, while the strategic environmental assessment is evolving to define that of the macro-environment. However, one of the major obstacles in the evolution of macro-environmental policy is the strong influence of the EIA process on the SEA.⁹⁶ One of the main, and the most commonly used, SEA techniques is the EIA-driven technique wherein the EIA process and procedure are directly applied to environmental policies, plans and programs. However, a number of environmental policies that have been in place for a long time have almost been accepted as postulates to sound environmental management practices. For example, it is an accepted

⁹⁴ Refer to a good discussion by Irwin Francis (1991) *An Integrated Framework for Preventing Pollution and Protecting the Environment. Environmental Law at Lewis Clark Law School*, 22. See also J. Krier and M. Brownstein (1992) *On Integrated Pollution Control, Environmental Law at Lewis Clark Law School*, 23. at p. 119

⁹⁵ Riki Therivel (2004) *Strategic Environmental Assessment in Action*, London, Earthscan Publication Ltd. This book reviewed and analysed the SEA practices worldwide with special focus on the EU .

⁹⁶ David Annandale, John Bailey, Ely Anthony Ouano, Warren Evans, Peter King (2001) Potential Role of Strategic Environmental Assessment in the Activities of Multi-lateral Development Banks. *Environmental Impact Assessment Review*, 21, 407-429. This paper briefly reviewed the various types of SEA as it applies to various stages of non-physical projects such as policy reforms, institutional reforms, programming and planning. The World Bank maintains an online site on country environmental analysis. The site could be accessed at World Bank (2001) *Country Environmental Analysis*. webpage at <http://www.countryanalyticwork.net/> accessed on November 15, 2006.

dictum that for sound environmental management, biodegradable wastes are preferable to non-biodegradable wastes. The dictum may hold true when solid wastes are analysed using the city and the surrounding region within the system boundary, but when the system boundary is extended to consider global warming and ground water pollution, the contrary holds true.

Tall Smokestack as an Example

Power plants and combustion processes that use high sulphur fuel generate large quantities of sulphur dioxide. The sulphur dioxide combines with water in the air to form sulphurous acid. In the presence of fine particulates and/or salt, the sulphurous acid reacts with the oxygen in the air, forming sulphuric acid, which is a stronger and more corrosive acid than sulphurous acid. The sulphuric acid corrodes important historical monuments made of marble, weakens concrete structures, increases the corrosion of metals, kills plants and increases respiratory diseases in humans as well as animals. One of the common atmospheric phenomena is the presence of an inversion layer, which practically isolates the air mass close to the ground level. Air pollutants discharged above or close to the inversion layer are carried over long distances before they are deposited in the ground. In developing regulations to control the negative impacts of sulphur dioxide emissions from combustion processes using high sulphur fuel, the upper limit of the system boundary is the inversion layer; the sides are defined by the physical boundaries like a mountain or sea, and the lower boundary by the land surface. In this particular case, the system boundary is also called the “airshed”.

In building tall smokestacks to control the negative impacts of sulphur dioxide emissions in the vicinity of the power plant, the decision-makers often believe that the sulphur dioxide will be diluted to a very low concentration in the atmosphere so as not to cause any

damage. The sulphur dioxide emitted has to be within the assimilative capacity of the environment to be incorporated into the natural cycle, specifically the sulphur cycle. After all, sulphur dioxide is commonly found in nature from volcanic eruptions and forest fires.

An increase in rainwater acidity is noted downwind of the smokestack. The initial impact of acid rain on forest and vegetation is deemed positive. The increase in rainwater acidity increases the decomposition rate of the soil and the leaching of essential minerals, resulting in a higher level of available nutrients. The vibrant forest growth is noted.

On the other hand, while the sulphur dioxide concentration in the rainwater is very low, when the rainwater evaporates, the sulphuric acid is concentrated, destroying the leaves. The rapid decomposition of the soil destroys the soil structure. The high soil acidity reduces the decay rate of organic material in the soil and the recycling of essential nutrients. The overall cumulative impact of the tall smokestack is negative to the environment outside the system boundary, but highly beneficial to the environment in the immediate vicinity of the power plants.

The use of tall smokestacks to improve the air quality in the immediate vicinity of the power plants and industries emitting large quantities of sulphur dioxide is included in the regulations of most environmental management authorities. As late as 1988, the United States environmental authorities were questioning the negative impacts of tall smokestacks and resisting the request from Canada to change the policies and control strategies.⁹⁷

⁹⁷ J. Britton, and H. Dale (1995) Canadian Coalition on Acid Rain. seen 25 November 2005 at <http://library/waterloo.ca/discipline/SpeColl/acid> and L. Parker (1994) Implementing Acid Rain Legislation, The Committee for the National Institute for the Environment, Congressional Research Service. accessed on October 12, 2004 at http://www.cnle.org.nle/air_8html.

Other examples on the contradictory nature of local and global environmental policies are the so-called hydrogen economy, the use of biodegradable materials and the conventional wastewater treatment plants. Hydrogen is a carrier of energy. The hydrogen in the air is too dilute to be used as fuel. Hydrogen is produced by breaking water into hydrogen and oxygen. In the city, air pollution is minimized using hydrogen-fuelled cars. The emission from a hydrogen-fuelled car is simple water. However, the energy to break the water into hydrogen and oxygen may come from a coal-fired power plant that emits carbon dioxide and nitrogen oxides that are well-known greenhouse gases. On the global scale, the hydrogen-driven car contributes to global warming, although it reduces air pollution in the city.

Strategic Environmental Assessment

The EIA is a valuable tool for incorporating environmental issues into the design of individual projects but it does not deal with the cumulative impacts, indirect impacts and large-scale effects. The EIA process is focused on a project and its impact on the immediate environment. With concerns for sustainable development in recent years, the shortcomings of the EIA process have become more evident. The EIA is beset with a number of weaknesses and limitations particularly the relatively late application of the process to the project and the resultant lack of choice of alternatives. Although an EIA report normally has a section on alternatives, the analysis of the alternatives considered is often limited to the components of the project, the do-nothing alternative and alternative technologies. Very often the alternatives will not look at the basis of the project or the timing of the project implementation with

respect to cumulative impacts of related activities. The need to evaluate the environmental impacts of all initiatives affecting the environment directly or indirectly has resulted in the development of the SEA. Although SEA was practised informally to some extent in the decision-making hierarchy other than projects, the systematic growth of interest and development of the SEA process has taken place only during the last 5 years.

The status of SEA application today is similar to the status of EIA application to projects in the late 1970s. While there is a strong group of proponents for the concept, full integration of the SEA into the bureaucratic process has not occurred. Commentators tend to agree that there are three main benefits associated with adapting SEA into the policy, programs and plans (PPP), namely, moving towards sustainability, strengthening the project EIA and addressing cumulative and large-scale effects. Sadler and Verheem⁹⁸ looked at SEA as a process to incorporate environmental objectives and considerations into the upstream part of the decision making process where, traditionally economic, fiscal and trade policies guide the overall course of development. The SEA process allows environmental factors to be taken into account as early as possible in the planning process to avoid irreversible environmental damage or costly reformulation of the project than what could be done with the EIA. Ouano⁹⁹ noted that by taking a comprehensive view of a sector or region's development, the cumulative impacts of multiple investments and impacts of relevant PPP could be analysed. The SEA process is equipped to deal with indirect impacts; Therivel and Partidario¹⁰⁰ list those impacts that the SEA can deal with and include:

⁹⁸ B Sadler and K. Verheem. (1996) *Strategic Environmental Assessment: Status, Challenges and Future Directions*, Ministry of Housing, Spatial Planning and the Environment, The Hague, The Netherlands

⁹⁹ Ely Anthony Ouano (2001) Country Environmental Analysis. Washington DC, World Bank , [http://lnweb18.worldbank.org/essd/envext.nsf/41ByDocName/SummaryofWorkshopProceedings200239KBPDF/\\$FILE/CEAWorkshopSummaryWebVersion2002.pdf](http://lnweb18.worldbank.org/essd/envext.nsf/41ByDocName/SummaryofWorkshopProceedings200239KBPDF/$FILE/CEAWorkshopSummaryWebVersion2002.pdf), accessed on September 21, 2005

¹⁰⁰ Riki Therivel and Maria Partidario (1996) *The Practice of Strategic Environmental Assessment*, London, Earthscan Publication Ltd. at pp. 1-3

- (i) induced or secondary impacts and tertiary impacts arising from other developments stimulated by the project; and
- (ii) synergistic and additive impacts of several small projects where the combined effect of the impacts is far greater than those proposed for each individual projects.

Types of SEA

There are four major types of SEA, namely, sector environmental assessment, regional environmental assessment, policy environmental assessment and programmatic environmental assessment. Sector environmental assessment is the most common SEA. It involves examining the potential environmental implications of the widest range of potential projects that could be proposed or are proposed for the same sector. For example a SEA conducted for the forestry sector will consider first the goal and then the potential projects that could be proposed in the sector. The SEA study will then review the existing activities and projections of the need for expansion or reductions activities and the new technologies that may replace the technologies used in existing activities. The options do not necessarily fall under the conventional definition of the sector. For example, development of alternative construction materials to wood, and collection of rubbish wood for chipping could be alternatives that will be evaluated in the forestry sector. Without being site-specific, the sector SEA could include a list of three types of projects, namely, projects that will be prohibited or discouraged, projects that would be promoted and “neutral” projects. The sector environmental assessment influences the project selection – an option that could not be done with the EIA since the EIA is project specific. The EIA is carried out once the project has been identified. Aside from affecting the choice of alternatives, the sector environmental assessment provides a stronger justification for the project in terms of the sectoral goals, the interrelationship of the project’s

environmental impacts to environmental impacts of other proposed and existing projects in the sector plus the timing and cumulative long term impacts.

The regional environmental assessment is the process of determining the impacts of multi-sector developments within a well-defined geographic area over a certain time. Delineation of the geographic sector could be based on ecological boundaries such as forest area or watershed; or socio-economic boundaries such as industrial areas or residential areas; or administrative boundaries such as state, county or city. Regional environmental assessment is usually used when an undisturbed or relatively pristine area is likely to be subjected to intense development pressure for the first time or when an area is proposed for major development. The regional environmental assessment is often carried out in conjunction with a regional development plan and could assist in shaping the investment priorities and activities. As regional development plans are continuously evolving, the regional environmental assessment would often become part of the updating process than a one-time exercise and may be more frequently used than the sector environmental assessment.

Policy environmental assessment means integrating the environmental concerns and issues in the policy conceptualization, debate and amendment. As Sadler and Verheem¹⁰¹ noted, there is at present no consensus how environmental assessment could be easily applied to policy proposals. Policy environmental assessment procedures are greatly affected by the intricacies of the policy making process used by an organization or a government. Policy environmental assessment could take the form of debates and discussions among the policy and decision-makers or elaborate technical analysis of the environmental implications of a policy proposal. Once the policy is translated into programs and later into plans, the results of

¹⁰¹ Sadler, B. and Verheem, R. (1996) *Strategic Environmental Assessment: Status, Challenges and Future Directions*, Ministry of Housing, Spatial Planning and the Environment, The Hague, The Netherlands

the policy environmental assessment are translated to operation and later incorporated in the EIA at the project level. Often casual examination of policy such as interest rate policy may give the decision-maker an impression that the environmental impact is minimal. However, the secondary and even tertiary impacts of the policy may result in significant environmental impacts. For example, tightening the monetary credit as applied in the Asian economies during the 1997 crisis resulted in a number of factories forgoing the operation of their waste treatment facilities. Workers were rendered jobless by the economic slowdown and were forced into marginal forestland, often resorting to slash and burn agricultural practices to survive. Policy environmental assessment will also assure consistency of the environmental impacts of various policies. A number of policies are focused on a particular topic such as mining, forestry and fishing whose impacts on biodiversity could be negative. Requiring a policy environmental assessment will highlight the environmental concerns and conflict of the proposed policy that would have normally been overlooked in a traditional policy making process. The unstructured nature of policy environmental assessment may not satisfy environmental pressure groups. Decision makers could merely go through the policy environmental assessment process as a mere formality but the simple fact that environmental concerns are highlighted and the decision makers are held responsible to consider future negative impacts of the policy is a much needed improvement over the traditional policy making process.

Programmatic environmental assessment is also commonly known as programmatic EIA and in fact experts are debating whether programmatic environmental assessment is a type of SEA. Programmatic environmental assessment is applied to groups of projects that have technical and geographic similarities and therefore the analysis tends to be site specific rather than strategic. Since programmatic environmental assessment is site and technology specific, the standard EIA procedure is commonly used.

SEA Methodology

Policies, plans and programs (PPP) must be defined properly before any SEA methodology and guidelines could be developed. PPP vary in different countries, organizations and discipline. PPP are developed and implemented at all levels in an organization depending on the assigned task and at all stages of project implementation. Examples of PPP after project completion include operating and maintenance policies, evacuation and emergency plans, and rehabilitation programs. Therivel¹⁰² states that policies are inspiration and guidance for action, plans are sets of coordinated and timed objectives for implementing the policy and programs are group of projects in a specific area. SEA is generally applied to PPP in the macro-level before the project. As the main purpose of the SEA is to bring environmental assessment as early as possible in the project cycle, the policies normally covered by an SEA are:

- (i) legislation;
- (ii) cabinet and ministerial ruling;
- (iii) implementing rules and regulations;
- (iv) international conventions, treaties and declarations; and
- (v) bilateral agreements between two sovereign States.

A number of policy statements by the government are held confidential because of their sensitive nature such as monetary policy. Nevertheless a SEA could be done by the staff and discussed by the decision-makers before the policy is made.

¹⁰² Riki Therivel (2004) *Strategic Environmental Assessment in Action*, London, Earthscan Publication Ltd.

There are two main schools of thoughts in the SEA methodology.¹⁰³ The first school is based on the traditional EIA or is EIA driven. The SEA is done only when or after the PPP has been proposed. The traditional steps and procedures of an EIA are followed – such as scooping, identification, prediction and evaluation of environmental impacts and development of mitigating measures to overcome or minimize the expected environmental impacts. A public document will be produced and public hearings carried out to solicit ideas and opinions. The PPP may be revised depending on the outcome of the public hearing and the SEA documentation. This method is useful for plans and programs where typical projects, location and activities are already identified but is difficult to apply to policies. The programmatic environmental assessment follows this procedure and environmental groups and professionals tend to favour this procedure because of their familiarity with the EIA process.

The second school of thought is the sustainability led or integrated model. The main objective of a SEA using this method is to integrate environmental consideration to all stages of decision making before the actual decision is made. The objective is not the production of a SEA report for the public and the decision-makers to consider. This approach is normally used in policy development and for plans and programs that have a very high level of abstraction and uncertainty. For example, state plans and programs to protect biodiversity may be too abstract to use an EIA driven SEA. An example is a plan to increase the parks and forestland by 10 per cent with the next 10 years within particular emphasis on increasing the buffer zone to existing protected areas. In line with this plan will be a program to involve phasing out a number of activities in the buffer zone, acquiring more lands, and other similar solutions which are abstract, tentative and full of uncertainties. The SEA procedure will be

¹⁰³ David Annandale, John Bailey, Ely Anthony Ouano, Warren Evans, and Peter King (2001) Potential Role of Strategic Environmental Assessment in the Activities of Multi-lateral Development Banks. *Environmental Impact Assessment Review*, 21, 407-429.

informal and will vary depending on the development trends as determined by the political agenda. In fact, a written document may be considered too formal and rigid to respond to the changing development priorities.

Plans and programs could use both the EIA driven and integrated methods for SEA as discussed earlier. The approach to utilize for plans and programs will depend to a large extent on the context, time and resources available, the stage of development of the PPP and organizational procedures for developing the PPP. Plans and programs developed in initial response to a new policy are often conceptual in nature and it would be economically inefficient to allocate time and resources to gather extensive sets of data and information on the environmental impacts at this stage. Experts' opinion, literature, and debates with the precautionary principle as a guide are often sufficient. Some organizations may be hesitant to release plans and programs at the conceptual stage. But other organizations will take the release of the conceptual plans and programs as an invitation for the public, private sectors, and other interested parties to comment and participate actively in future activities. A rigid and well-defined plan and programs may turn off the public, private sector and other interested parties. Their interests and concerns will be difficult to include and integrate in the plans and programs. As the plans and programs mature, the activities and location could become more site specific and the SEA process also evolves gradually to the EIA driven approach. The EIA driven approach could also be utilized in evaluating the environmental impacts of existing policies, plans and programs. Considering the number of existing policies plans and programs whose indirect environmental impacts have not been evaluated, there is a huge backlog for SEA application in those areas.

There is an apparent contradiction in the environmental impacts of policies on the micro-environment and the macro-environment. The environmental policy may have

beneficial impacts on the micro-environment and detrimental impacts on the macro-environment and vice versa. The problem is exacerbated by the tendency to treat the micro-environment and the macro-environment separately, and in the case when there is a desire to analyse the environmental impacts of policies, plans and programs on the macro-environment, the tools used are similar to those used in analysing the environmental impacts on the micro-environment such as the EIA-driven methods for SEA. Realizing the contradictions of environmental policies on the macro-and micro-environment, I foresee the evolution of a whole new field of study on the macro-and micro-environment policies as has taken place in the field of economics in the 18th century. The most interesting aspect of macro-and micro-environmental policies is not the divergence and contradictions of the two fields as described in this paper. Of greater interest is the complementary nature of the causes and effects of macro-and micro-environmental policies on the overall environment. For example, the macro-environmental policies could be manipulated to control the behaviour and response in the micro-environment, in a similar manner that macroeconomics policy such as monetary policy could be used to control consumer spending at the microeconomics level. The carbon tax is an example of a macro-environmental policy tool to control impacts at the micro-environment level by suppressing energy consumption from hydrocarbon sources. The extensive use of market-based instruments in environmental policy today compared with command and control policies would facilitate the use of macroeconomics and microeconomics concepts and principles in the evolution and development of macro and micro-environmental policies. The contradictions between the two will continue and will persist, but by knowing the contradictions, decision-makers will have a better control of the environmental variables especially those that have negative impacts.

One of the distinguishing features of human civilization is the continuous struggle to improve tools. Initially tools were used for survival, primarily for food gathering and fending off predators. Later, tools were used for comfort, aesthetics and prestige.

Man is also in continuous competition and cooperation with fellow men for scarce resources. Most of the significant improvements in tool-making and their subsequent use in agriculture and infrastructure building were related to warfare. The knowledge and skills in improving tools and materials were derived by trial and error. The accumulated knowledge and skills were handed down from one generation to another, often within a selected group or family. The group responsible for preserving and improving the knowledge and skills often covered their activities with mysticism and rituals to maintain their power and prestige.

Towards the end of the Middle Ages, the causes and effects of natural phenomena were studied in a more systematic manner. In a number of instances, the cause and effect followed simple rules which later evolved into the various laws of physics and chemistry. Subsequently, the art of tool-making became more systematic, based on the laws of physics and chemistry. Such that tools built on the same set of principles were expected to have equal performance.

Later, scientific rules superseded the rituals and rites. In the last 500 years, human tools have grown in sophistication and functions. Today, we have human tools producing and developing other human tools. In tool-making or technology as it is more commonly called today, the mystic rituals have been replaced by scientific procedures. If the scientific procedures are followed, the results must be the same or at least similar.

It is not surprising that when “clean technology” was proposed in the middle of the 1980s, scientists and engineers considered the technology as just another technological innovation whose time had come. The decision to implement clean technology was made in a similar manner as any other technological innovation. First, the technology must be tested in the laboratory to establish the different laws of nature governing the movement or reaction taking place. Then a demonstration or pilot test is carried out to test various variations, establish the limitations of the various parts, and optimize the operation and interactions of the various components. The results of the demonstration projects are then assigned costs and a feasibility study is sent to management for decisions. Management looks at the financial, technical and market factors as well as the competition and decides to either implement the changes, ignore the recommended changes or call for additional studies to be made before implementing the change.

Reasons for the failure to implement cleaner production include the need for additional studies to establish the financial, technical and market response as if a new product is produced, or the new product is a unique variation of the existing product. As cleaner production normally involved the production of similar products which are of better quality, technology transfer is concentrated on demonstration projects and project financing. If cleaner production is not accepted, then additional demonstration projects must be carried out. If the possibilities for demonstration projects are exhausted, then the problem must be in financing. Grants, soft loans, long-term loans and other financing options are needed. As discussed in Chapter I, this paradigm of demonstration projects and financing packages does not guarantee that cleaner production is in fact implemented, much less to say that it will be successful.

As discussed in the previous section, the discharge standard is not a sufficient incentive for a waste discharger to use cleaner production. In fact, the waste discharger is

inclined to overuse environmental resources such as water to dilute the waste stream and thereby comply with the discharge standard. On the other hand, the waste load-based environmental standard is directly linked to a specific type of process; therefore, it is to the waste discharger's advantage to adopt cleaner production to reduce the waste quality and quantity.

The second condition for cleaner production to succeed is the presence of a competitive market. In the absence of a competitive market, the monopolistic waste discharger will completely ignore the environmental standard and guidelines especially if the discharger supplies a product with high social value such as staple food, or employs a large number of unskilled and semi-skilled labourers who will have difficulty in finding alternative livelihoods.

Chapter VI includes a detailed discussion of the impact of monopolistic industry on the enforcement of environmental laws and regulations, and presents the sugar industry in the Philippines as a case study. Chapter VI also discusses strategies in weaning monopolistic industries from the "business as usual" practices and encouraging them to use cleaner production.

Cleaner Production and Market-Based Instruments

The traditional concept with respect to the use of environmental resources is based on the free use of the resource. Resource management and allocation imposed additional obligations on the user to preserve the resource quality and quantity in a way that imposed an

additional cost or burden on the other users.¹⁰⁴ In recent years, preservation of the resource quality and quantity has been extended to the future and/or intended use of the resource as discussed in the previous section. In all these stages of the development of environmental resource management, the environmental resource is still considered free.

In the mid-1960s, resource economists started placing some monetary value or shadow pricing on the resource. Valuation of environmental resources was considered very controversial as there was no financial transaction that was at all related to the environmental resource. The results of the shadow pricing analysis were dependent on questionnaire results and various trading scenarios. Knowing that they were not going to make actual payments, the interviewed subjects often quoted ridiculously high prices or the willingness to pay for the resources.

In spite of all the concerns on the depletion and pollution of environmental resources, current pricing policies place practically no value on the resource itself. Prices are normally based on the cost of storing, transmitting, treating and distributing the environmental resource. Prices are primarily based on the cost of making the resource available where it is needed and when it is needed. Primarily, the price of a resource and commodity is profit plus the cost of production, distribution and marketing. This pricing principle is not only used for environmental resources, but even for non-renewable resources such as metals, energy, forest products and even commodities. For resources other than environmental resources, scarcity factors or constraints in the supply chain may temporarily increase the price above the cost of production, distribution and marketing. Conversely, in time of oversupply, the price may go below the cost of production, distribution and marketing.

¹⁰⁴ A good example is the riparian rights on the use of water. While riparian rights are concerned only with the use of the water and do not grant ownership, limited abstraction or reduction in quality and quantity is allowed.

Environmental resources are considered as being in oversupply most of the time, and even in periods of scarcity – such as water during a drought – placing a premium on the resource is seldom done. Environmental resources are considered a basic resource needed for human survival or for living. Governments will employ other strategies to supply the environmental resource where it is needed and when it is needed. While governments are reluctant to acknowledge the reality that environmental resources have values higher than the cost of production, distribution and marketing, private corporations have seized the opportunities of the public willingness to pay a premium for environmental resources. For example, in cities with high air pollution levels, private companies and entrepreneurs have opened oxygen bars. Bottled water is a major commodity even in cities with good potable water supply systems such as Sydney, Australia.

As discussed in Chapter III, this pricing principle has a serious impact on the implementation of cleaner production, especially for cleaner production processes using recycled and reused materials.

While it is acknowledged that government pricing policies do not reflect the real value of environmental resources to the users, there is a growing concern that government's physical interference in the distribution of environmental resources through a system of standards, fines and penalties¹⁰⁵ will be rendered unworkable in societies where the interactions of the various users are very complex and difficult to model or quantify. As discussed earlier, the waste load standards and allocation require extensive modelling, monitoring, database management, communications and strong enforcement mechanisms to

¹⁰⁵ Direct government control in environmental management through a system of standards, fines and penalties are known as "command and control". The government commands the users to treat their wastes to the specification of the standards and compliance is controlled by a system of fines and penalties.

function. Under the command and control system, the government or its agencies will only have to monitor the users' compliance, and in case of violations, to bring the violators to the judiciary or adjudication to extract the fines and penalties.

Market-based instruments are fiscal or monetary sets of incentives and disincentives for the users to collect from the government and other users in order to meet the environmental management objective. Market-based instruments could be in the form of environmental resource tax, discharge permit pricing and trading, and/or tax credits.

Environmental resource taxes are attempts to place a value on the environmental resource above and beyond the cost of production, distribution and marketing. They are often estimated based on the cost of providing additional infrastructure to secure the availability of the environmental resource. For example, the water tax may go to a specialized fund for the rehabilitation of watersheds, or even controversially, the construction of new dams.

In a number of instances, the environmental resource tax is imposed to control wastage. For example, Sydney Water imposed a water conservation policy by banning water sprinklers and limiting the time for watering the gardens using hand-held hoses. This is an example of command and control regulation. Councils have employed full-time staff to monitor their jurisdiction and apprehend violators. In addition, the councils are dependent on neighbours reporting on their neighbours violating the restrictions. While the measures have reduced water consumption, their effectiveness was more apparent in the social consciousness of the citizenry. Considering the rampant violations occurring within the community, it is only a question of time when social consciousness will wear thin. The additional cost of monitoring is never fully recovered from the current apprehension and conviction rate.

Market-based instruments will determine and set the reasonable water consumption level and place the exponentially increasing water rates for consumption above the reasonable consumption level. Large families could apply for larger levels of consumption. The family size could be checked against the electoral role or the census data. Under this approach a person could water their garden at will, provided they pay for their extravagance. The government thereby collects more funds which could then be used to develop other water resource schemes, such as drilling bore holes for watering open spaces and common areas under council control.

Under a market-based system, the government determines the assimilative capacity of the environment over a particular period and sells it to the users through a bidding process. The time period will depend on the sophistication of the modelling system to predict the assimilative capacity and the monitoring system to measure the discharge rate from the users. The permit sold could be based on the allowable hourly discharge rate for the next 24 hours or may be considered valid for the next seven days. The users could sell the unused assimilative capacity to other users who have difficulty in treating their wastes in accordance with the purchased assimilative capacity. The buyer could then use the purchased assimilative capacity to meet their obligations.

Under the market-based system, the environmental resource is not free, although it is still available to the public. The government, as the representative of the public, sells it to the users and uses the funds to further develop and protect the environmental resources. The user has the option of building large holding ponds to store the wastes and waiting for a period when the cost of the assimilative capacity is low, such as after a big storm. If the storm does not eventuate and the holding pond is full, the user will have to buy from the other users or

the market for the additional assimilative capacity to fully or partially empty the holding pond. Under this condition, they may have to pay a higher price.

In a fully developed market for assimilative capacity, a futures market will allow users to hedge their potential loss, resulting from the high price of the assimilative capacity. The industry with wastes that are difficult to treat will buy the needed future assimilative capacity at an agreed price. It will be to the advantage of the industry with wastes that could be easily treated to sell part or all the potential assimilative capacity in the market to protect their income from unforeseen natural events. In the event of a drought, when the assimilative capacity of the river is very low, the user does not have to pay a premium as they have previously committed the seller to a particular price. In the event of a flood when the assimilative capacity is very high, the seller does not lose income from the sale of the assimilative capacity as he has previously fixed the price with the user. Normally, a serious player in the future market will balance the potential loss from the physical transaction with the trading in the future markets. However, there is no assurance that the speculators will not enter into the future markets and drive the prices of the assimilative capacity erratically.

The common opinion among experts is that market-based instruments will assist in the introduction of cleaner production. Market-based instruments, just like cleaner production, will only work if the market mechanism is properly functioning. As discussed in Chapter VI, the Philippine government introduced market-based instruments into the sugar industry, but the exercise failed because the industry functions as a monopoly within an environmental region.

An environmental region is often defined as the watershed for a water system, an airshed for air control and an ecological zone for biodiversity control. The boundaries of the

watershed, airshed and ecological zone may not coincide. The user adopting cleaner production will reduce their waste discharge, thus reducing the over-all demand for the assimilative capacity within the environmental region. With the reduction in demand, the price of the assimilative capacity will go down. Hence, users who do not adopt cleaner production will still benefit as the price of the assimilative capacity or its waste treatment cost goes down.¹⁰⁶ The government income from the sales from the assimilative capacity decreases as the unit price goes down with the demand, considering that the assimilative capacity is fixed over a particular period.

Market-based instruments will improve the use of cleaner production if the waste load is allocated to the users rather than being sold by the government. The user adopting cleaner production could sell the excess assimilative capacity to other dischargers who are having problems in treating their wastes. Again, the excess assimilative capacity going into the market will depress the unit value of the assimilative capacity benefiting the user who has difficulty meeting the standards and even the user who has low concern for the environment. Market-based instruments have to be crafted with other environmental management procedures in order to be effective in encouraging cleaner production.¹⁰⁷ More detailed analysis and discussion are carried out in Chapter VI with the analysis of the case study.

¹⁰⁶ Consider a case where all the users except for one have adopted cleaner production, thereby reducing their waste discharge to a very low level so that the combined waste discharge is even lower than the assimilative capacity. The lone user will not have to purchase any assimilative capacity and may even forego operating their waste treatment plant.

¹⁰⁷ Carolyn Fischer, Cees Withagen, and Michael Toman (2003) Optimal Investment in Clean Production Capacity, *Environmental and Resources Economics*, 1, 1-21. In page 18 the authors stated “If clean technology has a dominant advantage over the dirty technology and one’s pollution damage cost are internalized, then of course the clean technology will displace the dirty technology as soon as capacity can be accumulated (leaving aside other possible market failures related to technology diffusion that are not addressed in this paper). And if utilizing clean technology makes economic sense on in a highly polluted environment, it naturally follows that this technology will not have any future once the environment recovers.”

CHAPTER III

CLEANER PRODUCTION

Introduction

The previous chapter discussed the evolution of environmental management techniques and how cleaner production fits into waste load standards and market-based instruments for pollution control. While environmental management is multidisciplinary in nature, covering environmental science, economics, law, and social sciences, most practitioners of environmental management take a narrow view and often this is equated with pollution control. It is for this reason that innovations in environmental management such as cleaner production fail or have a limited success –environmental managers often fail to convey and convince the other stakeholders on the need to adopt their innovations. This chapter will review the principles behind and the evolution of cleaner production through waste minimisation, international agreements and national promotional initiatives in the Asia-Pacific region, together with the failure of these efforts.

Evolution of Cleaner Production

To better understand the analysis carried out in this chapter, it is worthwhile visualising any natural and anthropogenic process or activity in the context of the box diagram shown in Fig. 3-1. Taking wine making as an illustration, grapes, water, phosphoric acid, sulphur dioxide and yeast are the raw materials. Phosphoric acid is used for pH control;

sulphur dioxide to disinfect the fermenting vats and other utensils; and water for cleaning the fermenting vats and other equipment. The main product after fermentation is wine. The process is basically the conversion of the sugars in the grapes to alcohol and a mixture of trace aromatic compounds collectively called fusel oil. The fusel oil gives the distinctive flavour and aroma to the wine. The resulting by-product carbon dioxide could be used in the production of carbonated beverages and fire extinguishers. In most instances it is not economical to recover and market the carbon dioxide because the wineries are often located far from the potential users and as such it is merely vented into the atmosphere as wastes material. The other by-products such as grape pulps and peelings could be composted. The water from vat and equipment cleaning is included in the waste stream. The quality of the grapes is affected by the climate¹⁰⁸, soil, water availability and weather. The grape variety grown is dependent on the cultural preferences of the market and the quality of wine on the buyers' capacity to pay. The political system may try to discourage wine consumption by heavily taxing local consumption while at the same time subsidizing the production for export market. If there is an over supply of wine in the market, the price will go down. Wine producers may distil the wine and produce brandy and in extreme cases wine vinegar.

¹⁰⁸ Weather is short term changes in temperature, humidity, rainfall, wind direction and velocity normally evaluated in hourly, daily or at most weekly intervals. Climate is long term changes of the same factors with a minimum of 30 years cycles and up to 25,000 years cycles. Keith Colls and Richard Whitaker (2001) *Australian Weather Book*, New Holland Publishers (Australia) Pty Ltd., Sydney. Page 155 of the book gives a brief description of the definitions of climate used in meteorological research.

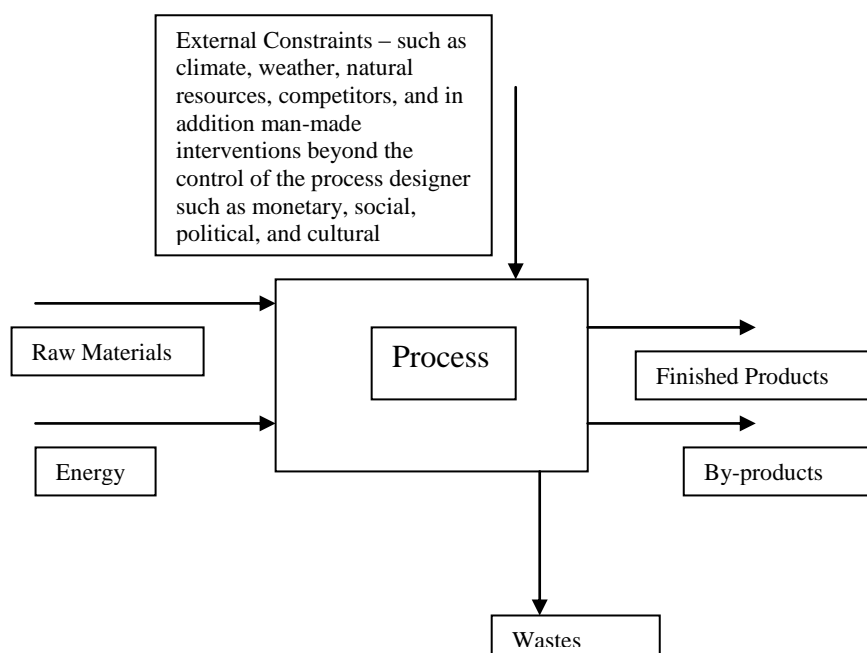


Figure 3.1: Simplified Diagram of Natural and Anthropogenic Processes

Natural and anthropogenic processes need raw materials and energy. In living organisms, the main energy source is the sun. Solar energy,¹⁰⁹ through the process of photosynthesis, converts inorganic compounds with low energy levels such as water and carbon dioxide to high energy organic compounds, mainly carbohydrates. Through the food chain or the prey-predator relationship, the carbohydrates or high- energy organic compounds are converted to plant and/or animal tissues with lower energy levels. Ultimately, at the lowest energy level, the animal and plant tissues are converted to carbon dioxide and water. In essence, a portion of the solar energy is stored in the high-energy compounds and ultimately released back to the atmosphere.¹¹⁰ In anthropogenic processes, especially industrial

¹⁰⁹ In isolated areas with high energy concentrations, such as deep sea thermal vents, living organisms are able to use the geothermal energy instead of solar energy to drive the food chain.

¹¹⁰ A portion of dead organic materials may be converted to hydrocarbons or coal by geological forces and stored underground for long periods. Natural processes such as underground fire, volcanic activities and plate movement as well as human activities recycle those materials back to carbon dioxide and water.

processes, the raw materials and energy are converted to finished products and by products. The raw materials in an industrial process may be agricultural products, minerals, or semi-finished products from other industries. Energy sources could be manpower, animal power, hydro power, nuclear energy or energy from the combustion of coal, gas and other fuels.

In recent years, manpower and animal power have been on the decline. As discussed earlier, all natural and anthropogenic processes have efficiencies of less than 100 per cent.¹¹¹ Wastes are unavoidable and unwanted output is present in all natural and anthropogenic processes, although the quantity of wastes could be minimised by improving the efficiency of the process. The maximum operational efficiency of a process is dependent on a number of external conditions. In natural processes, the external conditions are normally the environmental conditions such as climate, weather, soil fertility and water availability, and competitors. On the other hand, man-made processes operate under a number of human-imposed external constraints such as economic and financial, social, political, and religious policies in addition to the factors affecting natural processes. The policies may be in the form of legislation, decrees or executive orders. Some policies are well established and their origins or rationale are difficult to trace, but they have become part of human habits, norms, customs and traditions. The economic and financial policies commonly affecting the performance and efficiency of anthropogenic processes are taxation, financial subsidies and penalties, interest rates, preferential access to markets, import and export control, and foreign exchange valuation. The important social policies are employment practices such as retention and dismissal of labour, which affect the flexibility of the labour market, minimum wage, labour benefits, saving habits, purchasing preferences, education and training. Some political policies

¹¹¹ Refer to Chapter I for a short discussion on the laws of thermodynamics. While the first law of thermodynamics states that matter and energy could not be destroyed or created, the second law states that during the transformation from one form to another, the quality of energy is continuously degraded.

may involve the promotion of domestic production and nationalistic activities, national security and the role of the military and the police, the independence of the judiciary, control of corruption and promotion of good governance. Religious policies may control the timing and spending patterns with some festivities, the banning and/or preference for specific types of processes or products, the handling and control of wastes, and the pre-processing of the raw materials.

Process design and development is often considered the exclusive domain of science and engineering. The traditional and conceptual picture of the development of the process, even from ancient times, is the reclusive alchemist or inventor mixing a wide range of ingredients or the backyard eccentric fabricating weird machines. Businessmen and practitioners in other disciplines such as public relations or advertisement experts, legislators, and consumers' advocates become involved after the process has been well developed and ready for marketing or mass production.

The process development is considered to be a purely scientific and technical process, and intervention by other disciplines will only retard and impede the work. Even the investigation and analysis of natural processes are traditionally considered the domain of the scientist. While reviewing some of my lecture notes in environmental engineering from 32 years ago, I noticed that the external constraints were simply labelled "operating environment". The operating environment was limited to the physical and chemical conditions the processes will be operating in. It referred mainly to the weather, climate, and reserve of natural resources. The impacts of other disciplines and policies were neglected.

From the standpoint of environmental management, the main concern is the reduction of the waste generated. From Fig. 3-1, wastes could be minimised by improving the process

efficiency to produce more products and by-products, and by using better quality raw materials and energy sources. The improvement of the process efficiency has been a natural and long-term objective of research and development and in fact could be considered a human instinct or habit. Building a bigger and better machine or process even to the point of irrationality is an inventor's competitive justification for working day and night in often uncomfortable circumstances, in a similar manner as an artist or an athlete. Very few of the patented inventions are commercial successes, but inventors go on working for the recognition of inventing a better machine or process, even for something as simple as a mouse trap. Even when the patented invention is a success, most inventors simply return to their workshops to work on another invention.

Although modern processes are quite efficient compared to their predecessors at the start of the industrial revolution, the efficiency rates are still very low. For example, typical coal-fired power plants are still operating at efficiencies of 36 to 38 per cent; while recent developments in supercritical power plants are able to attain efficiencies higher than 50 per cent. In simple terms, approximately 50 per cent of the energy in the fuel is lost to the atmosphere, cooling water and mechanical friction, even in power plants designed and operated at supercritical conditions.

Since the improvement of process efficiency was the primary concern in reducing the waste stream, the concept was initially called "waste minimisation" or "clean technology". Later, to emphasize the positive environmental impacts, the concept was renamed "pollution prevention" and much later, "environmentally sound technology". As discussed later in this chapter, while improvements in process technology remains the focal point in reducing wastes, experts in environmental management have realized that other aspects of production such as management practices, policies, and environmental awareness play an important part

in reducing wastage. After all, the industry could be provided with the most efficient process, but if this is not properly maintained because of poor management or lack of appreciation of its proper operation and maintenance, it will not function properly. Hence, the use of the word “technology” is discouraged as being too narrowly focused.

The second priority in process development has been focused on the conversion of the waste into useful by-products. “Someone’s wastes is somebody else’s resource” is a common slogan used to promote the use of waste materials and to reduce, if not prevent, their disposal to the environment. The reuse of waste materials has a number of advantages over the use of new resources. For example, the use of waste paper for production of low grade paper not only conserves forest resources or the trees in the forest, but also reduces the energy and chemical requirements. The waste discharge to the environment is also reduced as shown in Table 3-1.

Environmental impact	Unbleached Kraft paper (brand new)	Using waste paper pulp	% change due to reuse of waste paper
Oven dried fibre required	1,000 tons	0	-100
Water consumption	90,000 cum	39,000 cum	-61
Energy consumption	5 million kw-hr	1.5 million kw-hr	-70
Air pollutants generated	42 tons	11 tons	-73
Water pollutants as biochemical oxygen demand	15 tons	9 tons	-44
Water pollutants suspended solids	8 tons	6 tons	-25
Solid wastes	68 tons	42 tons	-39
Miscellaneous¹¹² wastes	850 tons	250 tons	-71

Table 3-1: Comparison of the Environmental Impact of the Use of Recycled Paper ¹¹³

While the reduction in the waste discharged to the environment from the use of waste paper is very significant, most of the waste paper collected in developed countries is used to substitute fuel in cement and power plants. Paper has a lower heating value than coal, but

¹¹² Primarily from the fibre lost during processing.

¹¹³ Ueta (1991) Socioeconomic Evaluation of Municipal Wastes Recycling Schemes, *International Expert Seminar on Solid Wastes Management*, Bandung, Indonesia, United Nations Centre for Regional Development, Nagoya, Japan. Kraft paper is the material commonly used in making grocery bags, envelopes, and folders. Kraft is normally produced from wood with long fibres by digesting the wood in solution of sodium sulphate. When abaca or hemp is used instead of wood, the paper is called Manilla paper or Manilla envelope.

cement and power plant operators are paid for handling the “recycled” paper in addition to the fuel saved.¹¹⁴ While recycled paper is gaining acceptance even in packaging materials, the supply of recycled paper often exceeds the demand, since the demand is artificially suppressed through various taxation methods, quotas, social policies, and even environmental policies. The use of those factors to suppress demand will be discussed in detail in the next two chapters.

The third strategy in process improvement is to modify or change the raw material and energy source. If the raw material and energy source contain fewer wastes or chemicals with a potentially high negative impact on the environment, then the outgoing waste stream will be reduced or will be easily assimilated into the environment. The use of waste paper from offices, residences and commercial establishments is also an example of the reduction of the waste stream directed to the environment through changes in the raw material output. Another example is the use of ozone to bleach paper instead of chlorine gas. Chlorine reacts with organic compounds in the paper to form halogenated organics, which have properties similar to chlorine-based insecticides like DDT and are highly persistent in the environment. While ozone is not as effective as chlorine in bleaching the pulp, the main waste materials after bleaching are oxygen and excess ozone. Ozone is an unstable substance and after a few minutes it is reduced to oxygen. An ordinary oxygen molecule in the air contains two atoms of oxygen. Ozone, on the other hand, contains three atoms of oxygen, and for this reason it is unstable and reactive under room temperature.¹¹⁵ Ozone oxidises the organic material,

¹¹⁴ U. Treibsweller and U. Hitchene (2004) The Impact of Environmental Regulation on Competitiveness in the German Manufacturing Industry- Comparison with Other Countries in the European Union. *Journal of Cleaner Production*, 12, 21.

¹¹⁵ In a highly urban environment, ozone readily reacts with partially burnt hydrocarbons causing smog. The earth’s atmosphere is covered by an ozone layer produced from the interaction of oxygen and high energy solar radiation. The process acts like a screen preventing the high energy solar radiation from reaching the earth’s surface.

decolorizing the pulp in a similar manner as the dyes fading in clothes exposed to the air and sunlight. Chlorine is a much stronger oxidising agent than ozone.

It is often technologically more efficient and cost effective to treat large quantities of a material in a small area than small quantities spread over a large geographic area. This is commonly called “the economies of scale”. For example, it is easier to remove the sulphur from crude oil in the refinery, and market the recovered sulphur to chemical plants than to recover the sulphur dioxide from motor vehicles. It would be economically impossible to collect the few grams of sulphur that might be recovered from each motorist and market it. Aside from the cost of collecting the few grams of sulphur from the motorists, there is also a question of quality control. The quality of the sulphur recovered from individual motorists is affected by their individual traits and habits such as cleanliness, maintenance of the collection containers and storage.

Today, waste reduction also covers the product itself. The product is designed to facilitate the dismantling and segregation of recoverable materials to speed up the recycling and reuse. Parts of the products that are difficult to segregate are matched with materials which will have minimal impacts on the quality of the recycled materials. The automotive industry is a forerunner in product redesign with the objective of maximising recycling and reuse. One of the constraints in the recycling and reuse of the ferrous components in cars is the impact of copper and aluminium on the metallurgical properties of the recycled iron. The copper and aluminium impurities in steel reduce the ultimate strength. Steel made from old cars is used for non-structural purposes and the demand is limited. In old cars, it is very labour intensive to segregate the parts such as radiators that may contain aluminium or copper. However, even in developed countries such as Australia, scrap yards are still designed to merely squash the car for low cost recycling.

In countries such as Denmark, reusable packaging such as glass bottles is standardised to facilitate recycling and reuse. However, the standardisation of reusable containers to improve efficiency has been questioned in a number of cases as trade protectionism disguised as environmental measures. Standardisation of reusable containers effectively places external suppliers at a disadvantage since it is expensive for them to modify their manufacturing process to accommodate the variations, especially if the quantities requiring the change are very small. Danish law, on the other hand, allows the use of non-refillable bottles provided a deposit, return and recycling system is set up which results in the same outcome as the use of refillable bottles. The European Commission noted that the Danish laws allow foreign suppliers and manufacturers of goods packaged in non-refillable bottles to compete with Danish manufacturers and suppliers of similar goods provided they set up the necessary infrastructure to collect the empty bottles. However in practice there was no commercial possibility for the foreign competitors to build the infrastructure independent of the local companies.¹¹⁶ It is very expensive for foreign competitors to build and operate the recycling infrastructure for a very small volume of recycled materials.

A similar case in 1990 was decided by the High Court of Australia in favour of Castlemaine Tooheys Ltd.¹¹⁷ Since the 1970s, the use of non-refillable glass bottles in Australia for the sale of beer has increased at the expense of refillable bottles. There are very strong financial incentives for beer manufacturers to use non-refillable beer bottles – from lower initial cost of the bottles, lower plant and equipment cost and lower transport cost. To reduce the quantity of non-refillable beer bottles in the domestic solid wastes, South

¹¹⁶ Working Group of Experts (1990) *Use of Economic and Fiscal Instruments in the European Commission Environmental Policy*, European Commission, Brussels.

¹¹⁷ *Castlemaine Tooheys Ltd. v South Australia* (1990) 190 CLR 436 F.C. 90/001. High Court of Australia.

Australian parliament passed the Beverage Container Act 1975 (SA)¹¹⁸ that provided refundable deposit of A\$0.05 for every bottle of beer sold. The refundable deposit scheme effectively penalised the non-refillable beer by an equivalent amount. In January 1986, Bond Brewing Companies trading as Castlemaine Tooheys Ltd, embarked on a strong marketing campaign in South Australia capturing almost 10 per cent of the market and displacing the local beer brewers. The South Australian Parliament passed the Beverage Container Act Amendment (SA) Act of 1986¹¹⁹, increasing the refundable deposit from A\$0.05 to A\$0.15 per bottle on the contention that the quantity of non-refillable bottles going to the landfill was increasing and the A\$0.05 incentive to recycle the used beverage bottles was no longer attractive due to inflation in the past 11 years. While the title of the Act addressed the beverage industry in general, the Act continued to require a lower deposit for carbonated soft drinks, water, and mineral water at A\$0.05. The deposit for refillable beer bottles was reduced to A\$0.04. Aside from using refillable bottles, the South Australian brewers were using 350 ml bottles in addition to the standard 750 ml bottles. Bond Breweries only used the 750 ml bottles in order to reduce the packaging and transport cost. Section 7 of the 1986 Act exempted the 350 ml refillable bottles from any deposit. The High Court decided that the Beverage Container Act Amendment (SA) Act of 1986 was protectionist, discriminatory and infringing on sec. 92 of the Australian Constitution.¹²⁰ Section 92 of the Australian Constitution states:

“On the imposition of uniform duties of customs, trade, commerce, and intercourse among the States, whether by means of internal carriage or ocean navigation, shall be absolutely free.

But notwithstanding anything in this Constitution, goods imported before the imposition of uniform duties of customs into any State, or into any Colony which, whilst the goods remain therein, becomes a State, shall, on thence passing into another State within two years after the imposition of such duties, be liable to any duty chargeable on

¹¹⁸ Beverage Container Act 1975 (South Australia)

¹¹⁹ Beverage Container Act Amendment Act 1986 (South Australia).

¹²⁰ The Commonwealth of Australia Constitution Act 1900 (The Constitution) accessed on February 12, 2006 at <http://www.aph.gov.au/senate/general/constitution/>

the importation of such goods into the Commonwealth, less any duty paid in respect of the goods on their importation.”

Practices to reduce wastage from a process that goes beyond technological innovation and considers all the factors affecting the production of useful products and by-products as well as wastes are commonly called “cleaner production”. The factors affecting the production of useful products, by-products and wastes are shown in Fig. 3-1. However, the focus on other production factors evolved slowly from the initial focus on technological innovation such that a number of countries and international organizations have had their own programs and preferences in place before the use of the term “cleaner production” became widely accepted. In each of those jurisdictions, the original terms used in their legislation and regulations are maintained. Researchers such as Fosch and Gallopoulos¹²¹ and Fosch¹²² integrate the relationships of industries, society and environment and are of the opinion that the analysis of the production factors shown in Fig. 3-1 should not be limited to a particular industry but integrated with all the industries and the society using the products and by-products, as well as the environment receiving the wastes.

Definition and Scope of Cleaner Production

The United Nations Environment Programme defines “cleaner production” to be “the continuous application of an integrated, preventive strategy applied to processes, products and services in the pursuit of economic, social, health, safety and environmental benefits.”¹²³ The

¹²¹ Robert Fosch and Nicolas Gallopoulos (1989) Strategies for Manufacturing. *Scientific American*, 261, 144-152.

¹²² Robert Fosch (1992) Industrial Ecology: Philosophical Introduction. *Proceedings of the National Academy of Sciences*. Washington, DC USA, National Academy of Sciences.

¹²³ United Nations Environment Programme, *International Declaration on Cleaner Production*, June 1, 2001.

Asia Pacific Economic Cooperation (APEC) 1997 Environment Ministerial Meeting on Sustainable Development in Toronto, Canada stated:¹²⁴

“Cleaner production covers both processes, products and services and all impacts, including their design, utilization and usage of raw materials and energy. It covers all wastes – hazardous/toxic or not – whether emitted into the air, water and onto land. The term acknowledges that cleaner production requires not only improving efficiency and material substitution using tools such as technology and know-how but new managerial skills and policies as well. It also acknowledges the importance of design and the use of products as well as services.”

UNEP’s definition is:

“Cleaner production is the continuous application of an integrated, preventive strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment.”¹²⁵

APEC and UNEP defined the scope of cleaner production as:

“ For production processes: cleaner production includes conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes before they leave the process.

For products: the strategy focuses on reducing impacts along the entire life cycle of the product from raw materials extraction to ultimate disposal of the products

For services: cleaner production reduces the environmental impact of the service provided over the entire life cycle, from system design and use to the entire consumption of resources required to provide the services. Cleaner production requires applying know-how, improving technology and changing attitudes.”

It should be noted that a number of international organizations such as the Association of South East Asian Nations (ASEAN) preferred to segregate the technological aspects from cleaner production, although almost all of its member countries are signatories to UNEP’s International Declaration on Cleaner Production as of 30 September 2005 and are members of the APEC. Thus, the ASEAN Yangon Resolution on Sustainable Development signed on 18 December 2003¹²⁶:

¹²⁴ Asia Pacific Economic Cooperation (1997) Ministerial Declaration on Sustainable Development. Environment Minister Meeting, APEC Secretariat, Singapore.

¹²⁵ UNEP Cleaner Production <http://www.unpie.org/pc/cp/understanding_cp/home.htm> seen September 28 2005

¹²⁶ Association of South East Asian Nations (2003) Yangon Resolution on Sustainable Development, ASEAN Secretariat, Jakarta, Indonesia.

“...acknowledge the importance of promoting environmentally sound technologies for effective environmental management and economic growth through appropriate regional mechanism as envisaged in the Hanoi Plan of Action by the year 2004.”

ASEAN insistence on the use of the term “environmentally sound technologies” instead of “cleaner production” can be traced back to the ASEAN Resolution on Environment and Development signed in Singapore on 18 February 1992.¹²⁷ During this meeting, the ASEAN member countries agreed “to promote the application of appropriate and environmentally sound technologies, as well as to encourage support from the business sector and the public for clean production and industrial practices”. It should be noted that in this resolution, the ASEAN ministers distinctly differentiated environmentally sound technologies from cleaner production. The idea could be further traced to Agenda 21 signed in 1992 at the United Nations Conference on Environment and Development (UNCED),¹²⁸ where environmentally sound technology was defined on a broader scale than “cleaner production”. Agenda 21 also used the terms “cleaner production” and “clean technology” interchangeably with “environmentally sound technology” in a very confusing manner as discussed later in this chapter.

The United States and Canada preferred to use the term “pollution prevention” instead of “cleaner production”. Environment Canada¹²⁹ defines “pollution prevention” as the use of processes, practices, materials, products or energy that avoid or minimise the creation of pollutants and wastes, and reduce the overall risk to human health or the environment. Environment Canada’s definition of “pollution prevention” is very similar to UNEP’s

¹²⁷ Association of South East Asian Nations (1992) Singapore Resolution on Environment and Development, ASEAN Secretariat, Jakarta, Indonesia.

¹²⁸ .United Nations Conference on Environment and Development (1992) *Agenda 21 -Sustainable Development*, Doc A.CONF.151/126 Volumes I, II and III, United Nations, New York

¹²⁹ Environment Canada (2006b) Pollution Prevention, Ottawa. <http://www.ec.gc.ca/cppic/En> seen on January 6, 2005.

definition of “cleaner production”. The US Pollution Prevention Act of 1990¹³⁰ identified “pollution prevention” as the national environmental policy of the United States. Sec. 13101 of the Act states:

“The Congress hereby declares it to be the national policy of the United States that pollution should be prevented or reduced at source whenever possible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycle should be treated in an environmentally safe manner whenever feasible; and the disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.”

This definition of “pollution prevention” is much narrower in scope than “cleaner production” as defined by UNEP. The US definition of “pollution prevention” is more widely used than the Canadian definition. “Pollution prevention” is primarily focused on the process and its potential negative impact on the environment and human health. It normally does not include services and has only minor concern on the management of the products beyond the manufacturing stage.

“Wastes minimisation” is used interchangeably with “cleaner production” under the Canadian definition of “pollution prevention”. Under US practices, “wastes minimisation” has a wider scope than “pollution prevention” as it also covers recycling, reuse and recovery of the product after the latter has served its intended purpose. The US and Canada preferred to use the term “pollution prevention” instead of “cleaner production” as the broader government policies on industrial operation discourage the government and its instrumentalities from interfering with management prerogatives in the operation of private businesses.

¹³⁰ Pollution Prevention Act 1990 (US) PL 101-508, 104 Stat 1388-321, Title 42 USC 13101

“Green productivity” is defined as a strategy for enhancing productivity and environmental performance for overall socio-economic development. The Asian Productivity Organisation coined the term “green productivity” in 1994 and has been using this term instead of “cleaner production”. “Green productivity” is seldom used by other organizations outside of the International Productivity Organization and its affiliates.

“Cleaner production” is more widely used among member countries of the United Nations because of the frequent use of the term in official communications of the UN and its affiliated agencies. However, environmental writers and mass communication experts are always developing new terms to attract readership and public support for their particular views and concerns. For example, the concept of “industrial ecology” and/or “industrial metabolism” has evolved in recent years. Industrial ecology and/or industrial metabolism is the study of industrial systems and economic activities and their link to fundamental natural systems. While the definition of “industrial ecology” does not have any similarity to the definition of “cleaner production”, the scope and strategy used in the former is very similar. As summarised by UNEP,¹³¹ the six principal elements of “industrial ecology” are:

- (i) creating industrial ecosystems that maximise the use of recycled materials in production, optimising the use of materials and embedded energy, minimising waste generation and re-evaluating “wastes” as raw material for other processes;
- (ii) balancing industrial input and output to the natural ecosystem capacity: understanding the ability of the larger natural system to deal with toxic and other industrial wastes in typical and catastrophic situations;

¹³¹ UNEP’s definition of “industrial ecology” is used in this thesis as it is the most authoritative summary of the evolving field of industrial ecology. Practitioners in the field of industrial ecology could not agree on the definition and scope of the discipline except for the application of the concept that industry or industrial activity should be integrated into the natural ecosystem through the six elements mentioned above. United Nations Environment Programme Trade, Industry and Environment Office (2001) Cleaner Production- Related Concept, UNEP, Paris accessed on December 27, 2006 at http://www.uneptie.org/cp/understanding_cp/related_concepts.htm.

- (iii) dematerialising industrial output by reducing materials and energy intensity in industrial production;
- (iv) improving the metabolic pathways of industrial processes and materials use, reducing or simplifying industrial processes to emulate natural and highly efficient ones;
- (v) systemic patterns of energy use to promote the development of an energy supply that functions as a part of the industrial ecosystem and is free of the negative environmental impacts associated with current patterns of energy use; and
- (vi) policy alignment with a long-term perspective of industrial system evolution with nations working together to integrate economic and environmental policies.

The term “industrial ecology” was first used by Robert Fosch and Nicolas Gallopoulos¹³², while the term “industrial metabolism” was first used by Robert Ayres,¹³³ in his paper of the same title. The definitions of “industrial ecology” varied from the perpetual motion concept as expounded by Robert Fosch to the mere modification of existing practices as defined by Lowe¹³⁴. As discussed earlier in Chapter II of this thesis, the perpetual motion machine is scientifically impossible to attain because of the continuous degradation of the quality of energy as defined by the second law of thermodynamics. However, the notion of a perpetual motion machine is so attractive that a number of those machines do get registered in the patent offices of various countries. According to Robert Fosch:¹³⁵

¹³² Robert Fosch and Nicolas Gallopoulos (1989) Strategies for Manufacturing. *Scientific American*, 261, 144-152.

¹³³ Robert Ayres (1989) Industrial Metabolism: . *Technology and Environment*. Washington, National Academy Press.

¹³⁴ Ernest Lowe (1992) Industrial Ecology: An Organizing Framework for Environmental Management. *Total Quality Environmental Management*, 3, 73-85. at p. 73

¹³⁵ Robert Fosch (1992) Industrial Ecology: Philosophical Introduction. *Proceedings of the National Academy of Sciences*. Washington, DC USA, National Academy of Sciences., 800-803. At p. 801

“The idea of an industrial ecology is based upon a straightforward analogy with natural ecological systems. In nature an ecological system operates through a web of connections in which organisms live and consume each other and each other’s wastes. The system has evolved so that the characteristic of communities of living organism seems to be that nothing that contains available energy or useful material will be lost. There will evolve some organism that will manage to make its living by dealing with any wastes product that provides available energy or usable materials. Ecologist talk of a food web: an interconnection of uses of both organisms and their wastes. In the industrial context we may think of this as being use of products and wastes products. The system structure of a natural ecology and the structure of an industrial system or an economic system are extremely similar.”

The fallacy of Fosch’s concept is very apparent as communities of living organisms are very inefficient in utilizing the materials and energy inputs with the result that a large amount of energy and matter is wasted. Coal and petroleum resources are nothing more than the material and energy wastes in past geologic eras that communities of living organisms could not utilize and had to discard as wastage. Human consumption is merely an attempt to use those accumulated waste materials and energy with potentially dangerous impacts on the environment – especially through global warming. On the other hand Ernest Lowe¹³⁶ stated:

“The heart of industrial ecology is a simple recognition that manufacturing and service systems are in fact natural systems, intimately connected to their local and regional ecosystems and the global biosphere ... the ultimate goal ... is bringing the industrial system as close as possible to being a closed loop system, with near complete recycling of all materials”.

From his definition, Lowe is very much aware that the recycling of materials requires inputs of high quality energy as discussed in Chapter II and while the quantity of energy is conserved, the quality is continuously and irreversibly degraded. Hence, he did not mention the recycling of energy.

The main difference between “industrial ecology” and “cleaner production” is the wider scope of analysis involved in the former. Industrial ecology involves the interrelationship of a particular industry to other industries in addition to the environment. As

¹³⁶ Ernest Lowe (1992) Industrial Ecology: An Organizing Framework for Environmental Management. *Total Quality Environmental Management*, 3, 73-85. At p. 73

Gradel and Allenby¹³⁷ put it “No firm exists in a vacuum. Every industrial activity is linked to thousands of other transactions and activities and to their environmental impacts.”

Evaluating these thousands of other transactions and linkages is one of the main difficulties in applying industrial ecology into practice. Even from the standpoint of national planning, the resources and cost of identifying, quantifying and evaluating the linkages and impacts would be very high, and ultimately the benefits of the exercise could not justify the resources expended. It would be almost impossible for a private company to obtain information from linked industries especially those where its interaction is indirect. For example, an industry using steel will have some difficulty in obtaining information on production, operational and environmental impact from the steel mill with which it has direct contact but it would be next to impossible to obtain production and operational information from the transporter of the raw materials to the steel mill and the coal, limestone, and iron ore miners. The steel mill may have a number of coal, limestone and iron ore suppliers. The proportion of the goods from each supplier could vary from time to time. In periods of scarcity, the steel mill may buy the iron ore on the spot market and to inquire on the linkages, environmental impacts and other transactions of the supplier on the spot market will cause unnecessary delays. Lastly, some information is protected by intellectual property rights and confidentiality of business information.

Environmentally sound technology is another term commonly used in UN documents especially Agenda 21¹³⁸. Chapter 34 is devoted to the transfer of environmentally sound technology, cooperation and capacity building. Traditionally, environmentally sound

¹³⁷ Thomas Gradel and Brad Allenby. (1995) *Industrial Ecology*, Prentice Hall. at page 2

¹³⁸ United Nations Conference on Environment and Development (1992) *Agenda 21 -Sustainable Development*, United Nations.

technology has a narrower scope than cleaner production, as it is limited to the technology aspects as defined in Sec. 34.1 and Sec. 34.2 of Agenda 21.

Sec. 34.1 of Agenda 21 states: “Environmentally sound technologies protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of the wastes and products and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes”. However, Sec. 34.2 of Agenda 21 states: “Environmentally sound technologies in the context of pollution are ‘processes and product technologies’ that generate low or no wastes for the prevention of pollution. They also cover ‘end of pipe’ technologies for treatment of pollution after it has been generated.” Further on in Sec. 34.3 of Agenda 21 the meaning of environmentally sound technologies is expanded from the context of products and processes to include services, design, management and organizational structure to make it synonymous with cleaner production. Sec. 34.3 of Agenda 21 further states:

“Environmentally sound technologies are not just individual technologies, but total systems which include know-how, procedures, goods and services, and equipment as well as organizational and managerial procedures. This implies that when discussing transfer of technologies, the human resource development and local capacity building aspects of technology choices, including gender relevant aspects, should also be addressed. Environmentally sound technologies should be compatible with nationally determined socio-economic, cultural and environmental priorities.”

UNEP considers “cleaner production” as equivalent to “environmentally sound industrial production technology”. For example, in the 16th Governing Council Meeting of UNEP, the council recommendation on the Transfer of Environmentally Sound Industrial Production Technology¹³⁹ was based solely on the definition of “cleaner production”. UNEP through its Division of Technology and Industry and Economics located in Paris organizes high level seminars on cleaner production, and with UNIDO coordinates the worldwide

¹³⁹ United Nations Environment Programme Governing Council. (May 1990) Decision 16/33 Transfer of Environmentally Sound Industrial Production Technology, United Nations Environment Programme.

programs of National Cleaner Production Centres. However, for urban environmental problems, UNEP created the International Environment Technology Centre (IETC) in Osaka and Shiga, Japan in 1994.

IETC promotes environmentally sound technologies. From the operations of IETC and the UNEP Division of Technology and Industry as well as from Agenda 21, it can be seen that “cleaner production” is merely a sub-discipline of “environmentally sound technology”. “Cleaner production” is environmentally sound technology as applied to industrial production processes.¹⁴⁰

For economic efficiency, most manufacturers prefer to locate close to the market, transportation hub, skilled and unskilled labor pool and other industries that provide finished and semi-finished products. For this reason, a large number of industries are located close to urban centers.¹⁴¹ The optimal application of the concepts of “cleaner production” extends beyond the confines of the manufacturing plant and practice, especially considering the environmental and social impacts of the products and waste emissions. In fact, industrial ecology even considers the integration of the industry into the natural ecosystem in addition to anthropogenic ecosystems such as the urban environment.

¹⁴⁰ United Nations Conference on Environment and Development (1992) Agenda 21- Sustainable Development, at Chapter 34 on Means of Implementation

¹⁴¹ Exceptions are often the extractive industries such as mining. Nevertheless, major manufacturing activities such as smelting, steel production, and fabrication are still carried out close to urban centers. Hong Hwang and Chao-Cheng Mai (2004) The Effects of Pollution Taxes on Urban Areas with an Endogenous Plant Location. *Environmental and Resources Economics*, 29, 57-65. This paper provides a good discussion from the decision-maker perspective in minimizing the total cost when Best Available Technology (BAT) is used. Environmental concerns is just one of the factors, the decision maker has to consider. With BAT the other factors such as transport, labour, security, storage and inventory costs of locating close to the city dominates over the cost of environmental protection. Sangeeta Bansal, and Shubhashis Gangopadhyay. (2005) Incentives for Technological Development: BAT is Bad. *Environmental and Resources Economics*, 30, 345-367. at page 345 also reached similar conclusion on the impact of BAT. They found out BAT is a barrier for the adoption of cleaner production.

The various terms used to define cleaner production are coined by mass communication experts, and are used to encourage businesses and the public to use those techniques to reduce wastage and hence the waste discharged to the environment. As earlier discussed, the terms that have been used and are widely accepted by the public are “eco-efficiency”, “green productivity”, “pollution prevention”, “environmentally sound technologies”, “wastes minimization” and “clean technology”. As will be discussed later in this chapter, those terms are incorporated in national legislation and programs of international organisations and non-governmental organisations. Like the ASEAN countries, a number of national and international organizations are reluctant to accept or change the titles of their programs or amend their legislation to use the term “cleaner production”. The problem is further compounded with the new terms being coined and used in literature, often with still undefined meaning and scope, which for all purposes and intent are very similar to “cleaner production”. The term “industrial ecology” is an example of this emerging field of study. For this reason, the UNEP International Declaration on Cleaner Production¹⁴² of 2001 recognises those strategies as different and distinct from “cleaner production”. The preamble of the Declaration explicitly states: “We believe that Cleaner Production and other preventive strategies such as Eco-Efficiency, Green Productivity and Pollution Prevention are preferred options. They require the development, support and implementation of appropriate measures.”

Unlike other international declarations sponsored by the United Nations and its agencies, the International Declaration on Cleaner Production is open to provincial, state and local governments, private business, business associations, professional associations, consultants, academia, non-governmental organizations, international agencies and inter-governmental organizations. As of 30 September 2005 only 54 sovereign states had signed the

¹⁴² United Nations Environment Programme (2001) International Declaration on Cleaner Production, United Nations Environment Programme, Nairobi, Kenya

Declaration compared to 220 private companies, 35 local governments and 220 from business associations, the academia, and other groups.. Among the G7 member countries, the United States, France, Germany and Japan have not signed the declaration.¹⁴³ It should be noted that the International Declaration on Cleaner Production is silent on “environmentally sound technology”, the main equivalent of Cleaner Production in Agenda 21. Agenda 21 is the main UN document approved by head of states at the United Nations Conference on Environment and Development (UNCED) for the world to attain sustainable development. In the same declaration UNEP declared that “cleaner production” is equivalent or similar to “eco-efficiency”, “green productivity”, “pollution prevention” and “industrial ecology”.

The Promises of Cleaner Production

As shown in Table 3-1, “cleaner production” is an effective way of reducing the wastes discharged into the environment. Demonstration projects have shown that the economic rate of return for cleaner production is higher than 20 per cent per annum, and in a number of instances may exceed 100 per cent. Cleaner production reduces the cost of waste treatment by reducing the quantity of waste and its persistence in the environment. It also improves the recycling and recovery of the product, thus increasing the “sunk value” of the product after it has gone beyond its usefulness. Sunk value, also known as salvage value, is the value of the product after its useful life. For example, the sunk value of a junk car in Sydney today is A\$50 plus free pick up. If there more uses for the junk car, the price will go up. Cleaner production improves the gross income of an industry by creating markets for by-products, and even wastes. Cleaner production programs involving by-product sales from wastes are commonly called “waste exchange programs”.

¹⁴³ Ibid. list of signatories

The potential advantages of cleaner production could extend beyond the protection of the environment. Jose Goldemberg, former Minister of Education for Brazil from 1990 to 1992, was a strong proponent in international fora on the use of cleaner production policies and strategies to enable developing countries to develop rapidly or “leapfrog”.¹⁴⁴ He took the stance for cleaner production after studying the historical trend in energy intensity of a number of countries undergoing various stages of development. Energy intensity is defined as energy consumed to generate \$1,000 of gross domestic product. However, energy intensity has a number of shortcomings as a measurement of economic efficiency.

Firstly, the developing country’s salary levels are low because of a large labour surplus and other economic policies such as the minimum wage. A labourer in a developed country may consume three times more energy than a labourer in a developing country in digging one cubic meter of soil but since the former is paid ten times more than the latter, the energy intensity for this particular job in the developed country is 0.3 times compared to that of the developing country. This could be corrected by using the purchasing power parity. Purchasing power parity is an adjustment factor to consider the variations in the prices of basic commodities and services where the income is spent or applied. While developed countries have higher income levels than developing countries, the costs of basic commodities and services are also higher. Hence, \$1 paid to a worker in a developing country, when adjusted by the purchasing power parity, is doubled if the cost of basic commodities in the developing country is one half of the cost in the developed country being compared. Similarly, the energy intensity difference narrows down from 0.3 times to 0.6 times.¹⁴⁵

¹⁴⁴ Jose Goldemberg (1992) Transfer of Environmentally Clean Technology from North to South: Technological Leapfrogging. *Los Angeles International and Contemporary Legal Journal*, 15, 123-137.

¹⁴⁵ *The Economist* magazine has been proposing through the years the use of McDonald index as a substitute to Purchasing Power Parity (PPP) and issue regularly the comparative PPP based on the price of McDonald

Secondly, inflation has a strong impact on the gross domestic product, lowering the energy intensity without necessarily increasing the production efficiency.

Lastly, the service sector has a lower energy consumption per worker, but the salary level is much higher than in the manufacturing sector such as ore and metal refining. While energy is a common commodity in all aspects of the economy, the consumption in the manufacturing industry is much higher than in the service sector. Energy is used in the manufacturing sector to refine the raw materials, while in the service sector, energy is used primarily to run the office air conditioners, elevators and computers.

Energy intensity is to some extent a good indicator of the inefficiency or wastage in the economy. During the initial years of development, the energy intensity is higher and as the development process matures, it gradually declines. As Goldemberg noted:¹⁴⁶

“Peaks in energy intensity are less intense for latecomers to industrial development than they are for pioneers of industrial development, such as the United Kingdom or the United States. This is because the later developing countries have more modern and efficient technologies at the outset, which allow them to “leapfrog” steps taken by pioneers of industrial development. This paper argues that the strategy of “leapfrogging” is the only way to reconcile the aspirations of developing countries for modernization with the high environmental cost that such modernisation creates at both the local and global levels”.

Goldemberg’s optimism at the potential of improved process efficiencies or cleaner production in general is shared by leaders in developed countries as well. As Senator John Kerry¹⁴⁷ of the United States puts it:

hamburger in both developed and developing countries. The main premise of the McDonald index is the uniformity of the production and quality of the hamburger among McDonald franchise holders. Franchise holders are required to pass intensive course in hamburger preparation. However, McDonald hamburgers are almost made exclusively using local materials and sold considering the capacity of the local population to pay for the product. Hence, the price of McDonald hamburgers reflects the price differential of procuring the same type and quantity of good produced locally in different countries.

¹⁴⁶ Jose Goldemberg (1992) Transfer of Environmentally Clean Technology from North to South: Technological Leapfrogging. *Los Angeles International and Contemporary Legal Journal*, 15, 123-137. at page 127

“Many of our best environmental technologies are cleaner production design, as opposed to end-of pipe clean up or control technologies... Although it is a good place to start, our efforts need not, and should not, focus only on promoting our industries. We have at our disposal a host of tools for encouraging other nations to adopt more economically and socially sound development paradigms. Because we are all in this together, the effective use of those tools is not just a moral imperative: it is a survival imperative.”

In his paper, Senator Kerry elaborated on the tremendous potential trade and market for US industries. He estimated that the US could export more than US\$400 billion per year and possibly play a dominant role. As he states it ¹⁴⁸

“Envirotech is a \$200 billion a year industry headed for a \$400 billion or more at the end of the decade. It is an industry in which the United States begins with a forty per cent market share and has enormous capacity to expand. Environmental needs and environmental awareness are growing around the globe, as evidenced in everything from trade negotiations that emphasize environmental standards to new consumer publications that highlight environment friendly goods. The demand is there. There are hundreds of thousand of jobs waiting to be created in recycling technologies, in energy conservation and alternative sources of power, in new manufacturing design, in pollution clean up and in environmental services.”

Cleaner Production and International Conventions

Considering the potential economic, social and environmental benefits of cleaner production, international organizations have readily embraced the concept as the cornerstone of their environmental management program. In 1992, at the United Nations Conference on Environment and Development in Rio De Janeiro, Brazil, cleaner production was identified in Chapter 30 Agenda 21 document as the main environmental management tool to address

¹⁴⁷ John Kerry (1994) Trade and the Environment: Charting a New Course. *Cornell International Law Journal*, 27, 447-457. at p. 454

¹⁴⁸ Ibid at p. 453.

industrial pollution, especially the disposal of toxic and hazardous wastes.¹⁴⁹ This was barely two years after the “cleaner production” definition and scope was formally promulgated by UNEP.

Agenda 21

Agenda 21 is a detailed action plan to be carried out by the member States of the United Nations into the 21st century to promote sustainable development by addressing the social, environmental and development programs that were identified by the various preparatory and working committees of the conference. The implementation of Agenda 21 is considered crucial for the continued well-being of humanity. Thus the opening sentence of Agenda 21 declares that humanity is at a defining point in history. Chapter 1 of Agenda 21 is the preamble, and the first paragraph of the preamble states:¹⁵⁰

“Humanity stands at a defining moment in history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, health, and illiteracy, and the continuing deterioration of the ecosystem on which we depend for our well being. However, integration of environment and development concerns and greater attention to them will lead to the fulfillment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. No nation can achieve this on its own; but together we can – in a global partnership for sustainable development.”

Aside from the global version of Agenda 21 that was approved at UNCED, each nation was to develop its own national Agenda 21 following a similar pattern to the main document – adhering to the principles of the Rio Declaration on Environment and Development in addressing domestic issues in accordance with the capacities and priorities of

¹⁴⁹ United Nations Conference on Environment and Development (1992) *Agenda 21 -Sustainable Development*, United Nations.

¹⁵⁰ Ibid.

the countries. Countries within the same region may also prepare a regional Agenda 21. The last paragraph of the Agenda 21 preamble states:¹⁵¹

“The program areas that constitute Agenda 21 are described in terms of the basis for action, objectives, activities and means of implementation. Agenda 21 is a dynamic program. It will be carried out by the various actors according to the different situations, capacities and priorities of countries and regions in full respect to the different principles contained in the Rio Declaration on Environment and Development. It could evolve over time in the light of changing needs and circumstances. This process marks the beginning of a new global partnership for sustainable development.”

The aggregate of the national Agenda 21 plans was expected to attain sustainable development as envisaged in the last sentence of the first paragraph of the preamble: “No nation can achieve this on its own; but together we can – in a global partnership for sustainable development”.

Agenda 21 as signed at UNCED in 1992 was designed as a basis for action for the signatory countries to attain sustainable development by the 21st century. Agenda 21 is divided into action programs, with each program having defined objectives, activities and means of implementation. It is a dynamic document which required the signatory countries to regularly meet to review the implementation progress regularly. In spite of the importance and urgency in implementing it at the international, regional and national levels, Agenda 21 is a non-binding agreement and action plan among the signatories.

In the first review of the Agenda 21 in 1997¹⁵², the UN General Assembly reiterated its importance in attaining sustainable development. The third paragraph of the Statement of

¹⁵¹ Ibid

¹⁵² United Nations General Assembly (1997) Programme for the Further Implementation of Agenda 21 Document no. A/RES/S-19/2. New York, United Nations. at paragraph 4

Commitment of the UN General Assembly resolution No. A/RES/s-19/2 of 19 September 1997 states:¹⁵³

“Our focus at this special session has been to accelerate the implementation of Agenda 21 in a comprehensive manner and not to negotiate its provisions or to be selective in its implementation. We reaffirm that Agenda 21 remains the fundamental programme for achieving sustainable development.”

Although Agenda 21 has been identified as the main mechanism for attaining sustainable development, the programs, objectives, activities and means of implementation have not been analysed and justified in terms of the meaning of sustainable development.

Chapter 30 of Agenda 21¹⁵⁴ is “Strengthening the Role of Business and Industry”. The first program area of this chapter is promoting cleaner production. The main objective of the program is for government, business and industry, including trans-national corporations, to increase the efficiency of resource utilization, including reuse and recycling of residues, and to reduce the quantity of waste discharge per unit of economic output. The suggested activities to attain the objectives are:¹⁵⁵

- (i) for government to identify and implement a mix of economic instruments and normative measures to promote cleaner production with especial consideration for small and medium sized enterprises;
- (ii) for government, business, academia and international organizations to develop and implement concepts and methodologies to internalise the environmental cost in the accounting and pricing mechanisms;

¹⁵³ Ibid at paragraph 3.

¹⁵⁴ United Nations Conference on Environment and Development (1992) *Agenda 21 -Sustainable Development*, United Nations.

¹⁵⁵ Ibid.

- (iii) for government to promote technological know-how and cooperation between enterprises, encompassing identification, assessment, research and development, management marketing and application of cleaner production;
- (iv) for industry to incorporate cleaner production policies in its operation and investments, taking into consideration its influence on suppliers and consumers;
- (v) for industry and business associations to encourage individual companies to undertake programs for improved environmental awareness and responsibility;
- (vi) for international organizations to increase education, training and awareness activities relating to cleaner production; and
- (vii) for international and non-governmental organizations, including trade and scientific organizations to strengthen their “cleaner production” database.

In Chapter 20 of Agenda 21, “Environmentally Sound Management of Hazardous Wastes”, the implementation and activities of the first three program areas are mainly based on the use of cleaner production. The three main program areas in this chapter are:

- (i) promoting the prevention and minimisation of hazardous wastes;
- (ii) promoting and strengthening institutional capacities in hazardous waste management; and
- (iii) promoting and strengthening international cooperation in the management of trans-boundary movements of hazardous wastes.

Significant sections in this chapter dealing with cleaner production are:

- (i) Sec. 20.13 (b) for government, with the help of multilateral cooperation, to provide economic and regulatory incentives to stimulate industries towards cleaner production methods;

- (ii) Sec. 20.13 (e) for government to cooperate with industry to develop guidelines and a code of conduct leading to cleaner production;
- (iii) Sec. 20.13 (h) for governments to promote cleaner production through the establishment of centres providing information and training on environmentally sound technologies;¹⁵⁶
- (iv) Sec.20.13 (i) for industry to establish an environmental management system including the environmental auditing of its production and distribution systems in order to identify the areas where cleaner production methods are needed;
- (v) Sec. 20.13 (j) for the relevant and competent agencies of the UN to take the lead to develop guidelines for estimating the costs and benefits of various approaches to the adoption of cleaner production;
- (vi) Sec. 20.14 (c) for international organizations, through UNEP and the International Cleaner Production Information Centre, to extend and strengthen the existing database for collection of information about cleaner production;
- (vii) Sec. 20.14 (d) for all UN organs and organizations to promote the use and dissemination of information collected through the Cleaner Production Network;
- (viii) Sec. 20.17 (c) for States to encourage industry to develop schemes to integrate the cleaner production approach into the design of products and management practices;
- (ix) Sec. 20.18 (a) for governments, international organizations, and industry to encourage industrial training programs incorporating hazardous wastes prevention and minimization techniques and launching demonstration projects at the local level to develop “success stories” in cleaner production;

¹⁵⁶ This particular provision identifies environmental sound technologies as a sub-group of cleaner production contrary to provisions in Chapter 34 of Agenda 21.

- (x) Sec. 20.18 (b) for industry to integrate cleaner production principles and case examples into training programs and establish demonstration projects/networks by sector/country;
- (xi) Sec. 20.18 (c) for all sectors in society to develop cleaner production awareness campaigns and promote dialogue and partnership with industry and other actors; and
- (xii) Sec. 21.19 (c) for governments to work with industry on sector-by-sector cleaner production and hazardous wastes minimization campaigns, as well as on the reduction of such wastes and other emissions.

In environmental science, toxic and hazardous substances are often addressed at the same time, as a large number of hazardous chemicals are also toxic. Hazardous substances include those which are explosive, contaminated with pathogenic substances or corrosive. For example, hospital wastes are considered hazardous wastes rather than toxic wastes. Gasoline is often categorized as a hazardous substance as the risk comes more from a fire and explosion rather than poisoning, although gasoline taken in high concentrations is poisonous and long-term exposure to gasoline is carcinogenic. Chapter 19 of Agenda 21 deals with the “Environmentally Sound Management of Toxic Chemicals, Including Prevention and Illegal International Traffic in Toxic and Dangerous Products”. One of the main applications of cleaner production is the reduction of toxic chemicals in the wastes, by-products and products themselves through the substitution of non-toxic chemicals in the raw materials and intermediaries. However, Chapter 19 is silent on the application of cleaner production and instead the implementation and activities are based on clean technology.

The programs in Chapter 18 of Agenda 21 are also based on “clean technology” rather than on “cleaner production”. Chapter 18 is the “Protection of the Quality and Supply of

Freshwater Resources: Application of an Integrated Approaches to the Development, Management and Use of Water Resources”.

The implementation of Agenda 21 was reviewed in 1997¹⁵⁷, five years after UNCED and in 2002 at the Earth Summit in Johannesburg, South Africa. In the 1997 review, the UN General Assembly noted that a large number of positive results had been achieved since UNCED, but there was general concern on the continued deterioration with respect to sustainable development.¹⁵⁸ Prior to the review in 1997, a number of concerns were raised on the appropriateness of Agenda 21, but the UN General Assembly rejected those concerns.¹⁵⁹ However, during the Earth Summit at Johannesburg from 26 August to 4 September, 2002, the UN Secretary General issued a press statement on the weak implementation of Agenda 21, although he reaffirmed that Agenda 21 is a good plan¹⁶⁰. In the same press statement, the UN Secretary General also recognized the changing conditions and priorities and emergence of new issues that Agenda 21 has to take account of in order to be effective.

For a major international document at a defining historic moment for mankind, Agenda 21 surprisingly has a number of technical problems and issues in relation to environmental management strategy. First, Agenda 21 does not have a comprehensive

¹⁵⁷ United Nations General Assembly Resolution A/RES/S-19/2 of September 19, 1997, Programme for Further Implementation of Agenda 21.

¹⁵⁸ Paragraph 4 of the same General Assembly Resolution A/RES/S-19/2 states: “We acknowledged that a number of positive results have been achieved, but we are deeply concerned that the overall trends with respect to sustainable development are worse today than they were in 1992. We emphasize that the implementation of Agenda 21 in a comprehensive manner remains vitally important and is more urgent now than ever.”

¹⁵⁹ Paragraph 3 of UN General Assembly Resolution A/RES/S-19/2 states further: “Our focus at this special session has been to accelerate the implementation of Agenda 21 in a comprehensive manner and not to renegotiate its provisions or to be selective in its implementation. We reaffirm that Agenda 21 remains the fundamental programme of action for achieving sustainable development.”

¹⁶⁰ United Nations Department of Public Information (2002) Press Summary of the Secretary-General's Report on Implementing Agenda 21 DPI/2244, United Nations, New York.

definition of terms, especially the terms related to the implementation plan. “Environmentally sound technology” is defined in Chapter 34 and goes beyond technology to include the total systems. “Environmentally sound technology” as defined in Agenda 21 is synonymous with, if not broader in scope than the commonly accepted definition of “cleaner production”. In fact a much simpler procedure would have been to extend the scope of “clean technology” to cover the total systems in the same way as “environmentally sound technology” has evolved. In Agenda 21 “cleaner production” has become a specialised form of “environmentally sound technology” applied to industrial processes. “Environmentally sound technology” also covers environmental management in urban and rural systems and includes solid wastes, air pollution, water pollution, land degradation, marine pollution, and biotechnology. As far as “cleaner production” and related methodologies are concerned, there seems to be little coordination among the committees writing various chapters of Agenda 21 or little coherence with the definitions commonly used in technical literature. Rather than confronting the anomaly, UNEP in its Cleaner Production Declaration defines “cleaner production” as equivalent to “environmentally sound technology”, “clean technology”, “eco-efficiency”, “green productivity” and other terms preferred and used by other national and international organizations. After reading Agenda 21, I have to admit some degree of confusion on the terminologies used within Agenda 21 and a higher degree of confusion when I tried to relate the definitions in Agenda 21 with the broader inventory of literature on the subject of cleaner production.

The problem is further compounded during the implementation of Agenda 21 at the national level. In a number of instances such as in the People’s Republic of China, duplication of centres and programs takes place under different ministries using the variations of the terminologies. For example, the Administrative Centre for China Agenda 21 (ACCA21) under the Ministry of Science and Technology operates the Environmentally Sound

Technology Transfer Centre. The establishment of the centre was funded by the Asian Development Bank and I was the project officer in charge of designing and administering the technical assistance grant. In contrast, the China Cleaner Production Centre is attached to the State Environmental Protection Administration.

United Nations Environment Program

The United Nations Environment Program (UNEP) coined the term “cleaner production” as a comprehensive and integrated approach to environmental protection. UNEP is the sponsor of the International Declaration on Cleaner Production. The declaration is open to national governments, local governments, the private sector, academia and non-governmental organizations. The declaration is basically an affirmation by the governments, the private sector, the academic and non-governmental organizations of the objectives, activities and implementation plans in Agenda 21. UNEP works closely with the United Nations Industrial Development Programme (UNIDO) in developing regional and national cleaner production centres, demonstration projects and information dissemination in relation to cleaner production.

Asia Pacific Economic Cooperation

The Asia Pacific Economic Cooperation (APEC) is an organization of 21 economies¹⁶¹ around the Pacific Rim. The main objective of APEC is to promote free and

¹⁶¹ Taipei, China and Hong Kong, China are APEC members. Hong Kong, China is a special autonomous region of China. Taipei, China is also known as the Republic of China. Most countries do not maintain diplomatic relation with the Republic of China and instead recognize the People's Republic of China under a “One China Policy”. However, Taipei, China is a mature economy with large trade and investments in the Asia Pacific

open trade and investment in the region. APEC has set a target of removing most trade and investment barriers in developed member countries by 2010 and in developing countries by 2020.¹⁶² Unlike the World Trade Organization (WTO), the member economies of APEC have no treaty obligations. Decisions are reached by consensus and commitments are undertaken on a voluntary basis. The APEC member economies account for approximately 60 per cent of the world's gross domestic product, 47 per cent of the world's trade and almost 35 per cent of the world's population. In the last 10 years, APEC members accounted for 70 per cent of the global economic growth.¹⁶³

The ministers responsible for the environment of the APEC member countries first met in Vancouver, Canada on 23 to 25 March 1994.¹⁶⁴ The Vancouver meeting was a brainstorming meeting to identify the major problems, potential solutions and interests. In 1996, the APEC Ministerial Meeting on Sustainable Development¹⁶⁵ was held in Manila. During this meeting, four major issues were discussed and given priority for program development and implementation. The four issues are:

- (i) sustainable cities/urban development;
- (ii) cleaner production/clean technology;
- (iii) sustainability of the marine environment; and

region. As such Taipei, China is a member of a number of international organizations such as the Asian Development Bank, WTO and APEC.

¹⁶² As of October 1, 2005 the member economies of APEC are Australia, Brunei Darussalam, Canada, Chile, People's Republic of China, Hong Kong, Indonesia, Japan, Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Republic of the Philippines, Russian Federation, Singapore, Chinese Taipei, Thailand and the United States.

¹⁶³ Statistical data from APEC webpage: www.apec.org seen on October 20, 2006

¹⁶⁴ APEC Ministers Responsible for the Environment (1994) APEC Environment Ministerial Meeting on Sustainable Development, Vancouver, 23-25 March 1994, Vancouver, Asia Pacific Economic Cooperation Secretariat, Singapore.

¹⁶⁵ APEC Ministers Responsible for the Environment (1996) Report of the APEC Ministerial Meeting on Sustainable Development July 11-12, 1996. Manila, Asia-Pacific Economic Cooperation Secretariat, Singapore.

- (iv) innovative approaches towards environmentally sustainable development.

To promote cleaner production in the region, the Ministerial Declaration¹⁶⁶ after the meeting called on the members and the organization for the:

- (i) formulation of specific strategies for the industrial and agricultural sector to promote the dissemination of clean technologies and experience;
- (ii) mobilization of public-private partnerships in major industry sectors to promote cleaner production;
- (iii) sponsoring of government-industry workshops, seminars and demonstration projects on cleaner production;
- (iv) sharing of information on clean technologies and cleaner production policies;
- (v) strengthening of government capabilities through capacity building at both the national and local levels providing tools needed to achieve cleaner production goals;
- (vi) conducting cleaner production training through the APEC Sustainable Development Training and Information Network;
- (vii) improving APEC member economies' access to expert input and facilitating the exchange of expertise related to the implementation of cleaner production methods;
- (viii) promoting ISO 1400,¹⁶⁷ which involves voluntary actions by industry to establish environmental management systems and committing to continuous improvement in environmental performance; and

¹⁶⁶ Ibid section 2

¹⁶⁷ International Standard Organization (ISO) has a series of environmental management system standards commonly called the ISO 14000 series.

- (ix) focusing on the special needs of small and medium sized enterprises and promoting cleaner production technologies that help minimize or eliminate greenhouse gas emissions.

The 1997 APEC Ministerial Meeting on Sustainable Development was held in Toronto, Canada on 9 to 11 June 2007.¹⁶⁸ During this meeting the participating ministers agreed on an APEC Cleaner Production Strategy. The APEC strategy adopted UNEP's definition of cleaner production and established two main goals. The two main goals and objectives are;

- (i) to achieve dramatic progress in reducing environmental impacts on various industry sectors through the promotion of appropriate cleaner production technologies, policies, and practices; and
- (ii) to achieve broader adoption of cross-cutting policies and methods for cleaner production through institutional, professional and private sector partnerships.

In order to attain the goals and objectives, the strategy paper restated in practical terms the nine elements for the promotion of cleaner production of the 1996 APEC Ministerial Meeting on Sustainable Development held in Manila and summarised in the previous paragraphs.

It should be noted that APEC ministerial declaration on sustainable development in 1996 had clear distinction between “cleaner production” and “clean technology”. In this ministerial declaration, “cleaner production” was confined to the policy aspects and “clean technology” to the hardware and physical components as could be inferred from the four main

¹⁶⁸ APEC Ministers Responsible for the Environment (1997) Report of the Environmental Ministerial Meeting on Sustainable Development 9-11 June 1997, Toronto, Canada, Asia-Pacific Economic Cooperation Secretariat, Singapore.

issues identified in the preparatory meeting in 1994. However, in the 1997 Ministerial Declaration, “clean technology” was recognised as a component of “cleaner production”. It should be noted that the March 1994 preparatory meeting was less than two years after the adoption of Agenda 21 at UNCED. The loose and often undefined use of “cleaner production”, “clean technology” and “environmentally sound technology” in Agenda 21 no doubt contributed to the distinct treatment of “cleaner production” and “cleaner technologies” in the 1996 APEC Ministerial Declaration on Sustainable Development.

Association of South East Asian Nations

The Association of South East Asian Nations (ASEAN)¹⁶⁹ currently has 10 member countries. The environment ministers of the 10 member countries meet regularly to review the implementation of environmental strategic plans. The environmental strategic plans are updated every five years. The initial strategic environmental plan is the Hanoi Plan of Action for 1999–2004.¹⁷⁰ After 2004, the Hanoi Action Plan was followed by the Vientiane Action Programme.¹⁷¹ The ASEAN strategic plan is primarily a reiteration of Agenda 21. For example, the 2003 Yangon Resolution on Sustainable Development¹⁷² requests member countries to: “Acknowledge the importance of promoting environmentally sound technologies for effective environmental management and economic growth through appropriate regional mechanisms as envisaged in the Hanoi Plan of Action by the year 2004.”

¹⁶⁹ The member countries of ASEAN are Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.

¹⁷⁰ Association of South East Asian Nations (1998) Hanoi Action Plan, ASEAN Secretariat, Jakarta

¹⁷¹ Association of South East Asian Nations (2004) Vientiane Action Programme, ASEAN Secretariat, Jakarta

¹⁷² Association of South East Asian Nations (2003), Yangon Resolution on Sustainable Development, ASEAN Secretariat, Jakarta.

While APEC preferred to use “cleaner technology” and “cleaner production” and has remained silent on the use of “environmentally sound technology”, the ASEAN plan conformed more closely with Agenda 21 by preferring to use “environmentally sound technology” instead of “cleaner production”.

European Commission

The European Commission (EC) issued Directive 96/61 entitled “Integrated Pollution Prevention and Control”.¹⁷³ As stated in Article 1:

“The purpose of the Directive is to achieve an integrated system of pollution prevention and control for a range of specified industrial activities including measures concerning wastes. The aim of the integrated system is to prevent or reduce emissions to air, water, and land (including wastes) and to achieve a high level of protection of the environment as a whole.”

The directive requires member states to establish an integrated system of permits that contain specific conditions, including emission limit values and the application of best available techniques – commonly known by the acronym BAT. Annex 1 of the directive lists the industries covered. Those industries are energy industries, metal processing/production, mineral and chemical industries, wastes management, pulp, paper and board production, pre-treatment dyeing of fibres, tanning, abattoirs, disposal of animal carcasses, various food processes and intensive poultry and pig rearing. All new installations and changes to existing installation require a permit. Permits granted to existing installations are reviewed periodically based on the best available technology. Installations in existence prior to 10 October 1996 or that have obtained permits before 10 October 1997 will have to comply by 10 October 2007.¹⁷⁴ “Pollution prevention” is an integral part in establishing the best

¹⁷³ European Commission(1996) Council Directive 96/61/EEC Concerning Integrated Pollution Prevention and Control. European Commission, Brussels.

¹⁷⁴ This procedure is commonly called a “grandfather clause”. It gives existing factories sufficient time to recover their investments and make the necessary adjustments.

available technology, and hence the allowable emissions or waste discharge are indicated in the permit granted to the industry.

The directive lists 15 considerations in establishing the best available technology and eight of those considerations are standard considerations or factors in evaluating pollution prevention. Those eight considerations are;

- (i) use of low wastes technologies;
- (ii) use of less hazardous substances;
- (iii) recovery and recycling of waste materials and by-products;
- (iv) alternative processes, facilities or operational methods;
- (v) technological changes and advances in science;
- (vi) nature and consumption of processed raw materials including water and energy;
- (vii) prevention of accidents and the need to minimise consequences to the environment; and
- (viii) assessment of the impact on the environment.

The seven other considerations are related to other EC directives and regulations such as trade effluent and discharge consent, wastes management licensing regulations, and control of pollution from slurry and agricultural fuel oil.

It should be noted that the EC directive utilised the term “best available techniques” whereas in North American practices the term used is “best available technology”. The use of the word “techniques” rather than technology signifies the broader aspect of the pollution prevention to include non-technology aspects of pollution prevention. These include changes in raw material specifications, use of alternative substances, recycling and reuse of wastes and

by-products which may not necessarily require modification of the processes but may call for management initiatives to find alternative suppliers and markets for the wastes and by-products.

“Pollution prevention” is the preferred terminology used by the European Commission and in fact by most national authorities such as in the United States, and Canada. The authorities, through directives or national legislation, try to avoid infringing or interfering with managerial practices and policies which may have a significant impact on the wastage and process efficiencies. Good housekeeping, operation and maintenance practices, incentive schemes, auditing and other managerial policies, programs and systems are standard components in the design and implementation of cleaner production programs, as those managerial practices and policies have significant impacts on waste generation and compliance with environmental standards and regulations. Management practices and policies also have a strong impact on profitability in addition to compliance with environmental standards, and most governments do not want to be seen as directly interfering with the managerial prerogatives.

However, EC Council Regulation No. 761/2001/EC entitled “The Eco-Management and Audit Scheme Regulation”¹⁷⁵ tried to overcome the shortcomings of the Integrated Pollution Prevention and Control Directive. The participation of industry in eco-management and audit schemes is on a voluntary basis, in contrast to the Pollution Prevention and Control Directive¹⁷⁶ where industry has to meet permitting standards. Article 1 of EC Regulation No. 761/2001/EC states:

¹⁷⁵ European Commission (2001) Regulation No 761/2001 Community Eco-Management and Audit Scheme. European Commission, Brussels.

¹⁷⁶ European Commission (1996) Council Directive 96/61/EEC Concerning Integrated Pollution Prevention and Control. European Commission, Brussels.

“ The aim of this Regulation, which repeals and replaces 1836/93/EC¹⁷⁷, is to encourage organisations whose activities have an environmental impact to continuously improve their environmental performance through voluntary eco-management and audit scheme. Participating organisations are required to establish and implement policies, programmes and management systems for their sites. These must be independently examined to ensure that they comply with the Regulations. Information about these policies, programmes and systems must be made available to the public. The regulation defines ‘organisation’ as meaning a company, corporation, firm, enterprise, authority or institution or part or combination thereof, whether incorporated or not, public or private, that has its own function and administration.”

It should be noted that compliance of the organisation to the directive is voluntary, but once the organisation has participated in the program the compliance and requirements become mandatory. EC has an official logo for eco-management and an audit scheme that the participating organisation could place in its premises and on its products. The use of the logo is an incentive for the organisation to join the scheme, as it is often a good advertisement and offers advantages over its competitors – especially if the market preferences are swayed by environmental concerns.

The two EC directives, although distinct with their implementation following different modes, if taken as a whole basically cover the whole aspect of cleaner production. The two directives cover both the technology and management practices and the policy aspects in reducing wastes and preventing pollution.

The World Bank Group

The International Bank for Reconstruction and Development (IBRD) was established with the International Monetary Fund at Bretton Woods, New Hampshire, USA on 1 July 1944. The initial purpose of the IBRD was to mobilise public and private funds to assist in the

¹⁷⁷ European Commission (1993) Eco-Management and Audit Regulation. European Commission, Brussels.

reconstruction of Europe from the damages of World War II.¹⁷⁸ After the successful recovery of Western Europe, IBRD shifted its focus and resources to the developing countries.

To provide more specialised programs and funding to the private sector, the International Finance Corporation¹⁷⁹ (IFC) was formed in 1956. In some instances, investors in developing countries may not need capital resources, but would like assurances on the repatriation of their capital or insurance against nationalisation and other political risks. Private insurance companies are not able to provide coverage against those risks, and if they are able to provide coverage the premium is very high. The Multinational Insurance and Guarantee Association (MIGA) was organised in 1985 to cover such risk. IBRD, IFC and MIGA form the World Bank Group.¹⁸⁰

A number of regional development banks have been organised under the auspices of the various economic and social commissions of the United Nations patterned after the World Bank. The regional development banks in operation today are the African Development Bank, Asian Development Bank, Inter-American Development Bank and the European Bank for Reconstruction and Development. As the biggest development bank and with the widest coverage, the World Bank normally takes the lead in the formulation and implementation of development strategies and initiatives.

¹⁷⁸ World Bank Group for additional information at <http://www.worldbank.org> accessed on June 15, 2006

¹⁷⁹ International Finance Corporation for additional information at <http://www.ifc.org> accessed on June 15, 2006

¹⁸⁰ Multinational Insurance and Guarantee Association for further information at <http://www.miga.org> accessed on June 15, 2006

The World Bank has published the *Pollution Prevention and Abatement Handbook: Towards Cleaner Production*¹⁸¹ to guide in the selection of technologies and best practices to minimise waste generation. Like the EC, the World Bank prefers to use the term “pollution prevention” rather than “cleaner production” as it tries to avoid interfering with management policies, programmes and plans in the operation and maintenance of the industry. While the World Bank Pollution Prevention Handbook has no legal standing, not even as a soft law, the handbook is more significant than the ministerial declarations of APEC and the ASEAN. The suggestions in the handbook are the basis for the design and implementation of projects financed by the World Bank and the regional development banks.¹⁸² As such, the borrowers have to willingly and sometimes unwillingly follow the suggestions given in the handbook. For example, Sec. 62 of the Environment Policy of the Asian Development Bank¹⁸³ specifically states that the World Bank Pollution Prevention and Abatement Handbook¹⁸⁴ is the standard to be complied with in Asian Development Bank financed projects unless there is a strong reason for deviation.

Global Environment Facility

The Global Environment Facility (GEF) was organised in 1991¹⁸⁵ on a pilot basis as a financial mechanism to promote international cooperation and foster action to protect the global environment. GEF formally started in July 1994 with the signing of the Instrument for

¹⁸¹ World Bank. (1999) *Pollution Prevention and Abatement Handbook: Towards Cleaner Production*, , World Bank, Washington DC.

¹⁸³ Asian Development Bank (2002) Environment Policy, Asian Development Bank, Manila Philippines.

¹⁸⁴ World Bank (1999) *Pollution Prevention and Abatement Handbook: Towards Cleaner Production*, , World Bank, Washington DC.

¹⁸⁵ As a pilot project there is no exact starting date for GEF. Environment Canada reported that GEF started in 1990. Environment Canada (2006) Global Environment Facility accessed on June 20,2006 http://www.ec.gc.ca/international/unorgs/gef_e.htm

the Establishment of the Restructured GEF¹⁸⁶. Unlike the United Nations, and similar to the World Bank, the voting structure in GEF is proportional to the nation's financial contribution. Hence, developed countries such as the United States, Japan and member countries of the European Union have predominant influence in the GEF.¹⁸⁷

GEF funds projects under six major areas, namely,

- (i) climate change;
- (ii) biodiversity;
- (iii) international water;
- (iv) persistent organic pollutants;
- (v) land degradation; and
- (vi) ozone depleting substances.

The six areas correspond to the six major international protocols that explicitly and implicitly designated GEF as the financial mechanism for the donor countries to comply with their financial commitments. Initially GEF was the designated financial mechanism by the conference of parties of the UN Framework Convention on Climate Change¹⁸⁸ and the Convention on Biological Diversity¹⁸⁹. Today GEF is the interim mechanism for the Stockholm Convention on Persistent Organic Pollutants.¹⁹⁰ Although GEF is not the

¹⁸⁶ Global Environment Facility (1994) Instrument for the Establishment of the Restructured Global Environment Facility, GEF Secretariat, Washington DC.

¹⁸⁷ Korinna Horta (1998) Global Environment Facility. *Foreign Policy in Focus*, 3, 1-4. At p.1

¹⁸⁸ The United Nations Framework Convention on Climate Change opened for signature on May 9, 1992 and went into force on March 21, 1994.

¹⁸⁹ United Nations Convention on Biodiversity opened for signature on June 5, 1992 and entered into force on December 29, 1993.

¹⁹⁰ Stockholm Convention on Persistent Organic Pollutants opened for signature on May 23, 2001 and entered into force on May 14, 2004.

designated financial mechanism of the Montreal Protocol on Ozone Depleting Substances¹⁹¹, and the UN Convention to Combat Desertification¹⁹², the GEF Council¹⁹³ recommended that its operation activities be aligned to the objectives of those international conventions.

GEF funding is primarily to the incremental cost for the enhancement of the global environment in traditional environmental projects and for new projects for the protection of the global environment that would normally be financed by traditional development financing. “Cleaner production” is not specifically identified in the GEF strategy. As discussed in this chapter, “cleaner production” is a national strategy by a number of developing countries and oftentimes part of the international strategy by bilateral and multilateral organizations such as UNEP to simultaneously address production efficiency and pollutant reduction and as such “cleaner production” is invoked in GEF projects even if it is not explicitly a GEF strategy.

International Organization for Standardization

The International Organization for Standardization (commonly known as ISO from the initials of its name in French) is a non-governmental organisation of the national standards institutions in 149 countries throughout the world. As a non-governmental organisation, its policies and standards have no legal authority. However, the member institutions of ISO are normally consulted by business and government to provide assistance in the development of

¹⁹¹ Protocol on the Control of Ozone Depleting Substances, opened for signature on September 16, 1987 and went into force on January 1, 1989. Revisions were made in 1990 in London, 1992 in Copenhagen, 1995 in Vienna, 1997 in Montreal and in 1999 in Beijing

¹⁹² United Nations Convention to Combat Desertification opened signature on October 14, 1994 and went into force on December 26, 1996.

¹⁹³ Global Environment Facility. (2006) Operational Strategy of the Global Environment Facility, GEF Secretariat, Washington, DC.

product and processing standards. The national standard institution normally puts its seal on products that have conformed to its standards. With growing international trade, businesses manufacture their products or provide services in accordance with the ISO standards. Products conforming to ISO standards after testing and confirmation by ISO authorized laboratories or institutions could attach the ISO seal to their products. The ISO seal of approval facilitates the export and import of goods and services, as it is easier for the trading parties to determine the quality of the product and services.¹⁹⁴

One of the main concerns in bilateral and multilateral trade agreements is the transfer of highly polluting industries to countries with lax enforcement of environmental standards to reduce the production cost. ISO developed a series of environmental management standards commonly known as the ISO 14000 series. The ISO 14000 series or environmental management standards requires businesses to develop environmental policies and systems and to integrate those environmental policies into the overall business management system. Application for accreditation to ISO 14000 is voluntary, but a number of businesses in developing countries are embracing the practice, as it facilitates the export of its products and services, builds up the confidence of environment-conscious buyers, and builds corporate goodwill. The EC Directive on Eco-management and Audit¹⁹⁵ scheme also recognised the ISO 14000 compliance.

Compliance with pollution prevention legislation and the voluntary ISO 14000 is equivalent to cleaner production. As discussed earlier, the pollution prevention directive covers the technology aspects of cleaner production while the ISO 14000 series covers

¹⁹⁴ Magale Delmas. (2000) Barriers and Incentives to the Adoption of ISO 14001 by Firms in the United States. *Duke University Environmental Law and Policy Forum*, 11, 1-38. at page 5

¹⁹⁵ European Commission (2001) Regulation No 761/2001 Community Eco-Management and Audit Scheme. European Commission, Brussels.

management practices, policies and compliance with environmental laws and regulations, and implementation of the best practices available and appropriate to the operating environment. The combination of the pollution prevention directives and the ISO 14000 series practically covers the field of cleaner production.

Cleaner Production and National Policy

Cleaner production or its variants are included in the national policy or domestic legislation independently or in response to binding international agreements. The European Commission directives on pollution prevention are the main sources of national legislation in the European Union member countries.

National Policy Based on International Commitments

The EC Directives are instructions to the member countries. The EC Directives on Integrated Pollution Prevention¹⁹⁶ and Control and Eco-Management and Audit Scheme¹⁹⁷ resulted in the enactment of national and local legislation in member countries. The need for local legislation depends upon each country's constitution and the manner by which environmental management is devolved to the local governments in each of the member

¹⁹⁶ European Commission (1996) Council Directive 96/61/EEC Concerning Integrated Pollution Prevention and Control. European Commission, Brussels.

¹⁹⁷ European Commission (2001) Regulation No 761/2001 Community Eco-Management and Audit Scheme. European Commission, Brussels.

countries. For example in the UK, Northern Ireland, Scotland, Wales and England each passed their own legislation to implement the directives.¹⁹⁸

Typical Domestic Legislation

The US Pollution Prevention Law is the oldest legislation predating the EC initiatives. Since its enactment in 1990, the law has not been amended and has served as a model to a number of domestic legislation on pollution prevention and cleaner production.¹⁹⁹

Like the EC, the US Act preferred to use the term “pollution prevention” rather than “cleaner production” as the law focused more on the technological aspects of waste reduction and efficiency improvement. The Act left out management policies, programs and practices which may have a significant impact on the resource utilisation, process efficiency, reuse and recycling of wastes as well as changes in the raw materials used. The Act recognised that managerial prerogatives have to consider a wide range of parameters other than environmental protection. It is for management to consider the trade offs as they affect the overall profitability of the company. Aside from the congressional declaration of “pollution prevention” as a national policy, the Act, unlike Agenda 21, has clearly defined the meaning, practice and scope of various aspects of pollution prevention. The Act also clearly defined the sequence of actions, priorities, and recourse for wastes that could be reused or recycled.

¹⁹⁸Scottish Environmental Protection Agency (2006a) Pollution Prevention and Control Legislation , at <http://www.sepa.org.uk/ppc/legislation> accessed on December 27,2006.

¹⁹⁹ Pollution Prevention Act of 1990 (US) Public Law 101-508, 104 Stat. 1388-321 *United States Code Title 42 USC13101*.

The Canadian Environmental Protection Act of 1999²⁰⁰ included in Part 4 provisions for promoting pollution prevention. The declaration section of the law states:

“It is hereby declared that the protection of the environment is essential to the well-being of Canadians and that the primary purpose of this Act is to contribute to sustainable development through pollution prevention.”

Like the US law, the Canadian law recognised “pollution prevention” as a national goal and the priority approach to environmental protection. In fact, the Canadian Labour Congress in its submission to parliament was very critical of the pollution prevention aspects.²⁰¹ To quote the submission of the Canadian Labour congress:

“Through there are rules for Pollution Prevention Plans in sec. 56(2), there are no requirements over the content, aims, objectives and goals of such plans. The model plans and the guidelines over the conditions under which Pollution Prevention Planning is appropriate (sections 54(1)(d), 61 and 62) have no legal force. Thus, there is no mechanism whereby the government can ensure that Pollution Prevention Plans will be effective, since only the form of plans, not the content, is regulated.”

The Cleaner Production Promotion Law of the People’s Republic of China is typical of the legislation in developing countries. Since I was involved in the development of this legislation, I would like to discuss it in detail. The National People’s Congress of the People’s Republic of China on its 28th Session on 29 June 2002 approved the Cleaner Production Promotion Law. This law took effect on 1 January 2003. It required the national and local governments to provide commendations, rewards and financial incentives for firms to adopt cleaner production. It required firms discharging and producing toxic and hazardous chemicals to undergo periodic auditing, and the government to develop a standard for packaging to reduce solid wastes and facilitate the recycling of packaging materials.²⁰² The

²⁰⁰ Canadian Environmental Protection Act of 1999. accessed on July 10, 2006 at <http://laws.justice.gc.ca/en/notice/index.html?redirect=%2Fen%2Fc-15.31%2F>.

²⁰¹ Canadian Labour Congress (1999) Submission (May 1999) Canadian Environmental Act (CEPA) to the parliamentary inquiry .at http://canadianlabour.ca/index.php/canadian_environment. Accessed on October 10, 2005.

²⁰² Cleaner Production Promotion Law 2002 (China) accessed on March 3, 2005 at http://www.chinacp.com/eng/cppolicystrategy/cp_law2002.html.

Asian Development Bank provided a cluster technical assistance grant of \$3.6 million to the People's Republic of China on cleaner production in July 1997. The technical assistance cluster consisted of five technical assistance grants and one of the components was to train and assist the legislative drafters in the Environmental Protection and Natural Resources Committee of the National People's Congress in developing a policy and possibly a law to promote cleaner production.

The Environmental Protection and Natural Resources Committee, under the Chairmanship of Prof. Qu Geping, initiated public consultation through public hearings, written submissions and intellectual discussions with practitioners, university professors, industrial leaders and government officials when they revised the Water Pollution Prevention and Control Law in 1995. The law was approved and took effect in 1996. The same public consultation procedure was followed in the development of the cleaner production law.

Intellectual discussions in China are more open and often are more freewheeling discussions than public hearings. The procedures for public hearings initiated by the Environmental Protection and Natural Resources Committee were later followed by other permanent committees of the National People's Congress. The first draft of the Cleaner Production Promotion Law was completed in early 2000 after the legislative drafters consulted a number of legal experts in the USA and Europe. Then in 2001, a series of public consultations and hearings were held throughout China. Dr. Aminul Huq and I designed the cluster technical assistance grant and I was directly responsible for designing and later for administering the component on the development of the Cleaner Production Promotion Law.

During the literature review process completed in the year 2000 as part of the development of the Cleaner Production Promotion Law in the People's Republic of China, the

consulting team noted that there was no precedent of any country developing a cleaner production or environmentally sound technology law, although most of the member countries of the United Nations are signatories to Agenda 21 wherein the signatory countries committed to promote the use of environmentally sound technology.²⁰³ In fact one of the major points of discussion was the need for legislation on an action that has a strong or even purely commercial rationale. Considering the strong or purely commercial rationale for the use of cleaner production in an industry, a policy statement would be sufficient.

The need for legislation on “cleaner production” was recognised in a similar manner to the successful implementation of “pollution prevention” in a number of countries. The pollution prevention legislation was a statement of national policy and strategy to address industrial pollution. However, in China with its tradition of central planning, there was less reluctance for the government to be actively involved in guiding management in the industries to use cleaner production. After all, “pollution prevention” is a component of “cleaner production”.

In a number of countries including Australia, “pollution prevention” or “cleaner production” is incorporated in a wide range of environmental legislation. For example, the New South Wales Waste Minimisation and Management Act of 1995²⁰⁴ required regional wastes boards to prepare and implement wastes management plans for reducing, reusing and recycling wastes. The New South Wales Wastes Reduction Grants provide up to \$100,000 for each project developing innovative and proactive approaches to reducing wastes. The terms

²⁰³ While it may be mere differences in definition of “environmentally sound technology” and “cleaner production” as used in Agenda 21 and in practice, from the institutional side two different ministries are promoting parallel programs, with one using cleaner production and the other using environmentally sound technology.

²⁰⁴ Wastes Minimisation and Management Act (1995). This act was repealed and replaced on October 8, 2001 by the Wastes Avoidance and Resource Recovery (New South Wales) Act 2001 copies of the acts are published by the New South Wales Government Information Service and complied by the Parliamentary Counsel's Office.

“cleaner production”, “pollution prevention”, “eco-efficiency” and “environmentally sound technology” may not be directly used in the legislation, but the actions, scope and objectives may fall under the practices of cleaner production. In a number of instances, a series of laws may have evolved over a period of 10 to 15 years with each law addressing a particular component of cleaner production. The series of legislation taken as a whole would constitute an integrated cleaner production legislation.

Other Countries

The Australian policy on pollution prevention is similar to those of the US, EC and Canada. The main role of the government is to influence and encourage industry to use pollution prevention techniques. As Senator Robert Hill, Australian Minister for the Environment stated during the Sixth Session of the High Level Segment of the Commission on Sustainable Development:²⁰⁵

“To influence and encourage industry in this, we cannot rely on regulation and indeed altruism. Viability and competitive advantage remain business imperatives. That is why concepts such as sustainable consumption and production and eco-efficiency really matter. Eco-efficiency makes sense for industry because it results in better environmental outcomes for industrial practices, and also improves economic efficiency. Tools such as cleaner production, life cycle assessment, environmental reporting, environment management systems and environmental accounting are very useful in helping industry move down the eco-efficiency path. Government should do what they can do to promote their use.”

As mentioned earlier, UNEP and UNIDO have been establishing cleaner production centres in developing countries. In the process, the international organisations often required the executing agency to develop and implement policies and programs to support the operation of the cleaner production centres. The policies and programs are often ministerial

²⁰⁵ Robert Hill (1998) Statement read at the Commission on Sustainable Development –Industry and Sustainable Development, Speech given at the 6th Session, High Level Segment, New York on April 30, 1998, Australian Year Book of International Law, Australian Practice in International Law, v. 19, p.375, see also <http://www.environment.gov.au/minister/env/98/sp30apr98.html> accessed on February 20, 2005

orders to the industry. For this reason, the Ministry of Industry is often the main agency implementing the development of cleaner production centres, although in a number of instances, the Ministry of Environment is also involved. As environmental audits would often identify potential violations of environmental rules and regulations, industries are often wary of using the cleaner production centres managed by the Ministry of Environment. For this reason the current preference is to establish the cleaner production centres in the Ministry of Industry.

For example, in the Philippines, the Department of Trade and Industry and the Board of Investment are responsible for developing policies for a cooperative, partnership approach to environmental improvement.²⁰⁶ The Department of Environment and Natural Resources is also involved in a number of cleaner production programs such as wastes exchange and wastes minimisation. Past experience has shown that industries were reluctant to join the cleaner production programs and, if they joined, were reluctant to provide the correct information as well as to participate effectively.

Unfulfilled Promises of Cleaner Production

Although the scope of cleaner production has expanded beyond the limits of purely technological research and development to include management procedures and policies, in practice cleaner production is still narrowly focused on technology.²⁰⁷ The cleaner production

²⁰⁶ Darren Sinclair and Neil Gunningham (2000) Promoting Cleaner Production in south East Asia: A case Study of the DTI/BOI Environmental Unit. Working Paper Series, Australian Centre for Environmental Law, Australian National University.

²⁰⁷ Part of the problem could be traced to Agenda 21 where cleaner production is considered a sub-discipline of environmentally sound technologies.

practitioners of today are for the most part the same practitioners as when waste reduction programs were called “clean technology”. The practitioners are mainly scientists and engineers. To scientists and engineers, policies are part of the operating environment just like the natural phenomena of climate, weather, geology etc. The technology is designed and built to function in a defined and fixed operating environment. The scientists and engineers are not trained to challenge the operating environment, but to make the best of the latter in designing and building the production process. Today, the early practitioners of clean technology are the major decision makers in cleaner production programs and projects. For this reason, cleaner production programs exclude any attempt to modify, alter or develop new sets of conditions for the operating environment. As Erica Phipps²⁰⁸ puts it:

“Although some government regulations require the use of specific pollution control techniques, most are flexible enough to allow pollution prevention. Nevertheless, the time comes to decide how to meet governmental regulations about pollution, both the regulators and the regulated parties tend to go with what they know – the traditional pollution control technologies – rather than pollution prevention.”

For example, between 1992 and 1998, the United States Agency for International Development (USAID) funded a US\$17.5 million cleaner production program among the member countries of ASEAN.²⁰⁹ The program design included all the possible components for successful introduction of cleaner production, including the development of supporting policies and rationalisation of the regional regulations and policies.²¹⁰ As Stevenson noted:

“The review should have been the starting point for a concerted effort both to rationalize the policies and laws of the ASEAN nations, an original objective of the ASEAN-EIP²¹¹ and to identify the forms that the policy and law would need to take in

²⁰⁸ Erica Phipps (1995), *Pollution Prevention Concepts and Principles, Introductory Pollution Prevention Materials*, University of Michigan.

²⁰⁹ The USAID program in the ASEAN program on cleaner production is one of the biggest cleaner production programs to date. Most of the cleaner production programs are limited to \$3 million and some programs are as small as \$100,000

²¹⁰ Robert Stevenson (2004) An Assessment of the Design and Effectiveness of the ASEAN Environmental Improvement Program. *Journal of Cleaner Production*, 121, 227-236 at page 233.

²¹¹ EIP- Environmental Improvement Partnership. USAID preferred to design its assistance programs as partnership agreements with the recipient governments. However, as Stevenson mentioned in his paper the decision to curtail the policy and legislation component of the program was a USAID decision.

order to promote change toward cleaner production. This should also have been the basis of the development of national strategies and subsequent development of integrated action plans of achievement of Cleaner Production in each nation. The donor curtailed this direction of inquiry after publication of the review in favour of increased work directly with the private sector, especially the promotion of environmental trade and investment.”

As Stevenson further noted “the ASEAN-EIP probably fell substantially short of its potential for several reasons”.²¹² One of the main reasons given by him was the lack of national policy frameworks and strategies for the achievement of cleaner production.

However, as briefly discussed in Chapter I, cleaner production is not living up to its promise and potential. As Danilhelka observed:²¹³

“Cleaner Production gives a powerful tool to decrease wastes production, to limit the pollution of the environment and depletion of natural resources. Moreover, the return of investment in cleaner production is quick and so it seems that cleaner production should be highly demanded by enterprises. The reality is less optimistic – frequently only limited interest is visible and even after an explanation, people in the enterprise hesitate to become actively involved”.

Danilhelka proposed the need to examine management attitudes toward risk taking as a constraint in adopting cleaner production. Managers of a factory are more inclined to take action on short-term or immediate risk, even if the potential damage is low compared to that of long-term risk. Non-compliance with either environmental standards or regulations is a short-term risk with immediate impact on management performance, whereas adoption of cleaner production is mitigating long-term risks that gradually take place, such as loss of competitiveness and market share.

²¹² Robert Stevenson (2004) An Assessment of the Design and Effectiveness of the ASEAN Environmental Improvement Program. *Journal of Cleaner Production*, 121, 227-236. at page 235

²¹³ Pavel Danilhelka (2004) Subjective Factors to cleaner production- Parallel to Risk Perception? *Journal of cleaner Production*, 12, 581-584 at page 581.

Danilhelka's analysis on the importance to cleaner production in the short- term and long-term risk taking attitude of management highlights the need to examine not only the anthropogenic aspects of the operating environment, but also the natural environment, especially human behaviour. Short-term and long-term risk taking attitudes are parts of human behaviour often considered as human instinct or habit. Compliance with environmental standards and regulations is a short-term and immediate risk to management, as the environmental laws were crafted to provide immediate punishment and reward for compliance. On the other hand, the adoption of cleaner production is a long-term risk, since there is no policy or law providing punishment or reward for failure to use it. Laws and policies properly crafted and implemented could alter the perception of risk without necessarily altering human nature in responding to the risk. Personally, I tend to disagree with Danilhelka's analysis. The use of cleaner production does affect the manufacturing efficiency, product cost and quality, and public perception to social and environmental concerns that is reflected in the company's increased profitability and market share. If the company is traded on the stock market, public perception of the company's profitability and future dividends from increase in market share is often reflected in the share price a few hours after the company releases its operating performance. The reward and punishment for using cleaner production is much shorter term than those related to compliance with the environmental standards, contrary to the proposition put forward by Danilhleka.

While human instinct and habit may have developed through the millennia as adjustments and struggle for survival, humans as rational animals are able to modify their habits and curtail theirr instincts. Environmental policies and legislation properly implemented have the potential of changing human habits and instincts. For example, the Report of the Working Group of Experts from EC Member States on the Use of Economic

and Fiscal Instruments²¹⁴ states: “Economic instruments affect through the market mechanism costs and benefits of alternative actions open to economic agents, with the effect of influencing behaviour in a way which is favourable for the environment.”

Changing and modifying human habits and instinct is a complex and long-term process. To potentially modify human habits and instinct, a well crafted policy or law has to be supported with proper training, education and peer pressure in addition to the rewards and penalties. For example, recycled paper was originally not accepted because it is grey and looks dirty. After more than 20 years of public education and environmental awareness campaigns funded by environmental legislation in Western Europe, recycled paper is now the preferred item over paper made from new fibres. In addition, paper made from new fibres is no longer heavily bleached.

On the other hand, laws promoting temperance and prevention of alcoholism in Western Europe and North America in the 1920s were dismal failures. Instead of modifying human habits and attitudes toward alcohol, the legislation only stimulated the growth of liquor smuggling and bootlegging, so the law was abandoned. Today, control on alcohol consumption is primarily through taxation to discourage over- consumption.

Phipps²¹⁵ identified four barriers to the use of “pollution prevention”. These are:

- (i) corporate culture and institutional norms;
- (ii) cost;
- (iii) prescriptive technology mindset; and

²¹⁴ Working Group of Experts (1990a) Report of the Working Group of Experts on the Use of Economic and Fiscal Instruments. Brussels, European Commission. at p. 455

²¹⁵ Erica Phipps (1995) Pollution Prevention Concepts and Principles. *Introductory Pollution Prevention Materials*. University of Michigan. at page 12

- (iv) difficulties in identifying pollution prevention opportunities.

The barriers identified by Phipps are very similar to those identified by UNEP seven years later in 2002. These consist of:²¹⁶

- (i) resistance to change;
- (ii) lack of appropriate demonstration projects;
- (iii) inadequate training;
- (iv) lack of cleaner production related information; and
- (v) problems in accessing technology.

Other barriers to cleaner production identified by UNEP as critical are lack of financing and lack of orientation to cleaner production of the national policy and regulatory framework. To address those barriers, UNEP, in coordination with other UN agencies has organised cleaner production centres worldwide and regional technology exchange centres. The cleaner production centres were to develop demonstration projects to change the corporate and institutional culture, and provide information and access to technology. UNEP also works with the multilateral and bilateral funding agencies to provide low-interest loans with longer repayment periods. In the establishment of the cleaner production centres and in the provision of the loans to the governments, UNEP and the multilateral funding agencies normally include a covenant for the borrower or aid recipient to develop policies and possibly legislation to encourage cleaner production.

In my experience, the provision of soft loans with longer repayment periods is unnecessary if cleaner production has a very high rate of return. Venture capital invests in projects with returns of five to six per cent above the cost of money, and if cleaner production has financial rate of return of 20 to more than 100 per cent, venture capitals should be filling

²¹⁶ United Nations Environment Programme (2002), Cleaner Production A Global Status Report, UNEP, Nairobi, Kenya at page 13-14.

the gap. Even with the latest round of interest rate increases by the US Federal Reserve Bank in the last two years from 2005 to 2006, the interest rate in US dollar time deposits is less than 6 per cent. Cleaner production should be an active area for venture capital, considering that the industry is an operating entity with its own market share and product line, comparable to investments in new companies that have just completed their business plans.²¹⁷

Constraints to Cleaner Production

None of the publications reviewed have pointed out the existence of laws which could impede the use of cleaner production. Prior to the emergence of environmental concerns, a number of laws were already in existence to facilitate the interaction of the capitalist, labourer, landowner and consumer with the national interest such as economic, territorial and national security. Those laws defined the behaviour and attitude of the various stakeholders that would be affected by the use of cleaner production. Unless those laws are modified or amended, the various stakeholders will not use cleaner production in spite of the knowledge of its advantages and benefits. The monetary and social cost of moving out of the safety net provided under the existing laws could far outweigh the benefits of cleaner production.

The constraints to cleaner production could be broadly classified into international and domestic constraints. International constraints are those related to common practices in

²¹⁷ I have been involved in the processing of the Metro Manila Air Quality Improvement Project. As part of the loan, the Asian Development Bank extended a \$25 million loan to the Land Bank of the Philippines for re-lending to industries initiating cleaner production to address their air pollution problems. Five years after the loan was approved less than 10 per cent of the loan was disbursed. In 2001, the Department of Science and Technology requested a grant for the establishment of a cleaner production centre to provide information, technology, demonstration projects and training. ADB extended the technical assistance grant upon request by the government. Considering that similar activities have been carried out under the ASEAN-AEP program described earlier in this section it is doubtful that the ADB technical assistance grant will change the dynamics of implementing cleaner production in the country. In December 31, 2002 the cleaner production loan component was cancelled with less than 10 per cent of the component used.

relation to international trade, monetary and intellectual property rights; and commitments to bilateral and multilateral agreements.

Domestic constraints are:

- (i) the domestic legislation and policies enacted or promulgated to implement the bilateral and multilateral agreements;
- (ii) local traditions, practices and customs as they affect the allocation of resources, pricing of commodities, promotion of competition and treatment of uncompetitive sectors of the economy;
- (iii) legislation²¹⁸ with respect to promotion of new sectors of the economy, social and environmental legislation, and the promotion of competitiveness and treatment of uncompetitive sectors;
- (iv) local fiscal, monetary and economic systems including the abstraction and conservation of both renewable and non-renewable natural resources, wealth distribution, market mechanisms; and
- (v) political system and political will to implement change.

As the domestic constraints to cleaner production are wider and more complicated, these are treated separately in Chapter IV. The international constraints to cleaner production are discussed in Chapter V.

²¹⁸ In a number of instances the legislation and written policies will differ from the local traditions, practices and customs. For this reason the two sets of policies and practices are treated separately in this research. In a number of instances, the traditions, customs and practices may conflict with the written legislation and policies. Implementation of the written legislation and policies would be very difficult.

CHAPTER IV

DOMESTIC CONSTRAINTS TO CLEANER PRODUCTION

Introduction

As discussed in the previous chapter, the identified barriers for effective utilization of cleaner production are:

- (i) financial constraints on the part of the users;
- (ii) lack of potential profit on the part of the supplier of cleaner production technology;
- (iii) lack of information on cleaner production;
- (iv) uncertainty or hesitation on the part of the users to embrace new and untried technology; and
- (v) absence of legislation and policy to support cleaner production.

To overcome these barriers, cleaner production proponents recommend: demonstration projects to allay the uncertainty of the users; development of information centres to disseminate the results of demonstration projects; and the provision of information to the users. The granting of loans with low interest rates and long repayment periods, commonly called soft loans, is also recommended.

As discussed in the previous chapter, cleaner production demonstration projects have shown very high financial rates of return which range from 20 to 100 per cent compared to the cost of borrowings which, in recent years, have ranged from 6 to 15 per cent worldwide. Soft loans provided by bilateral and multilateral financial institutions with interest rates as

low as two per cent per annum and up to 30 years repayment period are under utilized, and in a number of instances, the loan facilities have been cancelled.

UNEP and UNIDO have both established a number of international, regional and national centres for the promotion of cleaner production. Still, the recommendations to promote the use of cleaner production are to build more centres, initiate more demonstration projects and provide more financial incentives.

Pollution prevention with voluntary compliance with the ISO 14000 series is exercised by the government to guide if not to coerce the potential user to adopt cleaner production. Perhaps the strongest legislative initiative to guide the potential users into adopting cleaner production is contained in the provisions of the Chinese Cleaner Production Promotion Law²¹⁹. The law required industries to carry out periodic environmental audits to determine wastage, and identify areas for the application of cleaner production by comparing the industrial efficiency and waste generation with the best practices. The law also required existing users of toxic and hazardous chemicals to utilize the best industrial practices. Industries could be penalized for failure to carry out periodic environmental audits. They could also be fined for failure to adopt the best practices within a specified time period.

Chapter 5 of the Chinese Cleaner Production Promotion Law of 2002²²⁰ deals with Legal Liability. Article 40 of this chapter states:

“In any enterprise or individual who violates the provisions of the third paragraph contained in Article 28 of this Law, fails to implement cleaner production auditing and fails to accurately report the results thereof, the relevant departments responsible for environmental protection under the people’s government at or above the county level shall order such party to make rectification within a specified time limit, and may further

²¹⁹ Cleaner Production Promotion Law 2002 (China) accessed on March 16, 2005 at http://www.chinacp.com/eng/cppolicystrategy/cp_law2002.html

²²⁰ Ibid

impose a fine in an amount not to exceed RMB 100,000 yuan if the party fails to make rectification. (RMB yuan is the official currency of the People's Republic of China equivalent to 8.1 US dollar as of September 2006.)”

The third paragraph of Article 28 which is quoted in Article 40 of the same Chapter 5 states:

“Any enterprise using toxic and hazardous materials in production or discharging toxic and hazardous substances shall periodically conduct cleaner production audits and report the audit results to the relevant administrative department for environmental protection and the relevant departments for economic and trade under the local people's government at or above the county level”.

The cleaner production requirements related to storage, use and disposal of toxic and hazardous substances are treated in Article 12 of Chapter 5. Article 12 states:

“The nation shall implement a time-limited system for the elimination of obsolete or obsolescent production technologies, processes, equipment and products gravely hazardous to the environment and wasteful of resources. The relevant departments for economic and trade under the State Council shall issue a directory of production technologies, processes and equipment and products to be eliminated within the time limit, jointly with other relevant administrative departments of the State Council²²¹.”

There is no literature analysing the impacts of existing social, industrial promotion and environmental legislation on the adoption of cleaner production. The existing social, industrial promotion and environmental legislation provides incentives that might be lost in adopting cleaner production. As such, the potential user of cleaner production may incur financial and social burdens higher than the potential benefits. The benefits enjoyed under existing laws and practices are real and tangible, whereas the benefits from using cleaner production are potential benefits subject to a wide range of uncertainty. In addition to financial or monetary benefits, the potential user of cleaner production may enjoy a wide range of intangible benefits and securities from the existing setup that could be lost with the switch to cleaner production. This chapter will briefly analyse the potential impacts of those types of legislation on the potential users of cleaner production.

²²¹ The State Council in China is the equivalent to the cabinet of the executive branch of government in the United States, and Australia.

Labour Laws

Labour laws are made to facilitate the interaction between employers and employees in the workplace. These laws have a very strong orientation to social justice and equity. Common components of labour laws are related to minimum wage, security of employment from unfair dismissal, rights to form unions and to enter into collective bargaining agreements and strikes, work place safety and occupational health, working hours and overtime pay, plus basic privileges such as sick leave, vacation leave, hospitalization, maternity leave and holidays. Details of the labour laws vary from place to place in accordance with the local customs and traditions as they relate to the relationship between the employer and employees.

A common perception in labour law is the apparent weakness of the employee or labourer in his relationship with the employer. Conceptually, the labourer has a lower level of education, and financial, political and social clout in comparison to the employer. The exploitation of semi-educated and often unskilled labour in sweat shops, the growth of slums around industrial centres and petty crime were the common features of the social landscape in the early years of industrialization in Europe and North America. Corporal punishment was the standard procedure to maintain productivity and competitiveness. Petty crimes, often committed to ease the pain of hunger and deprivation, were meted out harsh sentences. Spontaneous mobs of labourers asking for reforms and improvement in working conditions were often quelled by strong military forces even in democratic societies like the US, UK and Australia. Indeed, 1 May commemorates the labourers who were killed when the National Guards fired on labourers protesting and rioting against the poor working conditions in the factories and very low wages in 1886 at the Haymarket in Chicago, US. May 1 is celebrated

in almost all countries today as Labour Day except in the US, UK and Australia. In these three countries, Labour Day is celebrated in September.

The inequality between employer and employees was not limited to the industries. In the agricultural sector, especially in large colonial plantations, the labour force was equally exploited. Large colonial plantations were dependent on slave labour. Most of the slave labour used in the New World was purchased from the West Coast of Africa and transported across the Atlantic Ocean. Even after the abolition of slavery in the mid 19th century in the Western hemisphere, the former slaves continued to till the land under substandard living conditions and low wages. Indentured labourers from other colonies, especially colonies with large populations and high population densities such as India and China, were recruited to supplement labour shortages in the plantations.

The development of agricultural plantations in Asia by the European powers began in the late 19th century after the abolition of slavery. A common feature of the British and French colonial policies was the importation of Indian and Chinese labourers to work in the plantations. Being foreigners, the indentured labourers were more subservient than the local labourers who could claim some form of ownership of the land and potentially organize a rebellion. Although the indentured labourers were paid for their efforts, they had to provide their own food, living quarters, amenities and transport cost. In a number of instances, the indentured labourers had to borrow money for their transportation and support the families left in their home countries. As a result, the living and social conditions in plantations were very poor and opportunities for advancement were limited.

The Communist rebellions in Malaysia and Indonesia in the 1950s had a strong base in the Chinese communities in those countries. The indentured Indian labourers in the tea

plantations of Sri Lanka, on the other hand, formed a distinctly disadvantaged social niche which continues to exist to this day. At the end of the colonial era, the indentured labourers and their descendants form a large portion of the population in relation to the indigenous population, thus creating a serious political strain. For example, in Fiji, the indentured Indian labourers and their descendants outnumber the indigenous population, creating a political problem which exists to this day – some 30 years after the British left Fiji.

Writers such as Charles Dickens stirred the conscience of the middle and upper classes in Europe and awakened their awareness of the misery of the poor and marginalized workers. In Central and Eastern Europe where the labour organizations were suppressed with brute force, the labour movement became more militant and went underground. Karl Marx had to escape from Germany to Britain where he wrote his Communist manifesto *Das Kapital*, calling for social revolution and the emergence of a classless society. The Communist manifesto found a large following not only among the labourers but also amongst the young and educated middle class who were unsatisfied with the social conditions of the day. In France, the educated middle class, mostly university students, went on rebellion and established the Paris commune. The Paris commune was very short-lived, as the rebellion was effectively crushed by the military. However, the end of World War I saw the Bolsheviks gaining control of Russia and establishing a Communist state. The ferocity of the power struggle and the annihilation of the upper and middle classes in Russia after the Bolshevik revolution rattled the privileged class in Western Europe.

The Establishment in Western Europe and North America have come to realize that they have to accommodate the legitimate demand of their labour force for improved working conditions. The International Labour Organization was formed in 1919 and it is one of the oldest international organizations affiliated with the United Nations to promote and protect

the welfare of labourers worldwide. With increasing manufacturing efficiency, large corporations found it necessary to broaden their market outside the traditional upper class. A well-paid labour force was a potential market for the surplus production.

Since the dawn of history, goods were made by craftsmen and their assistants who made the initial design, selected the raw materials, built and marketed the product. The craftsmen and their assistants also provided after-sales services or operation and maintenance. At the start of the industrial revolution, the factories were structured along the same lines as the traditional workshop of a craftsman, except that machines were added to lessen the work load and increase the production rate. The practice is still carried out in the manufacture of expensive and exclusive cars.

Henry Ford introduced the production line in the manufacture of his model T, which radicalized the design and layout of car factories. Machines were designed for a specific purpose and operators specialized in the operation of a specific machine. The parts were manufactured with precision, and the assembly of the parts to a functional unit was no longer dependent on the skill of the labourer. The labourer's main task was to maintain the quality of the output of their machine without any consideration for the ultimate use of the product. Ford was able to lower the cost of production and at the same time maintain high product quality. The production line concept was adopted in almost all industries mass producing consumer products.²²²

When labour was cheap, it was common for industries to assign labourers to operate a specific machine, and if the demand in the whole process was lower than the output of the

²²² While mass production started in the automobile industry, at present automobiles at the high end of the market continue to be handcrafted. Most of the clothes today are mass produced on a similar production line concept, but a large number of expensive clothes are still tailored to fit.

machine, the labourers were paid even if they were idle. For example, labourers assigned to produce nuts and bolts might be idle for half a day because the demand for the nuts and bolts in the assembly line was low and the stockroom was full of unused nuts and bolts. Similarly, the factory might maintain a large design force with little workload as the product design may remain constant for a long time as long as the market uptake is high.

With the increase in labour cost after World War II, the Japanese developed the “on time” manufacturing techniques. Japanese manufacturers were mere assembly lines.²²³ The production of the parts was sub-contracted to small family businesses which might even supply the same parts to competitors. The Japanese realized that large manufacturers did not have to manufacture the parts but could buy these from the market. The main consideration was the timely arrival of the parts in the assembly line – hence, the term “on time” manufacturing. The producer of the parts could run the equipment full time, as the output was used in a wide range of industrial products manufactured by a large number of companies. The main concern of the parts producer was to maintain the quality of the product at the minimum cost. As the parts producers’ main line of business was very specific, they carried out research and development to improve product quality and production efficiency even for the production of a very simple product such as a screw. In a large integrated industrial complex, nobody would care to improve the design and production of a simple part such as a screw. The user of the parts does not have to maintain a large inventory in the assembly line, and if there are changes in design, merely informs the supplier of the change.

²²³ Brian Baisgen and Andy Blunden (2005) Encyclopaedia of Marxism. Marxist Internet Archives at <http://www.marxist.org/glossary/about/index.htm> accessed on July 20, 2006. The “just on time” manufacturing process is also called “Toyotism” after Toyota Motors of Japan, the first major manufacturer to extensively apply the technique. I choose this website as it is critical to labour saving techniques used in industry.

By 1970, the Japanese manufacturing technique has been copied by manufacturers in other countries. Today, “on time” manufacturing is a standard industrial practice. For example, X brand of computer will have chips manufactured in Malaysia, Philippines and Singapore, plastic frames by Taiwan plastic, fans and surge control from Thailand etc. The Japanese manufacturing technique changed the nature of the labour force and its relationship to the employer. A large segment of the labour force is self employed or contractual. The workers may work in their house using the parts, materials and sometimes equipment supplied by the manufacturer. Even in the sweat shops manufacturing garments, bedding and tablecloths, the main activities, which are sewing and cutting, are subcontracted. A subcontractor with a small capital base posts a bond with the manufacturer to withdraw raw material to manufacture a specific number of garments. The manufacturer agrees to release the bond and pay the sub-contractor a specific price per unit of the finished product that passes through agreed quality control and is delivered within a specified time. The subcontractor pays the manufacturer penalties for products that do not pass the quality control test or are not delivered on time. The manufacturer concentrates on design, marketing and quality control, but with no direct contact with the labour force making the products.

While the practice may reduce the production costs and allow the manufacturer to effectively compete in the market, in recent years the trend has been to return to more traditional manufacturing arrangements. The main factors for reversing the manufacturing pattern are the emergence of high quality fake products and concerns by human rights organizations on child and female labour, the unhealthy working conditions in the subcontractor’s premises, and the absence of social safety nets such as medical insurance, vacations, sick leave and employment security.

High quality fakes are often made by the same person and equipment who used to make the real product. If the raw materials or semi-finished material are available in the local market it becomes difficult to control the production of high quality fakes. Campaigns by human rights organizations against poor working conditions, child workers and other social issues could result in loss in market share from bad publicity. For example, designer sport shoes manufacturers have been targeted by social campaigners in developing countries. The designer sport shoe manufacturers are criticized for paying millions of dollars for endorsement by known athletes while their sub-contractors are paying from US\$2 to \$3 per day to unskilled workers making the shoes.

Brian Langille²²⁴ summarized the above trend when he stated:

“In the last century, the transaction costs of the time, combined with the dominant management theory, led to the Taylorist mode of production, which involved vertical integration, the hiring of large numbers of employees on long term contracts, the construction of ‘internal labour markets’ and the rise of the basic understanding of the trade-offs that employees, as opposed to independent contractors, make. The basic trade-off was that those who are party to employment contract – employees – receive security and stability in employment through a long-term contract, in return for subordination to the control of the firm, while self-employed independent entrepreneurs forego security in return for the chance of profit, subsidized in part by the tax system. In this context, it was natural that labour law would focus upon regulation of the long-term employment contracts in the name of the employees conceived of as needing protection, because of unequal bargaining power. Contract of employment was the obvious platform for regulation and for the delivery of a social safety net that would protect against both employment risks and wider social risks, for the worker and the family.”

Even with the changing employee/employer relationship, most courts interpret the labour laws to protect the most vulnerable or disadvantaged person or group of persons, taking into account the person’s economic and social situation, dependence and insecure position.

²²⁴ Brian Langille (2005) What is International Labour Law for? International Institute for Labour Studies, International Labour Organization, Geneva. Switzerland at page 10

The introduction of cleaner production would require the re-evaluation of the manufacturing process, the management policies and structure as they affect the manufacturing efficiency, competitiveness and reduction of the wastes discharged to the environment. For a traditional manufacturing enterprise with a large number of employees on long-term contract or permanent employment status, the adoption of cleaner production would result in most instances in trimming down the work force. The work force could be trimmed down by: (i) non-replacement of positions vacated by retiring employees; (ii) early retirement of mature employees; and (iii) payment of separation benefits to redundant employees.

In developing countries with very high unemployment rates, the labour force, through the unions and sometimes on an individual basis, would resist retrenchment as it is very difficult for the separated personnel to find other employment, even for casual work. There are a number of instances when the labour protest simply goes out of hand and becomes violent. The problem is further compounded by cultural factors. For example, in the Japanese culture, the employer expects loyalty from the employee, which often means voluntarily staying at work after the normal working hours for free, and in return, the employee expects to be employed until he reaches retirement age. Separation from the job before retirement is often taken as an indication of poor performance or incompetence, making further employment prospects difficult.

While this phenomenon may be more pronounced and open in Asian cultures, it is really part of the human psyche. The problem could be just suppressed in Western cultures, especially in countries with a highly mobile population. There have been a number of instances in the US where a re-trenched employee lost control of himself and returned to the workplace, shooting former co-employees and supervisors.

The potential impacts on the labour force from the introduction of cleaner production would depend on a number of management strategies such as the phasing of the changes and the scope. Simple waste minimization is the most basic change that management could introduce with minimal change in the number of labourers and the skill mix. In fact, waste minimization through recycling and reuse may even result in the expansion of the labour force as the wastes are segregated, packaged and sold to potential users. Waste minimization from good housekeeping may result in more overtime and additional skilled labourers to immediately repair and clean leaks, maintain the drainage, pipes, and control valves. However, the environmental benefits of waste minimization through good housekeeping, recycling and reuse are often insignificant as those are considered in the initial process design. The wastes reduced or eliminated from good housekeeping, recycling and reuse should not have been there in the first place. A dirty and messy factory is not the factory that the designers have envisaged; its dismal state is the result of mismanagement. Retraining or changing the plant managers to clean up and operate the factory as intended should not be considered part of cleaner production.

In older industrial plants which are vertically integrated, the introduction of cleaner production could result in a significant reduction in the labour force as the industrial plant closes smaller units and decides to purchase the semi-finished products from outside specialized companies manufacturing these particular products. The factory specializing in the particular semi-finished product has the advantage of economies of scale allowing it to produce the product at a cheaper cost and often with a smaller labour force. The specialized factory is also in a position to carry out more intensive research and development as it is their main product and the cost of the research and development is spread over a wider market. On the other hand, for the vertically integrated industry, the industry's semi-finished material supplies only its own needs. The manufacturer has no incentive to carry out intensive research

and development to improve the quality and production efficiency of the semi-finished material especially for small items such as nuts and bolts. It does not compete in the market for the supply of the spare parts and semi-finished products as it only supplies its own needs. Improvement in efficiency of the small units is lost in the evaluation of the efficiency of the main production unit even if the sum of inefficiencies in the small units is much greater than any improvement in efficiency of the main production line. For example, in a vertically integrated car manufacturer the nuts and bolts accounts for almost 10 per cent of the material cost and up to 30 per cent of the assembly cost as bolting the other parts. However, research and development to manufacture nuts and bolts that are easier to tighten and once tightened do not loosen is a low priority or even neglected in favour of the car body design and the main assembly process that attracts the customer, the media and critiques. In the long term, customers often complain of rattling cars due to loose nuts and bolts.

A very good example of a vertically integrated factory is the car manufacturing factory in the 1920s. Henry Ford envisaged his factories as producing their own steel from basic raw materials such as iron ore, coal, and lime. From the steel, the factories produced the various types of alloys, machined the alloys to car parts, and assembled the parts. The research and development efforts were focused more on the design of new cars, more efficient car engines, and improved car safety than on the improvement of steel manufacturing, alloy quality and production, and spare parts production efficiency. While the steel requirement for an integrated car manufacturer is considerable, in the range of a hundred thousand tonnes per years, it is still very small for a state-of-the-art steel mill to operate economically today with minimum output of a million tonnes per year. The inefficiencies noted in the steel manufacturing process were easily absorbed by the value added in the car manufacturing process and were often left uncorrected. There was little research and development on steel production, alloy development, and even minor spare parts.

As mentioned earlier, the car manufacturer today buys a large number of spare parts from specialized manufacturers. The specialized manufacturers do not produce special alloys. In the same manner, the special alloy manufacturers do not produce their own steel, but purchase it from steel mills. However, the specialized manufacturers carry out extensive research and development to improve their products and the production efficiencies. They supply a wide range of markets aside from the car manufacturers. For instances, alloys could be needed in the manufacture of appliances, aeroplanes, tools, and heavy equipment. The improvements in transport and communications allow the car manufacturers to reduce their spare parts inventories to the basic minimum required for a few days of production.

Hence, to restructure a vertically integrated factory to meet the efficiency and manufacturing practices of modern factories, a large number of labourers will require retraining, and reassignment to other areas, and may even lose their jobs. Labourers relocated to other factory sites will have to break their social ties to the community. In cases of families where both the husband and wife are working for the same company, one member may be forced to sacrifice his or her career.

In a number of instances when the market is expanding, a vertically integrated industry may take advantage of the expanding market to expand its production capacity while closing the small and inefficient manufacturing processes peripheral to the main manufacturing line. This strategy was used extensively in the People's Republic of China in the 1990s.

At the end of the Chinese Civil War in 1949, Russia provided the technology for heavy industries. However, this cooperation was abruptly terminated in the mid-1950s when

China tried to exert its own independent position within the Communist bloc. The Chinese practically scaled up laboratory units into industrial sized factories. As a result, the manufacturing processes were very inefficient. In 1994, I visited a factory in Anhui province that was producing sulphuric acid. Elemental sulphur was manually fed to an oven to produce sulphur dioxide. The sulphuric acid was used in the manufacture of ammonium sulphate fertilizer.

To reduce the amount of pollutant discharged to the environment, one of the requirements of the Asian Development Bank was to discourage financing the expansion of the industrial capacity.²²⁵ However, the Chinese state enterprises, and later, the town and village enterprises, resisted all efforts to maintain the industrial capacity with the loans being allocated merely to improve the manufacturing efficiency and product quality.

China during this period had an “iron bowl” policy which granted lifetime employment in the industry. The common practice in China after the Civil War was to assign a person to a specific work unit or factory. Normally the person was employed in this work unit throughout life. In cases when his or her skills were needed in another work unit or factory, salary was still paid from the original work unit and was remitted by the new work unit. On retirement, the worker received retirement pay from the original work unit, which kept track of employee movement and maintained career folders. Hence, it was not just a question of closing down a work unit because it was losing money or was non-competitive in the market. The work unit served a number of social and official functions other than providing employment.

²²⁵ Kazi Jalal, Bindu Nath Lohani, Aminul Haq, Ely Anthony Ouano (1999) Asian Development Bank's role in Promoting Cleaner Production in the People's Republic of China. *Environmental Impact Assessment Review*, 19, 541-552.

With the introduction of reforms under a structure normally called “socialist market economy” entrepreneurs bought out their contract with the original work unit and paid a document-handling fee to a new type of work unit. To merely improve the manufacturing efficiency and the product quality would result in serious labour dislocation and possible social problem. The industry would still have to pay for the dislocated labour until the labourers were able to find alternative employment.

However, very few economies were expanding at the rate that China was expanding from the mid-1990s to date. During this period, the Chinese economy was expanding at a minimum rate of 9.4 per cent up to as high as 15 per cent per annum. Most of the foreign investments in China were direct foreign investments which took advantage of the lowly-paid and skilled labour market in China. Foreign investors were also very eager to establish themselves in the potentially huge Chinese markets for their products. Even with the rapid economic growth in China and the potential for displaced labour to find alternative employment, there are frequent reports in the Western press of labour unrest in old and inefficient factories that were later closed down.

In a number of developing countries, the industries are established close to the source of raw materials. Labour colonies or blocks of residential houses are built and used by the labourers in close proximity to the industrial plant. In traditional agro-industries such as sugar mills, the labour force has been in the labour colonies for generations. Aside from the financial and employment opportunities, the industry provides a social focal point for the labour force. The labour force also forms a very cohesive and tightly-knit social structure. The displacement of any member of the labour force is not a simple loss of employment opportunity, but it is also a loss of social ties. In a similar manner, the community rallies

behind the displaced labourer such that the industry may find it difficult to manage the loyalties of the labourers left behind. In instances when the introduction of cleaner production would call for the importation of new labourers with new skills and talent, the integration of the newcomers into the established community and the displaced labourers would be extremely difficult. In introducing cleaner production under this circumstance, industry has to consider the social and emotional impacts of its decision to adopt cleaner production on the remaining labour force and the community in addition to the financial cost of separation benefits.

The potential labour problems from modernization or change in technology are not limited to the developing countries. As late as the 1980s, most of the newspapers in Fleet Street in London, UK, were still employing typesetters. At this time, photo offset technology was already well developed, but the potential social and union problems from dislocation of the typesetters negated any advantage from using the new technology. Murdoch had practically to move out of Fleet Street and weather out labour unrest for insisting on the use of the new technology²²⁶. However, once Murdoch had weathered the labour unrest, he had strong advantages over his competitors, so that left the latter little option but to switch to new technologies. Like Murdoch, the other newspapers left Fleet Street to avoid confrontation with the labour unions who could easily rally their members in area. Today, there is no major British newspaper left operating on Fleet Street, and no major British newspaper is still using typesetting machines.

Edward Heath's government was brought down by the coal miners' strike and labour unrest when the government decided that it could not afford to continue subsidizing the coal

²²⁶ British Broadcasting Corporation (1986) Printers and Police Clash in Wapping. British Broadcasting Corporation accessed on May 2, 2006 at http://news.bbc.co.uk/onthisday/hi/dates/stories/february/15/newsid_3455000/3455083.stm.

mines. Margaret Thatcher gained the nickname “Iron Lady” for standing up to the coal miners.²²⁷ The British coal mines could not compete with the efficiency of the coalfields in Australia and Brazil that were using “state-of-the-art” technologies.

In summary, cleaner production would require significant financial costs to industry to retrain the labour force, compensate for retrenchment of redundant labourers and recruit labourers and managers with different skills that the existing labour force could not fill, even after retraining. In addition to the financial cost, industries will have to face the potential cost of inefficiencies caused by low morale in the labour force especially from sections in the manufacturing process that require significant retrenchment.

In addition to the financial cost, the industry implementing cleaner production also has to face negative social and political sanctions as well as the consumers’ perception that could affect the marketability of its product, and result in loss of market share and higher cost of public relations and advertisement. As explained earlier, the labour force is not just the producer of goods and services, but also forms a significant portion of the consumer market. New labour recruits may also face social dislocation in the new workplace from the displaced labour force, resulting in lower productivity.

Industrial Promotion Laws

Cleaner production operates on the assumption that economic efficiency is the primary consideration in the selection of industrial processes and the location of the industry. In

²²⁷ Peter Dorey (2006) Andrew Taylor. The NUM and British Politics.(Book review).*Journal of British Studies*, 45, 957(2). NUM stands for the National Union of Miners

reality, there are a number of sanctions that government policy makers may impose on the industrial establishment in both the private and public sectors. National security is one of those concerns where the process selection and location may override economic efficiency and the need to use cleaner production. The other factors that may override economic efficiency are social equity and balanced regional development.

Economic efficiency could also be classified into short-term and long-term goals. Ideally, a good government often takes a long-term perspective in planning, while business takes a short-term perspective. For example, balanced regional development would result in long-term economic efficiency and relieve the urban centers of problems associated with congestion such as pollution, inefficient transportation, high level of criminality and general dissatisfaction with the quality of life. Business, on the other hand, has to justify its profitability to its stockholders on an annual basis, and even more frequently by the perception of the stock market of its financial performance. In reality, government often takes a shorter perspective, as its decisions are influenced by businesses and the short-term needs of the electorate. In a democratic system, the decision-making timeframe of most elected government officials is constrained by the time interval between elections.

National Security

Even before the industrial revolution, the industrial policies at the national level had been developed to vertically integrate the industrial sectors. The vertical integration of the industrial sectors is often justified from the standpoint of military and national security interests rather than in maximizing profitability and market share. A nation would preferably

develop all types of industrial sectors without regard to their competitiveness in the international market for the same reason – especially those sectors that would be directly and indirectly linked to the production of materials and equipment needed for warfare. With the growth and development of organic chemistry and heavy equipment in the later half of the 19th century, most industrial production processes now have potential application to war efforts with or without further modifications.

For example, saltpetre or sodium nitrate deposits are concentrated in the Chilean deserts. At the start of the industrial revolution, sodium nitrate was the main source of nitrogen in fertilizer as well as a large number of inorganic and organic chemicals ranging from synthetic fibres used in ordinary clothes to high explosives. Control of the Chilean mines and the trade routes was a strategic objective of the competing European powers in the 19th century. European powers developed industries based on sodium nitrate in order to justify the stockpiling of the substance and the ready availability of equipment and expertise to produce war materials. Cellulose acetate or cellophane, and later, nylon, were extensively produced for wrapping materials, clothing fibres and other domestic uses in times of peace. The same production processes could be easily modified and upgraded to produce explosives. With the development of the Haber process,²²⁸ ammonia could be commercially manufactured using nitrogen from the atmosphere and hydrogen from the electrolytic decomposition of water. The importance of the Chilean saltpetre mines and the trade routes has become irrelevant.

²²⁸ Air is 78 per cent by volume nitrogen and 21 per cent oxygen. However, the nitrogen in the air is very stable. Water is primarily composed of hydrogen and oxygen. Haber discovered that under high pressure and temperature in the presence of a mixture of ferrous and ferric oxides and potassium aluminates catalyst, nitrogen reacts with hydrogen to form ammonia. Ammonia could be oxidised to form nitrates. The nitrates when acidified form nitric acid, an important chemical for the manufacture of explosives as well as large number of dyes, plastics, and industrial chemicals. For more detailed discussion, the reader is referred to Therald Moeller (1968) *Inorganic Chemistry An Advanced Textbook*, John Wiley and Sons Inc., New York . At p. 575

With the rapid advances in technology in the last 30 years, the dominance of a particular natural deposit is no longer as important as in the early years of the industrial revolution. Nations are reducing their stockpiles of strategic materials such as copper, nickel, zinc, tin and iron. Crude oil is stockpiled more for civilian economic activities than for military uses.

Rapid advances in technology also made it uneconomical and even irrational to totally devote whole production capacity, inventories of raw material, and semi-finished and finished products solely to potential war efforts. Unlike the crude weapons of warfare like the spear, sword, axe and bow and arrow that were standard weapons for hundreds of years, today's weapons become obsolete in less than 10 years.

The dual nature of the civilian/ military industrial complexes from research to full scale development is now much stronger than in the past. It is difficult to economically maintain an economy on war footing all the time. Hence, industrial policies evolved around the dual function of industries as sources of wealth and employment by producing consumer goods in times of peace, and, with the slightest possible modification, as venues for production of war materials.

Potential inefficiencies in the processes during peacetime are often the spur to facilitate the conversion or upgrading of the same processes for military use. For example, most of the pesticides and insecticides used in agriculture attack the nervous systems of insects and pests. With the heightened concerns on the environment, the insecticides and pesticides are formulated to degrade rapidly, hence, limiting their destructive force on the target pest population. The same manufacturing processes are precursors to producing more lethal chemicals that could be used in warfare. The environmental concern also coincides with

the military objective of developing lethal weapons to destroy the enemy, but reducing the residuals or the impacts of the residuals to the minimum in order to minimize damage to its own occupying forces once the enemy has been destroyed.

Most often, the dual uses of an industrial process for military and civilian purposes result in inefficiency and the generation of large quantities of wastes to the environment. For example, ammonium carbonate is very unstable, as it readily decomposes to ammonia and carbon dioxide under warm conditions and slight variations in soil acidity. A large portion of the ammonium carbonate fertilizer applied to the soil is released to the atmosphere as ammonia or washed out with the surface runoff, causing the eutrophication of rivers and lakes. On the other hand, another step in chemical processing will rearrange the elements in ammonium carbonate to urea. Urea is more stable and less affected by changes in temperature and variations in soil acidity. It is also easier for the soil matrix to absorb, resulting in a lower quantity of fertilizer application per unit area. However, urea is more difficult to convert to nitric acid, the main chemical precursor in the manufacture of nitrogen based explosives. For both military and civilian strategic purposes, ammonium carbonate is the preferred nitrogenous fertilizer rather than urea, although ammonium carbonate causes serious environmental problems and would be more expensive to farmers because of the higher dosage required.

The location of an industry is of primary concern in determining the competitive advantages and minimization of environmental impacts of an industrial plant. Locating the industrial plant close to the sources of raw materials and the consumers minimizes transport cost and the associated pollution from transport. It is therefore advantageous to locate the industry in areas classified as non-environmentally sensitive. Typical examples of environmentally-sensitive areas are endangered forests and wetlands. Locating the industry in

a non-environmentally sensitive area reduces the potential for negative environmental impacts. Consideration of atmospheric patterns and water resources to maximize the assimilative capacity of the environment to accommodate the waste discharge will also reduce the potential negative environmental impacts. However, from the standpoint of national security, those location criteria are often ignored. In 1995, I visited a plastics factory in China producing cellulose acetate and polyvinyl chloride resin. The factory was located near a cliff, such that the air pollutant discharge from the smokestack accumulated around the factory, especially during winter when the valley is capped by an inversion layer.²²⁹ Vinyl chloride monomer, the precursor of polyvinyl chloride resin, is a carcinogenic substance. From the standpoint of commercial and environmental interests, the location of the factory made no sense, but from strategic considerations, the turbulence near the cliff and the cliff itself made it difficult for an attacking aircraft to destroy the factory using World War II bombing technologies.

However, not all effects of the civilian/military synergy are negative to the environment. A large number of technologies used in cleaner production had their origin in military research and application. For example, the development of fuel-efficient and low-noise jet engines was practically made possible from military research on long-range and less detectable fighter jets. The combined cycle turbine power plants are basically jet engines used in commercial airlines.

The technologies for portable and package-type treatment plants for industrial and domestic wastewater were initially developed and field-tested in military camps and installations. Due to the importance of equipment and process reliability and efficiency in

²²⁹ An inversion layer develops over an airshed and especially in valleys when the air nearer to the ground is cooler than the air above the valley. The warmer air transported from warmer regions practically forms a lid on top of the valley.

military operations, the design methodologies, equipment specifications and performance had to undergo more rigorous testing, verification and updating than were normally carried out in profit-oriented civilian organizations. For example, the US Department of Defense centralized the design of facilities and infrastructure through the United Facilities Command. The design procedures and methodologies for a simple product such as wastewater treatment facilities for treating sewage, industrial and oily wastes are continuously upgraded as the users and researchers find newer and better procedures. Once every four years, the design manuals are reviewed and revised.²³⁰

Social Equity

Labour laws are sets of policies promoting social equity by protecting the rights of the workers in their relationship with their employer. As discussed in the earlier section, the labour force has historically been in a weaker or disadvantaged position in relation to the employer and the capitalist. In addition to labour laws, there are a large number of policies and legislation aimed at improving social equity and harmony within the country that affects economic efficiency and the decision to adopt cleaner production. Education, pedigree or caste, ethnicity, race, gender, and religion were factors that strongly affected the social and economic well-being of a person in the past, and because of these past intolerances, the person may continue to suffer economic and social disadvantages today even if the barriers have been officially removed. Historically, discrimination based on ethnicity, race, religion, caste and gender were prevalent in most countries. Most often, the discriminated group or

²³⁰ The United Facilities Command of the US Department of Defense published a *Manual for Treatment of Domestic Sewage* and another *Manual for Treatment of Industrial and Oily Wastewater*. Since 1987, the two manuals specified the use of design procedure that I developed for equalization basins in 1978. Out of interest or maybe part of an ego trip, I tried to compare the practices specified or required in the US Department of Defense manuals with those used in commercial and civilian treatment plants.

groups are the minorities, although there are instances when the majority group is discriminated by a conquering minority. Today, discrimination is illegal in most member countries of the United Nations, and in fact, the right to self determination and treatment of minorities are often cited as requirements for recognition of a newly established nation. However, discrimination does still exist in more subdued forms, and there are instances when the debate comes into the open with one or more political parties initiating it. The emancipation of slaves, indentured tenants, and serfs was undertaken widely in the 19th century worldwide. In most instances the emancipated groups were left on their own. The lack of resources for education and training maintained the social discrepancy that existed prior to the emancipation. Even in highly democratic countries like the US, the programs to address the social inequality that existed between the former African slaves and the other sectors of society were only extensively instituted in the 1960s.

The policies used by governments to diminish social inequity varies from

- (i) work quota and employment targets;
- (ii) training and education grants;
- (iii) job placement;
- (iv) adding handicap points in the procurement of goods and services, which are often viewed by the majority as reverse discrimination.

Employers, such as industry, may receive financial incentives to implement the policies. Industries may locate their factories in a depressed area because the financial incentives provided by the government to hire socially disadvantaged groups make their operation profitable, where under normal circumstances they would be in financial difficulties.

Adopting cleaner production could disrupt the structure of the labour force in favour of highly-skilled and educated newcomers. Subsequently, the redundancy and retrenchment of the socially disadvantaged labour force could result in loss of subsidies and other financial incentives that previously assured business profitability.

Unemployment reduces the person's economic status, and in a number of instances, self esteem as well. In a heterogeneous or multicultural society, a person's unemployment or employment is a socially divisive factor. Even modern democratic governments, such as Australia, try to minimize if not to eliminate the closure of highly labour-intensive industries and industries with significant linkages to other industries in the nation's economy. In modern democratic societies such as the United States and Australia, the government provides subsidies, tax breaks, tariffs and other economic incentives to maintain the operation of industries facing bankruptcy and thereby avert mass unemployment. In the case of the steel industry in the US, the US President Bush in 2002²³¹ invoked his right to temporarily increase steel tariff and protect the local manufacturers from foreign competition. An industry that seeks protection and additional subsidy from the government is normally in a difficult financial condition and has difficulty in meeting its financial obligations. Any financial assistance or protection from the government is taken as a temporary measure to provide the industry time and resources to restructure its debts and financial commitments. Process restructuring or the adoption of cleaner production would require longer-term financial commitment, normally equivalent to the normal depreciation period of the new equipment installed. For an industry in financial distress, very few financiers would provide long-term capital investment if additional support from the government is not assured. Investors are hesitant to provide the additional investment even if there is a strong potential for turning

²³¹ The President of the United States (2002) Steel Products Proclamation- To Facilitate Positive Adjustment to Competition From Imports of Certain Steel Products. Washington, D.C. Accessed on June 12, 2004 at <http://www.whitehouse.gov/news/releases/2002/03/20020305-7.html>

around the financial fortunes of an industry through the improvement in manufacturing efficiency, capturing a bigger share of the market and improved profitability. Investors would prefer financial restructuring and organizational streamlining with a short timeframe for implementation rather than adopting cleaner production. Cleaner production would involve revising the manufacturing process through the introduction of new technology and equipment and would require longer-term commitment. If the financial managers do consider cleaner production as part of their restructuring plans, the scope is often limited to improvement in the housekeeping and operational procedures.

Balanced Regional Development

Economic and social development often vary within a country. The capital city is usually the most developed area of the country, especially in countries with highly-centralized administrations. Governments may borrow money and spend a large portion of the national income in developing the infrastructure of the capital. Local and foreign businesses tend to hold offices in the capital to facilitate their lobbying and procurement of licenses. The capitals are often located in strategic coastal areas, river estuaries and mountain passes that in the past have gained prominence and importance because of their control of the flow of goods and services from the hinterland to the surrounding markets and sometimes to the regional and global markets. The standard of living in the capital cities of developing countries could be several times higher than in the rural areas.

While the phenomenon of the “primate city” is common in developing countries, the inequality in the economic and social development is also pronounced in developed economies such as the United States, European countries and Australia. The primate city is

defined in urban planning as the city whose population and economic productivity is more than two times bigger than the next city. Almost all the capital cities in South East Asia are considered primate cities. Manila, Bangkok, Jakarta and Kuala Lumpur are typical of the primate cities. In most nation states created by the de-colonization process after World War II, the national boundaries were established by the colonial rulers with little consideration for family and tribal lines. Families and tribes were often divided between two or more countries. When the national borders were informal and custom controls were weak, the divided families and tribes took little notice of the political changes.

The growth of the capital city as a primate city is encouraged as part of the nation-building exercise in integrating the diverse ethnic groups in the country. For example, in Manila, there are more Cebuanos than in Cebu City, the biggest city in the Visayas. In fact, the populations of the major ethnic groups are bigger in Manila than in any of the regional cities comprising the ethnic groups' heart land. In Manila, the intermarriages of people from various ethnic groups take place regularly, cementing the social structure of the republic. The salary structure in private corporations in Manila is three to four times higher than that in Cebu City, the second biggest city in the Philippines.

The unequal patterns of development have potentially serious environmental repercussions. Firstly, the higher standard of living in the primate cities results in rapid migration from the countryside and the secondary urban centers. The rapid migration strains the urban infrastructures and services such as water supply, sewerage, solid wastes management and transport. Housing affordability declines and less educated migrants are pushed to marginal lands often unsuitable for residential purposes. Air quality, plus ground and surface water quality deteriorate. Peace and order break down as a large portion of the

population that could not catch up with the higher cost of living engage in anti-social activities.

In most of the independent countries created from the de-colonization process after World War II, the growth of the capital to a primate city was encouraged by the government. The influx of population from various parts of the country was considered an essential integrator of the population, often with diverse cultures and histories. As the environmental, social and economic problems from overcrowding started to strain the resources of the capital cities, programs were initiated to reverse the trend. In some countries, the government moves the capital city to a new location rather than address the environmental, social and economic problems in the primate city. For example, Nigeria moved the capital from Lagos to Abuja, Brazil from Rio de Janeiro to Brasilia and Malaysia from Kuala Lumpur to Putra Jaya.

The problems of unbalanced regional development are not confined to developing countries. For example, the Appalachian region in the United States has a much lower economic and social development compared to the coastal states of New York and California. Considering economies of scale, it is cheaper and more efficient to provide services in cities than in sparsely-populated areas. For example, water supply, sewerage, electricity and telephone connections are made by pipes and copper cables. In sparsely-populated areas, the cost of providing the connections to individual households is very expensive. Households in rural areas often depend on on-site facilities for their water supply, waste disposal and even electricity. Health, education, recreation and cultural facilities are cheaper to provide in cities than in sparsely-populated areas. However, as the city size increases, the quality of life decreases due to environmental pollution, lack of privacy and stress from highly competitive lifestyles.

The residents could take advantage of the economies of scale in accessing the basic urban infrastructures and at the same time avoid the environmental and social deterioration associated with overcrowding. Industries are subsidized to locate and operate in depressed areas in a similar manner as the industries are encouraged to locate and to operate in less than ideal locations for reasons of national security. The subsidies are often focused on alleviating poverty and expansion of employment opportunities. Tax holidays, exemptions, fuel subsidies and access to low interest loans are provided to industries located in depressed areas. For example, one of the contentious issues between the states and the federal government is the sharing of the income from the goods and services tax. New South Wales claims it is subsidizing the less developed states of Queensland and Western Australia.

For an industry to use cleaner production, changes may be required in the industrial processes and business operating practices. The changes may result in the dislocation of the existing labour force and the hiring of new skills outside of the community. The changes would then result in the loss of the subsidies, tax exemptions and access to low interest loans that made the business profitable.

Other Reasons for Protecting Industries

In addition to national security, social equity and balanced regional development, government has other justifications and practices that distort economic efficiency, and subsequently, the adoption of cleaner production. Some of those reasons are

- (i) preservation of cultural and traditional values;

- (ii) pork barrel allocation;²³²
- (iii) political preferences; and
- (iv) political expediency such as response to pressure from business lobby groups, non-governmental organizations and voters.

If the region is underdeveloped, distortion of economic efficiency is justified on the grounds that the residents in the disadvantaged region need assistance and protection in order to compete with the other regions within the country and internationally. This rationale is also raised in international trade and environmental negotiations. Most often, the recipient undeveloped region proposes a set of target dates for the removal of the protection and assistance with the promise to change its production pattern to compete more effectively with the other regions.²³³

The more developed regions would still demand protection and assistance from the government in order to preserve their cultural traditions that are being threatened by competition. For example, with the high cost of labour in developed countries, the physical extraction of grape juice for wine production by stomping on the grapes is inefficient and uneconomical compared to mechanical extraction. Aside from the possible yeast species growing on the feet of the labourers that could give a particular flavour to the vintage, foot stomping has all the technical disadvantages of the mechanized wine-making process using technology borrowed from other fermentation industries such as the pharmaceutical industry. In a modern winery, stainless steel fermentation tanks are used, the temperature and pH are automatically controlled and the fermenting yeast is properly cultured and screened.

²³² “Pork barrel allocation” is term commonly used to indicate budgetary allocation to favoured projects of politicians in their constituencies often without the benefit of any feasibility study evaluation of alternatives.

²³³ A good example is the target for free trade agreement in the Asia Pacific Economic Cooperation or APEC. The developed countries agreed to remove tariff for trades among the member countries by 2010 and the developing countries by 2020. See <http://www.apec.org>

Ironically, the products of a modern mechanically-operated winery are often classified as cheap wine without much of a character because of the rigid quality control.

Agriculture and the processing of agricultural products in developed countries are highly subsidized and protected on the basis of preserving the cultural and traditional values in the rural and semi-rural regions. To prevent the oversupply and accumulation of highly subsidized agricultural products, the export of those products is subsidized as well. The import of similar or competitive products is impeded by economic barriers such as high tariff, duties and taxes. Non-economic barriers are import quota, rigid quality control and inspection, which are normally justified in preventing the potential spread of diseases. Products are marketed to highlight and encourage patriotic consumption of the local produce.

As will be discussed in the next chapter, the World Trade Organization is an international body mandated to promote free trade and reduce, if not eliminate, trade barriers. While almost all the member countries of the United Nations have become members of the World Trade Organization and subscribe to the idea of facilitating free trade, national interest especially in non-competitive sectors is still prevalent. For example, the United States is one of the main proponents of free trade. However, when it comes to manufacturing sectors where it is non-competitive, such as aluminum, steel or car manufacturing, it favors the formation of an aluminum cartel to control prices and assure profitability for the US aluminum companies, or import quotas and control in the case of steel and cars. In like manner, the European Union heavily subsidizes its agricultural sector and justifies the subsidies as a means of preserving the cultural and traditional values of its farming communities.

Developing countries are often used as an extension of the protective measures undertaken by developed countries to protect their uncompetitive industries. For example,

under the Lome Conventions²³⁴ and later the Cotonou Convention²³⁵ the least developed countries of Africa and the South Pacific are allowed to sell sugar to the European Union at prices almost equal to the prices of sugar produced internally in the EU. However, the sugar volume or quota is very small in comparison to the total sugar production in the EU, too small to seriously affect the prices and consumption of EU produced sugar. The developing countries indirectly are able to avail themselves of the sugar subsidies and will support the European Union in the world forum against the removal of the sugar subsidies and free trade of sugar in the EU. The United States also uses the same strategy with South American countries and the Philippines. There were even a number of years such as from 1991 to 2002 when the sugar production in the Philippines was lower than the domestic consumption, and the Philippines purchased sugar in the world market at a much lower price than its selling price to the United States under its sugar quota agreement.

When Australia wanted to include sugar in its free trade agreement with the United States, the Philippines and the South American countries lobbied for the exclusion of sugar in the discussion, to which the United States readily acceded, to protect the interest of its sugar

²³⁴ The Lome Conventions were a series of agreements between the European Community and the African, Caribbean and Pacific countries – in particular the former British, French, Dutch and Belgian colonies in those regions. The first Lome Convention took effect in April 1976 and expired on 31 December, 1980. The second Lome Convention took effect on 1 January 1981 and expired on 31 December 1985, and the third Lome Convention took effect on 1 January 1986 and expired on 31 December 1990. The fourth and the last Lome Convention was negotiated to take effect from 1 January 1990 to 31 December 1999. The Lome convention allowed agricultural and mineral exports from the developing signatory countries to enter the European Community free of duty, and for those items such as sugar and beef that could be in competition to the agricultural sector in the European community the quota system was imposed. In addition to duty free access to the European Community, the conventions provided financial aid and investments. The second, third and fourth Lome conventions were mainly on the expansion of the financial aid from Euro 3 billion in Lome I to Euro 12 billion in Lome IV. Forty six countries developing countries were signatories to Lome I and at Lome IV there were 70 signatories from developing countries. Details on the Lome convention are available at European Commission (2006) The Lome Conventions- Europa Development and Relations with African, Caribbean and Pacific States. Brussels. accessed on May 3, 2006 at http://ec.europa.eu/development/body/cotonou/index_en.htm

²³⁵ Ibid, The Cotonou Convention was negotiated for a period of 20 years starting in March 1, 2000 and ending in February 29, 2020. The convention built on the experience of the Lome conventions and emphasised on stronger political and social reforms among the signatory developing countries. Details are available at the website given in previous footnote.

farmers, and at the same time taking the moral high ground that the exclusion of sugar in the free trade agreement was based on US concerns for the plight of the sugar industries in developing countries.²³⁶

The profitability of the industry is highly dependent on domestic and international political factors rather than production efficiency. While a number of justifications and the accompanying subsidies have been in place for a long time, the investor is operating in a highly uncertain business environment. The investor knows that a change in political party, and international agreements may adversely affect the business. As such, the investor is hesitant to invest in new processes and equipment that may take more than three years to recover. For example, the Philippines' sugar quota has been in place for more than a hundred years now. Since the Philippines gained its independence from the United States in 1946, the size of the sugar quota has varied from year to year based on the convergence and divergence of US and Philippine foreign policies. Due to the uncertainty, the investors would prefer to buy sugar from the international market to fill the US quota rather than invest in cleaner production to increase the production by reducing wastage and improving production efficiency.

Nature of Industrial Protection and Promotion Laws

The main types of industrial promotion and protection laws and policies could be classified into (i) economic or financial and (ii) physical constraints. The most common economic and financial tools are protective tariffs, subsidies, tax exemptions or holidays, low

²³⁶ Anon (2004) Philippine/US: US-Australia Deal Eases Sugar Fears. *Oxford Analytica Daily Brief*. Oxford Analytica Ltd.

prices for raw material and energy, preferential access to loans and credits, and, rarely today but common two decades ago, preferential allocation of foreign exchange for imports and artificially favourable rates of foreign exchange in converting the export earnings. Tools of physical constraint are commonly in the form of land use control, import and export quota, dedicated access to transport, raw materials and energy, intellectual property rights and special licensing.

It should be noted that the industrial protection and promotion laws are of a similar nature to those suggested by various organizations promoting cleaner production as reviewed in the previous chapter. Easy access to low interest loans with long repayment, technology transfer and licensing of intellectual property rights and information were suggested to promote cleaner production. If the industry is already a beneficiary of industrial promotion policies, then the benefits of using cleaner production will be incremental, and in a number of instances, the industry may even lose the existing benefits.

Exemptions from Import Taxes and Import Duties

Promoted industries are exempted from paying import tax and duties. To prevent the diversion of equipment from the intended manufacturing process for other purposes, the protection and promotion benefits are tied up to a specific manufacturing process. For example, a mining company is exempted from import duties and other taxes to buy trucks, earth-moving machines, and pumps. These equipment could be used in developing residential and commercial subdivisions which will not qualify for exemption from taxes and duties. To prevent the mining company from prematurely diverting the equipment for other uses, the tax and duties exemption will specifically identify the location, function and operational

condition of the equipment in the industrial process to facilitate auditing and verification. The earthmoving equipment and the dewatering pumps should either be in the mine pit or in the maintenance shop.

If a promoted industry has already availed itself of the privileges of industrial promotion and protection laws, it may incur a significant cost to shift to cleaner production. For example, it might be cheaper for the mine to use conveyor belts instead of trucks. Trucks are more flexible and the capital cost is lower than for a conveyor belt. For a newly-starting company, trucks would be the preferable option. The capacity could be easily increased by adding more trucks, whereas a conveyor belt is built to accommodate the maximum capacity, and at the start, a large portion of the capacity may be unused. With conveyor belts, there will be less dust, noise and air pollution. Potential accidents along the truck route are also minimized. If the mining company shifts to conveyor belt, it will have to sell the trucks, losing all or a portion of the duty and tax exemptions. As the trucks are special trucks, the buyers are limited, and the company may not be able to get a good price. Most often, the trucks were imported in consonance with the expansion of the mine capacity. The taxes and import duties payable could have been also staggered. However, if the mining company will dispose of the trucks because it is shifting to a conveyor belt system, tax and duties payable for lost exemption will be due within a short time, causing serious cash flow problems for the company.

Investment promotion laws such as the Philippines²³⁷ penalize promoted companies for the early disposal of tax and duty-exempt importation by doubling the taxes and duties

²³⁷ "If the registered enterprise sells, transfers or disposes these machinery, equipment and spare parts without prior approval of the Board within five (5) years from the date of acquisition, the registered enterprise and the vendee, transferee, or assignee shall be solidly liable to pay twice the amount of the tax exemption given it." An Act Granting Tax and Duty Exemptions and Tax Credits on Capital Equipment. Republic Act 7369 of 1992 (Philippines) Laws and Resolutions Congress of the Philippines, National Printing Office, Manila, Philippines, pp. 1014-1043 Sec.1.,

payable. In recognition of the need for cleaner production, investment promotion laws do allow the beneficiary to sell the equipment in the local market and pay taxes in proportion to the remaining useful life of the equipment. This was instead of being penalized to pay twice the amount of taxes and duties waived if the beneficiary could prove that the change was necessary to improve the manufacturing efficiency and expand the production capacity. However, the documentation and the process to phase out the existing equipment are often difficult, especially in countries experiencing budgetary deficits. The cost of documentation for disposal of the tax and duty-exempt equipment may even involve governance issues that some companies would avoid or minimize. Nevertheless, the taxes in proportion to the remaining useful life of the equipment are immediately due and payable prior to the disposal of the equipment. As discussed earlier, this practice may create a serious cash flow problem for a company.

The problem is further compounded if the mining company availed itself of a soft loan with low interest and a long repayment period. Most developed countries have an export-import bank to provide soft loans to stimulate the export of specific equipment and products. For example, the United States has an export-import bank to provide soft loans to importers of US-made equipment. In purchasing the trucks, the mining company pays a low interest over a long repayment period. If the mining company disposes of the trucks, the loans to the export-import bank also become due and payable. The mining company will also have to pay termination pay for the early repayment of the loan. The loan repayment and penalties for early termination could strain the mining company's cash flow and affect its dividend payment as well as stock market valuation.

In 1985, I was working for a short time as environmental consultant in a copper mine in the Philippines. The mine was developed in the 1950s. Its mining operation, material

handling, ore processing and concentration plant were quite obsolete. It had 25,000 employees to extract 100,000 tons of ore every day compared to less than 100 employees for an Australian copper mine of that size. The water and energy consumption in the ore concentration was almost three times higher than that of a state-of-the-art ore concentration plant. The production cost was just a little below the world market price for copper, which allowed the company to continue operation in spite of all the inefficiencies. The copper mine had the intention of modernizing its operation but the potential labour unrest, back taxes and duties from usable and previously tax-and duty-exempt equipment had to be added to the cost of modernizing the mine. With the depressed copper prices in the late 1980s, the mine finally closed down in 1990.

If ever a mining company has to shift to procedures and processes using cleaner production, the shift has to be programmed and properly budgeted. One of the main shortcomings of studies supporting cleaner production is the non-enclosure of the cost of phasing out the existing procedures and process, especially if those enjoy substantial economic benefits from industrial promotion policies. The costs of phasing out the existing process consist of:

- (i) selling the phased out equipment at prices lower than the book value;
- (ii) cost of borrowing to pay for the taxes and duties on equipment imported and exempted from taxes and duties;
- (iii) cost of borrowing to pay soft loans;
- (iv) termination fees provided by export-import banks to purchase the phased-out equipment; and
- (v) transaction cost of documentation and bureaucratic paperwork to avoid paying the penalty for the early phase-out of the equipment imported, which are exempt from taxes and duties. The normal penalty is twice the taxes and duties waived.

Integration of Industries

Until the mid-1990s it was common practice in most Asian countries to build industrial colonies. Industrial colonies provided housing, commercial, recreational, educational and cultural facilities to the workers. The industry often subsidized the construction and maintenance of the facilities. The colonies stimulated a cohesive relationship among the workers. When industrial pollution was symbol of dynamic development, the colonies were built adjacent to the industry and in some instances within the industry perimeter. While industrial colonies stimulate loyalty to the industry, the restructuring of the labour force becomes difficult as discussed in the previous section on the impact of labour laws on the adoption of cleaner production.

Over a period of time, a number of smaller industries developed in close proximity to the large industrial facility, or used the large industry as a focal point. The smaller industries supplied the essential raw materials, semi-finished products, transport, warehousing and distribution of the finished products to the focal industry. The service sector also developed around the focal industry and its workers.

In adopting cleaner production in the focal industry, a number of smaller industries will require restructuring and sometimes closure. The output in the smaller industries is not needed anymore. The social and economic impact on the whole area could be substantial. The government may subsidize the focal industry to continue its existing operation and prevent social and economic collapse in the area. While the focal industry is in a position to improve its competitiveness by adopting cleaner production, the subsidy and social responsibility to its workers and the links to other industries discourage it from making the move.

The adoption of cleaner production in the focal industry would require new raw materials and semi-finished products. It would require a new set of linked industries and the economic and social dislocation could not be addressed with the linked industries individually adopting cleaner production. The linked industries have to institute changes simultaneously and in tandem with the changes taking place in the focal industry. However, the financial, technical and managerial capacities of the minor industries differ. As such, the shift to cleaner production by the focal industry will result in serious dislocation in the minor industries and their workers. For example, when the newspaper publishers decided to use computers and electronic typesetting, the industries producing and reprocessing the lead typesets had to close down as the provisions of computer and electronic parts were entirely alien to their operations. Down the line, the industries supplying chemicals for cleaning the lead typesets, the equipment for recycling and recovery of the lead parts and the spare parts for the typesetting equipment had to close down. Lead is a poisonous element that has been widely used by mankind since antiquity, and certainly the closing of the lead typesetters and allied industries reduces the lead burden on the environment.

While a government may have a cleaner production policy, the economic and social impacts caused by dislocation of existing industries when a major industry adopts cleaner production could be substantial so that it is even forced to subsidize the continued operation of an uncompetitive industry. In fact, one of the major problems of the cleaner production programs adopted by various international and national institutions is how the impact of the program is analysed for one particular industry operating in isolation. In reality, industries form a complex network of a supply and demand chain as well as a specific hierarchical structure. The impact of cleaner production could be beneficial to a particular industry operating in isolation. However, when the negative social and economic impacts on the linked

industries are considered, the overall benefit to society could be negative, although the benefits to one particular industry adopting cleaner production are highly positive. Hence, government and managers with long-term vision on the role of their industries in society will be reluctant to adopt cleaner production.

Environmental Laws

While cleaner production is considered a “win-win” proposition to address environmental degradation and at the same time improve industrial competitiveness, it is ironic that environmental laws are often used by the polluting industries to block new market entrants with more efficient manufacturing processes and using cleaner production from entering the market. While international organizations and their national counterparts are promoting cleaner production, polluting industries are exploiting and literally interpreting the provisions of environmental laws and regulations to block it.

Environmental Impact Assessment

Environmental impact assessment is a decision-making tool to establish the potential positive and negative impacts of the proposed project on the environment. Normally, an environmental impact assessment is carried out as part of the project feasibility study, but as an assessment focused on the environment, it is freed from the structural rigidity required in the technical, financial and economic assessments of a feasibility study. Normally, in a feasibility study, the technical, financial and economic assessments information are based on the actual performance of a similar facility, a market study of the cost of raw materials, labour, and other inputs. These may include a historical analysis of the prices of the outputs, a

market survey to gauge consumers' preferences and technological forecasting to determine potential obsolescence, identification of competitors, and competitors' and market responses to the entry of the project. The feasibility study may require the use of statistical, financial and economic models, and sensitivity of the project to various ranges of changes in the input and operating parameters.

Theoretically, in the use of environmental resources, the positive and negative impacts of the project on the environment are part of the economic analysis of the project. The incorporation of environmental costs and benefits in economic analysis is one of the factors which distinguish and differentiate an economic analysis from a financial analysis. Financial analysis involves the income, capital cost, operating and maintenance cost, and the depreciation or the actual flow of money in and out of the project; for this reason, the financial analysis is based on the expected cash flow of the project. From the traditional perspective of the project financier and commercial banks, the financial analysis is the most important factor affecting their decision to invest in or withhold investment from the project. The financial analysis gives an indication of the potential profitability, risks, and recovery of the investment. If the financial rate of return is higher than the cost of borrowing or rate of return from alternative investment, most likely the investors or commercial banks will finance the project subject to their appreciation of the risks as calculated from the sensitivity analysis. In fact, commercial banks and project investors seldom call for an economic analysis.

Economic analysis is wider in scope than financial analysis as it involves the evaluation of the project's indirect and direct impacts such as employment, stimulation of other development in the region, environment, social concerns such as elimination of child labour, encouraging women to participate, improvement in health and general welfare or quality of life. The economic analysis may use values different from the actual cash values

used in the financial analysis. For example, in areas with very high unemployment, the labour cost may be \$10/hour. In financial analysis, the \$10/hour rate is used in calculating the labour cost. In the economic analysis, a lower rate may be used, such as \$5/hr, even if the project will actually pay \$10/hr during implementation. The use of a lower labour rate reduces the calculated labour cost and the overall project cost for the labour-intensive alternative. A highly-labour intensive project will have a greater reduction in overall project cost compared to a highly mechanized alternative. The highly labour intensive project will then have a higher economic rate of return compared to the highly mechanized alternative and will therefore become the favoured option.

On the other hand, the labour rate for child labour may be several percentages higher than the actual cash paid. For example, a child may be paid only \$1/day for weaving carpets, but the economic analysis would use a rate of \$10/day to reflect the loss in potential future income by the child because the work has deprived them of higher education or the opportunity to acquire a better skill. In a rapidly expanding economy, the demand for skilled labour is expected to be higher in the future and the potential loss of income by the child will be higher compared to that in a stagnating economy or even in a failed State. In a failed State, the child labour rate used in the economic analysis may be very close or similar to the actual cash payment. There is not much difference if the child gets an education or improvement in skills if the knowledge or skills could not be efficiently used in the future.

The use of child labour or under-aged labour (the concept favoured by policy makers in developing countries) is highly controversial. A number of policy makers in developing countries favoured the continued use of under-aged labour if the task is not so physically demanding as to stunt the child's growth if there is no alternative to effectively utilize the child's time. Ideally, the child should be in school, but there are depressed communities

where schools and books are not available. Rather than for the child to waste his time roaming around the neighbourhood with other children and getting into trouble, some policy makers consider the early entry into the work force as educating and developing the child's skills for a future trade.

Labour cost as part of the employment and unemployment debate is commonly encountered in economic analysis. For this reason national planning agencies periodically release an analysis of the appropriate reduction factors to apply to the legislated minimum wage and to the various levels of wage structures – such as those that apply to semi-skilled workers normally receiving higher than the minimum wage, youth who are employed, and skilled workers. National planning agencies, especially in developing countries, regularly publish guidelines for economic analysis that include the factors to apply in the analysis.

One of the main problems in incorporating environmental factors in the economic analysis is the unquantifiable nature of environmental resources. Traditionally, the economic analysis of a project will just enumerate and possibly describe the potential positive and negative environmental impacts or else it just entirely ignores it. Project economists are often hesitant to get involved in the controversial costing of environmental benefits and damages which could place serious doubts on the soundness of their analysis. Kneese, Bower, Arrow and other economists at the Resources for the Future²³⁸ pioneered the development of economic techniques in the early 1960s to quantify the economic cost and benefit of a project on the environment. They applied willingness to pay, and other techniques commonly called

²³⁸ Resources for the Future is a non-profit organization based in Washington DC that pioneered in the economic analysis of environmental problems often considering an integrated approach.

“shadow pricing”. Bower received the Volvo Award for Environmental Economics in 1985 for his pioneering work.²³⁹

Economic analysis is important in decision making in the public sector or government institutions, and in development banks such as the World Bank, Asian Development Bank, Inter American Development Bank and African Development Bank as well as a number of development assistance agencies such as the United States Agency for International Development. However, in recent years, with the shifting emphasis to private/public sector development of infrastructure, cost recovery of investment and the user-pays principle, financial analysis has become as important as the economic analysis in public sector projects.

Considering the differences between economic and financial analysis, there are four possible combinations. The project will have either a:

- (i) negative economic rate of return and a positive financial rate of return;
- (ii) positive economic rate of return and negative financial rate of return;
- (iii) positive economic rate of return and positive financial rate of return; or
- (iv) economic and financial rate of return that are both negative.

No private business or investor would like to invest in a project with a negative financial rate of return, even if the economic rate of return is very high. Projects with negative financial rates of return mean that the investment will not be recovered and the investor will lose their money. To the investor, the consolation in investing in projects with high economic returns but low financial returns is the satisfaction of having done something worthwhile to improve

²³⁹ When I studied for my master’s degree in environmental engineering in 1970 my adviser was Dr. Richard J Frankel who was Prof. Kneese’s research associate at Resources for the Future and whose work was cited in the books that Profs. Kneese and Bower wrote on environmental management and economics. I had an interesting opportunity to read and discuss with Dr. Frankel the seminal and often controversial ideas in relation to the costing of environmental damage and use of environmental resources.

the environment, social services and general public welfare. In fact, a number of individuals, especially rich people, establish charitable foundations to carry out activities with high economic value but poor financial rates of return.

Traditionally, government is responsible for funding projects with negative or low financial rates of return but with high economic rates of return. Projects with high economic rates of return but with a negative or low financial rate of return are usually associated with environmental protection, education, police, court administration, defense, public transport and communication. However, governments often pass legislation to provide incentives to increase the financial benefits of the project and so make private investment possible. For example, in New South Wales, the government closed or narrowed the carriageway of the traditional east-west access across Sydney to channel the traffic to a privately-built cross-city tunnel that was charging a price higher than the public was willing to pay. Similarly, government at the state and federal levels subsidized private education to relieve the pressure on public schools and refunded a large portion of the private insurance premium to entice the public to take out health insurance coverage. At the same time, government would aim to accumulate a large budget surplus which often left the public to wonder if government had reneged on its responsibility.

Generally, taxes are paid for the government to carry out projects with high economic rates of return but very low financial rates of return. There is little rationale for the government to collect taxes, save the taxes and neglect the environment and social infrastructures such as education, health care, policing, and national security.

On the other hand, projects with high financial rates of return and a negative economic rate of return are normally projects associated with vices such as cigarette manufacturing,

alcohol, drugs, prostitution and uncontrolled extraction of natural resources, resulting in damages to the environment. Often the government attempts to control such projects through:

- (i) banning the activity or declaring it illegal;
- (ii) conducting an information campaign to scare the public and prevent it from using the projects;
- (iii) strict licensing and imposition of quotas;
- (iv) imposing a high tax; and
- (v) a combination of licensing and taxation.

A good example of the first strategy is the 18th Amendment of the US Constitution. The 18th Amendment was passed by the US Congress on 18 December 1917 and on 16 December 1919 was ratified by the required number of states in the US.²⁴⁰ The amendment came into force a year later. It banned the manufacture, sale, export and importation of intoxicating beverages. Unfortunately, it also encouraged smuggling and the illegal manufacture and sale of intoxicating liquors. Sub-standard and often poisonous liquors were sold in the market. On 20 February 1933 the US Congress proposed the 21st Amendment, thus revoking the 18th Amendment. The 21st Amendment went into force on 5 December 1933. A similar approach is taken with regard to environmental law, especially for activities related to biodiversity and forestry. For example, The Clean Air Act of 1999 in the Philippines banned the use of incinerators and as such hospitals and other generators of hazardous wastes have a difficult time treating their wastes.

Banning vices is often difficult, and the government's approach is to heavily tax the projects or activities so as to discourage the public from patronizing them. The government

²⁴⁰ 18th Amendment (1917) commonly called Prohibition-Alcohol Abolished
<http://www.usconstitution.net/const.html> accessed on August 25, 2006.

often imposes regulations through the planning laws to restrict the location and time in which the business providing the vices could operate. The practice is also used for highly-polluting industries. The government, through its zoning and planning laws, restricts the location of the highly polluting industry, requires a wide buffer zone and in some instances restricts the time of operation. At the same time, the government carries out public information campaigns hoping to wean the public from the products of the highly-polluting industry.

Aside from the physical restrictions on the location, output quota and operating time, the government uses economic disincentives in the form of high taxes and license fees. The taxes on tobacco and intoxicating liquors are examples of government taxes imposed on vices. In a number of European countries and in Japan, gasoline and diesel fuel are heavily taxed to reduce the air pollution from motor vehicles. The high taxes imposed on the “vices” often exceed several times the cost of policing and public information campaigns. A large portion of the taxes goes to the general fund for payment of other government services. In the long run, the government becomes dependent on the taxes raised from vices as well as from projects of environmental concern. While the government tries to discourage the air pollution emission from motor vehicles by heavily taxing the fuels, it also subsidizes the manufacture of motor vehicles and the building of more roads.

In a number of instances, the government may simply create a monopoly to control the project, and at the same time secure its financial benefits. For example, in Thailand, the government created the Thai Tobacco Authority to monopolize the manufacture, sale and importation of tobacco products. The proceeds or profits from the monopoly were used to build hospitals to counteract the effects of tobacco use. In environmental management, this concept is commonly called “internalizing the externalities”, with government exercising both

options of financially gaining from the vices and spending to overcome their negative impacts.

Projects with reasonable financial and economic rates of return are often left to the private sector. The government maintains regulatory powers to assure competition and collects taxes for the projects and services needed by society. For example, the private sector needs access to public transport and communication, police, a functioning legal system and an educated and trained workforce.

Projects with negative economic and financial rates of return are discarded, as it is often impractical for government and the private sector to invest in them. However, government does get involved in large “white elephant”²⁴¹ projects for reasons other than economics or financial efficiency.

The Environmental Impact Assessment Process

From the standpoint of environmental management, the most important aspect to consider is the case where the financial rate of return is very high and the economic rate of return is negative. The term “environment” covers the social and cultural aspects in addition to the physical and biological environment. A project with a negative economic rate of return normally has a high negative impact on the environment. As mentioned earlier, traditional economic analysis merely enumerates the environmental components whose costs and benefits are difficult to quantify. The environmental impact assessment basically goes around the problem of quantifying the environmental cost and benefits with the same rigidity as the

²⁴¹ “White elephant” is an idiomatic expression for an expensive item with little or no use. The expression is derived from the lavish and expensive maintenance of ceremonial white elephants in the Siamese court. The expenses to maintain a white elephant are so enormous that only the king could afford it.

other economic parameters in the project. The National Environmental Policy Act (1969)²⁴² of the United States, which served as the model for most EIA legislation in the world, mandated that the decision makers take a “hard look” at each project’s environmental impacts, and the mitigating measures available to reduce if not to eliminate those impacts. The effectiveness of addressing environmental concerns through the EIA process depends to a large extent on the procedural aspects and transparency and also how thoroughly all the possible environmental outcomes and mitigating measures raised by the public and the scientific community have been considered by the decision makers. As Ferrey²⁴³ noted, the courts normally differ to the administrator’s capability in deciding the technical aspects.

Public consultation and participation has become the cornerstone of the EIA process worldwide. Public consultation is normally carried out at the start of the process to identify public concerns, observations and issues related to the project. The public often raises questions which may be considered by a highly trained or technically skilled person to be irrelevant for purposes of the EIA process, but the decision maker has to satisfy the courts when their decision is questioned that they have taken a hard look at those issues, even if they seem irrational.

The second public consultation often takes place prior to the finalization of the EIA study. The EIA study may find some of the issues raised during the scoping process to be irrational, but it politely presents the facts and analysis. The public may not be satisfied with the explanation given in the EIA, but nevertheless, in the EIA process, the decision-makers have factored those concerns in the decision-making process, although in the final decision,

²⁴² National Environmental Policy Act of 1969 (US) National Environment Policy Act of 1969 (US), Public Law 91-190, 83 Stat. 852

²⁴³ Steven Ferrey (2004) *Environmental Law*, New York, Aspen Publishers at page 76.

the irrelevant concerns may have been ruled out. Most often, the EIA process becomes a political and even an emotional issue, especially if there is sparse or little information with which to make an unqualified recommendation and conclusion. Opponents to the project would often cite the precautionary principle. At this stage, the decision on whether to proceed with the project becomes a test of wills between the opposing parties, with different and often irreconcilable appreciations of risk.

Polluting industries or associations of polluting industries often use the EIA process to block state-of-the art and more efficient processes which could drive them out of business. From the standpoint of process inefficiency, existing and polluting industries have a high labour force with low productivity, and have to meet higher environmental standards with surrounding land uses that are incompatible with their operations. Incompatible land use around an industry may result from urban sprawl and an antiquated planning ideology. The planning ideology prior to the 1970s normally included the development of the areas surrounding the factory for workers' residences, and commercial activities to support the residents. It is not unusual for the polluting industries to increase their pollution emissions during the public consultation of a potential competitor to scare the public, especially those in the vicinity of the proposed competitor. A good example is the case of the cement industry in the Philippines. The Philippines started its industrial program before World War II, and the cement industry was one of the industries promoted by the government. By 1980, some of the pre-World War II cement factories were operating with very low efficiency. The energy consumption was three times those of the state- of-the-art cement plants, as most did not have any pre-calcliner and pre-heater, and were using the wet process. Clinker loss from dust was very high, polluting the surrounding areas. Some industrialists with foreign partners wanted to enter the cement sector. Proposed projects were subjected to the EIA process as required by law, and in all instances, public opposition was very strong. Project proponents even went to

the extent of taking the opposing parties to Thailand, Taiwan, Vietnam and Malaysia to show the actual operation of state-of-the-art cement plants often owned by the same project proponents. If the opposing parties were convinced about the environmental protection measures used in the state-of-the-art cement plants, this was soon forgotten, as horror stories were told by residents living in the vicinity of existing cement plants. Ultimately, with trade liberalization, the polluting plants were sold out. Modernization of the cement plants had to be done on the same site as the existing cement plants to avoid going through the siting problems related with the EIA process. While the modernized cement plants had a higher level of pollution control and process efficiencies, the overall efficiencies were still constrained by the past level of pollution, constraints imposed by the layout of the existing equipment, and the incompatible land uses of the surrounding areas, requiring more stringent environmental standards. I had a short discussion with Mr Antonio Tria, the Undersecretary of Environment and Natural Resources from 1986 to 1992, concerning my observations. He had similar observations. Today, the modernized cement plants have difficulty competing with imported cement. One of the cement plants, the Universal Cement Plant in Danao City, purchased by Lafarge of France in 2000 has been closed down.

Grandfather Clause in Environmental Laws

To prevent disruption in the supply of important and oftentimes strategic services due to new environmental regulations, existing industries such as power plants are often exempted or grandfathered. The exemptions given may be valid for a limited time. These exemptions will allow the industry to raise capital and restructure its processes to satisfy the new environmental regulations. However, in a number of instances, the only option available to industry is to close down its operation as restructuring would require practically tearing down the whole factory to accommodate the pollution control facilities or new processes. Under this

condition, the industry will be exempted from the new environmental regulations for the rest of its economic life. However, to prevent the industry from indefinitely extending its economic life, the exemption will be lost if the industry is substantially modified. If it were possible to substantially modify the industrial operation, it should not have been given the exemption. However, changes in technology do take place. At the time the new environmental regulations were promulgated, it might be impossible to modify or introduce cleaner production in the industry, hence the exemption. This condition may not hold true anymore, but industry will hesitate to modify its processes or adopt cleaner production if the benefits are minimal compared to those enjoyed with the exemptions.

For example, Robert Panasci²⁴⁴ cited the provisions of the Clean Air Act²⁴⁵ which required existing power plants in the United States to meet emission standards enforced at the time of commissioning, which could be thirty years earlier. On the other hand, new power plants have to meet the new source performance standards which consist of the best available technology or the lowest achievable emission rate. The new source performance standard is continuously updated as technology improves. The allowable emissions in 2004 are almost 50 per cent lower than those available in the best designed facilities in the 1950s. Old power plants which modify their processes must meet the more stringent new performance standards, unless they are covered by the six exempted categories. The six exemptions are:

- (i) routine maintenance, repairs and replacement;
- (ii) increased production without an increased capital expenditure;
- (iii) increased hours of operation;

²⁴⁴ Robert Panasci (2002) New York State's Competitive Market for Electricity Generation: An Overview. *Albany Law Environmental Outlook*, 6, 25-36. at p. 28

²⁴⁵ Clean Air Act of 1990 (US). Public Law 88-206, 77 Stat. 392

- (iv) use of alternative fuel;
- (v) addition of pollution control facilities; and
- (vi) change in ownership or relocation.

As Panasci noted “However, industry’s continuation of an increased emphasis on short-term price considerations may cause the old coal-burning power plants to increase their production”.

Unrealistic Environmental Laws and Standards

Cleaner production allows a factory to comply with the environmental rules and regulations at a minimal cost through reduction of the wastes by improving the production efficiency. In an old factory, the equipment cost has been fully recovered. An old factory may, however, incur additional or new capital for pollution control which has to be recovered. There are instances where an old inefficient factory operating with fully-depreciated equipment, and with minimal or without any pollution control facility, will have a lower production cost compared to a new state-of-the-art factory operating with minimum wastage. This condition normally takes place in highly capital intensive industries operating with low labour cost and relatively cheap raw materials.

A good example is the petroleum refining industry operating in a developing country. After the first Gulf War in 1991, the crude oil price dropped to as low as \$20/ barrel. In 1992, the Asian Development Bank evaluated the performance of the state- owned petroleum refineries in India in preparation for the opening of the industrial sector to private investments and more stringent enforcement of the environmental standards. The fact-finding mission found that the refineries were operating old equipment that had very low heat utilization and

recovery resulting in higher emissions from fuel combustion than in state-of-the-art refineries. Loan 5454 recommended a number of cleaner production options, but ultimately, most of the components of the loan were cancelled. Nevertheless, the oil refining sector was opened to public investment in 1993. The government-owned refineries and newly-established privately refineries were initially operating under a “cost plus” arrangement. The refineries were allocated crude oil for processing and were paid in accordance with their processing cost, plus an assured mark up. The oil refineries delivered the processed products to the government. The government sold the products in accordance with the perceived capacity of the users to pay. Diesel and cooking LPG were considered the fuel of the poor and working class and were sold at below cost. Premium gasoline was considered a luxury fuel and was sold with high mark ups. However, the government had to annually allocate an amount from the budget subsidy to the oil sector, as the additional income from luxury fuels was insufficient to cover the loss from the sale of LPG and diesel. In the year 2000, the refining sector was liberalized. The oil refineries could import their crude oil requirements directly and were allowed to set their own selling price. While the new refineries had higher efficiencies and lower wastages, they had to shoulder high depreciation costs and had a difficult time competing with the old and inefficient refineries whose equipment has been fully paid. The advantage is even greater if the environmental laws and regulations were not strictly enforced on the latter.

In setting standards, one of the main problems in developing countries is the lack of resources to carry out fundamental research and analysis to establish and enforce the appropriate environmental standards. Most often, the standard-setting committee merely reviews the various standards available in literature and picks the most stringent ones. Industry will then have problems in complying with the standards. In some instances, compliance may mean closure of the industry. While the environmental enforcement agency and industry may have a noble concern for the environment, the inappropriate environmental

standards could not be enforced without causing serious social and economic impacts. Inappropriate environmental standards are as good as or even worse than if there were no environmental standards. For example, the effluent discharge standard in the Philippines for zinc and copper was 1 and 0.1 mg/l, respectively. On the other hand, the drinking water standard was 5 and 1 mg/l for zinc and copper, respectively. As copper is normally added to control algal growth in water reservoirs, the drinking water normally contains more than 0.1 mg/l of copper. Industries were surprised that their effluents could be suitable for drinking, but not for discharge to the river. As discussed in the previous paragraph, one of the major financial benefits from cleaner production is the reduction of the cost of pollution control. If the environmental standard could not be enforced, there is lower incentive to use cleaner production. The benefits of cleaner production are limited to the improvement of a lower quantity of raw material and energy inputs, as the cost of environmental protection is discounted.

As discussed in the previous section, the EIA is a planning tool to facilitate the integration of environmental concerns in the decision-making process. The current planning and evaluation practice in most development banks and development assistance agencies is to incorporate the EIA as part of the feasibility study report. Just like any planning tool, the outcome and recommendations of the EIA depend on the development scenario. For this reason a sensitivity analysis is carried out to determine the possible deviations of the impacts as projected in the EIA from those that might take place in reality when the project is run. In reality, the operating environment is more complex than any of the scenarios developed during the planning process. The EIA, just like the feasibility study, engineering plans and architectural ideas, is a mere conceptualization of the expected operating conditions – often an idealization. A large number of operating conditions are beyond the control of the project owners and operators. Some of those conditions are weather variations, customers'

preferences, foreign exchange and macroeconomics changes, changes in legislation, and the taxation regime. Professionals preparing the EIA apply the best practice, the professional code of practice and guidelines, but no planning professional in their right mind will guarantee that the EIA projections and analysis will occur exactly as expected. In a similar manner, the feasibility study may show that the project is highly profitable, but the feasibility study does not guarantee that the project will not go bankrupt. Commercial banks make a thorough review of the project feasibility study prior to their funding the project, and they know that some of those “highly profitable” projects will fail. For this reason, commercial banks have provisions for bad loans.

The use of high-speed computers in environmental modelling gives an additional aura of correctness and extreme reliability to EIA projections. Natural processes including environmental processes are non-linear and do exhibit instability, commonly known as “chaos”. Computer modellers introduce linear approximations in their calculations to remove the instability, but the results are only valid for a very small region, with the region becoming smaller as the system becomes more complex. A good example is plain geometry applied to land survey. The Earth could be considered flat instead of a sphere. In surveying a small area such as a plot for a house, the results are accurate. However, if the land area surveyed is several hundreds of square kilometres – such as a state – then plain geometry fails.

The Philippine government has explicitly stated in its environmental laws and regulations that the EIA is a regulatory tool. For example, Article 1, Sec. 2 (b) DENR Administrative Order No.96-37²⁴⁶ issued on December 2, 1996, states: “This administrative Order shall have the following objectives: (b) Further streamline the current procedures in the

²⁴⁶ Department of Environment and Natural Resources (1996) To Further Strengthen the Implementation of the Environmental Impact Statement (EIS) System, Department Administrative Order 96-37.

conduct of the Environmental Impact Assessment (EIA) in order to improve its effectiveness as a planning, regulatory and management tool,” Although a number of developing countries do not explicitly state in their environmental regulations that the EIA is a regulatory tool, the practice of using it such is more prevalent. In the case of financial analysis, the cost of money as set by the bond markets, the interbank lending rates, and domestic lending rates define the acceptable financial rate of return and subsequent risk that the lender or investor may take. On the other hand, in the case of public sector projects, the planning agencies set the acceptable economic rate of return which serves as the acceptable cut-off for feasibility study acceptability, although political decisions to stimulate balance development, equitable allocation of the budget to various regions, or priming the economies of depressed regions may override the economic analysis. Technical analysis is controlled by the current engineering standards and guidelines, available technology and the capacity of the workforce in the study area to construct and manage the project.

There is no established control or benchmark such as the cost of money, minimum economic rate of return or engineering standards in evaluating whether the projected environmental impacts and the mitigating measures identified in the EIA are within acceptable risk levels. The cost of the mitigating measures is normally included in the feasibility study, and when built, the applicable engineering standards are applied. The main difficulties in using the traditional techniques of the feasibility study in environmental analysis are:

- (i) reliability and accuracy in calculating the environmental benefits;
- (ii) the risk involved if the mitigating measures are not implemented; or
- (iii) deciding if the mitigating measures are appropriate.

The social and cultural capacities of a country to take risks will be a major factor in defining and applying to practice the administrative prerogatives of “taking a hard look”. For example, Australia was a major whaling country in the South Pacific until the start of World War II. Today, Australian domestic and foreign policy is for the cessation of any whaling activity, while Japan treats whales as a marine resource. Decision-makers from both countries have different perceptions of whaling activities, and the positive and negative impacts of whaling and whale conservation on the environment. In the traditional sense, the decision-makers from both countries are taking a “hard look” at the potential environmental impacts, mitigating measures and hence, the environmental risks of whaling and whale conservation. Given the same information and data analysis using similar procedures, the decision makers from both countries will come up with widely divergent conclusions, as their perceptions of the environmental risk from whaling and whale conservation are very different.

The project proponent has criminal and civil responsibilities should the outcomes of the EIA which is used as a regulatory tool differ during actual operation from those projected in the study. The introduction of new technologies in a particular area has a higher risk than well-established technologies, even if the technology has been used for some time in other countries. The EIA as a regulatory tool discourages the introduction of new technologies including cleaner production, as it imposes unrealistic legal and financial responsibilities on the part of the project proponent. A good analogy is the economic and financial aspects in the feasibility study. The economic analyst and the financial analyst project the economic robustness and financial viability of the project, but do not and will not guarantee that the project will be an economic and financial success, as its actual operating environment is too complex to completely quantify. Nor are they asked to guarantee, that the economic and financial performance of the project will conform to the feasibility study. This is in spite of the fact that project’s economic and financial analysis already has well-established

procedures, these having been a requirement of lenders and financiers for more than a hundred years. Analysts carry out the analysis based on their best professional judgement and experience, in a similar manner to the administrator passing judgement on the EIA taking a “hard look”. The difference is that the EIA process is quite a recent development, and the techniques are still evolving.

Incidentally, the Philippines has made the EIA a regulatory tool in order for the administrator to avoid any legal and financial responsibility in endorsing the project for implementation. The project proponent guarantees all the potential impacts and successful mitigating measures in the EIA and the administrator merely notes down and archives the important points, rather than being part of the whole decision-making process that involves “taking a hard look” at the EIA. With the EIA as a planning tool, the administrator and even external parties could become active participants freely providing important inputs from their experience and expertise to improve the project design, as they do not have to face potentially damaging financial and legal responsibilities.

The scoping and the public participation aspects of the EIA process reflect the planning nature of the EIA. Members of the public giving their opinion and suggestions are doing it for the public good and for the good of a common resource –the environment – and should not be burdened with potential financial and legal responsibilities for their participation. It is up to the professional preparing the EIA to accept, expand or ignore the suggestions made during the public consultation using their best professional judgement. After taking a hard look, the administrator concurs or disagrees, if the risks to the environment are acceptable or reasonable.

The EIA process as a planning process should not be confused with the environmental standards which are regulatory tools. The EIA is based on a certain planning scenario, and sensitivity to variations in that planning scenario. Compliance with the environmental standard is based on the actual performance of the project with regard to the actual operating environment. A project EIA may show highly positive environmental contributions of the project, but compliance with the environmental standard is the actual proof that the project is operating within acceptable levels. A good example of the confusion between the EIA and compliance with the environmental standard is the position taken by the Environment Management Bureau in the Philippines with regards to the operation of electric power plants built from 1993 to 1997 when the electricity grid was experiencing serious supply shortages. President Corazon Aquino exempted the construction of new power plants from the EIA. Copy of the letter is shown in Appendix 2. The Environment Management Bureau ruled that since the power plants were exempted from the EIA process, they were also exempted from compliance with the environmental standards. In the absence of enforceable environmental standards, the power plants were discouraged from adopting cleaner production as the additional financial incentives from cleaner production could not be realized.

Even in developed countries with long experience with the EIA process, the often rigorous evaluation process deters the use of more efficient or cleaner production processes, especially if the project operates in a highly competitive environment. Pratt²⁴⁷ analysed the environmental impacts of Article X of the Public Service Law of New York²⁴⁸ of 1970 on the implementation of new power plants to meet the increasing power demand in the years prior

²⁴⁷ Charles Pratt. (2002) Re-Inventing New York's Power Plant Siting Law. *Albany Law Environmental Outlook*, 6, 1-10.

²⁴⁸ Public Service Law of 1970 (New York US) accessed on August 3, 2006 . <http://public.leginfo.state.ny.us/menugetf.cgi?COMMONQUERY=LAWS> . Article X is no longer included in the current Public Service Law. Power plant siting requirements under Article VIII, specifically section 140-149 although it expired in 1989 are still shown.

to 2002. Article X was enacted in 1992, and because of the very stringent requirements, no application was received in the first six years of its enforcement. Article X covers the environmental requirements for siting of power plants larger than 80 megawatts. The New York State Board on Electric Generation Siting and the Environment (the Board) is in charge of implementing Article X. For the first submission under Article X, the Athens project, the Board took approximately three years from the filing of the pre-application agreement to the issuance of a decision for a re-hearing. The Athens Project was finally approved on 13 June 2000. The pre-application agreement is normally done by the project proponent and the Department of Public Services on the nature of the environmental impacts studies to be carried out after the scoping process. When the environmental impact assessment is completed, the project proponent files an application with the Board. The Board is mandated to make a decision within one year. In the 10 years that Article X was in force, no power plant has ever been built in New York State.²⁴⁹ In the meantime, prospective developers of large power plants located their plants in other states where the siting requirements were less stringent or approval could be obtained in a shorter time, although the locations were sub-optimal. Pratt provided a comparative analysis of the siting requirements in the North East US.

Summary

There are a large number of laws, regulations and rules affecting management decisions to adopt cleaner production. Some of the rules and regulations are unwritten and evolved through human history, forming a set of social norms that industry will have to follow if it has to retain its social functions in the community and country as well as its obligations to

²⁴⁹ Robert Panasci (2002) New York State's Competitive Market for Electricity Generation: An Overview. *Albany Law Environmental Outlook*, 6, 25-36. at p. 28

consumers. After all, the financial viability of a business organization is determined more by consumers' preference and opinion rather than purely technological and scientific efficiency. In fact, it is very seldom that product advertisement focuses on the technological innovation. Product advertisement normally focuses more on the consumers' aspiration, dreams and other nuances.

While the environment is an important factor in most government decisions, there are a wide range of other factors and priorities involved such as employment, national security, balanced regional development, social integration and equity, stability and economic development.²⁵⁰ In pursuing those goals, the government in the past did provide incentives to industry as it exists and operates today. For industry to change its operation to cleaner production would, in a number of instances, negate the privileges and incentives that it enjoys today. It is for this simple reason that industry readily applies minor process modifications and wastage monitoring as part of its commitment to cleaner production, but is often reluctant to fully embrace cleaner production unless it is setting a new plant.

Industry is a commercial undertaking with profit as its main objective even if management is aware and interested in a number of social issues. Generally, industry exploits all avenues of minimizing its cost and maximizing its profits. Environmental laws, standards and regulations that are vague are exploited to the maximum.

²⁵⁰ The importance of a polluting firm to the political, cultural and social conditions of the community or even in the country could be very high that it has a very strong bargaining power in the enforcement and even development of environmental policy. The paper Hua Wang, N. M., Benoit Lapante, Susmita Dasgupta (2003) Incomplete Enforcement of Pollution Regulations: Bargaining Power of Chinese Factories. *Environmental and Resources Economics*, 24, 245-262. is an excellent study on this phenomena in China.

CHAPTER V

INTERNATIONAL CONSTRAINTS TO CLEANER PRODUCTION

The improvements in transport and communication have made international environmental²⁵¹, social²⁵², health²⁵³, trade and economic²⁵⁴ practices and agreements important factors in determining competitiveness. Even for a basic activity such as farming, foreign or imported inputs in terms of fuel, machinery and spare parts, fertilizers, pesticides and herbicides form a significant portion of the production cost in both developed and developing economies. While the utilization intensity of fuel, machinery and spare parts, fertilizers, pesticides and herbicides is lower in developing countries, those materials are mostly imported. In developed countries, the interdependence of the economies is much higher, so that it is not unusual to import at least one essential agricultural input to the economy from another country which could provide it at a cheaper price. For example, Switzerland is famous for its fine chocolate, but it does not commercially grow any cocoa trees, the main source of chocolate.

²⁵¹ Important environmental agreements affecting competitiveness are those related to movement of toxic and hazardous wastes, generation of ozone-depleting substances, generation of greenhouse gases, and bilateral agreements on the movement of tropical forest products, fisheries and endangered species.

²⁵² Important social agreements are related to labour such as child labour, women in the labour force, labour rights and welfare and working environment standards.

²⁵³ Health agreements include those related to quarantine, inclusion of chemicals with potentially negative impacts on health such as hormones, heavy metals and other preservatives.

²⁵⁴ Important trade agreements are those related to WTO such as intellectual property rights, reduction of trade barriers such as treatment of imported products vis-à-vis local products, bilateral and multilateral free trade agreements, and air, sea and land transportation and customs agreements including the passage of goods through landlocked countries.

A country may not be a party to an international agreement, but if the international agreement is agreed on by major industrial and trading nations, the agreement will still affect its competitiveness. For example, the annual meeting of the G7²⁵⁵ and Russia to review monetary policies, trade, and sometimes major social issues will affect practically all countries in the world. The meeting of senior government officials and heads of governments of the G7 and Russia²⁵⁶ normally sets the pace of the global trend on interest rates, foreign exchange rates and other macro-economic policies. As the US dollar and the euro are the major currencies used internationally as reserves or mediums of foreign trade, the exchange rates of those currencies affect the value of the currencies of even small nations. The interest rates and economic growth of the major world economies affect the demand for exports from small economies, the debt repayments and flow of capital and investments. Officially, the small economies have a say in the International Monetary Fund (IMF) where they are members. However, the voting power in the IMF is proportional to the stocks held by the country. The combined voting power of the G7 countries and Russia is more than two thirds

²⁵⁵ The G7 countries include the United States, Canada, United Kingdom, Germany, Italy, France, and Japan. With the fall of Communism, Russia was invited as an observer and later, as a member. There have been a number of criticisms on the European influence in G7. With the emergence of a common currency and therefore common monetary policies as well as trade and other economic policies, the European countries have been moving to include the European Union as an additional member. With the significant impact of the G7 meetings on world trade and economic growth, the new emerging economic powers like China, Korea and India are looking forward to membership. China's trade and gross national product is now larger than that of Canada or Italy expressed in US dollar terms. China's gross national product expressed in purchasing power parity (PPP) would make it the third biggest economy after the US and Japan. Traditionally, gross national product or GNP is expressed in US dollars; however, essential commodities could vary from one country to another. For example, a decent meal in the US may cost \$15, while in a developing country it is only \$1. Hence, a \$10 per day income in developing countries may be more comfortable than a \$100 per day income in the US in terms of its purchasing power. Gross national product statistics are mostly reported in traditional US dollar terms and in the US dollar adjusted to PPP. For example, India has a GNP per capital of \$500, but when adjusted to PPP, it is \$2,000. The Indian economy expressed in PPP is larger than that of either Canada or Italy

²⁵⁶ With Russia being a regular member of the G7 meetings, the grouping is also referred to as G8. The G7 operates by consensus, and for this reason there is reluctance among the members to expand the membership. It will be more difficult to reach a consensus with a large number of members with diverse backgrounds and vested national interests.

of all the votes, such that agreements made by G7 and Russia are more or less upheld at IMF meetings.

In addition to written international agreements, there are customary practices in international trade and economics that are commonly accepted by almost all countries. Most of the customary practices evolved from the predatory practices of conquerors, from those who merely pillaged the conquered lands, through to empire builders and colonial powers. The customary practices may seem out of place in the modern world especially in the international concern for the environment and social justice. Nevertheless, the customs and practices are accepted internationally so that they are seldom challenged, and if challenged, the practices are upheld by arbitrators. For example, the economic norms and practices before the establishment of agriculture placed no value on the natural resource in its original or natural form, although tribes and even nations may fight wars to control the reserves and extraction of natural resources. Under current economic accounting of the gross domestic product, a tree standing in the forest has no value until the tree has been cut. The value of the tree to the national economy increases as additional inputs are added to process the tree to produce various products. The cost of replanting to replace the cut tree will also count in gross domestic production statistics, but the value of the tree planted and growing does not count until the tree is cut and processed. For economic development, there is therefore a great incentive to cut the trees rather than to leave them in the forest.²⁵⁷ In fact, the economic incentive not only to cut the trees but also to destroy the forest is very high. Once the trees are cut, the forest land could be used for farming, grazing, and housing which have a higher economic productivity than the forest. In recent years, ecotourism has shown that natural resources left in the wild do have some economic value, and in the case of unique specie, the

²⁵⁷ While policies, legislation and programs for sustainable development have been promulgated world wide, they are unrealistic.

income from ecotourism could be higher than the utilization of the species. For example, the tourists watching whale migration are an important source of income in some coastal communities along the whale migratory paths. Sydney, Australia and its coastal environs are along the main whale migrating paths, and income from tourism from this source has been increasing in recent years. Tourists are willing to pay a premium to watch the migrating whales as the whale population has been decimated globally in the last century, for its oil. The tourists' willingness to pay to watch the migrating whale is enhanced by the rarity of the spectacle. In fact, it could be inferred that the ecotourism industry in Australia is a beneficiary of the continued Japanese whale hunting in the Southern Oceans. The Japanese whaling policy is very controversial and has attracted a strong interest on the whales and a perception of their rarity. The income from ecotourism is much more than the potential net income from selling whale meat. The anti-whaling lobby would like to cite the income from ecotourism as a major rationale for a ban. However, the extent to which tourists are willing to pay to watch the migrating whales if the whales were to be found in almost every coast and sea is questionable.

The same holds true for mineral deposits. While nations may fight wars for control of possible reserves of gold, oil and other valuable natural resources, the value of those resources is entered into the national wealth only when they are extracted, refined and used. The closest valuation of the natural resource in its natural state is the value of resource company stock, which is largely affected by the size of the natural resource reserve and in anticipation of the price that will be achieved when the resource base is extracted, refined and used. If the company decides to conserve the natural resource reserve, investors will automatically and proportionally reduce the value of the company stock to reflect the portion of the conserved natural resource.

The market price of the resource is determined more by the willingness of the buyer to pay rather than the replacement cost of the resource. This practice has been handed down from conquerors to colonial powers, and in recent history, to economic powers. The conquerors and colonial powers divided the spoils of their conquest and/or colonization, and in the process, set the price of the spoils. The conquered population and residents of the colonies were often included in the price negotiations by the conquerors and colonial powers in the same way as any of the resources found in the territory. In recent years, economic power has replaced military power in most of the transactions between nations. Nevertheless, the pricing of natural resources and even cultivated commodities is still dictated by the buyer's willingness to pay. For example, the price of oil in the world spot market is dictated by the buyer's willingness to pay, and in the case of the future markets, the buyer's willingness to pay and their perception of available supply. In the case of oil and other raw materials, the producer's leverage in affecting the price is to control the supply or availability, forcing users to pay a higher price. The cost of replacing or developing an alternative energy supply to balance the extracted oil is not included in the pricing equation.

With the decline of colonialism after World War II, most of the newly-independent countries tried to join or form a cartel in order to gain control of the pricing of commodities extracted from their natural resource base. Initially, the cartels were the exclusive club of the producers, but after the disastrous decline of their own economies, the cartels became a negotiating club between the producers and the major buyers. The International Sugar Organization²⁵⁸ is an example of a sugar producer club which later evolved as a negotiating club for the International Sugar Agreement. Today it is nothing more than an information database on sugar production consumption and production, new technologies in the

²⁵⁸ International Sugar Agreement (1987) opened for signature September 11, 1987, entered into force March 24, 1988 and terminated in accordance with its provision on December 31, 1992 United Nations, Treaty Series, vol. 1499, p.31.

production and uses of sugar, and research results on the negative and positive aspects of sugar consumption on human health. Another cartel, the Organization of Petroleum-Exporting Countries, is still an exclusive club of oil-producing countries, but it has become more of a quota-allocating forum in response to buyers' needs and political pressure.

The main reasons for the failures of the commodity cartels are:

- (i) the capacity of modern science to develop alternative or substitute products using a resource outside the cartel control;
- (ii) the impact of modern media to alter consumers' preferences for the substitute product;
- (iii) the availability of alternative sources and types of raw material;
- (iv) the absence of major differentiating factors among the products; and
- (v) difficulty in maintaining discipline among the members of the cartel.

For example, the rubber cartel lost its control because synthetic rubber was easily manufactured using crude oil and other hydrocarbon sources such as coal, coal tar and natural gas. Although natural rubber has properties such as superior traction that make it still a major component in specialized items such as airplane tyres, today synthetic rubber is commonly accepted by average car owners as superior to natural rubber.

Synthetic rubber products are more difficult to dispose of than those made from natural rubber, as the former emits a wider range of toxic chemicals when burned, and would call for high temperature incineration. From the environmental point of view, synthetic rubber has a very high negative impact. Unlike natural rubber, synthetic rubber stays in the environment for a very long time and when it is incinerated, it generates a wide variety of

toxic substances. The negative environmental impacts of synthetic rubber are seldom if ever accounted for in determining the price.

In the 1960s, major rubber-producing nations were cutting down the prices of rubber often below the cost of production. Producing countries were subsidizing their rubber products to prevent social disruption from displaced plantation workers. Malaysia, one of the major rubber producers, converted a large portion of the rubber plantations to palm oil plantations.

Maintaining discipline among cartel members is very difficult, especially in the absence of major differentiating factors in the products. Rubber that is produced in Indonesia and the Philippines is just as good as the rubber produced in Malaysia and South America. The products are completely fungible. Yet, considering that the members of the cartel have other financial responsibilities such as foreign debts and sometimes lack of governance in domestic administration, it is not unusual for some members to dump their inventories into the market even when the price is down, to the detriment of the other members.

In the case of the mining and forestry sector, the government may impose a royalty charge in proportion to the value of the mineral or forest product extracted. However, when the prices of commodities go down, the government may first decide to delay the collection of the royalties, then later on reduce the royalties, and finally forego collecting them. When the commodity prices go further down, it may even subsidize production to prevent the social dislocation of the workers.

When the government starts cutting down the royalties, the commodity price has gone below the production cost. The producer is starting to lose. In most instances, the producer

starts to consider options of reducing the production cost. Environmental protection is often the first item to be considered for reduction or elimination. Firstly, environmental cost is an externality with the producer bearing little burden for the damage. Secondly, environmental protection is a new item added in the last two decades, whereas the producer or their competitor has been operating since colonial times or longer without concern for environmental protection.

While cleaner production is conceived as a “win-win” strategy to improve competitiveness and at the same time reduce the waste generated, market forces do not function in the international market, especially for the major products from developing countries. Before the government cuts its royalties or taxes, it should encourage, if not require, the producer to adopt cleaner production in order to reduce the production cost and the waste discharged to the environment. This would be a practical approach if production efficiency were the main factor in the world market for most of the produce from developing countries.

The concept of ignoring or undervaluing nature is so ingrained in the decision-makers that rehabilitation of damages to natural assets is often taken with suspicion and potential benefits are likewise undervalued. For example, reforestation and afforestation projects are viewed as projects exclusively in the domain of non-profit organizations or the government. Restoration of forest and biodiversity is a public service with the initiative expected to lose or at most, to recover its cost. Private enterprises’ involvement in reforestation and afforestation projects is treated with suspicion. The potential motives of a private enterprise involved in reforestation projects potentially are:

- (i) to gain publicity and ride on the environmental bandwagon;
- (ii) to hide environmental misdeeds; and

- (iii) to undertake mere temporary measures to restore nature before the enterprise will start cutting down the trees in order to make a profit.

Most South East Asian countries require the logging concessionaires to reforest their concessions after they have cut the trees. Most logging companies declare bankruptcy after the logging operation. Governments often divert the funds collected from logging companies for other budgetary purposes.²⁵⁹

Even environmental enhancement initiatives such as the Kyoto Protocol are highly suspicious of forestation and afforestation projects. Extensive reduction and destruction of forestland worldwide is one of the accepted reasons for the increase of the carbon dioxide concentration in the atmosphere, since the trees and other vegetation in the forest absorb the carbon dioxide and convert it to biomass. Yet, while the value of the forest in sequestering the carbon dioxide from the atmosphere is recognized, in most of the meetings and negotiations of the conference of the parties, reforestation and afforestation were not accepted options for the greenhouse gas producers to offset their emissions for the simple reason that the sequestered carbon dioxide could be released back to the atmosphere when the trees are harvested or accidentally burned.

Accidental burning is a natural risk, even in natural forests. In fact, the reforested area will have a lower risk, as the cultivators will take the initiative of reducing the fire risk by removing accumulated debris on the forest floor, maintaining fire breaks, and operating fire-fighting equipment which procedures are normally absent in natural forests management,

²⁵⁹ For example, in Indonesia, the reforestation fees were used to support the national aircraft development program. Charles Victor Barber (2000) Section IV- Forest Resource Scarcity and the Growing Potential Conflict -The Case Study of Indonesia, Washington DC, World Resources Institute..

especially in developing countries. The cultivators of reforested areas will lose the financial incentives under the Kyoto Protocol if the trees are burned or destroyed.

The sixth Conference of Parties in 2000 failed because the United States pushed for the accreditation of carbon dioxide fixation in forestation, afforestation and even agricultural activities. The United States negotiator at the sixth Conference of Parties of the Kyoto Protocol was in a very difficult position, as the US senate had passed a non-binding resolution, Resolution number 98,²⁶⁰ against any agreement under the United Nations Framework Convention on Climate Change that did not include any reduction from developing countries with high emissions of greenhouse gases. Senate Resolution 98 was passed with a vote of 95 in favour, and no opposition on 25 July 1997. The Kyoto Protocol did not address the US concerns and President Clinton did not attempt to submit the Kyoto Protocol for ratification, while his successor President Bush rejected it outright. At the resumption of the Conference of Parties in Bonn in August 2001 (commonly called COP 6.5), carbon dioxide fixation from forestation and afforestation projects were finally accepted, but limited to a maximum of one per cent of the target reduction.

On the other hand, the Clean Development Mechanism of the Kyoto Protocol readily gave carbon dioxide emission reduction credits for an industrial project that reduces the emission to a level lower than “might have been emitted without the Kyoto Protocol”.²⁶¹ Emission reduction based on what “might have been emitted without the Kyoto Protocol” is a purely intangible reduction depending on the baseline, and the baseline has been revised a

²⁶⁰ Byrd-Hagel Resolution 105th Congress 1st session, Res. 98 passed in July 25, 1991, US Senate Report 105-54, "Expressing The Sense Of The Senate Regarding The Conditions For The United States Becoming A Signatory To Any Greenhouse Gas Emission Under The United Nations Framework Convention On Climate Change" Sponsored by Senators Robert Byrd and Chuck Hagel.

²⁶¹ This is commonly known also as the project additionality.

number of times to accommodate the needs of the signatories. For example, one of the main criteria for a project to qualify under the Clean Development Mechanism of the Kyoto Protocol is the financial additionality. Projects with very high financial rates of return are supposed to be implemented even without the Kyoto Protocol; hence, emission reduction from the project does not qualify. However, no financier or project proponent will invest in or finance a project that is marginally profitable at the feasibility study stage. Hence, it is not worthwhile to implement a profitable emission reduction project under the Clean Development Mechanism of the Kyoto Protocol.

The reduction of greenhouse gases from industrial projects is a fictitious or imaginary reduction from an action that did not take place or was prevented from having taken place because of the Kyoto Protocol. For example, if the power authority declares in their master plan the construction of a coal fired power knowing that a hydropower plant is available and feasible, they will qualify for carbon credits roughly equal to the emission of the coal fired power plant when they build the hydropower. However, if they are so honest that they declare building a hydropower plant as part of the original master plan, then, they will not get a single emission credit when they build the hydropower plant.

On the other hand, emission reduction from reforesting barren deforested land is an actual reduction in atmospheric carbon dioxide, although it is subject to some risk which might even be lower than that in the primeval forest. Young growing trees have faster growth rates and fix larger quantities of carbon dioxide per unit time per unit area than old and mature trees in the primeval forest. Considering the income stream from carbon dioxide fixation with the trees in place, and the potentially high insurance premium or even loss of insurance cover if the plantation owner does not exercise the appropriate safeguards against forest fires, the carbon dioxide sequestration is more tangible and realistic than that in the

industrial sector. Industrial processes could readily shift the fuel to a non-renewable one if it is cheaper to buy credits or if the cost of carbon credits in the market is less than the cost of the substitute fuel.

In recent years, resource economists have proposed new methods of accounting for economic development instead of the conventional methods of using the gross national production and the gross domestic production. Gross national product (GNP) is defined as the sum of the value of goods and services produced by the nationals of a country. It includes consumption plus gross investment (which is the increase in inventories plus gross births or the production of buildings and equipment and thus exceeds net investment by depreciation).^{262,263} As mentioned earlier, a tree standing in the forest does not contribute to the national wealth measured in GNP unless it is cut down and manufactured into some type of product for use in industry, government or private consumption. Resource economists use a different meaning of “sustainable development” from that of the Bruntland Commission. In resource economics, sustainable development is defined as development which results in non-declining per capita wealth, where wealth is defined in the broadest sense to include produced, natural, and human (including social) capital.²⁶⁴

²⁶² Definition quoted from Paul Samuelson *Economics*, 11th edition (1981) at page 177.

²⁶³ In mathematical terms, Gross National Product (GNP) is equal to the sum of consumption (C), private domestic and foreign investment products (I) and government expenditure on goods and services (G), hence, the commonly encountered formula $GNP = C + I + G$. In recent years, with the growth of large multinational companies even in small developing countries, Gross Domestic Product was used as an indicator rather than Gross National Product. Gross Domestic Product (GDP) differs from GNP in the calculations for investment products. GDP includes the products from all investments in the country and excludes products from investments of the nationals in other countries. GNP excludes the products from foreign investment in the country but includes the products from foreign investment by its nationals. For example, in calculating the GDP of the Philippines, production from foreign investors in the country such as Broken Hill is included, while the income from San Miguel in its Australian and overseas operations is excluded. In calculating the Philippines GNP, the San Miguel overseas productions are included and Broken Hill productions in the Philippines are excluded. The difference between GDP and GNP from large multinationals is not unique to developing countries. Nestle is a major component to the GNP of Switzerland, but most of Nestle’s production is counted in the GDP of other countries, as most of its manufacturing activities are located outside of the former.

²⁶⁴ Glen Marie Lange (2004) Wealth, Natural, Capital and Sustainable Development: Contrasting Examples from Botswana and Namibia *Environmental and Resource Economics*, v. 29, pp. 257-283, at page 257.

In 2003 the United Nations, European Union, Organization for Economic Cooperation and Development, and the World Bank established the System of Integrated Environmental and Economic Accounts (SIEEA). The techniques for measuring the SIEEA were developed in the mid 1980s and they have been tested in a number of developed countries including Australia. However, the procedure and the gathering of statistical information required to calculate the SIEEA are not available even in developed countries. As Lange noted:²⁶⁵

“The challenge of this wealth base approach to sustainable development is the lack of data, particularly of natural and human capital. There have been several attempts to measure total wealth or changes in national wealth, notably by Dasgupta, Hamilton and Clemens and the World Bank. However, those studies do not include all the natural capital and are based on rather crude data and assumptions that may not reflect economic values for natural capital in a given country. Most provide estimates only for a single year, which may not accurately reflect the trend over time. The most widely applied measure, Genuine or Comprehensive Saving, attempts to overcome the lack of data about wealth by measuring changes in assets from national savings adjusted for some environmental factors and expenditure for education. But this method does not measure several factors that influence the value of natural capital: new discoveries of natural capital, changes in resource management or production technology that affect the value of natural capital, and holding gains/losses”.

While the resource economist’s definition of sustainable development could be quantified, the condition of ever-increasing wealth is made possible through the assumption of an unlimited natural resource base and technological efficiencies. As Kenneth Arrow, Partha Dasgupta and Karl Goran Maler elaborated in their paper on “Evaluating Projects and Assessing Sustainable Development in Imperfect Economies”²⁶⁶, the rate of growth of a natural resource base is dependent on the resources allocated and accumulated for exploration and inversely proportional to the natural resource already extracted. In the real world, the resources do not have to be exhausted before non-sustainable conditions due to environmental

²⁶⁵ Glen Marie Lange (2004) Wealth, Natural Capital and Sustainable Development: Contrasting Examples from Botswana and Namibia. *Environmental and Resources Economics*, 29, 257-283. at p. 258

²⁶⁶ Kenneth Arrow, Partha Dasgupta, Karl Goran Maler (2003) Evaluating Projects and Assessing Sustainable Development in Imperfect Economies, *Environmental Resources Economics*, v. 26, pp. 647-685

degradation take place. For example, the world's supply of coal even at the accelerated consumption rate seen over the past 100 years is sufficient to meet the global energy need for another 200 to 300 years. The coal resource base could even extend further if more resources are committed to the exploration and development of coal extraction technologies. Coal is only a storage medium of solar energy fixed by ancient plants and animals. To release the stored energy in coal, the reverse reaction to the fixation of the solar energy has to take place – which means the production of carbon dioxide and water. Coal utilization has the tendency to revert the earth's atmospheric conditions and the climate to similar atmospheric conditions to when the solar energy was fixed millions of years ago. This would result in climatic conditions which are much warmer, with the highly unpredictable weather pattern than exists today. For this reason, there is a strong concern about the continued use of coal and related hydrocarbon resources for energy.

The concern of the international community about the continued high rate of coal and hydrocarbon utilization is shown by the ratification of both the United Nations Framework Convention on Climate Change and Kyoto Protocol. On the other hand, Vallente²⁶⁷ in her paper “Sustainable Development, Renewable Resources and Technological Progress”, using the same definition of sustainable development as Kenneth Arrow and his associates²⁶⁸, found sustainable development neutral to the cost of extraction of natural resources and more dependent on the development of resource-saving technology. Considering that the second law of thermodynamics puts a cap on the maximum efficiency of any man-made or natural processes, the development of resource-saving technologies is definitely constrained and

²⁶⁷ Simone Vallente, (2002) Sustainable Development, Renewable Resources and Technological Progress, *Environmental and Resource Economics*, v 30, 115-125.

²⁶⁸ Op cit.

therefore sustainable development, like the perpetual motion machine, could never be implemented in practice.

Consider Figure 3-1 again. The inputs to the manufacturing process are raw materials which are abstracted from non-renewable natural resources like minerals, and potentially renewable natural resources such as forest agricultural products. From the standpoint of currently accepted economic and developmental principles, the value of the natural deposits and reserves is only realized when it is abstracted. Hence, there is a very high incentive to maximize rather than minimize the use of raw materials going into the process, especially in the absence of any competition. In developing countries with large population pressure, there is a stronger incentive to cut down the forest not only to increase economic activities, but also to convert the land for more intensive economic activities such as grazing and farming. Until recently, the environment as the receptor of the waste product was thought of as available free of charge. Unfortunately, most environmental management systems still consider the environmental assimilative capacity free. Even in an environmental management system using market instruments, the assimilative capacity is allocated for free to the users with the efficient users making a gain from selling the excess allocation. From the current concept of economic development, there is little incentive to adopt cleaner production.

Laws are made to facilitate the interactions of the various stakeholders in society in attaining their economic and social objectives. It was only in recent years that the environmental objective became an integral part of legislation. Environmental laws in the past were merely part of the social objective, especially in protecting the health of workers and the general population. For example, the forestry policy of the Philippines before the 1970s, which is the typical forest policy adopted by other developing countries, required forest concessionaires or logging companies to cut specific volume of timber per annum and to clear

and convert the forest land to agricultural land after extracting the timber. The land is provided free or for a nominal price to landless farmers on condition that they cultivate it for a period of at least five years. The homestead or the land provided to the landless farmer was originally 25 hectares in size, but in later years this was reduced to 5 hectares. Land titles were issued to the farmers after they had proven that they had tilled and developed the land. President Ramon Magsaysay pursued the policy vigorously between 1949 until his death in 1957 to solve the Communist rebellion in central Luzon. Most of the forest land converted to agricultural land was in Mindanao. Similarly, Indonesia had its Transmigrasi program of resettling landless farmers from the highly congested island of Java to sparsely populated areas such as Borneo, Sulawesi and Irian Jaya. Malaysia and recently Indonesia are converting large tracts of forest land to oil palm plantation.

With improved transportation and communication systems worldwide, the laws of other countries may have an impact on the manner that the natural resources are being abstracted, altered and utilized. In a number of instances, laws to improve the environmental conditions in one country will have serious and adverse impacts on the environment in another country and possibly an adverse impact on the global environment as well. For example, the European Union has promulgated directives to use bio-diesel fuel in order to improve the air quality in major European cities. Bio-diesel is manufactured by esterifying vegetable oil from oil palm, coconut, linseed, soya beans, rapeseed, cotton and sesame with methanol or ethanol. Unlike diesel oil obtained from the fractionalization of mineral oil, bio-diesel residues are easily degraded. Bio-diesel does not contain sulphur and other impurities normally found in mineral oil such as aromatic hydrocarbons, which are known carcinogens. However, the vegetable oil yield is very small compared to the total annual demand for diesel of around 25 billion tons of diesel fuel in the European Union alone. Oil palm has the highest annual oil yield among the tropical crops at 3 to 4 tons per hectare compared to soya beans at

1.5 to 2.0 tons per hectare and coconut at 1.5 to 3 tons per hectare. If bio-diesel will supplement 10 per cent of the total diesel consumption in the European Union, approximately 1 billion hectares or 10 million square kilometres of oil palm plantations will be required. Most likely, 10 million square kilometres of forest land, grassland, and wetlands will have to be cleared and planted with oil palm. Bio-diesel is a renewable energy resource and it reduces the air pollution at the point of consumption. From the standpoint of the user, it involves cleaner production. From the standpoint of the vegetable oil producer it is economic development. To the world at large, where it is unknown or ignored by both users and producers, it means large scale loss of biodiversity and conversion of forest land, grassland and wetlands to vegetable oil plantations.

International Agreements

Sustainable development has become the main overarching objective in the evolution and growth of international environmental and trade agreements after the publication of the Bruntland Commission Report. The idea gained momentum after the United Nations Conference on Environment and Development in 1992. However, as Sands noted²⁶⁹, the concept of sustainable development preceded the Bruntland Commission. As a state practice, the concept of sustainability has been a part of the United States international legal relations since 1893. To quote Philippe Sands:

“State practice, however, suggests that their of ideas of ‘sustainability’ have been a feature in international legal relations since at least 1893, when the United States asserted a right to ensure the legitimate and proper use of seals and to protect them, for the benefit of mankind, from wanton destruction. Since then, the many treaties and other international acts have supported, directly or indirectly, the concept of sustainable

²⁶⁹ Philippe Sands (1995) *The Principles of International Environmental Law*, Cambridge, University of Cambridge Press. at page 198. Further discussions on sustainable development are given in page 198-208 and again in page 284- 286 on promoting sustainable development.

development and the principle that states have the responsibility to ensure the sustainable use of natural resources.”

In my opinion, the concept of sustainable development as defined by the Bruntland Commission, “as development that meets the needs of the present without compromising the ability of future generations to meet their own needs”, is part of human instinct – one of the instincts that separate the human species from other animal species. Unlike other animal species, mankind has a very strong inter-generational instinct. Mankind looks after their offspring well into adulthood and even in their adulthood maintains a strong relationship with them. In a similar manner, the succeeding generations look up to their forebears with respect – even forebears whom they have never seen or physically interacted with.

Most ancient cultures practised ancestor worship. In modern times, some form of ancestor worship is retained in the form of respect for heroes and saints, although some cultures such as those affected by the Confucian tradition retain the ancient rituals of ancestor worship. The various forms of ancestral worship or respect for heroes and saints are based on recognition of the ability of the past generation to work and sacrifice for the benefit of the succeeding generations.

It is for this reason that the concept of sustainable development is very popular and widely adopted by various governments, local governments, private business and institutions and even by individuals. In a span of less than five years after the publication of the Bruntland Commission Report in 1987, the concept of sustainable development had evolved into a principle of international law with the adoption of the European Economic Agreement in 1992.²⁷⁰ The preamble of the 1992 European Economic Agreement specifically referred to the

²⁷⁰ “DETERMINED to preserve, protect and improve the quality of the environment and to ensure a prudent and rational utilization of natural resources on the basis, in particular, of the principle of sustainable

“principle of sustainable development”. Principles 3 and 4 of the Rio Declaration adopted during the 1992 United Nations Conference on Environment and Development ²⁷¹ reiterated the principles of sustainable development. Principle 3 of the Rio Declaration states “ The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations” and Principle 4 states “In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it”.

Sustainable development is part of human instinct; it is an established state practice and a commonly-accepted principle in international law. Sustainable development should be an integrating principle to remedy and resolve the conflict between development and environmental conservation in the same manner that cleaner production resolves the conflict between the cost of environmental protection and profit margin. However, the human instinct on intergenerational interaction burdens the present generation with the responsibility that goes beyond the conservation of the natural resources to meet the needs of the future generation. Human instinct on intergenerational responsibility calls for the present generation to undertake developmental activities in order to *provide* for the needs of the future generations. As an instinct or emotional concern, “future generations” means all the generations to come until the end of the world and the needs of the future generations are presumed to be the same or similar to the needs of present generations. However, in reality the presumption that the needs of the future generations are similar to the needs of the present generation was not even valid in the pre-agricultural and nomadic societies.

development, as well as the principle that precautionary and preventive action should be taken;” Preamble of the European Economic Agreement 1992 commonly known as the Maastricht Treaty, signed on February 7, 1992 and entered into force on November 1, 1993. European Treaty Series, no. 1 including subsequent amendments.

²⁷¹ Rio Declaration on Environment and Development, United Nations Conference on Environment and Development in 1992 UN Document No. *A/CONF.151/26 (Vol.1)*).

The present generation clears forest lands, drains wetlands, builds infrastructure and undertakes other activities beyond the needs of a lifetime. The infrastructure, wealth accumulation and monument building require natural resources.²⁷² In the process of abstracting the natural resource the environment is altered. Often, in building the infrastructure, forests are cleared and wetlands drained. Workers are moved from one place to another. Slave labourers were imported to the Americas to work on the sugar and cotton plantations creating social dislocation on both sides of the Atlantic. Historically, large empires from the Egyptian to the Qin dynasty in China to name a few, moved a large portion of conquered population to work in building new cities, defence system and other infrastructure. Today, the movement of migrant labour continues from developing countries to developed countries as the developed countries continue the infrastructure building efforts for the benefit of their present and future generations. On the contrary, sustainable development, as defined by the Bruntland Commission is one of the major reasons for the continued degradation of the environment, the lowering of the standard and quality of life in developing countries and, in relation to this thesis, the slow adoption of cleaner production.

One of the main problems of the concept of sustainable development is the difficulty in translating its meaning and scope into operational terms as well as reconciling its purpose and intent with the conflicting needs of different sectors in society. Almost any action could be justified under the Bruntland Commission definition of sustainable development. Due to its vagueness, the concept of sustainable development is a very strong justification for environmental degradation, social inequality and short-term economic gain. For example, consider the logging of old growth forests. The forest concession holders, the loggers and

²⁷² When I visited the city of Pagan in Myanmar in 1993, I noted it was surrounded by vast tracts of desert-like land. According to the locals the area was once a large forest but the trees were cleared to manufacture the bricks used in the construction of temples.

their families, and the businesses supplying goods and services to the loggers and the forest concession holders will justify the logging of old-growth forests based on the concept of sustainable development. The logging of the old-growth forest is development that provides timber for the needs of the present generation for construction materials, raw materials for pulp and paper, furniture and other products. While trees have long life spans, like any living creature they don't live forever. These groups would even cite the higher carbon dioxide fixation potential of young trees over old trees. Pro-logging groups would like to cite conservation, preservation or no action as "no development", and therefore outside the scope of sustainable development. With regard to the need of future generations, pro-logging groups would like to project minimal need for timber and forestry products.

Anti-logging groups, on the other hand, will also justify the conservation and protection of old growth forest based on the concept of sustainable development. To the anti-logging group there is development in conservation. The development is the aesthetics, tourism, and potential medicines that might be extracted, from the genetic pool in the forest that could be lost forever once the forest is logged.

The present or tangible value of conservation might be low compared to that of logging, but the potential or future value (the need of future generations) could be higher. While sustainable development is hailed as the instrument of balancing development and environment, in reality it does not attain any purpose except to create increased uncertainty because of its vagueness. Almost anybody could use sustainable development or sustainability to justify an action. As Shaw and Murray²⁷³ put it:

"Sustainable development is a little like Zen. Everybody talks about it, but few people really know what it is. Sustainable development as a concept has been around for

²⁷³ Elizabeth Shaw and Kali Murray,(1999) Introduction,, Duke University Environmental Law and Policy Forum, v. 9,no. 2, pp147 at page 147

quite some time, but it only hit the mainstream environmental law with the World Commission on Environment and Development's Our Common Future. Our Common Future broadly defined sustainable development and promptly sent the world into a tailspin trying to figure out what it means, how it can be achieved, and ultimately, whether it is possible."

McCloskey, the past President of the Sierra Club in the United States, in his article "The Emperor Has No Clothes"²⁷⁴, raised similar problems on the concept of sustainable development and sustainability. In that article McCloskey wrote,

"In concluding, let me lament the declining faith in the concept of sustainable development. Intuitively, it seems to make sense and has an inspiring scope. It represents an advance over self-congratulatory terms of "wise use" or "rational use." It gets us beyond the tunnel vision implicit in "sustained yield" for a single output. It makes a noble attempt at grappling with the argument over escaping nature's limits by human ingenuity. It tries to reconcile the contending goals of development and the environment. And, in the Brundtland report, the exponents of it pledge allegiance to almost everyone's goals. Yet, if "the emperor has no clothes on," we must in the end acknowledge it. There was a day when we needed the high hope and the fine inspiration represented by the concept. But today, we need a usable line of thought -- an operational reality. We need a line of thought which can be extended rationally into the detail of research, planning and application. And sustainability does not seem to be that thought. What we now fear is that "sustainability" will prove to be no more than a boon to publicists who will paste new labels on old bottles and claim that every project that makes their clients rich is sustainable. In the absence of any operational definition, who is to prove them wrong?"

Sumudu²⁷⁵ considered McCloskey's comments on the nature of sustainable development rather harsh. However, considering the culture and nature of American environmentalists, McCloskey's comment is very diplomatic. American non-governmental organizations (NGOs) such as the Sierra Club that McCloskey headed at the time he wrote the article are known to litigate for the implementation and enforcement of environmental legislation and regulations. The environmental laws are analysed word for word and the

²⁷⁴ Michael McCloskey (1999) The Emperor Has no Clothes: The Conundrum of Sustainable Development". Duke University Environmental Law and Policy Forum, v. 9, no.2, 153-159 at page159 .

²⁷⁵ Atapattu Sumudu (2002) Sustainable Development, Myth Or Reality?: A Survey Of Sustainable Development Under International Law And Sri Lankan Law, Georgetown International Environmental Law Review, Winter 2002 issue, v. 14, 265-288. at page 287

meaning and intent of the laws constitute a battleground of the litigants. For example, Ferrey²⁷⁶ noted,

“The most significant sentence in Sec. 102(2) (c) of the National Environmental Policy Act of 1967 states that an agency must prepare an EIS whenever “proposals for legislation or other major federal actions significantly affect the quality of the human environment”. Each word has come to represent a battleground for NEPA litigation. A federal action must fall within the scope of all these operative words to trigger an EIS”.

There is no room for a vague and high-sounding term such as “sustainable development” which only creates uncertainty and justifies the questionable implementation and enforcement of environmental laws and regulations.

Sumudu, in her review of the myth or reality of sustainable development, had reservations on the impact of sustainable development on Sri Lankan developmental practices. Sumudu however, felt that Sri Lankan environmental law benefited from the concept. To quote her paper,²⁷⁷

“Having surveyed the international law and the law of Sri Lanka on sustainable development, the question remains whether the term is a myth or whether it actually serves a useful purpose in the decision-making process. A cautious yes can be provided to the latter question. This article submits that the concept of sustainable development, despite criticisms aimed against it, has influenced the development of environmental law, national as well as international, and contributed to the development of related principles such as precautionary principle, the ‘polluter pays’ principle and the intergenerational equity principles. It has refined, in relation to environmental issues, such procedural principles as access to information, participation in the decision-making process and the adoption of the EIA procedure.”

I would disagree with Sumudu that sustainable development is responsible for the development of international laws and Sri Lankan national laws in incorporating the precautionary principle, intergenerational equity, polluter-pays principle, and adoption of the EIA procedure. Environmental impact assessment (EIA) is considered one of the corner stones of sustainable development. The EIA process integrates environmental concerns with

²⁷⁶ Steven Ferrey, *Environmental Law*, 3rd ed., pp. 82.

²⁷⁷ *Op cit* at p.287

developmental and social concerns. As far as Sri Lanka is concerned, non-governmental organizations such as the Sierra Club, chaired by McCloskey have much more significant impact on the evolution and refinement of the EIA process than sustainable development.

Again, the US NGOs lobbied for the inclusion of public participation and disclosure of the environmental impact assessment in the appropriations bill authorizing US contributions to major multilateral financial institutions such as the World Bank, InterAmerican Development Bank, Asian Development Bank and the European Bank for Reconstruction and Development. The amendment is commonly called the Pelosi Amendment²⁷⁸ after Congresswoman Pelosi of California, who worked for its inclusion. As early as 1982, the forward thinking mission leaders at the Asian Development Bank already included an environmental assessment for large projects to prevent delays or challenges from American non-governmental organizations. The Canadian and the Scandinavian countries were also strong promoters of environmental assessment before the concept of sustainable development became part of international environmental law.

While a number of countries have environmental impact assessment legislation, the implementation and enforcement of the legislation is often of questionable quality. Again, the international non-governmental organizations are active catalysts, rather than the Rio Declaration or the concept of sustainable development. Projects funded by multilateral development institutions are being reviewed, and in a number of instances, the multilateral development banks and the executing agencies are found deficient in their compliance with

²⁷⁸ Pelosi Amendment-or Assessment of Environmental Impacts of Proposed Multilateral Development Projects an amendment to the International Financial Institution Act of 1977, section 1307, 22 USC 262m-7 required “any multilateral development bank (MDB) action which would have a significant effect on the human environment, unless for at least 120 days before the date of the vote an assessment analysing the environmental impacts of the proposed action and of alternatives has been completed by the borrowing country or the institution, and made available to the board of directors of the institution.”

their own regulations and policies. For example, of the four cases brought before the inspection function at the Asian Development Bank,²⁷⁹ the Bank was found to have violated its own environmental and social policies. While the inspection function explicitly excluded the executing agency or the government from any culpability, the actions and decisions of the government agencies were also brought into question by the NGOs and complainants, and as such, government agencies indirectly assumed some culpability for the environmental degradation.

Modelling, sensitivity analysis, benefit cost analysis and, in very critical projects, risk assessments, are integral parts of the EIA process. The working scenarios could vary from normal operating procedures to extreme events such as in a major accident or natural disaster. The potential presence of endangered species is an integral part of the EIA. The precautionary principle is implicitly included in the EIA. However, the EIA process is more systematic so that the direct application of the precautionary principle in the process is tied up with establishing decision-making rules and procedures, including decision making under uncertainty. For example, the EIA procedure in the United States is tied up to the Administrative Procedure Act of 1947, which clearly defines the rules that agencies must follow to ensure public access to information and participation.²⁸⁰

With regard to the “polluter pays principle” I have serious reservations as to the extent that the international and the national communities have progressed beyond the awarding of damages as normally and traditionally carried out in civil or tort cases. For example, the

²⁷⁹ The first case is the Samut Prakan wastewater treatment plant in Thailand. At the time the loan was processed the site of the wastewater treatment plant has not been determined. A generic environmental assessment was carried out and when the site was finally established no additional environmental assessment was carried out. The second project was the Chasma Irrigation Project in Pakistan. The third project was the Southern Transport Corridor project in Sri Lanka. The fourth project was the Sundarban Project in Bangladesh. Details could be obtained from the webpage <http://www.adb.org> and link to the Compliance Review Board.

²⁸⁰ Steven Ferrey (2004) *Environmental Law*, 3rd ed Aspen Publishers, New York. at p. 42

accountability mechanism in almost all multilateral financial institutions limits the right of complaints to persons affected by the project. For this reason, there is no case that has been brought to the inspection or compliance board at the Asian Development Bank dealing exclusively with damages to the environment. All the inspection cases are the results of damages to property, livelihood and health. Public interest litigation or litigation for the polluter to pay for environmental damage is still non-existent in most countries and even in multilateral development institutions. Multilateral development banks are the main proponents of the “polluter pays” principles.

One of the attractive features of sustainable development is the intergenerational concept. As mentioned earlier in this chapter, the human maternal and paternal instinct goes beyond the care and support of helpless minors, but has evolved into a social contract for the parents to pave and provide for the generations yet unborn and in return, for the future generations to pay homage and gratitude to them. It is part of the human quest for immortality. In some societies it is practised as ancestor worship, which could have been very widespread in early civilizations. In modern society, there are various manifestations of the practice ranging from the commemoration of heroic and benevolent deeds, discovery of natural law, etc. The prevailing intergenerational concept is not just to compromise the ability of the future generations to meet their needs but *for the present generations to provide for the needs of the future generations*. In order to provide for the needs of the future generations, the present generation clears forest land and converts it to agricultural land well beyond its needs, and builds cities with roads, bridges, tunnels, buildings and homes that would last beyond a lifetime.

With the monetization of the global economy, providing for the needs of the future generation becomes easier. The present generation mines and utilizes the earth’s resources to

the maximum and merely passes on to the succeeding generations the bank statements, bonds and stock certificates. To gain advantage of the earth's resource, the present generation does not necessarily have to farm the land or mine the earth; they merely talk with their investment brokers or financial advisers. The link between the environment and the owner is minimal, if any. Machines have minimized human involvement in agriculture, mining, forestry and other activities dealing directly with the environment. At the same time, the highly competitive nature of global business requires the exploitation of any available opportunities. Some experts may call it greed, but in reality, it is just a manifestation of the struggle of the present generation to provide for the needs of the future generations.²⁸¹ Yes, this practice is one of the main causes of environmental degradation and social inequality. Environmental degradation and social inequality could be minimized if the present generation will only think of its basic needs and leave the future generations to provide for their own needs. In that case, the present generation will not use the environmental resources on things that they could not take with them after their earthly existence is over.

Hence, Sumudu's cautious "yes" verdict on the reality and positive impact of sustainable development on the evolution of Sri Lankan environmental laws has no ground.

However, sustainable development is a very attractive concept that decision-makers, especially the politicians do not want to just ignore or even dump, as McCloskey suggested. In fact, some researchers such as Thomas Brinsmead of the University of Newcastle are developing indices and assessment criteria measuring sustainable development, although he

²⁸¹ A number of charitable institutions were founded by individuals who in their lifetime have been accused of greed and unfair business practices. Greed in their lifetime was a single-minded pursuit to provide for the future generations.

admitted in his research report that the meaning of sustainable development is highly contested. Brinsmead²⁸² noted in the introduction of his report that:

“For this report, *sustainability* is defined as the preservation of some valued conditions in some selected system. We make no commitment to specific valued conditions because the concept of sustainability is highly contested, owing to lack of consensus regarding what those conditions should be, because they change over time and depend on the material system to which the assessment applies. However, they should be made explicit in any specific sustainability assessment context. Assessment is the evaluation of some present or future conditions as desirable or undesirable. This again makes explicit the values (normative) dimension of sustainability assessment.”

Although Brinsmead has done away with quantifying specific valued conditions and simplified his study to the assessment of present and future conditions as desirable and undesirable, he has used a number of doubtful premises on which to base an assessment. First, the perception of desirable and undesirable conditions today may not hold true in the near future and much more for the distant future.²⁸³ As I mentioned in Chapter II, the smoke and smell of ammonia was a desirable condition in newly industrialized centres in the 1950s as a sign of progress, but today those are considered undesirable conditions.

Given the difficulty in implementing the concept of sustainable development, practitioners in the field of environmental and natural resources management have taken four main approaches. The first approach is to change the definition of sustainable development from those given in the WCED report to suit their needs. For resource economists, sustainable development requires non-declining per capita wealth, where wealth is defined in the broadest sense to include produced, natural and human (including social) capital.²⁸⁴ A search on the Internet showed that there are more than 100 definitions of sustainable development in

²⁸² Thomas Brinsmead, (2005) *Integrating Sustainability Assessment: Identifying Methodological Options*, University of Newcastle,

²⁸³ Alain Ayong Le Kama and Katheline Schubert (2004) Growth, Environment and Uncertain Future. *Environmental and Resources Economics*, 28, 31-53. This paper provides an interesting analysis on the changing attitude towards environmental assets by different generations.

²⁸⁴ Gleen-Marie Lange (2004), Wealth, Natural Capital, and Sustainable Development: Contrasting Examples from Botswana and Namibia, *Environmental and Resources Economics* 29, 257-283,

existence today.²⁸⁵ As mentioned earlier, old-growth forest tree loggers could use sustainable development as a reason for their activities and bend it exclusively to meet their needs and advantages.

The second approach is to ignore the definition of sustainable development and to consider any activity within the international and national Agenda 21 reports as implementation of sustainable development. The Preamble of Agenda 21, especially Section 1.6, states that the programs, actions, activities and means of implementation as described in the Agenda 21 report is the basis for global partnership for sustainable development. However, Agenda 21 does not provide any analysis as to how it will assist in the attainment of sustainable development. Agenda 21 does not even have a definition of sustainable development. This approach is used by the International Federation of Consulting Engineers. While almost all countries have developed a national Agenda 21, the implementation is rather weak. In 1997, the UN General Assembly noted, “We acknowledge that a number of positive results have been achieved, but we are deeply concerned that the overall trends with respect to sustainable development are worse today than they were in 1992. We emphasize that the implementation of Agenda 21 in a comprehensive manner remains vitally important and is more urgent now than ever”.²⁸⁶ On February 5, 2001 the UN General Assembly adopted resolution number *res* 55/199 to review the progress of the implementation of Agenda 21 in preparation for the Earth Summit on Sustainable Development in Johannesburg in 2002. The press release from the office of the Secretary General noted: –“Agenda 21 and Sustainable Development—Good Plan, Weak Implementation.”²⁸⁷ The same press release mentioned, “In

²⁸⁵ Corporate Social Responsibility. (2006) Definitions of Sustainable Development accessed on January 10, 2005 at http://www.article13.com/A13_M3_I2Definitions.asp#stoz.

²⁸⁶ Sec.4, United Nations General Assembly resolution Programme for the Further Implementation of Agenda 21, Document No. A/RES/S-19/2 of 19 September 1997.

²⁸⁷ Published by the United Nations Department of Public Information titled “ Press Summary of the Secretary-General’s Report on Implementing Agenda 21” Document No. DPI/2244 issued on January 2004.

August, governments, along with representatives of all sectors in society, will gather in Johannesburg at the World Summit on Sustainable Development. The focus of the Summit is to reinvigorate the political commitment and determination to implement the plan of action on sustainable development through new initiatives that are both practical and based on partnerships". As noted by McCloskey, sustainable development is a non-operational concept, and unless the world community realizes the shortcomings of this concept, it would be difficult to come up with practical initiatives. Initiatives could be identified and agreed on, but there is a need to consider a comprehensive or systems approach to the analysis and implementation. Otherwise, a piecemeal approach to environmental, social and developmental issues could result in wastage of resources or worst to unexpected negative environmental and social impacts. For example, the planting of eucalyptus trees in the Indian subcontinent was initially seen as an environmentally friendly or sustainable practice to provide communities firewood and to green the area.²⁸⁸ The trees greened the villages, but they also depleted the groundwater and affected the long-term economic productivity of the villages. Another example is the provision of tube wells in Bangladesh for potable water²⁸⁹. The tube wells are small water-supply projects and precaution was not taken to make detailed analysis of the groundwater source which incidentally, had high potential for arsenic contamination. The provision of clean water to poor villages is clearly part of the sustainable development agenda, and as such justifies its implementation as soon as possible. From those examples, it is apparent that a piece-meal approach even for very small projects could result in bigger problems.

²⁸⁸ Vandana Shiva. (1991) *Ecology And The Politics Of Survival -Conflicts Over Natural Resources In India*, New Delhi, United Nations University Press. See chapter 7.

²⁸⁹ Fred Pierce. (2001) *Bangladesh's Arsenic Poisoning- Who is to Blame?* UNESCO Courier , January 2001 issue, at http://www.unesco.org/courier/2001_01/uk/planet.htm accessed on December 30, 2006.

The third approach is to consider sustainable development in the context of the related documents and its historical evolution rather than through its definition. This approach is one commonly used by commentators on international law who are fascinated by the term and would like all developments in environmental law to revolve around it.

Sustainable development was the key theme providing a balance between development and environment. Hence, the principles of the Rio Declaration are the defining principles of sustainable development without further analysis. It is the same approach by which the programs, actions and activities of Agenda 21 implement sustainable development.

The fourth approach is to reclassify sustainable development to a “para-legal” term whose main function is to provide inspiration or guidance in developing and implementing operational tools. As a “para-legal” term, sustainable development could be classified on the same basis as democracy – a guiding principle rather than an operational principle. I really like the analogy. I made a quick scan for the word “democracy” or “democratic” on the Internet version²⁹⁰ of the United States²⁹¹, Canadian²⁹², Australian²⁹³ and other constitutions. The Canadian constitution of 1982 has three mentions of the words “democratic,” while the United States and Australian constitutions are silent on the words “democracy” and “democratic.” On the other hand, a number of countries²⁹⁴ use the word democratic in their official names and mention it a number of times in their constitution. For example, the

²⁹⁰ I preferred to use the internet edition as it is easier to search the specific words such as democracy or democratic.

²⁹¹ <http://www.usconstitution.net/const.html> seen on January 30, 2006

²⁹² <http://laws.justice.gc.ca/en/Const/index.html> seen on January 30, 2006

²⁹³ <http://www.aph.gov.au/senate/general/constitution/> seen January 30, 2006

²⁹⁴ Notable of the democratic republics are North Korea or People’s Democratic Republic of Korea, Lao People’s Democratic Republic, Democratic Republic of Congo, Democratic Republic of Gabon

constitution of the People's Democratic Republic of Korea²⁹⁵, commonly known as North Korea, mentioned the word "democracy" and "democratic" 28 times. Does the absence of the word "democracy" or "democratic" in the US Constitution make it less democratic than North Korea? Do the US or Australia have to amend their constitutions and liberally sprinkle them with the words "democracy" and "democratic" to make them at par with the other great "democracies" like North Korea?

Going back to sustainable development, will the world be much better if, after all the criticism of its extravagant consumption patterns, the United States will officially change its name to United Sustainable States of America and conduct business as usual? Or could Australia deflect further criticism on its land clearing and greenhouse gas emission practices by officially changing its name to Sustainable Commonwealth of Australia?

Switzerland has officially included sustainable development in its constitution although its web page²⁹⁶ has stated that no further action or legislation is in place. "Sustainable development" is a tenet to which the Swiss Confederation and the cantons are bound. Article 2 («Object») of the Federal Constitution declares sustainable development to be a national objective, while Article 73 («Sustainability») calls upon the Confederation and the cantons to strive for a balanced relationship between nature and its ability to renew itself, on the one hand, and the demands placed on it by the human race, on the other". As the Swiss constitution webpage noted, "No direct supplementary legislation has been enacted in support of these constitutional provisions; their primary role is as a vision to guide future action."

²⁹⁵ <http://www.loc.gov/law/guide/northkorea.html> seen January 30, 2006

²⁹⁶ Federal Office for Spatial Development. (2006) Sustainable development -definition and constitutional status in Switzerland. at <http://www.are.admin.ch/are/en/nachhaltig/definition/index.html> accessed on December 29, 2006. The website was visited earlier on November 16, 2005. The site still mentioned that sustainable development is primarily a vision to guide future action. Today, the site includes a link to Sustainable development in Switzerland: Methodological Foundation.

At this stage, the reader may question the relevance of the critical analysis of sustainable development to the implementation of cleaner production in industry. One may raise the point that except as a “win-win” strategy to simultaneously address pollution control and productivity improvement, cleaner production does not have a direct link to sustainable development and to the non-operational nature of the latter. As discussed in Chapter III, cleaner production is one of the fundamental strategies for the implementation of Agenda 21, both on the international and national levels. At the same time, Agenda 21 is the main action program to implement sustainable development, although Agenda 21 never had an analysis as to how its programs, when implemented, fulfil the definition of sustainable development. It seems to be a postulate or a given unquestionable dogma that Agenda 21 is the implementation strategy of sustainable development. Hence, cleaner production as a program to implement sustainable development is a postulate and dogma that should not be questioned.

“Sustainable development” is such a nice term that initially nobody questioned its non-operational nature. However, starting from the late 1990s, experts such as Fisher and McCloskey started to question the relevance of the term “sustainable development”, especially in putting it to practice or operation. As McCloskey concluded, sustainable development is non-operational in nature. Hence, does Agenda 21 try to implement a concept that is non-operational in nature such that Agenda 21 could not be reasonably implemented? Is this one of the reasons that the implementation of Agenda 21 is very poor as reviewed by the United Nations five years and ten years after the Rio Conference? Cleaner production as a key component of Agenda 21 is also poorly implemented and accepted in the field. Is the non-operational nature of sustainable development one of the reasons for the poor implementation of cleaner production?

If I may add another definition of sustainable development, I would define it simply as development that meets the minimum basic needs of the present generation. Food, clothing and shelter are commonly accepted as the basic human needs although the quality and quantity could vary and in direct proportion its impact on the environment. For example, shelter could be a simple structure providing privacy, protection from the elements and security or it could be a mansion. The resources and subsequently the magnitude of the impact on the environment in constructing a mansion and a simple structure differ greatly. Hence, there is a need to qualify human needs as basic human needs.²⁹⁷ However, it may be argued that “basic human needs” transcends food, clothing and shelter. Basic human needs may include the need for social mobility and hence the inclusion of a car.

Rhetoric and International Agreements

Every nation goes to an international conference with its national vested interest to protect, and if possible, to enhance. Nations with similar interests may form negotiating blocks to strengthen their bargaining positions and promote their vested interests. A nation may join a particular block during a particular conference topic, but the block membership can be very fluid, as nations shift their membership to other blocks depending on their national interests and the topic under discussion. For example, in the World Trade Organization round of meetings on agricultural subsidy and tariff, Australia was a member of the Cairns group²⁹⁸ consisting mostly of developing countries with large agrarian-based

²⁹⁷ An idea often alluded to Mahatma Gandhi, is that the resources of the world is more than enough to meet the basic needs of all its inhabitants but all the resources are not sufficient to meet the greed of one person.

²⁹⁸ The Cairns group first met in August, 1986 in Cairns, Queensland Australia. The group consists of 18 agricultural exporting countries and account for 25 per cent of the international trade on agricultural products. Australia and Canada are the only developed member countries in the group. Additional information could be obtained from the website: <<http://www.cairnsgroup.org/>>

economies. Australia with the other members of the Cairns group, negotiated for the removal or reduction of agricultural subsidies and tariffs in the European Union and the United States. However, when it came to the negotiations on the protection of intellectual property rights at the World Trade Organization, Australia negotiated with the European Union and the United States, while most of the Cairns group members went with the Group of 77 and China a grouping that consist exclusively of developing countries²⁹⁹.

In a number of instances the negotiating environment could become very confrontational, especially if the topic has broad public support in domestic political debate. For example, the positions of Japan and Australia in the International Whaling Commission meetings are highly volatile and often confrontational, with Australia publicly accusing Japan of enticing small developing countries to vote in its favour through promises of foreign aid. Considering that Australia is also a major donor country in the Pacific, and there are instances such as in the Solomon Islands, East Timor and Papua New Guinea where Australia had intervened directly to strengthen local institutions in addition to providing economic assistance, Japan also accuses Australia of using foreign aid to entice small developing member countries to support its position in the International Whaling Commission.³⁰⁰ However, when it comes to other environmental conferences such as the phasing out of ozone-depleting substances, Australia and Japan take a common position with other developed countries.

²⁹⁹ The group of 77 was organised on 15 June 1964 by developing countries in order to strengthen their negotiating position in international forums. Although the group membership has expanded to 131 countries, it still retained its original name. Additional information could be obtained from the website <<http://www.g77.org>>

³⁰⁰ The International Whaling Commission was organised on 2 December 1946 in Washington DC. At present there are 71 members of the commission including landlocked countries such as the Slovak Republic, Austria and Mongolia. The main purpose of the commission is to control the hunting of whales, the specie hunted and promote research on whale migration, population growth and establish whale sanctuaries. Additional details could be obtained from the website: <http://www.iwcoffice.org>.

Procedures in Treaty-Making

An international environmental treaty normally starts with a scientific study by one or more specialized agency of the United Nations. In most environmental issues, the United Nations Environment Programme (UNEP) takes the lead. However, a specialized agency such as the World Health Organization may work with UNEP on environmental health issues, with the International Maritime Organization on marine pollution, with the World Meteorological Organization on climate change, and with the International Labour Organization on occupational health and safety. With regard to cleaner production, UNEP normally works with the United Nations Industrial Development Organization. The scientific study may consist of several studies covering a number of years until some patterns on the environmental quality and quantity have been defined and possible reasons for the cause and effect have been identified. The studies are summarized and included in the annual report of each of the specialized agencies sponsoring the project. If the study reports serious potential impact on the environment, the findings are discussed in the governing board meeting of the UNEP and highlighted in the agency's report to the general assembly. Most, if not all, the members of the governing board of UNEP are also members of the United Nations. The representatives on the governing board may come from the ministries in the member countries with parallel responsibilities to the functions of the specialized UN agency. For example, the minister for environment represents his country in the governing board of UNEP, and the minister of health in the World Health Organisation. However, in a number of developing countries, the ambassador accredited to the headquarters of the specialized agency may also represent the country to save on the representation cost.

The UN General Assembly may authorize the Secretary General to convene an international conference with UNEP and the specialized agency co-sponsoring the study

serving as the secretariat. The UNEP and/or the specialized agency convene a technical committee of experts.³⁰¹ Aside from their technical expertise, the specialized agency may consider regional balance and significance of the country with regard to the issues discussed. For example, the US is one of the major emitters of greenhouse gases. Even if the US president has categorically declared that the US is not signing the Kyoto Protocol, the membership of the Intergovernmental Panel on Climate Change always includes a respectable US scientist or bureaucrat. The technical committee meets regularly for a period ranging from a few months to two years depending on the significance of the problem, the state of knowledge, and particular sensitivities of member countries or blocks of countries. The technical committee prepares a report summarizing the nature of the problem, the scientific research, solutions to address the problem at the national and international level, the cost of potential damage and the cost of mitigating measures. The technical committee may also prepare a draft document outlining the potential working arrangement between countries. Normally, the technical report is circulated among UN member countries for comments and suggestions. The review process allows the member countries to prepare their positions in future negotiation processes and identify countries with similar concerns. The legal team in the specialized agency or secretariat prepares a very rough draft of the agreement.

The secretariat convenes a senior officials' meeting³⁰² to review the technical report and the draft agreement. Prior to the senior officials' meeting, one or two nations may take the

³⁰¹ I was a member of the technical committee of the World Health Organization and the United Nations Environment Program Rural and Urban Development project from 1983 to 1993. Our work consisted of identifying the major issues related to environmental health in major urban centers, slum areas and depressed rural areas. When I was working for the Asian Development Bank, one of the technical assistance projects that I processed and administered was with the Economic and Social Commission for Asia Pacific to prepare the State of the Environment report and Ministerial meeting in preparation for the review of the implementation of Agenda 21 and other agreements at UNCED in the Asia Pacific region. The discussion here is based on those experiences and observations.

³⁰² "Senior officials" normally refer to government officials at the Director and Director General levels, whereas "high level official" refers to ministers and head of state.

initiative of organizing a preparatory meeting of countries in a similar situation in order to form a negotiating block. Members of a negotiating block normally meet after the session to review their negotiating positions and sometimes during the recess in between the sessions. Country representatives consult their home office for advice. They also brief the home office on the progress of the negotiations. UNEP recently published a guidebook for negotiations of multilateral environmental agreements³⁰³ and with the Foundation for International Law and Development a glossary of terms for negotiations.³⁰⁴

During the first senior officials' meeting the differences in opinion, strategies to address the problem, and the institutional arrangement are identified. Each of the negotiating blocks may authorize a representative to explore potential compromises or to resolve the differences identified. Two or more senior officials' meetings are convened by the secretariat until some form of working document is agreed on. It is not unusual for new issues and differences to be identified in the second and third senior officials' meetings.

When most of the major differences have been resolved, the secretariat convenes an international conference. The international conference starts with the senior officials' meeting to discuss the remaining differences in the text agreement. Normally, the senior officials could not agree on any compromise until the last day of their meeting. Newspapers covering the conference report a potential failure of the negotiations. Non-governmental organizations and other vested interests organize rallies, discussion forums, and circulate their own position papers. In most instances, just before the close of the senior officials' meeting an agreement is

³⁰³ United Nations Environment Programme and Foundation for International Environmental Law and Development (2007), Guide for Negotiators of Multilateral Environmental Agreements, UNEP Division of Law and Conventions, Nairobi, Kenya

³⁰⁴ United Nations Environment Programme (2007), Glossary of Terms for Negotiations of Multilateral Environmental Agreements, UNEP Division of Law and Conventions, Nairobi, Kenya

reached ready for signing in the high-level meeting that follows. The last-minute agreement covers the areas where a common consensus has been reached, and an agreement to meet again to discuss the contentious issues. In some instances, the creative writers in the secretariat come up with high-sounding phrases that no politician could disagree with without detriment to their career, but are non-operational in nature so as not to seriously affect their country's vested interest. "Zero wastes", "end to poverty", "eliminating poverty" and "sustainable development" are some of the catch phrases that have come up in various UN environmental and social conferences.

The catchy but non-operational phrases may save the day, making the conference a success, and facilitating future conferences of the parties to discuss and hopefully reach a workable solution to the pressing environmental problem. In fact, the publicity and suspense from the near failure of the conference and the potential environmental disaster that could follow if the parties did not reach an agreement attract public attention and sustain the discussion in between conferences. With increased publicity and public awareness, more funding for scientific research follows to fill in the gaps in scientific knowledge along the lines of the conference political agenda, strengthen the political will and increase the pressure on the decision makers to come up with a workable solutions in future meetings.

Impacts of Catchy but non-Operational Phrases

One of the main human ambitions since antiquity is to produce a perpetual motion machine to work for mankind. The discovery of the laws of thermodynamics³⁰⁵ in 1888 by

³⁰⁵ The three laws of thermodynamics are; (i) matter and energy can not be destroyed or created; this is commonly called the law of conservation of matter and energy;(ii) while energy cannot be destroyed or created,

Rudolf Classius had proven that it is theoretically and practically impossible to construct perpetual motion machines.

Perpetual motion machines could be broadly classified into two categories. Under the first category are machines that create their own energy or operate with efficiencies greater than 100 per cent – violating the first law of thermodynamics. Under the second category are machines that restore the quality of the energy to its original state after the energy has served its function – violating the second law of thermodynamics. Although the American, British and other major patent offices in developed countries reject outright applications for perpetual motion machines, in the year 2000 attempts were made by various inventors to patent more than 100 types of perpetual motion machines in the US patent office alone. However, some applications do get accepted and pass the careful scrutiny of patent examiners. Since 1900, some 103 patents were awarded to perpetual motion machines worldwide, but none of the patented inventions has functioned as claimed. How I wish that at least one of those patents really worked. We should not have any problem with global warming, air and water pollution, resource depletion and land degradation. The perpetual motion machine will just rework all the wastes into useful substance again without any external energy input and hence, pollutants generated.

Mankind's fascination with the perpetual motion machine is just the mechanical manifestation of inner longings for immortality. In the field of beauty, people searched for the fountain of youth. They fought wars for future generations to immortalize them in their stories, poems and arts. They built monuments that they hoped would stand the test of time and provide a testament to their deeds. Even in death, people aspire for immortality. When all

its quality is continuous; this is degraded, commonly known as the law of entropy; and (iii) entropy is zero at absolute zero.

their aspirations for immortality are being put into doubt by the potential destruction of the environment through their own actions, they find solace and comfort in principles and concepts such as sustainable development, and of course, the success of Agenda 21 in implementing it. Hence, the catchy and non-operational phrases often take a life of their own in the academe, legal circles, international organizations, government agencies and non-governmental organizations.

Like the ancient alchemist, intellectuals try to find ways and means of putting into practice the catchy and non-operational phrases. To go against the tidal wave of praise and general public acceptance of the catchy and non-operational phrases could be considered heretical, anti-social, and anti-environmental.

Professor William Easterly, Professor of Economics, New York University in his testimony before the US Senate Committee on Foreign Relations on hearing on March 28, 2006 on “Multilateral Development Banks: Promoting Effectiveness and Fighting Corruption” noted that the use of slogans and terms impossible to fulfil make the institutions unaccountable.³⁰⁶ To quote Professor Easterly,

“A big part of the problem in aid is that aid agencies like the World Bank adopt sweeping goals like ending world poverty, for which it is impossible to hold them accountable. ...However, Gordon Brown³⁰⁷ was silent about the other tragedy of the world’s poor. This is the tragedy in which the West already spent \$2.3 trillion on foreign aid over the last five decades and still has not managed to get 12 cent medicines to children to prevent half of all malaria deaths. The West spent \$2.3 trillion and still had

³⁰⁶ Professor Easterly labeled the professionals working on slogans that are impossible to fulfill as planners and those that find and implement solutions as seekers. Personally I feel the terms “planner”, and “seekers” are not appropriate. Good planners do find and implement good solutions, and I have seen seekers who move blindly and only implement a successful solution by chance because they work without any plan. I think the term “dreamers” is more appropriate than “planners” and “builders” is more appropriate than “seekers”.

³⁰⁷ Professor Easterly was referring to UK Chancellor of the Exchequer Gordon Brown who gave an impassioned speech at the National Gallery of Scotland on 6 January 2005 on International Development in 2005: The Challenge and Opportunity. In that speech, Mr Brown noted that millions of children are dying daily from easily preventable diseases. Mr Brown further called for the doubling of foreign aid and for the establishment of an International Financing Facility to borrow against future aids in order to rescue the poor of today.

not managed to get \$4 bed nets to poor families ... It is a tragedy that so much well-meaning compassion did not bring these results for needy people.”

Professor Easterly is critical of the doubling of aid funding and the establishment of an International Financing Facility to borrow tens of billions of dollars against future aid. Professor Easterly was concerned that the additional funding would be wasted or mired in inefficient and ineffective projects if aid agencies continue the present practice of setting unattainable goals, and if I may add, high-sounding but non-operational concepts.

It is worthwhile to note that of all the multilateral environmental agreements it is only the World Heritage Convention and the Convention on International Trade in Endangered Species (CITES) that have non-compliance penalties. In the case of the World Convention the non-compliance penalty is exclusion from membership in the World Heritage Committee³⁰⁸ and in the case of CITES³⁰⁹ the loss of privilege to issue exports and imports permits effectively suspending trade in listed species and corresponding economic losses.³¹⁰

Politicizing Science

Hitler and his propagandists organized a series of scientific conferences to discredit Einstein and the theory of relativity. The resolutions were endorsed by more than a hundred

³⁰⁸ Convention for the Protection of World Cultural and Natural Heritage of 1972 commonly known as World Heritage Convention, opened for signature in Paris on November 16, 1972 and entered into force on December 17, 1975 accessed on January 15, 2007 at <http://whc.unesco.org/en/conventiontext/>

³⁰⁹ Convention on International Trade in Endangered Species of Wild Fauna and Flora commonly known as CITES opened for signature on March 3, 1973 and came into force on July 1, 1975, United Nations Treaty registration 14537 vol. 993.

³¹⁰ United Nations Environment Programme (2007b) *Compliance Mechanism Under Selected Multilateral Environmental Agreements*, written and coordinated by Gregory Rose, Lal Kurukulasuriya, Amanthy Perera and Martin Krebs, UNEP Division of Law and Conventions, Nairobi, Kenya

German physicists including two Nobel Laureates, Philipp Lenard and Johannes Stark. When Einstein was interviewed on the impact of the resolutions on the veracity of the theory of relativity, he was said to remark that Hitler does not need the more than one hundred physicists and Nobel laureates if there is really something wrong with his theories. Hitler only needs one scientist to demonstrate the errors in his mathematical calculations.

Great scientific discoveries are made because one man or a team of men does not agree with the commonly accepted idea or the consensus of the scientific community. During Copernicus' time, almost every man of learning agreed that the earth was the centre of the solar system except Copernicus. Copernicus provided the mathematical proof. Riemann did not believe in the infallibility of Euclid's postulates and established a new field of geometry which is more general and with wider applicability than plain or Euclidian geometry. The list could go on and on.

Until very recently, scientific discoveries were made in experiments using simple and cheap equipment. Robert Millikan's experiment to measure the charge of an electron uses a simple jar, a perfume atomizer, a battery and copper plates that would cost less than \$100 today. Einstein developed the theory of relativity in his spare time. Today, most scientific discoveries are made using multimillion dollar equipment and the data analysed using super computers. Science has become dependent on government budgetary outlay and research grants from large foundations, sometimes with their own political agenda.

From ancient times, alchemists, mathematicians, astronomers and charlatans had political patronage to support their day-to-day work and living expenses. Except for the philosophers like Aristotle who dabbled in cosmic and physical sciences in a subjective manner, the involvement of ancient science in political debate was minimal.

The logic of modern science or the scientific method could be traced to Francis Bacon. Although the procedures used in antiquity were considered “hit or miss” or “trial and error”, a number of important scientific facts and principles were discovered. For example, Archimedes discovered the law of buoyancy and applied it to fraudulent adulteration of metals, ship design, pumps and other practical uses. Most of the ancient scientists were detached from society and worked in secrecy, usually for good reason as they were charlatans trying to discover the elixir of life that would make their clients immortal or forever young, or the eternal mixture that would make gold out of base metal. The ancient scientists hid the progress of their work, and at the risk of their lives, reported to their patrons exaggerated results to extract more support.

While science has progressed rapidly in the last 300 years, with scientists working in large research teams, the concept of a scientist as a loner working in seclusion, thinking and behaving³¹¹ differently from the rest of society, has remained to this time. The main thrust of scientific research was to discover something new that had never been tried or thought of before. As a consequence, major discoveries went against the accepted ideas of the day, or normally scientific consensus.

In modern time, the first direct involvement of scientists in the political debate was the declaration “To the Civilized World”³¹² made by a large number of German thinkers,

³¹¹ The terms “mad scientist”, “absent minded professor” and “eccentric thinker” are common perceptions of scientists, reflecting their tendency to work in isolation, to think and behave outside normal conventions. Today successful scientists are experts in writing research proposals, and marketing their ideas. Highly recognized and established scientific journals noted for their rigorous peer review system, such as *Nature*, have recently been accused of favouring topics that attract the media’s attention. Personally, I do not believe in the accusations, especially those against the journal *Nature*. I had a scientific paper published in it in 1978 and I underwent the rigorous review process which I think was fairly done.

³¹² John Moses (2002) *The Mobilisation of the Intellectuals 1914–1915 and the Continuity of German Historical Consciousness. Australian Journal of Politics and History*, 48, 336-352.

including well-known scientists, to justify the enormous casualty of the First World War inflicted by the German army using the discoveries of German scientists. The declaration justified the damage on the potential beneficial and civilized use of the same scientific discoveries that were made possible because of the resources provided by the German military establishment. The declaration then tried to justify the aggressive nature of the German war machinery and German society as a whole, as an important step in the advancement of a technology-based society. While the declaration caused some furore when it was made, it was soon forgotten. In fact, simultaneous with the declaration, a group of pacifist German thinkers passed a counter declaration titled “An Appeal to Europeans”, criticizing the use of technology for war purposes.

In 1863, the US Congress authorized the organization of the National Academy of Sciences to advise the government on important scientific issues. Last year, the US House of Representatives Committee on Energy and Commerce, chaired by Congressman Joe Barton, and the US Senate Committee on Environment and Public Works chaired by Senator James Inhofe, demanded an explanation on a US government-funded research on the multi-proxy analysis of the earth’s climate in the past 2000 years, which served as the basis of the chapter on past climate in the third report of the Intergovernmental Panel on Climate Change.³¹³ The US House of Representatives Committee on Science and Technology chaired by Congressman Sherwood Boehlert criticized the move by the two committees as an infringement on his committee’s mandate. As a compromise, Congressman Boehlert called on the National Academy of Sciences to investigate and report to the US Congress its findings.

³¹³ Intergovernmental Panel on Climate Change(2001) IPCC 3rd Assessment Report. Intergovernmental Panel on Climate Change, United Nations Environment Programme, World Meteorological Organization.

The National Academy of Sciences was caught in a political debate on the science of paleoclimatology. Paleoclimatology research is very expensive, often requiring cooperative efforts among nations, and because of the expense involved, there were instances when researches were abandoned when one national sponsor withdrew. Until the recent debate on climate change, the results of paleoclimatology researches were more of academic interest.

The National Academy of Sciences released the draft report³¹⁴ on its investigation into the earth's climate in the past 2000 years. The report is divided into two sections, with the executive summary devoid of any scientific details for general public consumption and the basis of the news releases by the Academy. The main section of the report detailed the scientific analysis, with Chapter 9 discussing in detail the use of tree rings, and Chapter 10 and 11, the statistical method of analysis. The Academy was treading on the horns of a dilemma. The executive summary and press releases confirmed that the earth's climate has warmed considerably in the last two decades, vindicating the third report of the Intergovernmental Panel on Climate Change or the so-called "hockey stick" rise in global temperature. The main report, specifically Chapters 9 to 11, was very critical of the scientific procedure used in deriving the "hockey stick". The climate sceptics praised the main report as justifying their position and were very critical of the executive summary and press releases.³¹⁵ The pro-warming group hailed the executive summary and the press releases as vindicating their position and felt that the Academy was very harsh on the "hockey stick" researchers in the main report.³¹⁶ Congressman Boelhort was satisfied with the executive summary and the press releases and Congressman Barton and Senator Inhofe were satisfied with the main

³¹⁴ National Research Council Committee On Surface Temperature Reconstructions For The Last 2,000 Years (2006) Surface Temperature Reconstructions For The Last 2,000 Years. Washington D, National Academy Of Sciences.

³¹⁵ Refer to the website: <www.climateaudit.org>

³¹⁶ Refer to the website: <www.realclimate.org>

report. As Congressman Boelkert put it, the Academy report has put to rest any controversy surrounding the veracity of the “hockey stick”. As Senator Inhofe puts it, the “hockey stick” is broken.

As described earlier, the technical committees of the United Nations and its specialized agencies take into consideration regional balance and representation from world powers in selecting the members. In practice, UN agencies directly, or through non-governmental organizations organize manifestos supporting controversial and sensitive agenda. For example, the most quoted response to climate change criticism is the manifesto signed by more than 4,000 scientists worldwide including a number of Nobel Laureates, whereas a counter manifesto is only supported by 1,000 scientists. As there are more scientists supporting the UN position on climate change, it is considered the consensus of the scientific community and must be the correct position.

In recent years, there has been a realization that scientific procedures of inquiry and development of facts are not sufficient to guide the development of environmental policies and legislation in a timely manner. While engineers and scientists do use the factor of safety to account for uncertainties, the adoption of the precautionary principle was the first formal policy declaration that policy-makers and the public could not wait for definitive scientific results before the potential environmental risks are addressed. There are a number of case studies showing the importance of the precautionary principle in averting potential disasters.³¹⁷ On the other hand, Roger Pielke Jr of the University of Colorado Centre for

³¹⁷ Poul Harremoes, Malcolm Macgarvin, Andy Stirling, Jane Keys, Brian Wynne, Sofia Guedes Vaz (2002) *The Precautionary Principle in the 20th Century: Late Lessons from Early Warnings*, Earthscan Publishers, London.

Science and Technology Policy Research³¹⁸ stated that the wasted resources and damage caused by the overtly conservative position taken in the application of the precautionary principle have not been documented, and he estimated they could be substantial. Like sustainable development, the precautionary principle could be used by both sides of the environmental debate. He particularly cited the case that US President George W Bush, when objecting to the Kyoto Protocol, was merely using the precautionary principle when he stated “We must be very careful not to take actions that could harm consumers”. There is a growing sense among policy makers that the scientific process with its rigorous sets of rules for verification, re-verification and replication of experimental results is too slow in addressing potential environmental concerns.^{319, 320}

Sociologists classify most of environmental science as “post normal science”. As the editor of the *Journal of the Royal Statistical Society* puts it in the Part 1, 2006³²¹ editorial:

“... in relation to policy, the environment is particularly challenging. It includes a mass of details concerning particular issues. The tasks differ from those of normal science owing to complexity, specifically radical uncertainty, a plurality of legitimate perspectives and very high risks. Post-normal science embraces issue driven scientific inquiry related to environmental controversies, the facts are uncertain, values are in dispute, stakes high and decisions urgent. Everything, the choice of what to measure, the modelling approaches and formation of theoretical constructs is shaped by societal values. Rather than knowledge discovery in traditional science, the ultimate goal of its post normal successor is consensual agreement.”

³¹⁸ Roger Pielke, Jr. (2002) Better safe than Sorry : Is the Precautionary Principle a useful guide to action. *Nature*, 419, 433-434.

³¹⁹ Daniel Sarewitz (2004) How Science makes environmental Controversies Worse. *Environmental Science and Policy*, 7, 385-403.

³²⁰ The proceedings on precautionary principles must be one of the last books Poul Harremoes edited before he died in 2002. I personally knew Poul Harremoes when he was a member of the governing board and later President of the International Association of Water Pollution Research. Prof. Harremoes was one of the pioneers in the development of wastewater treatment processes, especially fixed film reactors.

³²¹ Editors,(2006) Editorial: Post Normal Statistical Science, *Journal of Royal Statistical Society*, 169, , 1-4. at page 1

Post-normal science evolution is a formalization of the precautionary principle in decision-making through an established set of procedures involving peer communities, acknowledgement and demonstration of uncertainties, and explicitness of values. “Peer communities” is defined as the process wherein concerned citizens, government agencies, academia, and other local institutions monitor, track and respond to common community concerns rather than being dominated by a particular group of experts. As Fahey³²² noted:

“Policy making is shaped by diverse values and assumptions brought before the decision-making table, and political reasoning is an exercise in metaphor making where stories are told in a strategic way as to be able to persuade for the benefit of certain policies. Science is often used to help legitimize and therefore tell the stories. Therefore, whether or not it is ‘junk science’ or ‘sound science’, once it enters the policy arena it can be manipulated to serve the social construction of the day.”

Although most social scientists consider post-normal science a new approach to policy-making, there is really nothing new to it. The procedures and methodology of post-normal science have historically been the cornerstone of policy making, not only in environmental issues but for almost all political issues as diverse as interest rates, immigration, employment and work place conditions, health, security, and for that matter, any subject of human interest.

It is part of human nature to long for stability and continuity. In a democratic society, political parties of all colours of the spectrum take advantage of the human fear of potentially negative change and uncertainty to gain votes and political power. In non-democratic societies, dictators and tyrants use communal fears and uncertainty to gain and retain power.

Most humans are willing and ready to sacrifice basic freedoms to maintain stability and remove uncertainty in their lives. Even in modern and highly sophisticated societies like

³²² Nathan Satya Craig Fahey. (2005) The Use of Science in Environmental Policy Making and the Implications for Health: A Case Study of Bismuth Shot shells. *Environment and Resource Studies*. Waterloo, University of Waterloo.

the United States, Europe and Australia, the citizenry are willing to part partially with some of their rights, such as privacy rights, in the face of threats from terrorism. In fact, the popularity of environmental issues was due to the uncertainty and the potentially negative impacts that environmental degradation has on the individual's health, economy, and the general well-being of the planet.

Soap box orators and debaters were common features in the North American political landscape in the late 18th century until the start of the 20th century. Soap box orators were responsible for mobilizing public opinion for the westward migration, anti-slavery and pro-slavery ideas, as well as a number of scientific frauds such as snake oils and perpetual motion machines. The large number of fake scientific inventions and subsequent frauds that followed was one of the reasons that the US Congress established the National Academy of Sciences on 3 March, 1863³²³ to provide the government and the public with sound scientific advice. The Patent Office screened fraudulent claims. In the realm of public policy, scientific principles serve as an arbitrator between various schools of thought and a sound practical guide for the implementation of public policies involving technology.

Proponents of post-normal science claim that traditional science, with its rigid and time-consuming verification procedure, is still the final arbitrator on the soundness of environmental policies. Post-normal science is just an emergency or temporary measure to assist the development and implementation of environmental policies while traditional science takes its time in establishing and verifying the scientific facts. As discussed earlier in this chapter, scientific inquiry today requires large sums amounting to several millions of dollars so that an average foundation or research institution will have difficulty acquiring funding on

³²³ Additional information on the US National Academy of Sciences could be obtained in their website <<http://www.nasonline.org>> and for the US Patent Office at <<http://www.uspto.gov>>

its own. Government support for research, especially in environmental science, is required. In a number of instances, multinational support is required. For example, a number of research projects involving ice core drilling to determine the earth's past climate have been cancelled after one government withdrew or postponed its support. The global mapping of resources, depletion of forest covers, and depletion and recovery of the ozone layer depend on large government grants. If environmental policy as driven by post-normal science principles moves to a particular direction, it will be difficult and often impossible for researchers with contrary views to obtain research funding. The temptation for scientists to fudge their research findings in line with the prevailing and popular environmental policies would be very high.

While the general public may be afraid of the potentially negative impacts predicted through post-normal science, after some time the public would get tired of the information and would shift its attention to other areas. While post-normal science may result in a rapid response to potential environmental concerns, it also magnifies public apathy to environmental issues, such that when important environmental issues come up the public will be insensitive and will not respond. The post-normal science approach runs a risk similar to that of the "boy who cried wolf".³²⁴ Public attitude towards environmental issues and concern are potentially shifting to apathy.

³²⁴ In Aesop's fable, a shepherd boy out of boredom cried for help, shouting that a wolf was killing his sheep. The other shepherds left the flock to assist him, only to find out later that there was no threat and the shepherd boy was just joking. The shepherd boy repeated the same joke and each time fewer people responded. One day when a wolf came to attack his flock, nobody responded to his call for help. As US President Lincoln once put it, "You could fool all the people at a time, you could fool some of the people all the time but you could never fool all the people all the time".

As Von Storch³²⁵ of the Max Planck Institute of Meteorology in Hamburg, Germany, noted in his testimony before the US House of Representatives Committee on Energy and Commerce on 19 July 2006;

“A characteristic of post-normal science is that the boundaries between science and value-driven agenda get blurred; that representatives of non-governmental organizations are considered to know better about the functioning and dynamics of systems than scientists; that parliamentarian committees delve into the technicalities of science; that amateurs engage in technical debate; and that some scientists try to force solutions upon policymakers and the public. In such a situation it becomes entirely possible that individual scientists emphasize those insights which are assumed to influence certain policy decisions more forcefully, while downplaying others.”

As the result of the blurring between science and politics, the public has lost interest in environmental issues. Von Storch further noted in his testimony that the CBS television network survey in May 2003 showed that environmental issues were no longer considered by the American public as falling within the six major issues of concern. While in Germany, environmental issues are still a major public concern, he also noted a growing public distrust, and it is only a question of time when the German public will show the same apathy to environmental issues as the American public.

Cleaner production is not as controversial as climate change. However, the decision-maker, or any buyer for that matter, evaluates the salesperson's body language in addition to the technical, financial, and environmental performance of the goods and services offered. The decision-makers inquire from their friends and associates who have had past experience with cleaner production and are curious about their competitors' response to technological change. The decision-makers also read and make inquiries on related products that the salesman has on stock even if these are not offered to him. In terms of political inclination, business decision makers generally lean towards the conservative side even if they contribute

³²⁵ Hans von Storch. (2006) Testimony Before the US House of Representatives Committee on Energy and Commerce, July 19, 2006, Washington DC, US House of Representatives.

funds to all sides of the political spectrum to protect their interests from changes in political fortunes.

Business Response to International Agreements on Environment

For a commercial organization to remain in business it must generate profit. The commercial organization may be owned by a charitable foundation, but still it must generate profit to remain in business. The commercial organization may finance a charitable foundation, or sponsor community projects and other non-profit-making activities out of its public relation and advertisement budgets or from undistributed profits, but it must still generate profit. One of the interesting phenomena in current US business practices is that of decision makers and their organizations who engage in predatory business practices because of the highly competitive environment, but at the end of the day donate a large portion of their accumulated wealth to charitable foundations. For example, Nelson Rockefeller Sr and Standard Vacuum were heavily fined for violation of the anti-trust legislation in the mid-1930s, but a large portion of his wealth went to the establishment of the Rockefeller Foundation. In recent years, Microsoft was fined in the US for violation of the anti-trust law and using its market dominance in the operating system software by hampering the integration or use of competing application software. Netscape, the pioneer Internet browser, has practically been wiped out by Microsoft Internet explorer bundled with the Windows operating system software. On June 15, 2006 Bill Gates, the founder and major stockholder of Microsoft, announced that he was leaving the company on July 2008 to concentrate on his charitable foundation, the Bill and Melinda Gates Foundation.³²⁶

³²⁶ Additional information on the Bill and Melinda Gates Foundation could be obtained from the website; <<http://www.gatesfoundation.org>>

Due to their narrow focus on profitability, commercial organizations are very adaptable – perhaps the most adaptable type of organization operating on a mass scale. Commercial organizations tend to exploit every opportunity available to make a profit, or to provide an advertising opportunity to gain market share over their competitors, or to gain product exposure. Most often, commercial organizations are able to exploit the most potentially negative public sentiment to their advantage. For example, oil and energy companies were opposed to the global warming initiative and were known to finance studies and research to counter the studies by the World Meteorological Organization and UNEP on the negative anthropogenic impact on the earth's climate. The anthropogenic impact of global warming is mainly caused by carbon dioxide and methane. Carbon dioxide is generated from the combustion of hydrocarbons and coal, while methane is released during exploration and transmission of natural gas and from sanitary landfill operations. Concern for global warming is expected to reduce oil and natural gas consumption through the conservation and development of alternative energy sources such as nuclear power and renewable energy sources such as wind, solar, wave and biomass.³²⁷ However, businesses especially those involved in the energy sector, are finding opportunities for promoting their businesses. Oil and power companies have extensive information database on oil and energy production reserves, intelligence information on political and social stability of major energy suppliers, software and hardware in futures and physical trading of energy related commodities. While oil and energy companies are generally viewed in favour of climate change denial, in the short

³²⁷ Bob Ward (2006) Letter to Exxon to Stop Funding Climate Change Denial. Senior Manager Policy Communication, Royal Society, London, UK. , as reprinted in David Adam (2006) Royal Society Tells Exxon: Stop Funding Climate Change Denial. *The Guardian*. London, UK.

term they are profiting from carbon trading. ICF Consulting, an international firm involved in carbon trading noted:³²⁸

“Our analysis has shown that, even without including the value of emission permits received, many power stations in the UK will make more money carbon emission trading. This is because the marginal plant on the system is generally less efficient than the other operating power plants. As the marginal plant adds its cost of emissions into its bid, the resulting price rise is greater than the additional cost faced by most infra-marginal power stations. As price rise more than cost, profits will increase. The effect is more evident for nuclear and hydropower plant, which will incur no carbon emission costs.”

As most energy companies own power plants with range of efficiencies and technologies, they will maintain and continue operating the inefficient or marginal power that are often polluting in order to provide an expensive baseline for the bidding process and hence maximize their profits as outline in the above quotation. In simpler terms, power companies will be reluctant to adopt cleaner production in marginal facilities they owned.

Power and energy companies also see the potential public relation and advertisement potential of the climate change issue. For example, Chevron, one of the biggest international oil companies is advertising and promoting conservation by pointing out that for every two barrels of oil consumed, only one barrel of oil is discovered and added to the reserves. One may question if the advertisement is really intended to promote conservation or is it to soften public resistance to the exploration and future drilling in environmentally-sensitive areas?

Oil companies are promoting renewable energy. British Petroleum (BP), another of the big international oil companies is advertising the one million tons or so of carbon dioxide that their renewable energy program has displaced, ignoring or covering up the fact that their main line of business continues to add a billion tons per year of carbon dioxide to the

³²⁸ Abyd Karmali and Neil Cornelius (2005) Winning in the European Greenhouse Gas Emissions Trading Scheme: Insights for Power Generators. London, UK, ICF Consulting. At page 2.

atmosphere. Hence, nuclear energy is back on the agenda as an energy source which does not generate any greenhouse gas emission.

An interesting case is the action and possible litigation that Messrs Steve Malloy and Thomas Borelli are contemplating of bringing against the Chairman, Mr Jeff Immelt, and the Board of Directors of Merrill Lynch.³²⁹ Merrill Lynch has invested in a number of environmentally-oriented projects whose yields are lower than those of more traditional investments. Messrs Malloy and Borelli have questioned the propriety of the decision of the Chairman and the Board of directors of Merrill Lynch – which in their opinion, has reduced the value of their investments. They have even threatened to sue the Chairman and the Board of Directors, asking for damages, for failure to discharge their fiduciary obligations to protect and enhance the value of the shareholders investment. It is a commonly known fact that companies engage in environmentally – and socially – responsible projects as part of their public relations campaign. However, the companies will seldom admit that they are doing environmental and social projects for public relations purposes – otherwise the public relations promotion loses its value. Merrill-Lynch has a large business research and development group³³⁰ and certainly must have carried out extensive research on the promised or potential economic gains that could be made from cleaner production.

Business Response to Cleaner Production

³²⁹ Amity Shlaes (2006) Mr. Immelt, Explain Yourself, Fund Says:. *Bloomberg.com*. Internet Edition . New York, April 4, 2006 and accessed on the same date at http://bloomberg.com/apps/news?Pid=71000001&refer=columnist_shlaes&sid=af2ytle9stim.

³³⁰ http://askmerrill.ml.com/markets_front/ seen on January 31, 2007

While cleaner production is firmly based on the traditional science of thermodynamics, chemical kinetics and mass transfer, the adoption of the program as part of the more ambitious global initiative of sustainable development has created the negative backlash that Von Storch mentioned in his testimony before the US House of Representatives on 19 July 2006. Decision-makers in the industry are taking a second hard look at cleaner production, looking for potentially hidden and vague agenda. Burton Hamner, President of CleanerProduction.com and Anthony Chiu,³³¹ Cleaner Production consultant, noted that the private sector in the Philippines was relatively disinterested in recycling technologies. They rationalized that the private sector's lack of interest is caused by the relatively low cost of waste disposal and few government incentives to pursue recycling. They found that local government units have a strong interest in recycling and waste minimization as compared to the private sector. Considering the situation in the Philippines and other developing countries where the government promulgates environmental standards for waste discharge but exempts itself from complying with its own environmental regulations, the reasons given by Hamner and Chiu are not valid. Cleaner production is not just an alternative for wastes disposal but aims for improved production processes, higher efficiency and better quality products, resulting in lower wastage.

Summary

The production of goods and services has gone through radical changes throughout human history. The changes taking place today are more radical and are taking place within a shorter time span since the establishment of scientific principles 300 years ago. The

³³¹ Burton Hamner and Anthony Chiu (2000) The Philippine Clean Cities Project: Promoting Wastes Minimization through Local Governments.

development of systems engineering, computers and simulation techniques have reduced further the incubation period between the application and discovery of a scientific principle. As the systems engineers' motto puts it, "With proper systems analysis, the sum of the parts is greater than the whole." Systems engineering synthesizes new applications or systems by connecting information from diverse fields and discipline that on cursory inspection have no relevance to each other.

Historically, communities and later nations, were secretive of new inventions and innovations discovered by one of their members. The new invention or technology could mean a critical advantage in warfare and empire-building. A simple procedure such as the centurion phalanx formation allowed the Romans to conquer the known world at the turn of the Christian era. The Roman centurion phalanx is the equivalent to the modern day tank moving in the battle field in solid formation and defended on all sides. Akbar's effective use of gunpowder sound destroyed the Indian army that was a hundred times stronger than his cavalry. Most of the Indian army was destroyed by their panicking army elephants that were confused by the sound of gunpowder. At the start of the industrial revolution, the export of new mechanical machines from England was punishable by death. In spite of the death penalty, smugglers, spies and simple adventurers risked their lives for a meagre reward to transport plans, machine parts and sometimes whole machines to continental Europe to be copied.

In recent times, Henry Ford's assembly-line concept for manufacturing automobiles cheaply and with uniform quality was adopted by a wide range of industries. When World War II started, all the major warring nations were using Ford's assembly-line concept. The Japanese "just on time" manufacturing system is a very recent innovation, but almost all the competitive manufacturers are using the concept today. Ford and the Japanese manufacturers

would have been happier if concepts could be patented in the same way as machine parts. They could have kept the advantage to themselves and wiped out the competition. Like the genie freed from the bottle, a good idea is difficult to contain once it is discovered.

There was no need for an international convention to promote the assembly-line concept. There was no need to legislate and clearly state that the use of the assembly-line concept was a national policy. There was no need for international conferences, ministerial declarations and agreements to promote it. There was no need for any demonstration project, transfer centres, soft loans and concessionary financing to promote the use of assembly lines.

On the contrary, organizations finding new uses for the assembly-line concept patent their inventions and processes to prevent competitors from copying and using them. In countries where the patent laws are weak, inventors and innovators allocate a considerable sum to prevent outsiders from getting even a peek at their inventions.

What makes cleaner production different from Ford's assembly line concept or the Japanese "just on time" manufacturing concept is the array of support from ministerial declarations, demonstration projects, soft loans, information data bases, technology transfer centres, conferences and seminars. Business is sceptical because the concept is aggressively pushed to them. While the business motive is to make a profit, business operates in a complex world where decision-making is based on a wide range of parameters and values than shown in cleaner production literatures and demonstration projects. Business is sceptical of the claims of cleaner production because the latter offers a simplistic view of the business decision-making.

CHAPTER VI

CASE STUDY

Introduction

To illustrate the concepts discussed in Chapters IV and V, Chapter VI will describe and analyse a case and make recommendations to improve the use of cleaner production. Preferably, the case study should include all the domestic and international constraints relating to the transfer of cleaner production in a developing country. However, the domestic and international constraints are too many and too diverse, so that it will be difficult to identify one particular sector of an economy affected by the constraints discussed in Chapters IV and V.

After assessing the characteristics of the various industrial sectors and considering my familiarity with these, I decided to choose the Philippine sugar industry. The sugar industry in the Philippines is highly labour-intensive. The labour force is highly disadvantaged with skills often too limited for work in other industries. However, the labour force is politicized, and labour disputes have a tendency to turn violent, as in the case of the disputes in 2005 at the sugar plantation of the former Philippine President Corazon Aquino, where more than six people died. Historically, the sugar workers have been at the forefront of peasant uprisings and the Communist rebellion. The sugar sector is not just a vital industry for the Philippine economy, but the profitability and continuity of its operation are vital to national security.

As an industrial sector with very high social concerns and whose stability is important to national security, peace and order, and overall economic development, the sugar industry has historically and continuously received protection and encouragement under various investment laws, exemptions from land reform, and restrictive tariffs. The industry also enjoyed preferences in various industrial programs including demonstration projects for cleaner production.

The basic principles of sugar growing, extraction, and refining have remained the same as those used by primitive humans. However, the technology has grown in sophistication with the introduction of the steam engine, mechanical crushers, vacuum evaporators, and lately, membrane processes to separate the impurities. Through selective breeding, the sugar yield per hectare has increased and commercial varieties are more resistant to pests. The sugar cultivation and extraction technology is relatively simple, but nevertheless, significant changes have taken place in the last 50 years. With concern focused on pollution prevention, a number of cleaner production initiatives have been introduced in the industry. With the importance of the sector to a number of economies in developing countries, demonstration projects have been tested on a wider and larger scale than in most industrial sectors.

The sugar industry requires large volumes of water during cultivation, extraction, processing and refining. The water quality varies, with irrigation water of the lowest quality and the use of treated effluent from the sugar mills, to drinking water quality for water in contact with the finished and semi-finished products. As sugar is often used in conjunction with food and sometimes in pharmaceutical products, the purity of the water used is important.

Aside from sugar cane, there are a number of plants cultivated in tropical as well as in temperate climates that yield sugar. The most common alternative sources of sugar apart from sugar cane are sugar beets and maple trees. In recent years, the commercial production of fructose and glucose from the hydrolysis of corn starch has diminished the traditional sugar market. A number of organic sweeteners are also commercially available in the market for various specialized uses such as sorbitol, dulcitol, mannitol and xylitol.³³² However, sugar from sugar cane and sugar beet dominates the sweetener market because it is cheaper than most of the substitutes. Aside from the sweeteners derived from natural sources, chemists have developed artificial sweeteners, the most common of which are cyclamate and saccharin. Cyclamate is 300 times sweeter than sugar, but tests on animals show that cyclamate is potentially a carcinogenic substance. Cyclamate has been banned in the United Kingdom and the US since 1969 but it is legally used in Canada, Switzerland, and Norway. Saccharin is another popular artificial sweetener that has been shown to exhibit carcinogenic properties during animal trials, and since 1977 has been banned in the US and Canada for consumptive use, but has found continued uses in products such as toothpaste, and special soaps. Saccharin is 550 times sweeter than sugar, but requires blending with natural sugar, as it leaves a bitter aftertaste.

As sugar is produced domestically in both developed and developing countries, the trade in sugar is subject to international and bilateral agreements. The price of domestically-produced sugar in developed countries is much higher than the production cost in developing countries, but the trade in sugar is controlled by various quota, tariff and other trade barriers. While the developing countries may be selling their sugar at rates higher than those on the world market under the quota system, the long-term continuity of the quota allocation and

³³² Encyclopedia Britannica, (1994) Micropedia Ready Reference, v. 11, 15th edition

pricing are subject to a wide range of factors, other than the production cost, consumption and supply of sugar. The variation in the sugar quota and prices could vary in accordance with the divergence and convergence of the foreign policies of the developing country and the developed country.

The use of the sugar sector for a case study covers almost all of the domestic and international constraints to cleaner production discussed in Chapters IV and V. The case study starts with a short historical review of the international sugar trade, noting the social and cultural aspects that to date still affect the international sugar agreements and the markets. It considers the development of the industry in the Philippines from the later half of the 19th century, the American colonial period, the early years of independence, the martial law years under President Marcos, and the restoration of democratic government in 1985. The short historical note on the Philippine sugar industry illustrates the importance of the sector to the economy and the subsequent social, economic and political power that the stakeholders in the industry have gained in the Philippines and the strategy President Marcos used to control the industry and its stakeholders during the martial law period.

The second section of the case study reviews the sugar milling technology, efficiency, and pollution loads of Philippine sugar mills compared to state-of-the-art technologies. The technological review is followed by a review of the social conditions that defined the deep and wide income disparity between the landowners and the plantation workers, and the social unrest that followed. A short review of the legislation and regulations to address the social issues concerning landless plantation workers, profit sharing, as well as multilateral and bilateral trade agreements entered into by the Philippines is made, as these issues affect the efficiency, competitiveness and adoption of cleaner production in the sugar sector. The case

study closes with a brief description of the initiatives taken in recent years by stakeholders and the legal constraints still to be addressed.

Philippine Sugar Industry

History

Sugar cane is a perennial herb of the grass family which is scientifically referred to as *Saccharum officinarum*.³³³ The outstanding feature of herb is the reddish-brown to dark brown cane, which at maturity could reach 5 cm in diameter. The cane is divided into segments 0.15 to 0.2 m apart. The leaves, which are elongated and shaped like a saber, are located at the topmost portion of the cane. As the cane grows, the leaves in the lower portion of the cane are shredded, with the newer leaves growing at the top forming a crown. When the cane matures, 2 to 3 m of cane stands free and almost straight with another 2 to 3 meters of leaves at the top. Through the process of photosynthesis, sugar cane uses carbon dioxide from the air with water from the soil to form sugar. The sugar is stored in the stalk, which is protected by a thin layer of shell similar to bamboo. Just as in bamboo, the shell and the ring segments provide flexibility and strength to the cane. Sugar cane is the most efficient of cultivated plants in converting the carbon dioxide from the air and combining it with water to form sugar. The closest competitor to sugar cane in terms of photosynthetic efficiency and, not surprisingly, also the main competitor to sugar cane in the world sugar market is sugar beet.

³³³ Encyclopedia Britannica, Micropedia Ready Reference, v. 11, 15th edition

Sugar cane is a very delicate crop. To maximize sugar production, competing weeds, shrubs and grasses are manually removed. The growing cane is irrigated and fertilized. While machines have been designed and built to weed, fertilize and harvest the cane, most of the sugar cane farm maintenance and harvesting in developing countries is still done manually. It is only in the field of irrigation that mechanization has taken hold.

Initially, sugar was used in Europe and North America for medicine and spice. With the increased demand for tea, chocolate and other sweet consumables such as candies and cakes, sugar became a primary export product from tropical and subtropical regions of the world to Europe and North America. Prior to the opening of the Suez Canal on November 17, 1869, intensive sugar cane cultivation was centered in the Caribbean Islands, and the southern states of British North America.

Sugar cultivation requires large quantities of water, fertile soil and cheap labour. Cheap labour was provided by slaves purchased from the African west coast. Between 1450 until the middle of the 19th century, more than 12 million slaves were moved from the African west coast to the Caribbean sugar plantations. Europe, the Caribbean and the west coast of Africa formed a dynamic trading triangle, fueled by the demand and income from sugar production and trading. The West African tribal leaders spent most of their income from the slave trade in purchasing armaments from Europe in order to wage wars against other tribes and capture slaves for the sugar plantations in the Caribbean. The Europeans used the income from the armaments to purchase sugar and rum from the Caribbean, and the sugar planters in the Caribbean spent most of their income buying slaves from the African west coast. Rum is the distilled product from the fermentation of molasses, a by-product from sugar milling.³³⁴

³³⁴ C. Henderson (2000) Sugar Cane, sugar cane, Wherefore art thou? accessed on June 6, 2004 at <http://www.apmforum.com/columnsoreintseas17.htm>

At the 1814 Vienna Congress, most of the European countries agreed to end the slave trade from West Africa, although slavery was continued in their colonies. Under the Ashburn Treaty signed on 4 April, 1842 the United States and Britain agreed to station a naval squadron in the African West Coast to stop the slave trade.

Although sugar cane is a native of New Guinea and was cultivated in South East Asia and South Asia prior to the European Age of Discovery, most of the sugar cane plantations and production were centered in the Caribbean because of the difficulty of shipping the sugar to the European and North American markets. Sugar cane was grown mostly for subsistence or domestic consumption in the Philippines. With the increased labour cost in the Caribbean after the closure of the slave trade and the lower shipping cost with the opening of the Suez Canal, sugar cultivation became more widespread in other parts of the world, including the Philippines.

In 1850, a British businessman, Nicolas Loney, recognized the export potential of sugar from the Philippines.³³⁵ He bought the first machinery for extracting the sugar juice from the cane, purifying the juice and concentrating the sugar. He located his sugar mill in Iloilo City, and to this date the main sugar terminal in Iloilo City is called Muelle Loney. Loney's venture was also facilitated with the opening of the Visayan ports of Cebu and Iloilo to international trade in anticipation of the opening of the Suez Canal. With more frequent international shipping schedules, sugar was exported to Europe on time. Loney was followed by other Spanish businessmen from Manila and the Visayas. Soon after, the sugar planters expanded to the nearby island of Negros, clearing the land and building gravity-flow

³³⁵ Ibid.

irrigation systems. Kanlaon Volcano at the centre of Negros Island is an active volcano that periodically explodes, with little damage to the surrounding areas, but the volcanic ashes maintain the soil fertility of the islands. By the end of the 19th century, Negros accounted for more than 50 per cent of the sugar exports from the Philippines. More than 70 per cent of the land area in Negros was cultivated to sugarcane.

By the time the Americans took over the colonial administration from Spain in 1898, the sugar industry in Negros and Iloilo was already well-established. In fact, a number of sugar plantations were also developed in Central Luzon, Batangas, and Cavite. Those areas are closer to Manila, but the soil was less suited to sugar cane than that of in Negros. In 1909, the US Congress passed the Payne-Aldrich Act³³⁶ which guaranteed preferential tariff for sugar exports to the US in a similar manner as Hawaii. The Hawaiian Islands were then a US colony and a major producer of sugar cane. It might be worthwhile noting that the American intervention in Hawaii and its subsequent colonialization was instigated by American sugar planters. The Payne-Aldrich Act assured a good price for the Philippine sugar in the US market, several times higher than the production cost and well above the world market price. In 1934, the Jones-Costigan Act³³⁷ was passed by the US Congress, reinforcing the privileges

³³⁶ 1909 *Payne-Aldrich Act*. The Payne Aldrich-Act, when it was approved in August 5, 1909, divided the Republican Party under President Robert Taft. The Act increased the tariff for a wide range of import goods but provided a low tariff or even exempted imports from territories ceded to the US by Spain. The privilege given to the Philippines was similar to those given to Puerto Rico (US Code Title 19, 1485). The provisions related to the Philippines under the Payne-Aldrich Act were omitted from the US Code when the Philippines gained its independence on 4 July 1946.

³³⁷ Jones-Costigan Act of 1934 (US) Sugar Act, An Act to include sugar beets and sugarcane as basic agricultural commodities under the Agricultural Adjustment Act, and for other purposes, Public Law 73-213, 48 Stat 670. When the law was approved on 9 May 1934 it was initially intended as a temporary measure of assigning quotas to US territories to control the influx of cheap agricultural imports from US territories that were threatening the producers in the US mainland. The features of the Jones-Costigan Act became permanent with the Sugar Act of 1937 An Act, to regulate commerce among the several States, with the Territories and possessions of the United States, and with foreign countries; to protect the welfare of consumers of sugars and of those engaged in the domestic sugar -producing industry; to promote the export trade of the United States ; to raise revenue and for other purposes, Public Law 75-414 , 50 Stat. 903 and are still used today. Refer to the commentary (1938) The Sugar Act of 1937. *The Yale Law Journal*, 47.

of the Philippine sugar producers through a system of quotas. To date, the Philippine sugar sector is allocated a quota to export sugar to the US at prices close to the US market price and well above the world market price. The US sugar market price is supported by subsidy, so that the US sugar growers and producers are able to earn and maintain an equivalent standard of living as the other sectors of the US economy. In essence, the Philippine sugar exports under the quota system are subsidized to a certain degree, in the same manner as the local US sugar producers.

Aside from the Philippines, the US government grants sugar quotas to a number of sugar-producing South and Central American countries. After the Philippines gained its independence, the sugar quota fluctuated year after year, depending on the divergence and convergence of Philippine and US interests in the international arena, and sometimes in the domestic affairs of the Philippines. In recent years, there were periods when the sugar production in the Philippines was insufficient to meet the domestic consumption, and the Philippines had to buy sugar in the world market. However, the Philippines is still allowed to sell sugar to the US at prices higher than the world market price, provided it is within the allocated quota.

The world sugar market is the dumping ground of excess sugar produced in highly-subsidized agricultural farms, primarily in Europe. As such, the sugar price in the world market is much lower than the production or domestic sugar price in Europe and North America. The European Union has also followed the US policy of using the trade on sugar and other tropical crops as an instrument of foreign policy through the Lome Convention, wherein the European Union allocates sugar quotas to sugar producers in depressed countries in Africa and the Pacific, allowing them to sell their sugar produce at prices much higher than the world market price. The member countries of the Lome Convention share the sugar

subsidy that the European countries provide to their local sugar producers in the same manner as the Philippines, Central and South American countries share the sugar subsidy the US government provides to its domestic sugar producers.

To ensure that domestically produced sugar is available after each milling season to fill the Philippine sugar quota in the US market, the *quedan* system or warehouse receipt system was introduced to the Philippines in 1920 by the American colonial government.³³⁸ All of the sugar produced for the crop year is classified according to its market destination. The sugar is stored in warehouse-based potential destinations. The different types of warehousing receipts are distributed to the producers in proportion to their production. Hence, no producer is able to gain a monopoly of a particular destination. Subsequently, any price advantages or subsidies are automatically distributed to the producers in proportion to their contribution to the overall sugar inventory. Similarly, any losses when the sugar stock is sold to the world market at prices lower than the production cost are automatically divided among the producers. While the sugar stock is stored in the warehouse, the producer could use the warehouse receipt as collateral to secure financing for the next planting season. When the shipment is completed and paid for, the sugar producer could convert to cash his warehouse receipt and pay the bank.

In the early 1970s, the world market price for sugar was on the uptrend until November 1974 when it reached a peak of US \$0.56 a pound.³³⁹ During this period, the Philippine sugar production reached an all time high of 2.74 million metric tons, of which 1.7

³³⁸ Michael Billig (2003) *Barons, Brokers, and Buyers: The Institutions and Cultures of Philippine Sugar*, University of Hawaii. The book is an excellent account of the cultures in the sugar growing areas of the Philippines. From my own interaction with the people in the area, especially in Negros and Iloilo, I find the social dynamics are more complex than Billig's study.

³³⁹ The pound is the common weight measurement used in sugar trading reflecting the US predominance in the market although production figures are quoted in million metric tons which is equivalent to 1,000 kgs and is 10 per cent higher than the British tonnes which is only 2,000 lbs or 900 kgs.

million metric tons were exported to the US and 0.7 million metric tons were sold to the world market. In September 1972, President Ferdinand Marcos declared martial law in the Philippines. The sugar planters and millers had a strong influence in Philippine politics because of the large number of families working directly or indirectly in the sugar sector. As discussed in detail in a later section on social aspects, the social structure in the sugar plantations is feudalistic, with the sugar planters and millers commanding the respect of their workers and exercising control over the latter. In order to control the economic and political powers of the sugar planters and millers, President Marcos created a sugar monopoly, the Philippine Sugar Marketing Corporation or PHILSUMA ³⁴⁰ under the Philippine Sugar Commission. The Philippine Sugar Commission was created by Presidential Decree 388,³⁴¹ which under Sec. 4 (d), on Powers and Functions, stated as its aims: “to act as the single buying and selling agency of any sugar on the quedan-permit level, in order to promote the effective merchandising and distribution of sugar”. The price control authority, which was the commission, was defined in Sec. 4 (e) on Powers and Function of the same presidential decree which stated:

“To determine the floor ceiling price of sugar which will ensure the planters, millers, traders, wholesalers and retailers a fair return on their investments, Provided, That such floor ceiling price of sugar for any crop year shall be the total anticipated cost of production per picul ³⁴² of sugar as determined by the Commission plus a corresponding reasonable margin of profit set by the Price Control Council or any other government agency authorized to regulate prices of commodities and services after taking into consideration the effects of devaluation and other economic factors affecting production, processing, marketing transportation and other related expenses including the minimum wage for agricultural and industrial workers: Provided further that the floor ceiling price established by the Commission shall be adjusted in direct relation to significant changes in the cost of production as determined by the Commission and the Consumer Price Index prepared by the Central Bank of the Philippines.”

³⁴⁰ Presidential Decree No. 388 of 1974 Creating the Philippine Sugar Commission, Presidential Decrees and Related Documents, issued on February 2, 1974, compiled and edited by F.D. Pinpin, N. Cacho Hermanos, Inc., Manila, Philippines, book IV, p. 171

³⁴¹ Ibid.

³⁴² Picul is a unit of weight equivalent roughly to 135 pounds or 61.6 kg or 100 Chinese catties. Picul and Chinese catty as a unit of weight were widely used in South East and East Asian commerce even before the establishment of European trading and colonies in the region.

While the decree allowed reasonable profit margins and subsequent price adjustment, in practice price adjustment lagged behind the changes in the cost of production, distribution and marketing. The Commission was only required to adjust the prices if there were *significant changes*, and a creeping inflation was not considered a significant change. To improve the martial law regime's economic credentials and to reduce consumer discontent, the Central Bank underestimated the inflation rate as well as the increase in the Consumer Price Index. A large number of sugar production, distribution and marketing inputs such as machinery spare parts, hauling and transport equipment, office and warehousing cost, to name a few, were not included in the Consumer Price Index. Presidential Decree 388 was amended two times during the martial law regime of President Marcos, the first time on August 24, 1975 and the second time on September 2, 1977. The amendments and the original decree are briefly discussed below.

Presidential Decree 775,³⁴³ issued on August 24, 1975 expanded the Powers and Functions of the Philippine Sugar Commission (PHILSUCOM). Under Presidential Decree 388, Sec. 4 (j), Powers and Functions, the Philippine Sugar Commission was empowered to register, control and supervise the registration of sugar planters and marketing cooperatives.

Sec. 4 (j) states:

“To determine the manner and extent by which powers, privileges and incentives provided under existing laws shall be exercised or enjoyed; Provided, that the Commission shall promulgate rules and regulations to govern the promotion, organization, registration, re-registration, control and supervision of all sugar planters and sugar producing cooperatives.”

And Sec. 4 (k) states:

“To suspend the operation or cancel the registration of any sugar planters and/or sugar planter producer marketing cooperatives after hearing and when its best judgement based on findings, such cooperative is operating in violation of this Decree, rules and regulations, existing laws as well as the by-laws of the cooperatives”

³⁴³ Presidential Decree 775 of 1975(Philippines), Amending Section 4 of Presidential Decree No.388 Creating the Philippines Sugar Commission , (Philippines). issued on August 24, 1975, Presidential Decrees and Related Documents, compiled and edited by F.D. Pinpin, N. Cacho Hermanos, Inc., Manila, Philippines, v. XIX, pp.270

PHILSUCOM was headed by a close ally of President Marcos, Mr Roberto Benedicto, who was from a sugar planter and miller clan of Negros and Iloilo. Mr Benedicto was also appointed President of the Philippine National Bank, the largest bank in the country and majority-owned by the government. Mr Benedicto gave preferential access to financing and export allocation to the sugar planters and millers aligned with President Marcos, while pushing those perceived to be or against the martial law regime close to bankruptcy. The powers of the Philippine Sugar Commission were expanded by Presidential Decree No. 1192³⁴⁴ issued on September 2, 1977. Sec. 2(b) of the decree stated:

“To enter into contracts, transactions and undertakings of whatever nature, with or without public bidding, which are necessary or incidental to its functions and objectives with any natural or judicial person and with any foreign government, private corporations, partnerships, institutions, or private person, including but not limited to buying, selling, trading, loading, unloading, transportation, vessel-charters, warehousing, marketing, processing or re-processing of sugar, by-products, and derivatives, acquisition by lease purchase or other modes, of materials, supplies, equipment and facilities relative hereto and for the cultivation, production, transportation and processing of sugar cane and related products.”

The presidential decree Sec. 2(f) stated, “To borrow money from local and foreign sources as may be necessary for its operation”.

Two notable powers granted under this decree were the exemption of the commission from public bidding and the authorization to borrow money from local and foreign sources. The exemptions from public bidding reduced the governance in the commission to its lowest level, especially in the absence of any potential complaints and oversight from civil society under the martial law regime. As a government entity, the local and foreign borrowings of the commission were government guaranteed loans or sovereign loans. Foreign lenders were just

³⁴⁴ Presidential Decree 1192 of 1977 (Philippines), Further Amending Presidential Decree 388 Creating the Philippine Sugar Commission, issued on September 2, 1977, Presidential Decrees and Related Documents, compiled and edited by F.D. Pinpin, N. Cacho Hermanos, Inc., Manila, Philippines, v.47, pp.76

too willing to provide the funds as sovereign loans, knowing that in case of default, the International Monetary Fund would assure repayments.³⁴⁵ Sec. 2 (f) assures the continuous flow of funds and Sec. 2(b) assures the misuse of the funds.

Sugar is one of the three political-agricultural commodities, along with coconut and rice. Similar presidential decrees and monopolies were created for coconut and rice. In the industrial sector, the power industry was also nationalized under the National Power Corporation. By 1983, the Philippine foreign debt had reached \$48 billion and the foreign lenders were thinking of reconsidering their lending policy to the Philippine government and government-owned corporations. The problems were further compounded by the assassination of President Marcos' main political rival, Senator Benigno Aquino, on August 26, 1983. The Philippine peso started the year with an exchange rate of P4 to US\$1, but at the end of the year it was trading at P18 to US\$1 in the official exchange market and at ranges of P25 to P30 to US\$1 in the black market. The sugar monopoly affected not only the sugar industry but the whole Philippine economy.

One of the major impacts of the sugar monopoly was the decline in governance, especially in the granting and use of bank loans. Instead of utilizing the loans for improving the sugar plantation and milling equipment, the sugar planters and millers used the loans for large parties, cars, mansions, luxury goods and foreign trips. Most felt that the loans were granted for their loyalty to the martial law regime instead of seeing them as repayable business loans. "Behest loan" was a local term for loans granted to individuals or corporation by government banks upon instruction from the martial law authorities without any due investigation of the capacity of the borrower to effectively use and repay the loan.

³⁴⁵ Joseph Stiglitz (2002) *Globalization and its Discontents*, London, Penguin Books. At p. 7

In order to satisfy and maintain the loyalty of the masses, President Marcos fixed the prices of basic commodities like rice, sugar and cooking oil at very low prices, often lower than the cost of production. The low price of sugar encouraged domestic consumption and the growth of food industries using large quantities of sugar such as preserved fruits, soft drinks, candies and baked products.

When President Marcos was overthrown in the People's Revolution of February 1986, the Philippine National Bank was bankrupt and the sugar production was down to 1.4 million tons per year. At the same time, the domestic sugar consumption went up from 0.7 million tons per year to 1.4 million tons per year due to the increase in population and consumption. By 1990, the Philippines had become a sugar importer in order to meet its domestic consumption and comply with its sugar quota.

President Marcos was succeeded by President Corazon Aquino, whose family owns the sugar plantation of Hacienda Luisita in Tarlac province. One of the first acts of President Aquino was to abolish the sugar monopoly under Executive Order 18 issued May 28, 1986³⁴⁶. The main purpose of the Executive Order was to dismantle the sugar monopoly. Sec. 13 of the Executive Order stated, "The Philippine Sugar Commission (PHILSUCOM) is hereby abolished." In place of PHILSUCOM, the Sugar Regulatory Administration was created. The existing laws, rules and regulations currently in force or which affect the sugar sector are discussed in detail later in this chapter.

³⁴⁶ Executive Order No. 18 of 1986, Creation of Sugar Regulatory Administration, Sugar Regulatory Administration, Quezon City, Philippines. President Marcos was overthrown in the People's Power Revolution of February 20-25, 1986. President Corazon Aquino headed a revolutionary government until the new constitution was ratified on February 7, 1987. During this period President Aquino was exercising executive and legislative authority similar to President Marcos authority during the martial law period. However, President Aquino did not want to issue presidential decrees but preferred to issue executive orders. The executive orders issued by President Aquino during this period had the authority similar to an Act. Generally executive orders are issued by the President to assist in the implementation of existing laws, or to fill gaps in legislation until such time that congress has taken the appropriate action. As such, executive orders have lower authority than legislation passed by Congress and approved by the President.

Technology

The first process in sugar production involves cleaning the cane of mud, leaves, weeds, and dead or stale stalks, commonly called trash. The trash that is not removed will increase the volume of bagasse,³⁴⁷ and in the process, entails sugar juice. A one per cent increase in trash decreases the sucrose recovery from 0.38 to 0.55 per cent and the overall sugar recovery by 0.30 to 0.55 per cent. After the trash has been removed, the cane is sent to the crushers. The crushers normally consist of two rollers. The juice is expelled from the cane during the crushing process and collected in a pan below the crushers. Some juice is retained in the cane after the first crushing. Water is then sprayed on the crushed cane to dissolve the sugar in it and the crushing process is repeated. The sugar concentration after the second crushing is lower and will require more energy to remove the water and concentrate the sugar. If the sugar price is low, the third and fourth wetting and crushing are normally foregone.

The sugar juice is then strained or filtered to remove coarse impurities, mostly short fiber bagasse, and some of the trash materials that were not removed in the cleaning operation. Lime and phosphate are added to adjust the acidity of the juice, reduce the sugar losses from fermentation or spoilage, and also to improve the removal of particulates. The sugar juice is then pumped into a gravity clarifier to remove the fine particulates and most of the colloidal particles. After the clarification process, the juice is pumped into a series of vacuum evaporators to remove the water. As water has a lower boiling point under vacuum, the energy required to reduce the water is lower than if the evaporator is operated. The concentrated sugar is left as syrup after most of the water has been removed. Lime and

³⁴⁷ The fibrous cane material left after the sugar juice has been extracted is known as “bagasse”.

phosphates are again added to assist in the flocculation of fine particles. The syrup is sent to a vacuum pan to further remove the water, and then to a crystallizer. The sugar forms brown crystals while the lime, phosphates and other impurities remain in suspension. The sugar crystals and the impurities are then separated in a centrifuge. At the bottom of the centrifuge is a sticky substance containing the impurities, called “molasses”. The sugar crystals, after drying, are normally called “massecuite”. Part of the massecuite is returned to the crystallizer to initiate and hasten the crystallization process. Most of the sugar sold in the world market and exported from the Philippines is brown sugar, also known as raw sugar or massecuite.

Massecuite is refined further into white sugar which is normally sold in the supermarket. In the sugar refinery, the massecuite is washed with sugar-saturated water in a process called “affination”. Affination loosens the residual molasses particles. The sugar is then melted by adding hot water. Lime, phosphoric acid, synthetic flocculating agents and carbon dioxide are added. The impurities are separated from the sugar crystals by a centrifuge. The next step is to add activated carbon or bone char to absorb or remove the residual coloration. The activated carbon is separated from the sugar syrup by a centrifuge. Water is removed from the syrup by a series of vacuum evaporators, followed by crystallization and vacuum pan drying. For a more detailed description of the sugar production and refining process, the World Bank Handbook on Pollution Prevention can be consulted.³⁴⁸

In 1994, the Asian Development Bank provided a technical assistance grant to the Philippine Government to evaluate the production efficiency and compliance with the environmental standards in key industrial sectors including the sugar industry. Sinclair Knight

³⁴⁸ World Bank (1999) *Pollution Prevention and Abatement Handbook: Towards Cleaner Production*, World Bank, Washington DC. at p. 401

Merz of Australia was the consultant in the project. I designed the technical assistance grant and administered its implementation. Sinclair Knight Merz noted in its final report that the Philippine sugar industry is very inefficient compared to the state-of-the-art sugar mills in Australia. Australian sugar mills generate 4.0 kg of organic wastes per ton of raw sugar, while the Philippine sugar mills generate 43 kg of organic wastes per ton. Most of the organic wastes are unrecovered sugar. In terms of air pollutants, the emissions from Philippine sugar mills are comparable to those of Australian sugar mills; the Philippine mills also performed better than the US EPA standard as far as emission factors were concerned. The emission from Australian sugar mills is 1.4 kg of particulate matter per ton of bagasse burned, while the USEPA maximum emission is 3.8 kg of particulate matter per ton of bagasse. The sugar mills in the Philippines have an average emission of 1.41 kg of particulate matter per ton of bagasse.³⁴⁹

Aside from losses in the wastewater stream, a large portion of the sugar is lost in the inefficient milling operation, clarification and centrifuging process. In the survey made by Sinclair Knight Merz of 16 sugar mills in the Philippines, 15 to 20 per cent of extractable sugar is lost in the waste stream. In Australian sugar mills the losses vary from 2 to 5 per cent – losses above 10 per cent are considered a major failure.³⁵⁰ As Mr Jose Marie Zabaleta of the Sugar and Beverages Group of the Food and Agriculture Organization noted, most of the sugar mills were left in a state of disrepair and obsolescence during the martial law period of the 1970s and 1980s. It was only in 1991 that a number of sugar millers started to implement the Rehabilitation and Modernization Program.³⁵¹ Mr Zabaleta later became the Executive

³⁴⁹ Sinclair Knight Merz(1997) Review of Environmental Standards and Performance in Selected Industrial Sectors in the Philippines. Asian Development Bank, Manila, Philippines. at pp. 2-5

³⁵⁰ Ibid at pp. 2-6

³⁵¹ Jose Marie Zabaleta (1997) Will the Philippines Revert to Its Net Sugar Exporter Status, Food and Agriculture Organization. Rome, Italy. at p. 4

Director of the Philippine Sugar Millers Association and the focal point of official publications, research reports and press releases of the association. This study extensively quoted Mr Zabaleta's papers as he presented them in national and international conferences on behalf of the association. As Zabaleta further noted, a number of sugar mills did not modernize or even rehabilitate their processes as they have a monopoly in their relationship with the farmers. To quote Mr Zabaleta,

“While it is true that some of the mills have invested and completely rebuilt and changed their equipment, making them the equivalent of new mills, and others have made major investments in upgrading or adding equipment, it is undeniable that many mills are also maintained in a dilapidated state and are used as milking cows by their proprietors. Those mills not only produce inferior sugar which oftentimes fetches lower prices, but also prevent farmers from optimizing the potential of their farms. They are prone to breakdown and cause harvest losses and have very poor extraction, significantly contributing to the decline in sugar recovery per ton of cane.”

Social Aspects

The labour force consists of both migrants and resident labourers. The migrant labourers commonly called “sacadas”, are residents of neighbouring islands or provinces who travel and work in the sugar cane farms during the harvesting and planting seasons. Once the planting and harvest season is finished, they return to their home towns where they have their families and often engage in another trade or work. The permanent labour force is normally made up of tenants and they live on the farm to carry out various tasks in between the planting and harvesting such as weed and pest control, applying fertilizers, and operating the irrigation system. The tenants also carry out various household tasks assigned by the landowner. The tenants may request the landowner to be allowed to cultivate a small garden and raise some domestic animals for home consumption. Sacadas who do not have a particular work or trade in their home towns normally request to settle on the farm and join the ranks of the tenants. While the sugar lands were exempted from the land reform program of the government on the justification that it is very uneconomical and inefficient to cultivate and operate small farms,

there is always fear among the landowners that in the future, the sugar lands will be included. For this reason, landowners are reluctant to accede to sacadas' requests to settle on the farm.

Most tenants claim or trace their ancestry to the indigenous population of the area prior to the Spanish colonialization of the islands and assert that they are being deprived of their birthright to own and cultivate the land of their ancestors. During the early stages of the Spanish colonial rule, the Spanish administrators, missionary orders, migrants and their descendants were given titles to large tracts of lands known as "encomiendas" by the Spanish Crown. The title to the land included the services of the existing inhabitants in a similar arrangement as that involving the serfs in medieval Europe. The size of the original encomienda in the 17th century covers an area equal to one or two provinces today. The owner of the encomienda or "encomiendero" subdivided the encomienda into smaller parcels called "haciendas" for his followers. The hacienda owners or "hacenderos" took charge of the local population who were indentured to cultivate the land and serve the hacenderos.³⁵² As the population density at this time was very low except in trading centres such as Cebu, Manila and Iloilo, the hacenderos and their descendants had to clear the forest lands using the native labour force. Aside from the charter or title to the hacienda given by the encomiendero, the hacenderos claimed attachment to the land through their efforts in clearing the forest, improving the drainage and providing primitive roads for the farm animals. In some areas, large stones, rocks and unsuitable soils had to be cleared. The tenants claimed attachment to and ownership of the land through their ancestry which predates the Spanish colonialization and the labour provided by their ancestors in converting the forest land to agricultural land. The hacenderos and their ancestors merely supervised the forest clearing and land conversions.

³⁵² Rene Javellana (1998) Organizing a Colony. in. *Kasaysayan- The Story of the Filipino People. an especial 12 volume series to commemorate the centennial celebration of Philippine Independence from Spain*, edited by Jose C. Arcilla, Manila, Reader's Digest at pp. 61 and 62

The exercise of land ownership by the hacenderos could be direct, which comprises day-to-day management of the farm such as organizing the workforce, planning and construction of farm infrastructure, and expansion of the farmed areas. The hacenderos also assisted the missionaries in the religious conversion of the population. In return, the religious conversion of the population to Christianity also strengthened the administrative hold of the hacenderos on the native population. Near the cities, the hacenderos, especially the religious orders, exercised land ownership in a subtle and indirect way. The religious orders often requested contributions or tributes to the church for special occasions and for day-to-day maintenance of the church and its facilities.

Towards the end of the 18th century, the encomienda system was replaced by an administrative system with the Spanish Governor General holding office in Manila as representative of the Crown. The provinces were governed by a governor and the municipalities by a little governor or “gobernadorcillo”. The administration of the villages had always been left to the traditional village chiefs or “Cabeza del Barrio”, who collected the taxes and organized the local labour as the hacendero or the municipal administration might require from time to time. Most often, the hacendero as the richest and the most influential person in the municipality was also the gobernadorcillo. Parallel to the civil administration was the administration of the Church with the parish priests serving one or two municipalities and a group of parishes forming a diocese, and the archdioceses in Manila at the top of the hierarchical structure.

At the end of the 19th century, after almost 300 years of Spanish colonial rule, less than 1 per cent of Filipinos were literate. At the end of the Spanish rule, almost 95 per cent of

the population was devout and very conservative Catholics.³⁵³ When the Philippines was ceded to the United States under the Treaty of Paris in 1898 at the close of the Spanish-American War, the American occupation of the islands was resisted by leaders of the church and civil administration. The American expeditionary forces fought their first guerilla war that lasted until 1906.

To pacify the leaders of the church and civil administration, the US military and later, civil government, recognized the church and the hacenderos' ownership of the haciendas. While this policy facilitated American colonial rule in the Philippines it has left the country with a social problem that has not been resolved up to now. Land ownership, and subsequently the income distribution disparity, grew bigger with the rapid increase in population. A number of hacenderos, especially the religious orders, were willing to negotiate with the US government for an amicable transfer of the land titles to the indigenous population.³⁵⁴

Unlike the Spanish colonial policy that left most of the native population uneducated, the American colonial policy called for rapid education of the masses. American English became the medium of communication among the diverse cultural and linguistic groups. Democratic elections were introduced. Freedom to join organizations, change religion and speak without censorship was introduced. By the mid-1930s, simultaneous with the formation

³⁵³ "Catolico cerrado" literally means "closed Catholic". It is a term commonly used to describe a person or group of persons with complete and unquestioned adherence to the church doctrine. The church doctrine is not open for discussion.

³⁵⁴ The first page of the US Supreme Court decision in *Philippine Sugar Estate Development Co. v. Government of the United States* 246 U.S. 385 (1918) summarized the US government policy as quoted below "When Spain ceded the Philippine Islands to the United States, large tracts of agricultural lands were owned by religious orders. For political reasons, it was deemed advisable that our government should acquire the Friar lands and sell them to tenants in small holdings on easy terms. Lengthy negotiations conducted to that end by the Civil Governor were concluded in 1903. Most of the lands owned by the Dominican order, amounting to 60,461 hectares, had been conveyed to the Philippine Sugar Estates Development Company; and with that corporation a contract of sale and purchase was executed by the government of the Philippine Islands under date of December 22, 1903."

of various Communist parties in Asia, the haciendas and the ownership of the hacenderos were the focal point of the discontent of the native population. The native population demanded ownership of the land. By 1951, the Communist forces were operating at the outskirts of Manila until Magsaysay took over the Department of National Defense and instituted reforms in particular, distributing public land in sparsely-populated Mindanao. Since then, the strength and decline of the Communist party insurgency has moved in inverse proportion to the price of sugar. When sugar prices are high and the sugar workers receive large bonuses, the insurgency declines, and when the sugar prices go down, the insurgency gains strength.³⁵⁵

At present, there are 40,000 sugar farmers and another 500,000 farm workers. This translates to roughly 5,000,000 individuals dependent on the sugar sector or 7 per cent of the country's total population.³⁵⁶ The relationship between the hacendero and the workers was feudal until recent times. While the hacendero retained and demanded obedience from his workers he also took paternalistic care of them from cradle to grave, serving as godparents, paying the medical bills, and even occasionally bailing the workers out of jail.³⁵⁷

Legal and Institutional Aspects

Labour Laws

³⁵⁵ The social structure and social issues in the sugar plantations are more complex than could be explained in the short historical note and analysis in this chapter.

³⁵⁶ Jose Marie Zabaleta (1997) Will the Philippines Revert to Its Net Sugar Exporter Status. Food and Agriculture Organization. at p. 1

³⁵⁷ Clarence Henderson. (2000) Sugar cane, sugar cane, Wherefore art thou? accessed on June 6, 2004 at <http://www.apmforum.com/columnsoreintseas17.htm>

The Labour Code of the Philippines³⁵⁸ was promulgated as Presidential Decree 442 by President Marcos using his martial law authority. The salient features of the law as it affects the sugar workers are:

- (i) minimum wage required rest between working periods;
- (ii) improvement in women's working conditions;
- (iii) guaranteed workers' right to form unions and to strike; and
- (iv) initiation of the break up of large agricultural estates.

Sugar estates were exempted from the land reform provisions of the labour code on the justification that economy of scales is important for the sugar farms to remain competitive. However, exempting the sugar lands was an unpopular decision, especially with the abuses of the Philippine Sugar Commission, as described in the previous section. Article 7 and 8, Book I, Chapter II of the Labour Code titled "Tenant Emancipation" states:

“ART. 7. *Statement of objectives.* - Inasmuch as the old concept of land ownership by a few has spawned valid and legitimate grievances that gave rise to violent conflict and social tension and the redress of such legitimate grievances being one of the fundamental objectives of the New Society, it has become imperative to start reformation with the emancipation of the tiller of the soil from his bondage.

ART. 8. *Transfer of lands to tenant-workers.* - Being a vital part of the labour force, tenant-farmers on private agricultural lands primarily devoted to rice and corn under a system of share crop or lease tenancy, whether classified as landed estate or not, shall be deemed owner of a portion constituting a family-size farm of five (5) hectares, if not irrigated and three (3) hectares, if irrigated.

In all cases, the landowner may retain an area of not more than seven (7) hectares, if such landowner is cultivating such area or will now cultivate it.”

The minimum wage for agricultural workers was initially fixed in the Labour Code and it included provisions for adjusting the minimum wage. The minimum wage is fixed on a regional basis to account for variations in the cost of living, and encourage dispersal of the labour force and industry outside the major city centers. Article 124, Book II, Title II, Chapter II of the Labour Code stated:

³⁵⁸ Presidential Decree 442 of 1974 Labour Code of the Philippines issued on May 1, 1974, Presidential Decrees and Related Documents, compiled and edited by F.D. Pinpin, N. Cacho Hermanos, Inc., Manila, Philippines, v. XVIII

“ART. 124. *Standards/Criteria for minimum wage fixing.* - The regional minimum wages to be established by the Regional Board shall be as nearly adequate as is economically feasible to maintain the minimum standards of living necessary for the health, efficiency and general well-being of the employees within the framework of the national economic and social development program. In the determination of such regional minimum wages, the Regional Board shall, among other relevant factors, consider the following:

- (a) The demand for living wages;
- (b) Wage adjustment *vis-à-vis* the consumer price index;
- (c) The cost of living and changes or increases therein;
- (d) The needs of workers and their families;
- (e) The need to induce industries to invest in the countryside;
- (f) Improvements in standards of living;
- (g) The prevailing wage levels;
- (h) Fair return of the capital invested and capacity to pay of employers;
- (i) Effects on employment generation and family income; and
- (j) The equitable distribution of income and wealth along the imperatives of economic and social development.

The wages prescribed in accordance with the provisions of this Title shall be the standard prevailing minimum wages in every region. These wages shall include wages varying with industries, provinces or localities if in the judgment of the Regional Board, conditions make such local differentiation proper and necessary to effectuate the purpose of this Title.”

The Labour Code further recognized special needs of women in the work force. Book III, Title III, Chapter I, dealt with this issue:

“ART. 130. *Nightwork prohibition.* - No woman, regardless of age, shall be employed or permitted or suffered to work, with or without compensation:

- (a) In any industrial undertaking or branch thereof between ten o’clock at night and six o’clock in the morning of the following day; or
- (b) In any commercial or non-industrial undertaking or branch thereof, other than agricultural, between midnight and six o’clock in the morning of the following day; or
- (c) In any agricultural undertaking at night time unless she is given a period of rest of not less than nine (9) consecutive hours.

ART. 132. *Facilities for women.* - The Secretary of Labour and Employment shall establish standards that will ensure the safety and health of women employees. In appropriate cases, he shall, by regulations, require any employer to:

- (a) Provide proper seats for women and permit them to use such seats when they are free from work and during working hours, provided they can perform their duties in this position without detriment to efficiency;
- (b) To establish separate toilet rooms and lavatories for men and women and provide at least a dressing room for women;
- (c) To establish a nursery in a workplace for the benefit of the women employees therein; and
- (d) To determine appropriate minimum age and other standards for retirement or termination in special occupations such as those of flight attendants and the like.

ART. 133. *Maternity leave benefits.* - (a) Every employer shall grant to any pregnant woman employee who has rendered an aggregate service of at least six (6)

months for the last twelve (12) months, maternity leave of at least two (2) weeks prior to the expected date of delivery and another four (4) weeks after normal delivery or abortion with full pay based on her regular or average weekly wages. The employer may require from any woman employee applying for maternity leave the production of a medical certificate stating that delivery will probably take place within two weeks.

(b) The maternity leave shall be extended without pay on account of illness medically certified to arise out of the pregnancy, delivery, abortion or miscarriage, which renders the woman unfit for work, unless she has earned unused leave credits from which such extended leave may be charged.

(c) The maternity leave provided in this Article shall be paid by the employer only for the first four (4) deliveries by a woman employee after the affectivity of this Code.”

The Labour Code further recognized the rights of workers to form labour union and enter into collective bargaining agreements. It was considered unfair labour practice for management to dismiss or demote a labourer for joining a labour union. Book III, Title III , Chapter I of the Labour Code states:

“ART. 243. *Coverage and employees’ right to self-organization.* - All persons employed in commercial, industrial and agricultural enterprises and in religious, charitable, medical, or educational institutions, whether operating for profit or not, shall have the right to self-organization and to form, join, or assist labor organizations of their own choosing for purposes of collective bargaining. Ambulant, intermittent and itinerant workers, self-employed people, rural workers and those without any definite employers may form labor organizations for their mutual aid and protection.”³⁵⁹

The Labour Code, Book III, Title I, Chapter I fixed the minimum working hours and stipulated the additional compensation paid for overtime work. Article 83 states, “Normal *hours of work.* – The normal hours of work of any employee shall not exceed eight (8) hours a day.”

³⁵⁹ This clause is inserted in the Labour Code based on the provisions of Batas Pambansa No. 70 of 1980 An Act to Strengthen the Constitutional Rights of Workers to Self Organization, Free Collective Bargaining and Penalize Unfair Labour Practices signed on May 1, 1980, Acts and Resolutions Batasang Pambansa, 2nd Regular Session, Bureau of Printing, Manila, pp. 255. In response to international criticism President Marcos called for an election for parliamentary system of government with the parliament called Batasan. Batasan could be literally translated as law making body. Batas Pambansa is national law.

The amendments to the Labour Code issued under the martial law administration were related to arbitration of labour conflicts and powers of the Department of Labour to certify the order to return to work. For a martial law regime, the benefits, rights and working conditions provided in the Labour Code were considered very liberal. However, the implementation of the law equally to all employers and sectors of the economy was not uniform. Corporations or employers who had strong connections to the martial law regime, commonly called crony capitalists, were often exempted from complying with the law.³⁶⁰ Today, the labour forces in the sugar mills are highly unionized and covered by collective bargaining agreements. However, the farm workers, especially the migrant and temporary workers, are often left on their own.

As mentioned in the previous section, the areas cultivated to sugar were centres of the Communist rebellion, especially in the later 1970s when the sugar prices in the world market collapsed. In addition to the workers' rights and benefits under the Labour Law, the Social Amelioration Act of 1991 or Republic Act 6982 was enacted.³⁶¹ Republic Act 6982 imposed a lien of P5.00 per picul of all sugar produced and an additional lien of P2.00 per picul every two years until 10 years after the enactment of the law. Eighty per cent of the fund was

³⁶⁰ In July 1980, I received one of the Ten Outstanding Young Scientists awards. After receiving my award at the Presidential Palace, I went straight to the national convention of the Pollution Control Association of the Philippines where I was a speaker. Feeling thus invulnerable from martial law constraints on free speech, I made a critical analysis of the highly idealistic and impractical environmental standards being enforced. The Philippine environmental quality standards were almost exact copies of the California standards and because there was no capability to determine and allocate the assimilative capacity, the receiving water standard was used as effluent standard. This made the Philippine standards some ten times more stringent than the California standard. General Prospero Olivas, who was the martial law administrator enforcing compliance, was also speaking at the conference. A large number of managers, even company presidents, were detained in the military stockade at Camp Crame for violation of the environmental laws. General Olivas called me for a private meeting to make me explain in detail my analysis. During the whole meeting, he just nodded and never said much. I realized the impractical environmental standards were a legal way of closing down companies suspected of supporting the opposition, and at the same time appealing to the environmental consciousness of the public.

³⁶¹ Republic Act 6982, Social Amelioration Act of 1991 (Philippines) An Act Strengthening the Social Amelioration Program in the Sugar Industry, Providing Mechanics for its Implementation and other Purposes, Laws and Resolutions, Congress of the Philippines, National Printing Office, Manila, Philippines, p. 142.

distributed directly to the workers and the remaining twenty per cent was allocated for social programs administered by the Bureau of Rural Workers.

In addition to the mandatory lien, the Sugar Industry Foundation Incorporated, a tri-sector foundation composed of sugar planters, millers and workers, initiated social and economic programs for the workers and their families. The foundation was principally funded by nine per cent of the funds collected by the Bureau of Rural Workers.³⁶² The most significant use of the fund was to capitalize workers' cooperatives, education grants, health programs, skills upgrading and small business enterprises.³⁶³ As Mr Jose Marie Zabaleta pointed out, "Sugar is a seasonal crop, even if high wages would become mandatory and enforceable; the conditions of feasts and famine would continue to exist among plantation workers. This, again like in other sugar growing areas around the world, is not unique to the Philippines." Mr Zabaleta pointed out the need to subsidize the workers during the off-season, which is basically the worker-hacendero relationship under the feudal system that existed from the Spanish colonial period until recent times. Mr Archimedes Amarra, Executive Director of the Sugar Master Plan Foundation Inc, however, recommended the development of rural industries to provide off season employment.³⁶⁴ Mr Amarra as the Executive Director of the foundation is also the focal point for information and documentation related to the work and recommendations of the foundation.

Land Laws

³⁶² Archimedes Amarra (2003) Action Plan for the Philippine Sugar Industry. Makati City Philippines, Sugar Master Plan Foundation Inc. at pp. 9-10

³⁶³ Sugar Industries Foundation Incorporated (2004) SIFI Funds, SIFI secretariat, Makati, Philippines

³⁶⁴ Ibid at p. 10.

While the tenancy emancipation section of the Labour Code covered land planted to rice and corn, the Comprehensive Land Reform Law or Republic Act 6657³⁶⁵ covered all tenanted agricultural lands. Chapter II, sec 4(d) states, “All private lands devoted to or suitable for agriculture regardless of the agricultural products raised or that can be raised thereon.” Sec. 6 allowed the landowner to retain only five hectares of land and three hectares for the children above fifteen years old. Section 6(1988)³⁶⁶ states

“Retention Limits. – Except as otherwise provided in this Act, no person may own or retain, directly, any public or private agricultural land, the size of which shall vary according to factors governing a viable family-sized farm, such as commodity produced, terrain, infrastructure, and soil fertility as determined by the Presidential Agrarian Reform Council (PARC) created hereunder, but in no case shall retention by the landowner exceed five (5) hectares. Three (3) hectares may be awarded to each child of the landowner, subject to the following qualifications: (1) that he is at least fifteen (15) years of age; and (2) that he is actually tilling the land or directly managing the farm”. Priority coverage of the land reform were land planted to rice and corn with sugar lands included in the third phase. The land owners were paid 35 per cent of the lands value in cash and the remaining 65 per cent in government bonds.”

Sugar lands were included in the third phase or Sec. 7 of Republic Act 6657³⁶⁷ which states:

“Phase Three: All other private agricultural lands commencing with large landholding and proceeding to medium and small landholdings under the following schedule:

- a) Landholdings above twenty-four (24) hectares up to fifty (50) hectares, to begin on the fourth (4th) year from the effectivity of this Act and to be completed within three (3) years; and
- b) Landholdings from the retention limit up to twenty-four (24) hectares, to begin on the sixth (6th) year from the effectivity of this Act and to be completed principally the right of farmers and regular farm workers who are landless, to own directly or collectively the lands they till.”

However, the implementation of the comprehensive land reform is affected by budgetary constraints, especially the requirements for cash payments. A number of sugar

³⁶⁵ Republic Act 6657, Comprehensive Agrarian Reform Law 1988 (Philippines) Laws and Resolution of the Congress of the Philippines in 1988, National Printing Office, Manila, Philippines, p. 201.

³⁶⁶ Ibid.

³⁶⁷ Ibid.

lands larger than the retention limit continued to be owned and cultivated by the present owners. Since the land is subject to expropriation, the existing land owners are reluctant to invest in or even maintain the existing infrastructure such as irrigation, roads, and drainage system beyond and above the basic minimum required for continued cultivation. Moreover, the banks are reluctant to provide financing, since it is difficult for them to foreclose the land and sell it in the open market. As Sec. 71³⁶⁸ states:

“Banks and other financial institutions allowed by law to hold mortgage rights or security interests in agricultural lands to secure loans and other obligations of borrowers, may acquire title to these mortgaged properties, regardless of area, subject to existing laws on compulsory transfer of foreclosed assets and acquisition as prescribed under Section 16 of this Act.”

Allowing the banks to foreclose the land pledged as loan collateral from delinquent borrowers, Section 16 prevents them from selling the foreclosed property in the open market. Sec. 16 implicitly required the banks and financial institutions to sell the foreclosed properties to the agrarian reform program. At the same time, the beneficiaries of land reform could not borrow or use their land as collateral until they had fully paid the government banks. The normal repayment term by the beneficiaries was 30 years. As Zabaleta³⁶⁹ noted,

“This (Comprehensive Land Reform Law) has resulted in lowered productivity, insufficient technology, and new bondage to the soil by small farmers who in time have discovered few options but to abandon, lease or sell their rights. The meager size of their holdings, whether individually or collectively owned, has contributed to this problem.”

Sugar Sharing. To facilitate the interactions between the sugar millers and the sugar planters, the government in 1952 passed the Sugar Act or Republic Act 809³⁷⁰. A production agreement scheme was introduced in the act to supplement the need for long and often

³⁶⁸ Ibid.

³⁶⁹ Jose Marie Zabaleta (1997) Will the Philippines Revert to Its Net Sugar Exporter Status. Food and Agriculture Organization. at p. 3

³⁷⁰ Republic Act 809, Sugar Act of 1952, Philippines Laws and Resolutions Passed During the third, sixth and seventh special sessions of the 2nd Congress of the Republic of the Philippines, Office of the President, Bureau of Printing, Manila, Philippines, p. 408

contentious negotiations between the sugar millers and producers in sharing the sugar and by-products. Sec. 1 of Republic Act 809 states:

“Sec. 1. In the absence of written milling agreements between the majority of planters and the millers of sugar-cane in any milling district in the Philippines, the unrefined sugar produced in that district from the milling by any sugar central of the sugar-cane of any sugar-cane planter or plantation owner, as well as all by-products and derivatives thereof, shall be divided between them as follows:

Sixty per centum [60%] for the planter, and forty per centum [40%] for the central in any milling district, the maximum actual production of which is not more than four hundred thousand piculs: Provided, That the provisions of this section shall not apply to sugar centrals with an actual production of less than one hundred fifty thousand piculs.

Sixty-two and one-half per centum [62-1/2%] for the planter, and thirty-seven and one-half per centum [37-1/2%] for the central in any milling district the maximum actual production of which exceeds four hundred thousand piculs but does not exceed six hundred thousand piculs;

Sixty-five per centum [65%] for the planter, and thirty-five per centum [35%] for the central in any milling district the maximum actual production of which exceeds six hundred thousand piculs but does not exceed nine hundred thousand piculs;

Sixty-seven and one-half per centum [67-1/2%] for the planter, and thirty-two and one-half per centum [32-1/2%] for the central in any milling district the maximum actual production of which exceeds nine hundred thousand piculs but does not exceed one million two hundred thousand piculs;

Seventy per centum [70%] for the planter, and thirty per centum [30%] for the central in any milling district the maximum actual production of which exceeds one million two hundred thousand piculs.

By actual production is meant the total production of the mill for the crop year immediately preceding.”

Republic Act 809 is a social legislation to assist the plantation workers, although the law stipulated that the sharing was between the sugar planter or hacenderos and the sugar millers. As described earlier, the social structure in the sugar plantation is feudal with the sugar planters exercising patriarchal roles over the plantation workers who were mostly semi-literate and lacked the resources to litigate against the sugar millers. This position is

highlighted in the case of *Spouses Garcia versus Victorias Milling* where the Philippine Supreme Court stated:³⁷¹

“It is thus the inescapable obligation of the Garcias and Ferraris to see to it that 60% of what they are to receive by virtue of this decision are paid, under the supervision of the Secretary of Labour, to their labourers who worked during the material period in dispute. The Court holds that in no sense should the Act be implemented with the result that only the planters would benefit there from, to the exclusion of their plantation labourers. It is our uncompromising view that Republic Act 809 is a social legislation primarily, and only secondarily a means to alleviate the unequal situation the planters find themselves in with the centrals vis-a-vis the sharing of the sugar mined from the sugar cane produced by them. To reiterate, the law is a social justice measure — the benefits of its implementation must reach labour under all circumstances.”

The production sharing arrangement between the millers and the planters is the most common method of allocating the products and by-products. Normally, the planters receive 60 to 70 per cent of the total production including the excess bagasse if disposed in the market. The sugar mills receive 30 to 40 per cent of the production. Under the *quedan* system, the sugar millers and planters are initially paid with warehousing receipts that they could cash later when the sugar is sold.³⁷² As Sinclair, Knight Merz noted, the production sharing arrangement discourages the sugar millers from instituting efficiency improvement measures, especially capital intensive improvements as the 60 to 70 per cent of the gains in productivity will benefit the sugar planters and the planters do not even have to spend a single centavo. Sinclair, Knight and Merz studied the productivity improvement in the sugar mills and were silent on the impact of the production sharing arrangement on farm productivity.

As Archimedes Amarra noted,³⁷³ the plantations have low productivity. The average productivity in the Philippines is only 59 metric tons of cane per hectare per year and there is

³⁷¹ *Spouses Garcia v Victorias Milling G. R. L 21733*. Philippine Supreme Court.

³⁷² Sinclair Knight Merz (1997) *Review of Environmental Standards and Performance in Selected Industrial Sectors in the Philippines*, Asian Development Bank, Manila, Philippines. At pp. 2-10

³⁷³ Archimedes Amarra. (2003) *Action Plan for the Philippine Sugar Industry*. Makati City Philippines, Sugar Mater Plan Foundation Inc. At pp. 3 to 5

the potential to increase to 75 tons per hectare per year. However, to attain this productivity, the planters have to change the current varieties grown with higher yielding and disease resistant varieties. The Sugar Regulatory Authority has 150 research stations and nurseries distributing the new sugar cane varieties.

The area of productivity improvement identified by Amarra is expansion of the irrigation system. At present, only 10 per cent of the sugar cane plantations are irrigated. Proper irrigation will potentially increase the yield from 50 to 80 per cent. Fertilizer usage has increased from 180 kg per hectare in 1991 to 340 kg per hectare in 1996 but the yield did not increase proportionately. Amarra cited poor agronomic practices and control of pests and diseases as reasons for stagnating productivity, even with increased fertilizer usage. Improvement in the hauling and transport system as well as timely milling of the harvested cane will improve the sugar yield. Lastly, migrant workers and untrained workers tend to cut the cane above the plant base and include the trash with the harvested cane.

Amarra did not cite production sharing as the main disincentives for the planters to initiate productivity improvements. Improving the irrigation system and pest and disease control methods, improved fertilizer application, and training of workers all involve capital outlay from the planters. However, the planters will only get 60 to 70 per cent of the improvement in plantation efficiency and productivity. The sugar millers who do not have to make a single centavo investment on the plantation will get the 30 to 40 percent the benefits from improvement in plantation efficiency.

As a result of the sugar production sharing arrangement, the sugar millers and planters are hesitant to initiate productivity improvement.³⁷⁴ Each party considers the other party a freeloader in any improvement in productivity. If one party has to borrow money to initiate the productivity improvement, the financial rate of return must be almost double to account for the other party's share.

International Agreements

Sugar is an important commodity to the European and North American economies as an ingredient in a wide range of consumer goods that use sugar. The continued and secure supplies of sugar from cane and beets were even included in the military strategies of major European powers and their economic policies. As the commentary in *The Yale Law Journal* puts it:

“ Its importance and relative cheapness, the ease with which its few channels of production may be controlled, its specialized nature rendering protection once granted is hard to discontinue, and its importance in military strategy make sugar peculiarly susceptible to a policy of economic nationalism. But each attempt at artificial control of production has resulted in frequent and aggravated dislocation of world markets, necessitating in turn more drastic and far-reaching measures.”³⁷⁵

As the commentary further noted, “Even England, rebuilding her navy to protect overseas trade, is at the same time subsidizing her beet sugar industry against the day when her navy will no longer be able to protect food imports.”³⁷⁶

³⁷⁴ Richard Hooley (2003) Review of Michael S. Billig Barons, Brokers and Buyers: The Institutions and Cultures of Philippine Sugar. *Economic Development and Cultural Change*, 257-260.

³⁷⁵ Anon. (1938) The Sugar Act of 1937. *The Yale Law Journal*, 47. At pp. 980-981

³⁷⁶ Ibid. at p. 981.

Improvements in transport and production of sweeteners from other sources such as corn syrup and even synthetic sources have reduced the strategic and economic importance of sugar from cane and beets. However, sugar is still subject to various multilateral and bilateral agreements among and between the sugar producers and consumers. The important multilateral and bilateral agreements affecting the sugar sector in the Philippines is briefly reviewed and analyzed in this section.

US Sugar Quota. At the end of the Spanish American War, the US ended up in control of the Spanish colonies of Puerto Rico and the Philippines and exercising a strong influence over Cuba. The three previous Spanish colonies are major sugar-producing areas. Puerto Rico and the Philippines as US colonies were entitled to sell into the US mainland sugar without duties. As the labour cost in the Philippines is significantly lower than that in the US mainland, the unlimited sugar imports threatened the viability of the sugar estates in US mainland. During this period, the Philippines, with Cuba and Puerto Rico, became one crop countries.³⁷⁷ In 1937, the US congress passed the Sugar Act of 1937, introducing a sugar quota to its colonies as well as major sugar producers in Central and South America. The Philippines accounted for 25 to 30 per cent of the total allocation. When the Philippines gained its independence, the Laurel-Langley Agreement exempted US citizens from the commercial restrictions imposed on foreign capital. Wholly-owned American businesses were allowed to continue operating in the country and in return, the Philippines retained its sugar quota. In fact, when Cuba fell under the Communist regime, the Cuban quota was mostly given to the Philippines. In 1974, the Laurel-Langley agreement expired, and the Philippines decided not to renegotiate or renew the agreement. Simultaneously, the Philippine sugar quota

³⁷⁷ Ibid. at p. 981.

was cut back from almost 1.6 million tons per year³⁷⁸ to approximately 140,000 metric tons today³⁷⁹. The impact of the reduction of the sugar quota to the US was not immediately noticed, as sugar was trading at the world market at US 0.50 a pound and way above the production cost in the Philippines. Towards the end of 1974, the world sugar prices peaked at US 0.67 per pound. However, in the next two years, the price of sugar dropped to US\$0.10 a pound, and in May 198, it dropped to US\$0.03 a pound, or approximately 30 per cent of the production cost in the Philippines. By 1987, the sugar production in the Philippines had dropped to 1.7 million tons.

Trade Agreements. With the collapse of the world sugar market price and the reduction of the US sugar quota, the sugar industry was considered a “Sunset Industry”. A large number of sugar farms, especially those close to the sea, were converted to prawn farms, with Japan as the prime export market. In the ASEAN preferential trade agreement of 1977, the Philippines offered to reduce the margin of preference for refined sugar imports to the Philippines at 35 per cent.

At the Uruguay Round of the General Agreement on Trade and Tariff in 1990, the Philippines agreed to a reduction in sugar tariff from an initial 100 per cent to 50 per cent. The Philippines’ tariff reduction on sugar was the highest tariff reduction among the sugar producing countries. In 1997, the Philippines requested for a modification of its tariff commitments under Article 28. The sugar industry is also taking recourse under the Safeguards Measure Act (Republic Act 8800) passed by Congress in 2000. The main purpose

³⁷⁸ Jose Marie Zabaleta (1997) Will the Philippines Revert to Its Net Sugar Exporter Status. Food and Agriculture Organization. At p. 2

³⁷⁹ Anon. (2004) Philippine/US: US-Australia Deal Eases Sugar Fears, *Oxford Analytica Daily Brief*. Oxford Analytica Ltd. At p. 2

of the Safeguards Measure Act(2000)³⁸⁰ as stated in Sec. 2 is, “The State shall promote the competitiveness of domestic industries and producers based on sound industrial and agricultural development policies and on the efficient use of human, natural and technical resources. In pursuit of this goal and public interest, the State shall provide safeguard measures to protect domestic industries and producers from increased imports which cause or threatened to cause serious injuries to those domestic industries and producers”. In line with the Philippine government commitment to the World Trade Organization, Sec. 17 of the Act required the secretary of agriculture, in the case of sugar products, to notify the concerned Committee on Safeguards.

The International Sugar Organization was established under the International Sugar Agreement of 1968 with headquarters in London. The organization is managed by the International Sugar Council consisting of representatives of all the member countries, normally the major sugar exporting and importing countries. The Sugar Agreement of 1968³⁸¹ established quotas for various exporting countries and a price band. The organization supervised the implementation of the agreement. Under Article 41 of the Sugar Agreement of 1968, the Philippines was granted an annual export quota of 100,000 tons. Article 41(b) states: “The Philippines shall have a net export entitlement of up to 60,000 tons in any quota year when the level of the aggregate of quotas in effect is above 100 per cent of the total of basic export tonnages. This entitlement shall not be subject to any adjustments under this chapter.” However, the sugar agreement collapsed in 1973 when sugar was in short supply and the sugar prices went up. The exporting countries wanted to avail themselves of the high

³⁸⁰ Republic Act 8800 Safeguard Measures Act of 2000 (Philippines) passed July 17, 2002 , Laws and Resolutions, Congress of the Philippines, National Printing Office, Manila, Philippines.

³⁸¹ International Sugar Agreement opened for signature on December 24, 1968 and entered into force provisionally on January 1, 1969 and definitely on June 17, 1969 and expired on December 31, 1973. United Nations, Treaty Series, v. 654, p.3.

sugar prices to expand the acreage cultivated to sugar cane and the milling capacity. Importing countries shifted the sourcing of their sugar to alternative sources like sugar beet. By 1976, the sugar market was flooded with excess sugar and the sugar prices collapsed. In 1984, the International Sugar Organization abandoned its quota and price fixing roles.³⁸² Based on its revised charter in 1992, the main objectives of the organization as stipulated in Article 1 are³⁸³:

- i. "To ensure enhanced international cooperation in connection with world sugar matters and related issues
- ii. To provide a forum for intergovernmental consultation on sugar and on ways to improve the world sugar economy
- iii. To facilitate trade collecting and providing information on the world sugar market and other sweeteners
- iv. To encourage increased demand for sugar, particularly for non-traditional uses."

The 1992 charter of the International Sugar Organization is very subdued compared to its objectives when it was founded in 1968. In 1968, the objectives of the organization as given in Article 1 of its charter³⁸⁴ were:

- (i) to raise the level of international trade in sugar, particularly in order to increase the export earnings of developing exporting countries;
- (ii) to maintain a stable price for sugar which will be reasonably remunerative to producers, but which will not encourage further expansion of production in developed countries;
- (iii) to provide adequate supplies of sugar to meet the requirements of importing countries at fair and reasonable prices;

³⁸² Peter Baron (1999) *The Role of ISO in a More Liberal World. 4th International Conference Sugar and Sweeteners*. Brussels, Belgium. At p. 3

³⁸³ op cit

³⁸⁴ International Sugar Agreement of 1992 drafted on March 20, 1992 and opened for signature on May 1, 1992, provisionally entered into force on January 20, 1993 and definitely on December 10, 1996. United Nations, Treaty Series, v. 1703, p. 203

- (iv) to increase sugar consumption, and in particular, to promote measures to encourage consumption in countries where consumption per caput is low;
- (v) to bring world production and consumption of sugar into closer balance;
- (vi) to facilitate the coordination of sugar marketing policies and the organization of the market;
- (vii) to provide for adequate participation in, and growing access to, the markets of the developed countries for sugar from the developing countries;
- (viii) to observe closely developments in the use of any form of substitutes for sugar, including cyclamates and other artificial sweeteners; and
- (ix) to further international cooperation in sugar questions.

The Philippines, as did most of the founding countries, continued its membership in the organization. Except for the military planning and contingency, the fluctuations in sugar prices, supply and demand, and importance of the sector to the political structure of developing and developed economies have remained the same as those described in the 1938 commentary of the US Sugar Act of 1937.³⁸⁵

Kyoto Protocol.³⁸⁶ One of the international agreements signed at the United Nations Conference on Environment and Development (UNCED) in 1992 is the United Nations Framework Convention on Climate Change or UNFCCC³⁸⁷. The UNFCCC came into force on March 21, 1994. Under article 4 of the UNFCCC, all the parties are committed to gather and share information on greenhouse gas emissions, national policies and best practices, and

³⁸⁵ Anon (1938) The Sugar Act of 1937. *The Yale Law Journal*, 47. At p. 981

³⁸⁶ *Kyoto Protocol of the United Nations Framework Convention on Climate Change*. Signed at the third Conference of Parties of the United Nations Framework Convention on Climate Change in Kyoto, Japan on 11 December 1997 and went into force on 16 February 2005.

³⁸⁷ The United Nations Framework Convention on Climate Change. Opened for signatures during the UNCED at Rio De Janiero June 4, 1992 and entered into force on 21 March 1994 . United Nations, Treaty Series, v. 1771, p. 107

cooperate in preparing adaptation to the impacts of climate change. As most of the greenhouse gas emissions are from developed countries, and the per capita greenhouse gas emissions in developed countries are four to five times higher than those in developing countries, the developed countries listed under Annex I of the convention had to launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries. Article 4 of the UNFCCC concerns the commitments of the parties. Sec 2 of Article 4 states:

“2. The developed country Parties and other Parties included in Annex I commit themselves specifically as provided for in the following:

(a) Each of these Parties shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs. These policies and measures will demonstrate that developed countries are taking the lead in modifying longer-term trends in anthropogenic emissions consistent with the objective of the Convention, recognizing that the return by the end of the present decade to earlier levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol would contribute to such modification, and taking into account the differences in these Parties’ starting points and approaches, economic structures and resource bases, the need to maintain strong and sustainable economic growth, available technologies and other individual circumstances, as well as the need for equitable and appropriate contributions by each of these Parties to the global effort regarding that objective. These Parties may implement such policies and measures jointly with other Parties and may assist other Parties in contributing to the achievement of the objective of the Convention and, in particular, that of this subparagraph;”

Greenhouse gases trap the heat re-radiated from the earth, resulting in an increase in atmospheric temperature and subsequent changes in global weather patterns, the melting of the ice caps, and increase in sea level. The major greenhouse gases are water vapour, carbon dioxide, methane, oxides of nitrogen, and a large number of synthetic chemical substances, some of which are controlled under the Montreal Protocol on Ozone Depleting Substances.³⁸⁸

³⁸⁸ Montreal Protocol on Ozone Depleting Substances implementing the Vienna Convention on Ozone Depleting Substances 1985. Opened for signature on 16 September 1985 and went into force on 1 January 1987. United Nations, Treaty Series, v. 1522, p.3 The Montreal Protocol is primarily designed to control the emissions of chlorofluorohydrocarbons, and halons used in refrigerants, welding coolants, solvents and spray propellants. The Montreal Protocol was amended in London in 1990, Copenhagen in 1992, Vienna in 1995, Montreal in 1997 and Beijing in 1999.

While water vapor is a significant greenhouse gas, the Kyoto Protocol³⁸⁹ is focused on greenhouse gases from anthropogenic sources.

The Kyoto Protocol is the mechanism for the developed countries to reduce their greenhouse gases. While the developing countries such as the Philippines have no commitment to reduce their greenhouse gas emissions, under Article 12 of the Kyoto Protocol, the developed member countries could include in their greenhouse gas reduction commitment the apparent reduction in emissions from developing countries in their projects or intervention. The process for developed countries to obtain credits from apparent emission reductions³⁹⁰ in developing countries is called Clean Development Mechanism, commonly called CDM.³⁹¹

The Kyoto Protocol was signed on December 11, 1997 and came into force on February 16, 2005. Article 12 of the Kyoto Protocol summarized the Clean Development Mechanism principles which are:

“The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I³⁹² in achieving compliance with their quantified emission limitation and reduction commitments under Article 3.

3. Under the clean development mechanism:

(a) Parties not included in Annex I will benefit from project activities resulting in certified emission reductions; and

³⁸⁹ The greenhouse gases controlled under the Kyoto protocol are Carbon dioxide, Methane, Nitrous oxide , Hydrofluorocarbons , Perfluorocarbons and Sulphur hexafluoride.

³⁹⁰ Except for the reforestation and afforestation projects and operating projects, emission reductions are based on the emission that could have taken place without the CDM and the actual emissions. For a non-operating project there is no physical method of measuring the emissions prior to the use of the CDM. The emission is calculated based on agreed baseline scenario. .

³⁹¹ Article 12 of the Kyoto Protocol Kyoto, a protocol of the United Nations Framework Convention on Climate Change. United Nations, Treaty Series, v. 1771, p.109

³⁹² Annex I countries refer to the developed countries and economies in transition that have required reduction targets that are enumerated in Article 3 of the Protocol. Australia is an exemption among the developed countries as it is allowed to increase its greenhouse gas emission by eight per cent, considering that its economy and population are not mature.

(b) Parties included in Annex I may use the certified emission reductions accruing from such project activities to contribute to compliance with part of their quantified emission limitation and reduction commitments under Article 3, as determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

4. The clean development mechanism shall be subject to the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to this Protocol and be supervised by an executive board of the clean development mechanism.

5. Emission reductions resulting from each project activity shall be certified by operational entities to be designated by the Conference of the Parties serving as the meeting of the Parties to this Protocol, on the basis of:

- (a) Voluntary participation approved by each Party involved;
- (b) Real, measurable, and long-term benefits related to the mitigation of climate change; and
- (c) Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.”

While sugar milling is seasonal in nature, the operation potentially generates more energy than it uses. The energy is generated from the burning of the trash and bagasse. As mentioned earlier, sugar cane is an efficient fixing agent of carbon dioxide and solar energy. Burning the bagasse and trash does not add carbon dioxide as the carbon dioxide generated is fixed in the next growing season. Bagasse and trash are considered renewable energy. If to meet the power demand, the power plant using bagasse and trash for fuel displaces, and makes the construction of the construction of a coal-fired power plant redundant, then the sugar mill could claim carbon credits from the energy it supplies to the grid equivalent to the carbon dioxide generated by the coal fired power plant to generate the same amount of energy. The CDM Board has established the procedures for registration, verification and validation of the carbon credits. Once the CDM Board has certified the carbon credits, the sugar mill could sell these to companies in developed countries facing difficulty in meeting their emission targets through process change. Like sugar prices, the price of carbon credits has fluctuated dramatically from US \$5 per ton of carbon dioxide to a low of US \$2 when there were indications that Russia would not ratify the treaty, to a high of US\$20 when Russia ratified it. The most recent price is in the range of US\$12 to US \$15 per ton of carbon dioxide.

Aside from the burning of bagasse and trash for electricity, ethyl alcohol could be obtained from sugar and molasses. Ethyl alcohol could be blended with gasoline and used to fuel motor vehicles. Ethyl alcohol is considered a renewable energy. The carbon dioxide generated from the combustion of ethyl alcohol is fixed at the next growing season, and as such it is not counted as a greenhouse gas emission.³⁹³

Cleaner Production

The technology used in the sugar sector varied greatly, depending on the interrelationship between the sugar planters and the sugar millers, the sugar planters and the plantation workers, and the downstream processing of sugar and its by- products. Some sugar mills that expanded to sugar refining tended to modernize the sugar milling operation, as the impurities in the brown sugar or massecuite increases the refining cost. When Edna Tatel³⁹⁴ in 2002 analyzed the impact of environmental regulations on the production cost of raw sugar, she used the typical sugar mill built in the 1920s. She found out that the price of raw sugar is dictated by the world market price while the cost of environmental regulations is fixed. She estimated the cost of complying with the environmental regulations at approximately P43 per ton or approximately 1.6 per cent of the total production cost. She noted further that the air pollution from bagasse burning was high, which contradicts the survey conducted by Sinclair,

³⁹³ At the Asian Development Bank, I was head of the Renewable Energy, Energy Efficiency and Climate Change (REACH) Project. My duties involved attending the Conference of Parties of the Kyoto Protocol, organizing side events during the conference, sounding out the position and interest of the Bank's member countries, and organizing regional conferences and seminars around Asia to encourage industries to participate in CDM. The sugar industry actively participated in the meetings but to date no Philippine sugar mill has processed its application with the CDM Board.

³⁹⁴ Edna Tatel (2002) An Analysis of the Effect of Environmental Regulations to the Production Costs and Prices of Raw Sugar, *Economics Department*. Asian Social Institute. at p. 1

Knight Merz³⁹⁵ that showed the emission from sugar mills using air scrubbers and mechanical collectors was performing better than the US EPA requirements. Sinclair, Knight, Merz surveyed eight sugar mills that had installed air pollution control facilities while Tatel's analysis was centered on the sugar mills built before 1920 and are still operating. The two studies showed the wide variations in attitude of the sugar millers towards environmental protection and the use of modern technologies. As Zabaleta noted, a number of sugar millers take advantage of their monopolistic status and do not care to upgrade their facilities. Those mills produce poor quality sugar.³⁹⁶

The International Sugar Organization Common Fund for Commodities³⁹⁷ in the year 2000 initiated a five-year project to improve the sugar cane varieties in five South East Asian countries, with the Philippine Sugar Institute taking the lead role. The grant was for US\$ 1 million. The study covered the Philippines, Indonesia, Thailand, Malaysia and Bangladesh.

The Asian Development Bank provided a technical assistance grant (TA 2623) of \$600,000 to the Department of Environment and Natural Resources to study the potential application of cleaner production in the sugar, cement and power industry. Sinclair Knight Merz was the project consultant and the report was completed in 1998. The study identified five major areas for introduction of cleaner production which are:

- (i) bagasse drying, to reduce the moisture and improve combustion efficiency;
- (ii) recycling of spent condenser cooling water;
- (iii) installation of entrainment separators in the evaporator system;

³⁹⁵ Sinclair, Knight, Merz (1997) Review of Environmental Standards and Performance in Selected Industrial Sectors in the Philippines), Asian Development Bank, Manila . at p. 2-5

³⁹⁶ Jose Marie Zabaleta (1997) Will the Philippines Revert to Its Net Sugar Exporter Status, Food and Agriculture Organization, Rome. at p. 4

³⁹⁷ Jose Marie Zabaleta (2004) Sugar Sector--Still Sweet Another Aesop's Fable, *Mid-Year Food and Agribusiness Conference*, University of Asia and the Pacific. at p. 6

- (iv) magnetic field treatment in the heat exchange evaporators; and
- (v) better cane handling and management.

While administering the technical assistance, I had an opportunity to review the cleaner production initiative in the sector. I found that the cleaner production initiatives were almost all centered on waste minimization that were mere palliatives, and even a distraction to the real problem of outmoded technology and equipment. The sugar mills needed a complete overhaul and modernization.

The United States Agency for International Development funded the Asia Foundation through the United States–Asia Environmental Partnership to study cleaner production in 14 sugar mills. The study was started in July 1996 and completed in December 1997. The study included:

- (i) good housekeeping and operational practices;
- (ii) waste segregation;
- (iii) recycling and reuse of water;
- (iv) systems modification, which may require capital-intensive projects and re-engineering; and
- (v) improvement in working conditions.

Of the 14 sugar mills studied, demonstration projects were carried out in three sugar mills.³⁹⁸

The Development Bank of the Philippines, AF-International of Sweden and the Philippine Sugar Millers Association developed an Environmental Management Plan. The

³⁹⁸ Philippine Sugar Miller Association Incorporated (2004a) Case Studies on Wastes Minimization in Sugar Manufacturing, Makati, Philippines.

plan identified a wide range of potential measures to improve the production efficiency, reduce the wastewater discharge, air emissions and solid wastes generation.³⁹⁹

The Philippine Sugar Millers Association carries out periodic reviews of new technologies and the potential application of those technologies to the Philippines. In its review on the energy and environmental issues in the sugar industry, the association identified the potential replacement of lead acetate with polymers as a clarifying agent. (Philippine Sugar Miller Association, 2004b)⁴⁰⁰ Zabaleta⁴⁰¹ cited the potential cogeneration fueled by bagasse and selling the power directly to the grid. If properly utilized, the electricity generated from the bagasse has a potential value of \$150 million per year. He foresees ethanol production as another major product to wipe out excess inventory when sugar price is low.⁴⁰²

To modernize the sugar industry, the Philippine Sugar Millers Association, the Sugar Regulatory Administration, Philippine Sugar Institute and Sugar Planters Association set up the Sugar Master Plan Foundation. The foundation in consultation with the planters, millers, researchers, financial institutions and traders have formulated an integrated plan called the Sugar Plan to improve the productivity and efficiency of plantations, harvesting, transport, processing and refining. The Sugar Plan would require an investment of 42.7 billion pesos⁴⁰³ over a five year period. Approximately 24 billion pesos is allocated for the upgrading and modernization of 28 mills. Improvement in the plantation required an allocation of 15 billion,

³⁹⁹ Philippine Sugar Miller Association Incorporated (2004d) Environmental Management Plan (EMP) Sugar Milling and Refining, Development Bank of the Philippines, Manila, Philippines. at pp. 13-21

⁴⁰⁰ Philippine Sugar Miller Association Incorporated (2004b) Energy and Environmental Issues in the Sugar Industry, Makati Philippines.

⁴⁰¹ Jose Marie Zabaleta (2004b) Technological Breakthroughs in Sugarcane Milling and Processing, *10th Annual Asia International Sugar Conference 2004*, Kuala Lumpur, Malaysia. at pp. 2-3

⁴⁰² Ibid at p. 3

⁴⁰³ One US dollar is approximately 55 pesos when the Sugar Master Plan was made.

research and development at 800 million and training at 120 million. Road and transport is estimated to cost 2.3 billion. Ninety five per cent of the investment will be financed from loans.⁴⁰⁴ As Zabaleta⁴⁰⁵ pointed, out the sugar planters have difficult finding financiers as land above 5 hectares is subject to the distribution under the Comprehensive Agrarian Reform Program. Most of the plantations bigger than 5 hectares continued to operate because of the insufficient funds from the government and the Land Bank of the Philippines to pay for the lands. On the other hand, the Sugar Master Plan did not address in detail the financing arrangement for the plantation owners to secure the loans.

The Sugar Industry in Transition

With the failure of the sugar prices in the late 1970s, the inclusion of sugar lands in the land reform program and division of land through inheritance, today, 78 per cent of sugar land is less than 5 hectares, with a productivity of 42.16 tons of cane per hectare, which accounts for 18 per cent of the total production. This compares unfavourably with the national average of 59 tons of cane per hectare. Sugar lands larger than 100 hectares account for less than 5 per cent of the total land area planted to sugar cane, but account for more than 40 per cent of the total production.⁴⁰⁶ Aside from addressing the land ownership issue, one of the main justifications for the comprehensive land reform is improvement in productivity. The tiller owns the land and does not have to share the produce with his landlord whose historical ownership the tenant and sacada consider questionable. The tiller is expected to devote more

⁴⁰⁴ Archimedes Amarra (2003) Action Plan for the Philippine Sugar Industry, Sugar Mater Plan Foundation Inc., Makati, Philippines at p. 11

⁴⁰⁵ Jose Marie Zabaleta. (1997) Will the Philippines Revert to Its Net Sugar Exporter Status, Food and Agriculture Organization, Rome at p. 3

⁴⁰⁶ Archimedes Amarra (2003) Action Plan for the Philippine Sugar Industry, Sugar Mater Plan Foundation Inc., Makati, Philippines at p. 2

effort and exercise more care in maximizing the output from the land. As owner of the land, the former tenant will not be working for the minimum wage and the benefits provided by the Labour Code. The former tenant will get the full benefit of his labour. The former tenant becomes an entrepreneur in his own right.

While the comprehensive land reform program included technical support for the emancipated tenants,⁴⁰⁷ due to budgetary constraints, the support is minimal and insufficient. For this reason, the sugar master plan called for the Sugar Master Plan Foundation to provide extensive support services. As Zabaleta⁴⁰⁸ pointed out, the emancipated tenants have difficulty in accessing bank loans to acquire tools, equipment, seedlings, fertilizers and pesticides, as the land ownership is not complete until the tenant has paid the Land Bank of the Philippines.

Under the feudal system that existed in the sugar growing areas for more than a hundred years, all the decisions related to farm productivity and even the tenants' family affairs were made by the landlord. Culturally, the labourer follows the instructions given without question or justification.⁴⁰⁹ The emancipated tenant will have to adjust to a new environment wherein he has to make his own decisions and take complete responsibility for his actions. Productivity improvement has its risks and its rewards.

⁴⁰⁷ "Emancipated tenants" is commonly use in the Philippines in relation to land reform to highlight the real or perceived disposition of the indigenous landowners and their conversion to landless tenants.

⁴⁰⁸ Jose Marie Zabaleta (1997) Will the Philippines Revert to Its Net Sugar Exporter Status, Food and Agriculture Organization, Rome at p. 3

⁴⁰⁹ One of the obvious manifestations of this culture is the dominance of Filipina domestic helpers and care givers in Singapore, Hong Kong, Middle East, and Europe today.

Zabaleta⁴¹⁰ and Amarra⁴¹¹ have been critical of the impact of comprehensive land reform on the productivity of the plantation, although a number of foreign commentators consider the negative impact of the *quedan* system on productivity as more critical. As Zabaleta noted:⁴¹²

“The *quedan* system of Warehouse Receipts as it now operates was established by the American Colonial government in the 1920s. The system offers an ideal framework to take out this. All sugar is classified as to the market destination and market benefits are fairly distributed to all producers. The sugar *quedan* likewise offers itself to collateralization through the Warehouse Receipt Law, and, therefore, secures financing for sugar and enhances its trade and marketing. A review of the system of classification as to market share or destination is, however, necessary as mills located near urban centers or located in the interior are no longer interested in the export markets, while mills with their own ports in distant provinces can efficiently export sugar to viable markets such as the US or even the world market when price justifies.”

Mr Jack Roney, in his testimony before the Committee on Agriculture,⁴¹³ pointed out that the American sugar planters are in distress even if their productivity is very high. In spite of very high labour cost, the US sugar production cost is lower than those of 50 countries out of 120 surveyed. Mr Roney also noted that the Philippines is the only country using the *quedan* system to meet its US quota⁴¹⁴. With the distressed condition in the US sugar industry and the US production of sugar substitutes such as glucose and fructose from corn syrup, the US quota for imported sugar is on the decline. As per the statement of Dr Peter Baron, Executive Director, International Sugar Organization, the US will have difficulty cutting down the import quota as the existing quota is close to the minimum it commits under the

⁴¹⁰ Jose Marie Zabaleta (1997) Will the Philippines Revert to Its Net Sugar Exporter Status, Food and Agriculture Organization, Rome at p. 3

⁴¹¹ Archimedes Amarra. (2003) Action Plan for the Philippine Sugar Industry, Sugar Mater Plan Foundation Inc., Makati, Philippines at p. 2

⁴¹² Jose Marie Zabaleta (1997) Will the Philippines Revert to Its Net Sugar Exporter Status, Food and Agriculture Organization, Rome. at p. 6

⁴¹³ Jack Roney (2001) The Future of US Sugar Policy Testimony on behalf of US Sugar Industry. Washington D.C., Committee on Agriculture. at p. 1,

⁴¹⁴ Ibid. at Figure 7.

North America Free Trade Agreement and the World Trade Organization.⁴¹⁵ For the Philippines, the US sugar quota today is less than 7 per cent of the total sugar production, whereas in 1970 it was almost 70 per cent. The quedan system is no longer relevant to the Philippine sugar industry today.

The Philippine Sugar Millers Association is exploring the possibility of backward integration of sugar production for the millers to lease larger tracts of lands. Backward integration will give the millers better control of the harvesting program and synchronize the milling operation. At present, the delay in processing the cane accounts for huge sugar losses.⁴¹⁶ While this option has the maximum productivity potential, it is politically sensitive, as it will sideline the beneficiaries of the land reform program especially if the millers will mechanize the plantation operation. Mechanization will require a smaller labour force and a large number of the land reform beneficiaries do not have the skills necessary to operate the machines.

The other option is for the small landholders to form cooperatives in order to improve the operation of their farms, especially in coordinating the harvesting and the milling schedule. The cooperatives could negotiate with the millers for advances in kind or in cash for necessary inputs such as improved sugar cane varieties, fertilizers, pesticides, and basic farm machinery. The formation of cooperatives is encouraged in the Comprehensive Agrarian Reform Law⁴¹⁷; specifically, sec. 2 of the Act states:

⁴¹⁵ Peter Baron (2001) Roundup of Key Developments and Issues that will Shape the Future of World and Asian Sugar Industries, *7th Asian International Sugar Conference 2001*, Bangkok, Thailand. At p. 5

⁴¹⁶ Jose Marie Zabaleta (1997) Will the Philippines Revert to Its Net Sugar Exporter Status, Food and Agriculture Organization. at p. 5

⁴¹⁷ Republic Act 6657 Comprehensive Agrarian Reform Law of 1988 (Philippines) Laws and Resolutions Congress of the Philippines in 1988, National Printing Office, Manila, Philippines.

“The State shall recognize the right of farmers, farm workers and landowners, as well as cooperatives and other independent farmers' organization, to participate in the planning, organizations, and management of the program, and shall provide support to agriculture through appropriate technology and research, and adequate financial, production, marketing and other support services.”

The third option is to adopt the Queensland Sugar Act of 1999,⁴¹⁸ controlling the area planted to sugar to prevent oversupply. The sugar planters and the millers enter into a supply milling contract. The sugar planter is paid by the miller on delivery of the cane to the mill. Chapter 2 on Production, Supply and Milling, Part 1 On Cane Production Areas, Section 7 defines the interactions of the planters and the mills. As this particular section states:

“Cane Production Area

A person may hold an entitlement called a cane production area

(2) A cane production area entitles the person (a grower) to enter into a supply agreement with the owner of a particular mill for the supply to the mill of cane grown on a particular number of hectares situated within land of a particular description

(3) A grower is the only person who may enter into a supply agreement with a mill owner

(4) Subsection (3) does not prevent a person from entering into a supply agreement with a mill owner on condition that the person becomes the holder of the relevant cane production area

(5) A cane production area is property and may, for example, be sold, leased, subleased, or otherwise transferred, subject to requirements under this part

(6) Disposal of land included in a cane production area does not effect a disposal of the cane production area

(7) Land included in a cane production area may be the same area as, or greater than, but not less than, the number of hectares included in the cane production area

(8) a particular land may be included in more than 1 cane production area

(9) However, the total of all the numbers of hectares included in cane production areas in which a particular land is included may not be greater than the land's actual area

The first three subsections in the Queensland Sugar Act of 1999 as amended and enforced in 2004, guaranteed the sugar planter the exclusive right to enter into an agreement with the mill owner. Those sections prevent the mill owner from abusing his monopoly over a particular sugar growing area and importing canes from other areas in order to suppress the prices and enter into contracts that are disadvantageous to the sugar growers in the immediate vicinity of the mill who, reasonably, should be selling their crops to the mill. Subsection 8

⁴¹⁸ Sugar Industry (Queensland) Act 1999 as amended in 2004 accessed on May 12, 2006 at <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/S/SugarIndA99.pdf>.

further reinforces the sugar grower's right by allowing the inclusion of his land in more than one cane production area and thereby allowing the grower flexibility in choosing the sugar mill. Subsection 9 guarantees the mill that the sugar planter will not create an artificial shortage by entering into multiple contracts less than the total project yield of the farm.

In the Philippine situation, the miller may enter into a contract with the planters' cooperative or with individual planters in areas other than the production-sharing arrangement defined by the quedan system. However, the quedan system is not just a cultural practice, but because it has become a standard practice in the industry, the quedan system is institutionalized in the legislation such as the Sugar Act of 1952 or Republic Act 809. Until the legislative provisions involving the quedan system are repealed, it will be difficult for the planters and millers to use the Queensland system.

Changes in Environmental Practices

Since the adoption of the Sugar Master Plan by the planters and millers, the attitudes to environmental issues have changed. As the Philippine Sugar Millers Association⁴¹⁹ issue paper on energy and environment puts it:

“The sugar industry, like all industries around the world, faces increasing pressures from consumers, residents living near the sugar facilities, government and international organizations to make environmental considerations a major priority. The effects of these pressures are being seen at every level in the industry: from efforts to boost cogeneration, through attempts to minimize or eliminate traditional carbonation... Happily, environmental concerns are not as dramatically opposed to other critical considerations, like profitability, as many industrialists used to think. Indeed, the goals of minimizing the use of valuable resources, reducing wastes volumes and recycling heat, water and reagents as effectively as possible are equally important in both financial and environmental terms.”

⁴¹⁹ Philippine Sugar Miller Association Incorporated (2004c), *Energy and Environmental Issues in the Sugar Industry*, Manila, Philippines. at p. 2

At the conclusion of the issue paper⁴²⁰, the association further noted:

“Clearly, a major element of any environmentally sensitive industrial strategy will involve waste disposal methods that minimize pollution. Happily, the sugar industry is in a relatively luxurious position in this respect, since much of the industry’s bulk wastes allow considerable scope for generating by-products, which can significantly off-set the cost of waste treatment. By-products are traditionally beyond the scope of this annual review, so the subject will not be further treated here.”

The prevailing attitude before the adoption of the master plan was for the millers to complain and use their influence to gain exemption from environmental rules and regulations. For example, Tatel’s⁴²¹ analysis on the impact of environmental regulations on the production and competitiveness of sugar mills was not based on state-of-the-art mills, but on sugar mills built in 1927. As late as September 7, 1999, the Sugar Industry Environment Committee passed resolution no. 1,⁴²² requesting the Department of Environment and Natural Resources to defer the implementation or adoption of the Revised Industrial and Commercial Wastewater Permitting Rules and Regulations of 1999.

With the master plan in place in 1999, sugar production started to increase from 1.5 million tons per year to 2.4 million tons, just 0.3 million tons short of the peak attained in 1975. The implementation of the master plan was assisted by the recovery of the sugar prices in 1998 until June 2006. Sugar recovery from the cane increased from 6 per cent to 8 per cent. Of the ten sugar mills that modernized their facilities, the production increased from a low of 21.1 per cent at Tarlac Sugar Mill to a high of 153.8 per cent at Crystal Mill. However, five

⁴²⁰ Ibid. at 2.

⁴²¹ Edna Tatel (2002) An Analysis of the Effect of Environmental Regulations to the Production Costs and Prices of Raw Sugar, *Economics Department*, Asian Social Institute. at p. 1

⁴²² Sugar Industry Environment Committee (1999c) Resolution No. 1 , Requesting DENR to differ implementation of Revised Industrial and Commercial Wastewater Permitting Rules and Regulations of 1999, Sugar Industry Foundation Inc, Manila, Philippines

sugar mills closed down. As Zabaleta⁴²³ noted, “Of course some fell and died by the wayside, but culling is as good for mills and farmers.”

While the sugar extracted from the cane increased by 22.24 per cent for the 2002 - 2003 period compared to the 1997–98 period, the sugar cane tonnage increased only by 8.48 per cent during the same periods. Introducing improved sugar cane varieties, cultivation techniques, harvesting and transporting were more difficult than modernizing the sugar mills. Improvement in the sugar plantations’ productivity is subject to a wider range of social and cultural factors and legislation than in the sugar mills.

Summary

The sugar industry is a major sector of the Philippine economy. Sugar is a principal ingredient in a number of consumer goods ranging from soft drinks, toothpaste, cakes, candies, and medicine, to name a few. Sugar is produced in both developed and developing countries, although most of the exports come from developing countries. The price of sugar is subject to distortions, as importing countries protect their domestic sugar producers, and impose quotas to control imports. As developing countries like the Philippines are dependent on the preferential pricing under the quota system, the quota also serves as a foreign relations tool.

With the highly advantageous prices under the US sugar quota, the sugar mills and planters stagnated in competitiveness. In 1974, with the expiration of the Laurel –Langley agreement, the Philippine sugar quota was drastically reduced. The reduction coincided with

⁴²³ Jose Marie Zabaleta (2004a) Sugar Sector--Still Sweet Another Aesop's Fable, *Mid-Year Food and Agribusiness Conference*, University of Asia and the Pacific. at p.7

the collapse in the world market price from US 64 cents to a low of 3 cents in 1977. The sugar sector was further damaged by the monopolistic policies and lack of governance under the Marcos martial law regime. The sector further declined with the fractionalization of the sugar lands under the comprehensive agrarian reform program and the reduction of the sugar tariff under the Philippine commitment to GATT, and later WTO.

While the sector was subject to a number of cleaner production initiatives under bilateral and multilateral aid arrangements, the programs were mostly related to waste reduction or minimization. As the local and international demand for sugar continued to expand, local businessmen and entrepreneurs committed new capital and borrowed from local banks to modernize the sugar mills. The sugar plantations were also undergoing changes as the emancipated tenants formed cooperatives and worked closely with the sugar millers to improve their productivity. The sugar millers and planters used their business acumen to improve productivity without the slogans and rhetoric of cleaner production. The modernization and upgrading which the sugar millers carried out in 1999 was more comprehensive, and to all intents and purposes, nowhere near accommodating the cleaner production initiatives funded by multilateral and bilateral funding agencies. The modernization and upgrading programs were carried out in an integrated manner under license from specialized manufacturers of sugar mill process equipment. The modernization master plan of 1999 called for a complete overhaul and modernization of the sugar mills.

Moreover, the modernization and upgrading program resulted in the closure of five mills that were inefficient and had deteriorated to a stage that it was uneconomical to further operate them. This action is a break from tradition, where the sugar millers are provided incentives and assistance by the government regardless of the sugar mill losses because of the

large number of workers and planters affected.⁴²⁴ The sugar millers took commercial loans and the subsequent risks. Sugar mills with marginal profitability or which were facing high risks ceased their operation.

The *quedan* system of production sharing developed by the American colonial administration to maximize the sugar export to the US market, and later, to fill the US sugar quota, has remained a major barrier to further productivity improvement for the whole sector. Resolving the *quedan* issue is more of a cultural rather than an economic issue, as the US sugar quota today is less than seven per cent of the total sugar production compared to the mid 1970s when it accounted for almost 70 per cent. Considering US commitments under NAFTA and WTO, the Philippine sugar quota may decline further in the future.

The sugar industry in the Philippines has gone through the corrupt and crippling monopoly under martial law, the US quota, the break-up of large sugar estates, changes in planting and milling technology, reduction of protective tariffs, and entry into the market of competitive sweeteners. The last 30 years has been a testing time for the industry with a number of sugar planters and millers going out of business. The survivors now have better skills and knowledge to compete in the market.

The problem of the sugar industry in the Philippines is common to a number of developing countries. The Thai sugar industry is undergoing similar problem and will most

⁴²⁴ One of the five sugar mills closed is the Danao Sugar Central in Cebu. When it closed down, my sister lost her rental income from leasing her land. The closure of the sugar mills had serious economic impacts, but to survive, the affected persons tried to examine better options, and in a number of instances, found opportunities better than those provided by the sugar industry. During the collapse of the sugar prices in the late 1970s, the sugar planters in Negros shifted to prawn farming and exporting their products to Japan. My sister did not realize that her land had industrial classification and she could get better income by leasing it to industries rather than to sugar farmers.

likely follow the same restructuring pattern as in the Philippines.⁴²⁵ The Bangladesh sugar industry losses up to 38 per cent of the sugar in wastage⁴²⁶ and in 1996 the Asian Development Bank programmed a cleaner production loan for a soft loan with interest of 1 per cent annum payable in 30 years. The loan went into appraisal but was never formalized for lack of interest. I was a member of the appraisal team.

⁴²⁵ Editorial (2006) Bitter Pill for Sugar Industry, *The Nation*, English Edition ed., January 9, 2006, Bangkok, Thailand.

⁴²⁶ DKH Engineering Consultants (1996), Bangladesh Industrial Efficiency Project, Manila, Philippines, Asian Development Bank, Manila, Philippines.

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

Realities of the business world

Since the beginning of human history, inventions and ideas have been closely guarded lest those fall into the hands of competitors. Persons initiated into the important trades or practices are sworn to secrecy and failure to maintain secrecy is often punished by death or excommunication. Today, inventions and ideas are strongly protected by copyright laws. Industrial espionage is a major concern among competing economies and companies especially in the electronic age where information is readily stored and transmitted across national boundaries and the complexities of industrial products makes it difficult to detect and identify the copyright of each individual component.

However, technologies and practices related to cleaner production are promoted not only from technical and financial perspective but also through legislation. International agreements such as ministerial declarations, bilateral agreements, and resolutions in international organizations promote cleaner production technology and practices. Technology transfer centres are established to facilitate the adoption of cleaner production. Cleaner production is a concept that addresses pollution degradation and at the same time improves its user market competitiveness. Yet, a large number of cleaner production initiatives fail to attract interests from the investors and potential users.

The realities of the business, political, social and economic world are much more complex compared to the conceptualization of the proponents of cleaner production that would only work in a perfect or ideal market. However, free or ideal markets only exist in theoretical research. In the real world, national leaders promote social equity, protection of the labour force, balanced regional development, national security, preferential utilization of locally available resources, grandfather or exempt existing industries from environmental regulations, and the involvement of non-governmental organizations in the environmental impact assessment and in the process distort the market – often in favour of maintaining the existing situation. The distortion is further supported by the various controls in the international trading system ranging from:

- (i) direct and indirect control of monetary exchange rate;
- (ii) preferential multilateral trade agreements given to least developed countries for them to support national trade barriers;
- (iii) business apathy to the inclusion of catchy but non-operational slogans in international declarations; and
- (iv) soft laws promoting cleaner production.

The international organizations promoting cleaner production or its variants, develop their own terminology, programs and policy even within the same international documentation, such as the Agenda 21. This practice creates confusion, promotes duplication plans and programs, wastage of resources and confusion among the potential users of cleaner production.

Conclusion

In conclusion, the major shortcoming of the existing cleaner production programs is the inability of the promoters to comprehend the realities of the real world and move away from the narrow perspective of an ideal free market.

Recommendations

To improve the implementation of cleaner production, it is recommended that the international and bilateral organizations involved in the promotion of cleaner production reconcile the definition, scope, policies, programs and strategy. They have to sacrifice their ownership and exclusive rights to variations of the cleaner production in order to eliminate confusion and apathy among the potential users. A more coherent implementation strategy for cleaner production will result to more efficient use of scarce resources.

While it is difficult to obtain unanimous agreement among sovereign states participating in an international agreement, the long-term and common interest of mankind in protecting the environment and at the same time promoting development is best served by operational agreements rather than catchy and non-operational phrases.

It is recommended that cleaner production proponents should realize the market imperfections caused by national laws intended to promote (i) industrial development, (ii) national security, (iii) balance regional development, (iv) protection of the disadvantage groups such as labour laws, (v) utilization of locally available raw materials and energy resources (vi) stability and security of existing industries such as *grandfather clauses* in environmental legislation and (vii) politicization of science and technology.

It is also recommended that proponents of cleaner production consider the impacts of bilateral and multilateral treaties designed to ensnarl the national interests of developing countries into the protection of non-competitive production sector in developed countries.

It is further recommended, that proponents of cleaner production evaluate the impact of the market distortion caused by the flow of capital from one country to another as it affects the exchange rate of the local currency, and the monetary policy as it affects the international competitiveness and the pricing of labour, raw material and energy inputs hereby negating the potential benefits of adopting cleaner production.

It is strongly recommended the proponents of cleaner production evaluate the impacts of unrealistic environmental standards and regulations as they affect their enforcement hereby negating the environmental benefits of cleaner production.

As most proponents of cleaner productions are believers in the free and ideal market, history has shown that entrepreneurs willingly pay for technology and processes that improve their market competitiveness and if unable to secure the rights legally, they spy, forge, and illegally copy. In a free market and ideal market there is no need for proponents of cleaner production. Cleaner production is best left to the market and the decision makers in the enterprises that are potential user. The decision makers will have to evaluate the complexities of the real world and take the risk for the success and failure of cleaner production. After more than twenty years of promotion it is high time for the proponents to withdraw, find new challenges and let the potential users and the market decide. This is what I have done.

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<http://www.unfccc.org> website for the United Nations Framework Convention on Climate
Change

APPENDICES



DEPARTMENT OF
ENVIRONMENT AND
NATURAL RESOURCES
ENVIRONMENTAL MANAGEMENT BUREAU

Appendix I

6th Flr., PHC Bldg.,
East Avenue, Diliman,
Quezon City, PHILIPPINES
Tel. No.: 980421 loc. 2031
Fax No.: 2507 HEP-100

NATIONAL ENVIRONMENTAL
PROTECTION COUNCIL
SECRETARIAT

7 April 1988

DEPARTMENT ORDER NO. 1
Series of 1988

SUBJECT : CREATION OF LEGAL AND TECHNICAL
STANDARD COMMITTEES TO ASSIST
THE POLLUTION ADJUDICATION BOARD

In the interest of the service, and to enable the Pollution Adjudication Board (PAB) to effectively discharge its mandated functions as provided for in Executive Order No. 192, a Legal Committee and a Technical Standards Committee, are hereby created to assist the PAB:

I. LEGAL COMMITTEE

This committee shall have the following duties, functions, and responsibilities:

1. Assist in the resolution of legal issues of pollution cases referred to it by PAB;
2. Study cases and issues before the PAB and submit recommendations on:
 - a. Proposed rules and regulations, procedures, guidelines, environmental quality standards related to adjudication of pollution cases or amendments to existing ones; and
 - b. Proposed legislations on pollution control, prevention, and abatement.
3. Formulate policy guidelines governing the issuance of closure orders and the imposition of administrative penalties and other legal sanctions;
4. Assist the PAB in the enforcement of its decisions and orders; and
5. Perform other functions as may be assigned to it by the PAB from time to time.

The following members shall compose this Committee:

<u>NAME</u>	<u>AGENCY</u>
1. ANTONIO S. TRIA	Department of Environment and Natural Resources
2. ROMULO D. SAN JUAN	Department of Environment and Natural Resources
3. HIPOLITO TALAVERA	National Capital Region
4. ANTONIO ELUM	Department of Environment and Natural Resources
5. EUPRODINA M. ATIENZA	Environmental Management Bureau
6. NANCY MADARANG	Commission on Elections
7. NICOLAS ZARATE	Housing and Urban Division Board
8. GUMERSINDO MANIQUIS	Philippine Atomic Energy Commission
9. ALICIA DAYRIT	Lands Management Bureau
10. MONINA SANTOS	Bureau of Domestic Trade
12. JESUS DE LEON	National Water Resources Board

II. TECHNICAL STANDARDS COMMITTEE

This Committee shall have the following duties, functions, and responsibilities:

1. Assist in the evaluation of technical issues of pollution cases referred to it by the PAB;
2. Conduct studies for the PAB and submit recommendations on proposed sampling procedures, analysis of samples, and environmental quality standards related to existing cases;
3. Assist the PAB in the enforcement of its decisions and orders; and
4. Perform other functions as may be assigned to it by the PAB from time to time.

The following shall compose this Committee:

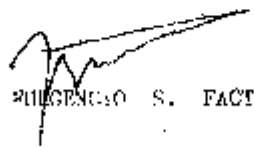
<u>NAME</u>	<u>AGENCY</u>
1. TOMAS ALCANTARA	Department of Trade and Industry
2. RUFINO LIRAG, JR.	National Institute of Science and Technology
3. DELFIN GONZALES	Department of Health
4. PEDRO VIRAY	National Capital Region, DENR
5. BETA P. BALAGOT	Environmental Management Bureau
6. JULIAN CENTENO	Laguna Lake Development Authority
7. REYNALDO LESACA	Test Consultants Inc.
8. RLY QUANO	Total Consultancy Services
9. FRANCISCO GUANZON	P C A P I
10. RUDY VILLANUEVA	Environmental Management Bureau
11. Representative from UP College of Engineering	

These Committees shall maintain support staff coming from the PAB Secretariat (Environmental Management Bureau) which shall be designated by the Director of Environmental Management Bureau.

As such, expenses that shall be incurred by these Committees in the discharge of their functions shall be charged against EMS funds subject to pertinent rules and regulations and availability of funds.

Further, members and support staff of these Committees are hereby authorized to collect an honorarium of P 200 for each meeting actually attended but not to exceed P 600 a month subject also to existing accounting and auditing rules and regulations.

This Order shall take effect immediately and shall remain enforce unless otherwise revoked/amended in writing.


EULENCIO S. FACTORAN

Appendix 2

Office of the President
of the Philippines
Malacanang

92 JUL 3 4:12

29 June 1992

RECEIVED
OFFICE OF THE PRESIDENT
MALACANANG
JUNE 29 1992

Mr. Paulo V. Malina
President, National Power Corporation
Diliman, Quezon City

DEPT. OF ENVIRONMENT AND NATURAL RESOURCES
MANILA

SIR:

Please be informed that Her Excellency, President Corason C. Aquino, has approved your recommendation for the exemption from the Department of Environment and Natural Resources' Environmental Compliance Certificate (ECC) requirement for the construction and operation of the power plants specified in your letter dated June 24, 1992.

Attached is your aforesaid letter which bears the handwritten approval of the President.

Best regards,

Very truly yours,

FRANCIS M. DILLON
Executive Secretary

Encl.: a/s.

11/06/92



REPUBLIKA NG PILIPINAS
Pambansang Korporasyon Sa Elektrisidad
(NATIONAL POWER CORPORATION)

24 June 1992

HONORABLE EXCELLENCY
PRESIDENT CORAZON C. AQUINO
Malacañang, Manila

Dear Madam President:

In the light of the present crisis and as agreed on during the June 23 and 27, 1992 meetings in Malacañang, the fast-tracking of power implementation will now be carried on. For this, NAPCOR has lined up five (5) power projects, four (4) on Build-Operate-Transfer (BOT) and one (1) on Build-Transfer-Operate (BTO) scheme. These projects which were approved by the ICC Cabinet Committee on its June 23, 1992 meeting are:

- a. Luzon
 1. 200 MW combined-cycle gas turbines in Subic (ESI)
 2. 100 MW gas turbines in Navotas (Hopewell Power Philippines Corporation)
 3. 105 MW Bunker C fired diesel generators in Balangas (TURBON)
- b. Mindanao
 4. 60 MW Bunker C fired diesel generators in Iligan City (Tampun-ALEXONS)
 5. 40 MW Bunker C fired diesel generators in Iligan City (Tampun) - BTO basis

These power projects will be of the same type as some existing power plants in NAPCOR, for which DENR has already issued Environmental Compliance Certificates (ECC) in the past. They will also be located in existing power plant sites which are industrial areas. By their nature, these power plants are environmentally compatible and will be constructed to comply with environmental standards. Their operation therefore will have minimal adverse impact to the environment. The combined-cycle power plants, specifically, employ waste heat (from the gas turbine) utilization (for the steam turbine), thus resulting in higher efficiency of power generation per quantity of fuel (diesel and bunker oils) burned. They will be equipped

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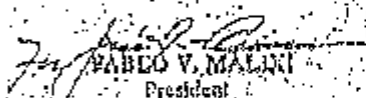
Appendix 2

with oil pollution control facilities, such as oil-water separator, and provided with oil spill control and clean-up equipment such as oil spill boom, skimmer and adsorbents. They will also have and institute oil spill contingency plans and procedures. Their noise emission will comply with DENR noise standards. Their thermal effluent will not violate the DENR standard of 3°C water temperature rise beyond the mixing zone. Their gaseous emissions, discharged through above-ground tall stacks, will comply with DENR ambient ground level standards for air pollutants such as Sulfur Dioxide, Suspended Particulate Matter and Nitrogen Dioxide. They will also comply with the DENR emission standards for Particulate Matter and Nitrogen Dioxide.


So far, the operating experience from similar power plants is devoid of environmental problems. This is also as predicted in the Environmental Impact Statements, which led to the past ECC fast-tracks by the DENR, for the previous similar power plants.

In order for these power projects to operate at the shortest possible time to augment power shortage by 1993, the zero-power plants' outright exemption from the DENR's ECC requirement for their construction and operation will be in order. We recommend that it be done, right away, to pave the way for project implementation.

Very truly yours,

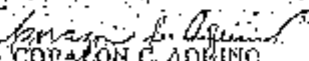

PABLO V. MALON
President

CONFORME:


FULGENCIO S. FACTORAN

Secretary, Department of Environment and Natural Resources

APPROVED:


CORASON C. AQUINO
President
Republic of the Philippines

