

PROACTIVATE



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**A transformational growth model
to secure humanity's future**

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INTRODUCTION

SUSTAINABLE DEVELOPMENT AND CLIMATE CHANGE

Concerns relating to the impact of anthropogenic activities on the environment date back to the nineteen twenties when A.C Pigou drew attention to the externalities generated by the production activities of corporations. The concern with externalities is basically a concern for the pollution of land and water that is concern about natural capital.. The production activities by adversely affecting natural capital have negative effects on human welfare(Pigou 1920).

Rachael Carson in her book Silent Spring (1962 Carson) argued against the indiscriminate use of insecticides. She stated that “It is not my intention that insecticides must never be used. I do contend that that we have put poisonous and biologically potent chemicals indiscriminately in the hands of persons largely or wholly ignorant of their potential for harm.” She explained how pesticides upset the balance of nature. She emphasized that pesticides is “As crude a weapon as the cave man’s club; the chemical barrage has been hurled against the fabric of life-a fabric on the one hand delicate and destructible and, on the other miraculously tough and resilient, and capable of striking back in unexpected ways.”

AL Gore was of the opinion that Silent Spring “Brought environmental issues to the attention not just to industry and government; it brought them to the public and put our democracy itself on the side of saving the earth.” This book made Al Gore think about the threats to the environment that are much more serious than washed out gullies-but much harder to see.”

The concept of deep ecology was put forward by Arne Naess (1972) when he made a presentation in Bucharest at the Third World Future Research Conference. In his talk he discussed the longer range background, the ecology movement and its concern with an ethic respecting nature and th inherent worth of other beings. Both historically and in the contemporary movement he saw two different forms of environmentalism, not necessarily incompatible with each other. One he called ‘the deep ecology movement’ and the other the ‘shallow ecology movement.’ The word deep referred to the level of questioning of our purposes and values when arguing in

environmental conflicts.. The deep movement involves deep questioning right down to fundamental root causes. The short term shallow approach stops before the ultimate level of fundamental change , often promoting technological fixes, recycling, increased automotive efficiency, export driven mono cultural organic agriculture based on the same assumption oriented values and methods of the industrial economy. The long range deep approach involves redesigning whole systems based on values and methods that truly preserve the ecological and cultural diversity of natural systems.

It is a holistic approach to seeing ourselves as part of the earth. It shows that ecology is not just something out there but something we are part of and have a role to play in it.

It may be useful to digress here into the concept of ecology The Ecological Society of America (1993) defines ecology as “The scientific discipline that is concerned with the relationships between organisms and their past, present and future environments. These relationships include physical responses of individuals, structure and dynamics of population, interactions among species, organizations of biological communities, and processing of energy and matter in eco systems.”

According to the Institute of Social Ecology “Social Ecology integrates the study of human and natural eco systems through understanding the interrelationships of culture and nature. It advances a critical olistic world view and suggests that creative human enterprises can construct an alternative future re-harmonizing peoples relationships with the natural world aand by reharmonizing their relationships with each other.”

The World Charter on Nature 1982 states “Where potential adverse effects are not fully understood the activities are the should not proceed.”

Concerns relating to the environment led to the appointment by the United Nations General Assembly to the appointment of the World Commission on Environment and Development.(WCED) The Commission submitted its report on March 20,1987 which is the most comprehensive study on sustainable development. The definition of sustainable development namely that it is development that “meets the needs of the present without compromising the ability of future generations” has been quoted by almost every writer and speaker on sustainable development but the essentials of sustainable development as spelt out by WCED has not been given the attention it deserves.

The Commission viewed development not just as economic growth measured by the growth in gross development product(GDP) but as a development path “which sustained human progress not just in a few places for a few years, but for the entire planet into the distant future. Thus sustainable development becomes a goal not just for developing nations but for industrial ones as well... The planet is going through a period of dramatic growth and fundamental change. The growth in industrial production leads to profound impacts on the biosphere as the world invests in houses, transport and industries. Most of the economic growth pulls raw materials from forests, soils, seas and waterways.... We have in the past been concerned about the impact on economic growth upon the environment . We are now forced to concern ourselves with the impact of ecological stress, degradation of soils, water regimes, atmosphere ad forests upon our economic prospects. We have in the more recent past been forced to face up to a sharp increase in economic interdependence among nations. Ecology and economy are becoming even more interwoven locally, regionally, nationally and globally into a seamless net of cause and effects.”

Let us take a look at Al Gore’s (1992) book Earth In The Balance from the point of view of :

- 1.. What creates the imbalance?
2. How does one bring about the balance?

Al Gore’s answer to the first question is: “ We lost our feeling of connectedness to the rest of nature. We now dare to wonder: Are we so unique and powerful as many of us act –and think- as if the answer is yes. It is now all too easy to regard the earth as a collection of ‘resources’ having an intrinsic value no longer than their usefulness at the moment. Thanks in part to the scientific revolution we organize our knowledge of the natural world into smaller and smaller segments assume that and assume that the connections between these separate compartments aren’t really important. In our fascination with the parts of nature we forget to see the whole.

The ecological perspective begins with a view of the whole, an understanding of how the various parts of nature interact in patterns cannot treat the earth as something separate from human civilization. We are part of the whole too and looking at it ultimately means also looking at ourselves. And if we do not see that the human part of the nature has an increasingly powerful influence over the whole of nature-that we are in effect a natural force just like the winds and the tides-then we will not be able to se how dangerously we are threatening to push the earth out of balance.” (introduction piii-iii)

Now let us see how Al Gore answers the second question how does one bring about the balance? His answer is, “if sustainable development is to become feasible our approach to economic policy must be transformed. At the earliest opportunity world leaders and their economic ministers should convene a global summit to discuss new approaches to this challenge. Their agenda should include a new set of rules of the road.

Following is a summary of those I have proposed.

1. The definition of GNP should be changed to include environmental costs and benefits.
2. The definition of productivity should be changed to reflect calculations of environmental improvement or decline
3. Governments should agree to eliminate the use of inappropriate discount rates and adopt better ways to eliminate to quantify the effects of our decisions on future generations
4. Governments should eliminate public expenditures that subsidize and encourage environmentally destructive activities,
5. Governments should improve the amount and accuracy of information on the environmental impacts of products and provide it to consumers.
6. Governments should adopt measures to encourage full disclosure of companies’ responsibility for environmental damages
7. Governments should adopt programmes which should assist companies in the study of the costs and benefits of environmental efficiency
8. Nations should revise their anti-trust laws to encompass environmental harm
9. Governments should require the incorporation of standards to protect the environment in treaties and international agreements, including trade agreements.
10. Environmental concerns should be integrated into criteria used by international finance institutions for the evaluation of all proposed grants of development funds.
11. Governments should make accelerated use of debt-for nature swaps to encourage environmental swaps to encourage environmental stewardships in return for debt relief
12. Governments should develop an international treaty establishing limits on CO2 emissions by country and a market for the trading of emission rights among countries that need more and countries have an excess amount.’

As one reads these recommendations one is left wondering whether the sole responsibility for improving the environment rests with government? What is the

role of the responsible citizen? In vain does one look for the answer to how is the relationship of human beings with nature to be established since the imbalance in the earth is caused by a misunderstanding of the causes of this imbalance

Herman Daly has suggested three simple rules to restore order in the natural system

- (1) For a renewable resource –soil, water, forest, fish-the sustainable rate of use can be no greater than the rate of regeneration
- (2) For non-renewable resources –fossil fuel, high grade mineral ore, ground water-the sustainable rate of use can be no greater than the rate at which a renewable resource used sustainably can be substituted for it.
- (3) For a pollutant the sustainable rate of emission can be no greater than the rate at which the pollutant can be recycled, absorbed and rendered harmless by the environment..

Donella Meadows in *The Limits: Sources and Sinks* (1992) states that “given the incompleteness of human understanding about limits” on the basis of the evidence it is clear that:-

- “Human society is now using resources and producing wastes at rates that are not sustainable.
- These excessive rates of throughput are not necessary. Technical, distributional and institutional changes could decrease them greatly while maintaining and even improving the quality of life of the world’s people
- But even with much more effective institutions and technologies the limits of the earth’s ability to support population and capital are close at hand not more than a doubling or two away.” (Meadows 1992).

UNFCC

Article 2 of the UNFCC Convention specifies (1992) the objectives of the Convention.

“The ultimate objective of the Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve in accordance with the relevant provisions of the Convention, a stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change to ensure that food production is not threatened to enable economic development to proceed in a sustainable manner..”

The IPCC Third Assessment Report (TAR) identified five reasons for concern in the context of Art 2 of UNFCCC (i) risks to unique and threatened systems (ii) risks from extreme climate events (iii) regional distribution of events (iv) aggregate impacts and (v) risks from large scale discontinuities.

The IPCC Reports have not used the term 'Natural Capital' but they are concerned with the services which natural capital provides. They divide these services into two categories namely (1) natural capital as a sink for greenhouse gases and (2) The ecosystem services provided by natural capital.

Let us first consider natural capital as a sink for greenhouse gases as examined in the IPCC Special Report on Carbon Dioxide, Capture and Storage. The Report points out that CO₂ capture and storage involves capturing CO₂ from the combustion of fossil fuels or from the preparation of fossil fuels. Capturing CO₂ involves separating CO₂ from other gases. Once CO₂ has been separated then it needs to be transported to a storage site where it will be stored away from the atmosphere for a very long time. (IPCC2001a)

The stabilization of concentrations will only occur when the rate of addition of GHGs to the atmosphere equals the rate at which natural systems can remove them.-in other words when the rate of anthropogenic emissions is balanced by the uptake of natural processes such as atmospheric reactions, net transfer to the oceans or uptake by the biosphere (para1.1)

“Natural sinks for CO₂ play a significant role in determining the concentration of CO₂ in the atmosphere. Examples of natural sinks that might be used for the purpose include forests and soils. (IPC 2000b) Enhancing these sinks through agricultural and forestry practices could significantly improve their storage capacity but this may be limited by land use practice and social and environmental practices.”

The IPCC Special Report on Ocean Storage observes “Various technologies have been envisaged to enable and increase CO₂ storage. One class of options involves storing a relatively pure stream of carbon dioxide that has been captured and compressed. This CO₂ can be placed on a ship, injected directly into the ocean or deposited on the sea floor. CO₂ loaded on ships could either be dispersed from a towed pipe or transported to fixed platform feeding a CO₂ lake on the seafloor. Such CO₂ lakes must be deeper than 3 kms. Where CO₂ is denser than sea water. Any of these approaches can be used in conjunction with carbonate minerals.” (6.1.1)

The Special Report Working Group II 1997 assesses the vulnerability of natural systems of major regions of the world to climate change. “Vulnerability is a function of the sensitivity of a system to changes to climate change.(the degree to which a system will respond to a given change in climate including both beneficial and harmful effects) and the ability to adapt the system to changes in climate.”

The Report observed that “Ecosystems are of fundamental importance to environmental functions and to sustainability .and they provide many goods and services critical to individuals and societies. These goods and services include (i) providing food, fibre, fodder, shelter, medicine and energy.(ii) processing and storing carbon (iii) assimilating wastes, (iv) purifying water, regulating water run off and moderating floods (v) building soils and reducing degradation (vi) providing opportunities for recreation (vii) housing the earth’s entire reservoir of genetic and species diversity. (4.1)

In his Nobel Prize lecture Dr.R.K Pachauri stated that “IPCC produces key scientific material that is of highest relevance to policy making, and is agreed word by word by all governments from the most skeptical to the most confident. The difficult process is made possible by the tremendous strengths of the underlying scientific and technical material included in the IPCC reports”

Dr. Pachauri further said “Neglect in protecting our heritage of natural resources could extremely harmful for the human race and for all species that share common space on planet earth. Indeed there are many lessons in human history which provide adequate warning about the chaos and destruction that could take place if we remain guilty of myopic indifference to the progressive erosion and decline of nature’s resources.”

Dr.Pachauri clarified that that the IPCC by its very nature is an organization that does not provide any directions that are policy prescriptive; it has not provided any directions on how conflict inherent in the social implications of climate change could be avoided or contained.

In Natural Capitalism Lovins L ; Hawkins P) (1999) the term natural capital is regarded as the sum total of the ecological systems that support life. It is different from human made capital in that natural capital cannot be produced by human activity. “The term natural in ‘natural capitalism’ is meant to indicate the movement of capitalism to less wasteful technology and its moving in the direction ‘naturally’ without political effort, which is carefully discounted by proponents of Natural Capitalism. But does it

seem likely that global capitalism will take such a direction of its own volition when to date unhampered movement has taken it in precisely the opposite direction, to shedding labour at the expense of increasing materials and energy throughput? The social forces that could or would make 'natural capitalism' take a benign direction of this kind when it is basically unaccountable remain unexplained.(2002 Val Plumwood)

“Capitalism is going green naturally, Levins et al suggest because greater efficiency in materials and energy is in its own interests. But capitalism must surely be divided on this score, since such a reduction is not in the interests of materials and energy producers, a big proportion of the corporate cast and some of the most powerful. In Natural Capital efficiency in energy and materials is presented as the whole answer when in fact it is only a portion of the answer. If we used a fraction of the resources that we currently use to build hyper efficient solar powered trawlers or bull dozers that continue to strip what is left in the oceans and forests the biosphere could still be seriously damaged. More materials efficient technologies can be used to destroy nature more efficiently especially where there is no deeper recognition of limits or of our dependency on healthy ecological limits.”

The MS Swaminathan Research Foundation started its work about twenty years ago in the thematic areas of coastal systems , biotechnology, biodiversity, eco technology, food security and information, education and communication. The approach is based on strategic and participatory research, capacity building, networking and partnership building based on the principles of social inclusion in access to technologies which will help to increase income and environment. Research and outreach strategies have been devised to bridge the rich-poor and gender divides in the areas of information , knowledge and skill empowerment

Amartya Sen in his Nobel Prize speech said “In understanding poverty and inequality there is a strong case for looking at real deprivation and not merely at mental reactions to these deprivations. There have been many recent investigations of gender inequality and women’s deprivation in terms of under nutrition, clinical diagnosed morbidity, observed illiteracy and even unexpected high mortality. Such interpersonal comparisons can easily be a significant basis of studies of poverty and of inequality between the sexes. They can be accommodated within the broad framework of welfare economics and social choice.”

In the concluding session of the United Nations Conference on Environment and Development the then United nations Secretary General sent a message of caution to his audience “one day we will have to do better.” Yet a decade later in 2002 the

incumbent UN Secretary General Kofi Aman said in a lecture at the London School of Economics that the concept of sustainable development and environmental protection had “Become a pious invocation rather than an urgent call to concrete action that it should be.” Even today the position remains unchanged.

Even at the corporate level, vision and mission statements, though generally very impressive, have not for a majority of companies been translated into strategy and implementation. Some companies are of course exemplary in the formulation of their strategy and its effective implementation,

THE BIRTH OF PROACTIVATE

This very brief review of some of the literature on sustainable development has highlighted the concerns generated by the patterns of economic growth, particularly the adverse impact of human activities on natural capital and its impact on equity among generations.

Individuals and institutions have focused on some components of sustainable development that appeared to be the most important but so far no one has taken a holistic approach to sustainable development by specifying specific areas for action nor has execution been emphasized.

Dr. Madhav Mehra sensitive to the environmental, social and economic injustice resulting from the patterns of growth as they have emerged over the years and the consequent adverse impacts on climate change which have further aggravated the injustices and deeply concerned about the inaction to remedy injustice, has developed a holistic model of action for moving on the path to sustainable development

PROACTIVATE weaves together the different strands of sustainable development and is a testament to Dr. Mehra’s unequalled ability to create a holistic model of international brand that will bring about a paradigm shift in policies and programmes for sustainable development

In June 2006 the model PROACTIVATE was first presented at the Eighth World Congress held at Palampur, Himachal Pradesh, India. The concept was further developed in an article by Dr. Mehra published in the Quality Times of July 2007.

The Third Global Conference on Social Responsibility was held in Portugal on 15-17 February 2008. The participants at this conference recommended the adoption of

the PROACTIVATE as a model for sustainable development. This model was further discussed and refined at the tenth World Congress on Environmental Management at Palampur.

The PROACTIVATE model has eleven constituents which are set out below:

P-Price Natural Capital

R-Radically Increase Energy Efficiency

O-Opt for Minimalist Life Style

A-Adopt Closed Loop and Zero Waste Systems

C-Capture and Sequester CO₂

T-Turn to Renewables

I-Invest in Green Issues

V-Vigorously Pursue Market Mechanisms

E-Execution and Not Sensationalisation

In the following chapters we examine the individual components of PROACTIVATE and finally show the links among the individual components which result in a holistic model which if followed will lead the economy on the paths to sustainable development

1.Lovins L; Hawkins P. 1999 Natural Capitalism : The Next Industrial Revolution, Earthscan, London

2.Val Plumwood 2002 Environmental Culture, Routledge, London and New York pp 6-7

3. op cit p.7

CHAPTER 1

PRICING NATURAL CAPITAL

Introduction

The two issues we need to consider here are why do we need to price natural capital and what are the possible methodologies for pricing natural capital? But even before we can answer these questions there are some other questions we need to answer: (i) what is natural capital (ii) how does it relate to ecology? (iii) What are the eco services provided by natural capital?

Natural Capital

Natural capital consists of non-living components and living components. The non-living components are water, soil, sun and air and the living components called organisms are plants, fish and animals. The relationships between the living and non-living components of natural capital is like an intricate tapestry which can only be understood by a very close look at each individual thread and the design woven by it to understand the whole tapestry.

The biotic and non-biotic components of natural capital constitute the biosphere. If we break down the biosphere into small distinct areas we get eco systems. Some examples of ecosystems are deserts, forests, mountains, oceans, lakes, pond, and wetlands. It follows that ecosystems can be of various sizes. A group of living things within an ecosystem is called a community. Within a community organisms typically reproduce within their own kind. Members of the same species sharing a habitat are called a population

Each kind of organism requires certain environmental features to provide what it needs to live. These places are called habitats. A habitat is where plants and species are naturally found and organisms are adapted to particular habitats. The type of vegetation in a habitat depends on climate, humidity, the amount of sunlight and rainfall that are available and the types of soil. Since plants provide food for other

organisms their appearance or disappearance has far reaching effects on other living things in a habitat.

The effects an organism has on its surroundings and how the surroundings affect the organism are collectively referred to as its ecological niche.

We have just examined how each organism fits into a system of biological organization. We now need to look at how organisms interact with each other. The most obvious way of interaction between living things in a community is the food they eat. This connection is called a food chain because one kind of organism is food for another.

The biotic components are of two kinds: producers and consumers. The producers are called autotrophs that are they nourish themselves. By utilizing the sun's energy they manufacture the complex organic molecules needed to nourish themselves and create or produce food for the next group of organisms .Examples of the first level of food chains are plants and algae.

The consumers in biotic communities called heterotrophs are unable to manufacture or produce food for themselves so they rely on producers to provide food for them. The consumers can be divided into three groups namely primary, secondary and tertiary. Primary consumers get their energy for sustenance and growth from nature Animals like goats or cows are primary consumers. Secondary consumers are those consumers who eat the primary consumers thus getting their energy indirectly from the primary producers. Tertiary consumers are those who obtain their food energy through most indirect means. These animals eat a secondary consumer who ate a primary consumer who in turn ate a producer.

Decomposers are organisms that nourish themselves by breaking down dead organic matter. Organic matter contains carbon. Decomposers not only obtain energy and nutrients for themselves, they perform certain vital functions in an eco system such as cleaning up.

The abiotic component of natural capital consists of (i) air, water and soil (ii) organic substances (iii) climate regimes, temperature and other physical factors that influence the environment and hence the conditions of existence of living organisms. Air, water and soil each consists mainly of inorganic substances in various compound forms They are available either in particulate form in soils or dissolved in water or gaseous molecules in the air. Carbon, oxygen, nitrogen are examples of the basic

inorganic substances. Carbon is an essential element in living organisms. Carbohydrates which act as fuel for living bodies are made up of carbon compounds and also contain nitrogen. Amino acids the building blocs of protein are also carbon compounds that also contain nitrogen. Carbon dioxide from the atmosphere is one of the components in the process of photosynthesis.

During photo synthesis plants take in CO₂ from the air through their leaves and obtain water from the soil through their roots. They combine this CO₂ with water (H₂O) using the light energy from the sun to make the sugar which is the source of energy from the plant. Oxygen is released as a by product of photo synthesis.

The sugar molecule produced during photosynthesis is a basic building block for many other kinds of compounds which the plant uses to maintain and grow. As plants grow they store more carbon containing compounds in their structure Decomposure organisms (bacteria and fungi) obtain their energy and building materials from the waste products of organisms by the same process of respiration. Thus even the carbon in wastes can be recycled.

The oxygen cycle involves the circulation of oxygen through various environmental compartments. Oxygen is released into the air by green plants during photosynthesis. Because of its role in these two processes, the circulation of oxygen is closely tied to the circulation of carbon.

Nitrogen fixation occurs in various ways but it is most often through biological means. Special nitrogen fixing bacteria algae and some lichens that live in the soil, convert atmospheric nitrogen into ammonia and similar compounds. Carbon, oxygen, nitrogen, silicon, iron, manganese, phosphorous sulphur and others are examples of the basic inorganic substances whose compounds are constituents of the abiotic environment.

Now let us look at the inorganic substances. Living organisms convert inorganic chemicals and organize them into organic chemical compounds which build organisms and keep them functioning. Living organisms are available in widely dispersed forms in the non-living environment. The four major types of organic compounds are carbohydrates (sugar and starch), proteins (enzymes) and fats (lipids) and nucleic acids (DNA, RNA)

We have just classified natural resources according to their biological characteristics. We now classify them on a time scale. On the basis of the time scale we classify

natural resources into depletable and renewable. Depletable resources are those that are made available only once by nature for example coal or gas deposits. Renewable resources are those where the utilization of the resource for consumption either directly or as an input for production is made up by further production of the natural resource. Examples of renewable resources are forests, fish and livestock.

Climatic Conditions

Climate is a category of abiotic component of a biosphere and may be considered a natural resource. In other words it is a manageable environmental asset. Climate is a global public good which is not owned by anyone but can be used by everyone. Climate may be viewed as a factor input for example in agriculture or as a final consumption good. Concerns arise because of the variations in climatic conditions. These variations can be characterized by their intensity, spatial extent and duration.

Climate change represents a long term shift in mean climatic conditions. Concerns arise when anthropogenic actions lead to shifts in climate conditions. We see that there is an interdependence of biotic and abiotic elements and this interdependence creates an in built mechanism to stabilize the eco system. This self regulating and self perpetuating mechanism characterizes the ecological balance of the system.

Historical Evolution of Concerns Relating to Natural Capital

The concerns relating to the deterioration and depletion of natural capital may be traced right back to Malthus and Ricardo who painted a really bleak scenario of the deteriorating quality of agricultural land and growing population. J.S Mill emphasized the importance of natural capital for the quality of life and expressed concerns about the deterioration in natural capital. (1848) "Solitude in the sense of being often alone is essential for any depth of meditation or of character and solitude in the presence of natural beauty and grandeur is the cradle of thoughts and aspirations which are not only good for the individual but which society could ill do without. Nor is there much satisfaction in contemplating the world with nothing left to the spontaneous activity of nature, with every rood of land brought into cultivation which is capable of growing food for human beings , every flowery waste or natural pasture ploughed up, all quadrupeds or birds which are not domesticated for man's use exterminated as his rivals for food , every hedgegrow or superfluous tree rooted out, and scarcely a place left where a wild shrub or flower could grow without being eradicated as weed in the name of improved agriculture. If the earth must lose the great portion of its

pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not a better or happier population. I sincerely hope for the sake of posterity that they will be content to be stationary long before necessity compels them to it”¹

William Stanley Jevons (1865) in *The Coal Question* observed “Coal in truth stands out not beside but entirely above all other commodities. It is the material energy of the country-the universal aid-the factor in everything we do. With coal almost any feat is possible or easy. Without it we are thrown back into the laborious poverty of early times. With such facts familiarity before us it can be no matter of surprise that year by year we make larger draughts upon a material of such myriad qualities-of such miraculous powers.”

Because the demand for coal grew exponentially and supplies were not unlimited Jevons foresaw that the limits to prosperity would be reached earlier than envisaged. “I must point out the painful fact that such a rate of growth will before long render our consumption of coal comparable with the total supply. In the increasing depth and difficulty of coal mining we shall meet that vague , but inevitable boundary that will stop our progress.”

The Declaration of the United Nations Conference on the Human Environment was deeply concerned about the need to preserve the natural resources of the earth. Four of the twenty-six Principles (The Stockholm Principles) were concerned with natural resources and eco-services:

Principle 2- The natural resources of the earth including the air, water, land, flora and fauna and especially representative samples of natural eco systems must be safeguarded for the benefit of present and future generations through careful planning or management as appropriate.

Principle 3- The capacity of the earth to produce vital renewable resources must be maintained and wherever practicable, restored or improved.

Principle 4- Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperilled by a combination of adverse factors. Nature conservation, including wildlife must therefore must receive importance in planning for economic development.

Principle 5- The non-renewable resources of the earth must be employed in such a way as to guard against the danger of their future exhaustion and to ensure that the benefits of such employment are shared by all mankind

“Man’s dependency on nature goes very deep indeed. His use and misuse of resources is only part of the picture. As man has become the dominant force in shaping the life systems on the Earth, his ascent has been accompanied by a reduction of the biological diversity in Nature. Species not perceived to be in the service of man have been systematically reduced in number or eliminated. Should this trend continue, Earth will soon be inhabited by a diminished number of species. Today we understand much better than our ancestors that the existence of all life on Earth-our own included- depends on the stability of the ecological system. An Earth with less diverse inhabitants might not continue to possess the stability essential for adaptation and survival. And if our ecosystem breaks down –even if only temporarily – the effect on mankind will be calamitous. The ultimate irony confronting technological man may well reside in the fact that nature’s most potent threat to human welfare are not her destructive power –earthquakes, tornadoes, hurricanes- but the fragility of the web of life, the delicacy of animate and inanimate realms so inextricably in the processes of life.” (Mihajlo Mesarovic and Eduard Pestel 1974)

“The long term survival of human society and the stability of the natural system upon which human society depends should be the highest goal of any policy. Therefore risks to the total system, should be minimized including implicit dependence on as yet unproven technologies.

That since survival has the top priority the costs of social change are more tolerable than the risk of physical destruction of resources or of environmental integrity It is far better to develop it is far better to develop new social norms and institutions consistent with zero growth than to risk the ecological damage that could result from disparate physical measures to sustain growth.”(Meadows 1977)

“Mounting destruction of the earth’s capacity to support life is not, we believe an inescapable destiny. The record of stagnation and decline can be reversed; these people

can begin to master their environment and thus gain hope for the future. But there must be immediate intervention to attack the root causes of poverty, for the stress on the economic system which is caused by peoples needs makes it harder in turn

for the vegetation and land to withstand the extremes of climate. What might elsewhere be an awkward period of low rainfall becomes in these regions a period of famine and reversion to desert. These countries must avoid the disastrous consequences of the deteriorating eco system: but the task is immense.” (The Independent Commission on International Development Issues 1980).

“A population and economy are in overshoot mode when they are drawing resources or emitting pollutants at an unsustainable rate but the stresses on the support system are not yet strong enough to reduce the rates of withdrawal or emissions.... A period of overshoot does not necessarily lead to collapse. It calls for fast and determined action if collapse is to be avoided. The resource base must be protected quickly. The drains on it must be sharply reduced.” (Meadows 1992)

Convention on Biological Diversity

The Convention on Biological Diversity which came into force in December 1993 had three major objectives: (1) conservation of biological diversity (2) the sustainable use of its components (3) and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

In ratifying the Convention countries committed themselves to (i) the conservation of biological diversity (ii) the sustainable use of its components (iii) the fair and equitable sharing of its benefits arising from the utilization of genetic resources. In ratifying the convention countries committed themselves to inter alia (a) developing national strategies and plans for the conservation and sustainable use of biological diversity (b) integrating biological diversity issues into relevant sectoral or cross sectoral plans; (c) identifying and monitoring the components of biological diversity (d) establishing a number of measures to conserve biodiversity such as through creation of protected areas.

In March 2008 on the occasion of the International Convention on Forests, Bioenergy and Climate Change at Casablanca, Morocco, Dr. Ahmed Djoghlaoui, Executive Secretary of the Convention on Biological Diversity, said in his message “Until now years of observation and data collection have allowed scientists to discern trends and make reliable predictions to facilitate effective forest management and conservation. However with the reality of climate change taking hold these trends and predictions no longer provide sufficient information. Climate change has introduced many new variables:

Managers must adapt their techniques accordingly and decision makers have to act in situations of increasing complexities and uncertainties. Every field is facing new hurdles for which solutions have yet to be assessed and tested.”

“Intact eco forest systems have an immense recreational, cultural, spiritual and aesthetic value in addition to important economic value of timber and non-timber forest products. The conservation and sustainable use of forest bio diversity, and the equitable sharing of its benefits are vital for our quality of life and are key to overcoming the challenges of global climate change.”

Eco services Provided by Natural Capital

The ecosystem and eco services have been studied in detail by the Millennium Ecosystem Assessment (MA). It was a four year scientific assessment of the consequences of ecosystem change for human well being. According to MA the ecosystem services are the benefits that human beings obtain from the ecosystems and they are produced by the interactions within the ecosystem. Ecosystems like forests, grasslands, mangroves, and urban areas provide different services to society. These include provisioning, supporting, regulating, and cultural. The provisioning services are food, fresh water, wood and fibre as well as fuel. The supporting services are nutrient cycling, soil formation, and primary production. The regulating services encompass climate regulation, flood regulation, disease regulation, and primary production. The cultural services provided are aesthetic, spiritual, educational and recreational.

According to the Millennium Ecosystem Assessment all these services are significant for human well being because (a) they provide security via personal safety (b) basic material for good life such as adequate livelihoods, sufficient nutritious food, shelter and access to goods (c) freedom of choice and action which involves an opportunity to be able to achieve what an individual values doing and being (d) health which means strength, feeling well, access to clean air and water. (e) good social relations which include social cohesion, mutual respect and ability to help others.

As the demands for the services provided by the ecosystem grow and the ability of the ecosystem to meet these demands is eroded increasingly difficult challenges must be confronted. Some of some of these challenges are:

- How do we meet the growing demand for food without further harming the environment or the integrity of the food supply chain?

- Given the uneven distribution of the supply of water how do we meet agricultural, industrial and consumption needs around the world?
- Given the projected increase in the demands for energy what are the most efficient and effective strategies to produce energy while also minimizing impacts on air quality and climate.
- How do we balance conservation of biodiversity with opportunities for economic development associated with alteration or conservation of habitats?
- How do we balance increasing demand for sea food and expanding demand for aquaculture while promoting the health of fresh and coastal waters and restoring depleted wild fisheries.

We shall focus here on the main findings of the Report of the Millennium Ecosystem.

Over the past 50 years humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fibre and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth.

The extent to which the world's ecosystems have been altered by human activity over the last 50 years is truly staggering. For example:

- Cultivated systems now cover one quarter of earth's territorial surface
- Since the early 20th century around 20% of coral reefs have been lost and a further 20% degraded. 35% of mangrove areas have been lost over this same period.
- Three to six times as much water is now held in reservoirs as in natural rivers

These alterations have led to fundamental changes in the diversity of life on earth and a dramatic loss of biodiversity. Over the past few hundred years humans have increased the natural extinction rate by as much as 1000 and now some 10-30% of mammal, bird and amphibian species are currently threatened to a medium to high certainty with extinction

These changes are a function of increasing demand for ecosystem services as since 1960 the world's population doubled to a billion people and the global economy increased over 6 times. The demand was met by consuming a greater proportion of the output of certain ecosystem services, such as taking more fish from the sea. It was also met by increasing the productivity of certain services through the application of new

technologies such as fertilizers, as well as through increasing the area managed for certain services such as crop and livestock production

The conclusions of the MA are clear. Human activity is fundamentally and extensively changing the world around us leading to extinction on a massive scale.. The extent of this loss should not be underestimated. It points to a sixth great extinction, on a par with historic global extinction episodes caused by asteroid impacts.

The changes that have been made to ecosystems have contributed to substantial net gains in human well being and economic development, but these gains have been achieved at growing costs in the form of degradation of many ecosystem services, increased risks of non-linear changes and the exacerbations of poverty for some groups of people. These problems unless addressed, will substantially diminish the benefits that future generations obtain from future services.

Globally and for most individual countries, the changes that have been made to ecosystem services have led to substantial gains to human well being and national development. These changes have been required to meet the demand for food, water and other ecosystem services leading to improved human health and a reduction in the number of people who are malnourished.

However the result of these changes in ecosystem services and the degree which they have exploited, means that around 60% of the ecosystem services evaluated in the MA are being degraded or used unsustainably. These include capture fisheries, water supply, natural hazard protection and climate regulation. The capture fisheries and fresh water systems are now so over exploited that they cannot meet even current demands, let alone future demands.

The substantial gains that humans have experienced by changing some ecosystem services have been at the expense, to varying degrees of other services. For increasing agriculture typically involves an increase in fertilizer and water use and the expansion into natural lands leading to a decline in water quality and availability and loss of biodiversity.

There has been a failure to consider the loss of certain ecosystem services since most management decisions are based on those services that enter into the markets. This means that the non-market benefits are not considered which may lead to

their degradation or loss. The value of these non-market benefits can be high and may be more valuable than those that pass through the markets.

The MA notes that that while degradation of some services overall may be justified by increase in well being often more degradation takes place than is in the society's interests. One reason for this is that that services being degraded are held in common so no one person feels an incentive to maintain the service. This also means that where degradation may harm specific individuals, there is no market mechanism to compensate them.

Despite dramatic increases in global human well being from the exploitation of ecoservices , levels of poverty remain high, inequities are growing and many people do not have access to ecosystem services. Degradation of ecosystem services accentuates this by exacerbating poverty and can also be the principle factor in causing poverty.

The continued damage caused to ecosystem services will male it harder to eradicate poverty

The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving to achieving the Millennium Development Goals.

The Millennium Developmen goals are:

1. Eradicate extreme poverty and hunger
2. Achieve Universal Primary Education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve material health
6. Combat HIV/AIDS, malaria and other diseases.
7. Ensure environmental sustainability
8. Develop a global partnership for development

The key messages by the Ecosystem Assessment Board are:

- Everyone in the world depends on nature and ecosystem services to provide the conditions for a decent, healthy and secure life
- Humans have made unprecedented changes in eco systems in recent decades

to meet growing demands for food , fresh water, fibre and energy.

- These changes have helped to improve the lives of billions, but at the same time they weakened nature's ability to deliver other key sources such as purification of land and water, protection from disasters and the provision of medicines
- Among the outstanding problems identified by this assessment are the dire state of many of the world's fish stocks, and intense vulnerability of the two billion people living in the dry regions to the loss of ecosystem services including water supply and the growing threat to eco systems from climate change and the nutrient population.
- Human activities have taken the planet to the edge of a massive of species extinctions further threatening our own well being.
- The loss of services derived from eco systems is a significant barrier to the achievement of the Millennium Development goals to reduce poverty, hunger and disease
- The pressure on eco systems will increase globally in coming decades unless human actions and attitudes change
- Measures to conserve natural resources are more likely to succeed if local communities are given ownership of them, share the benefits and are involved in decisions
- Even today's technology and knowledge can reduce considerably the impact on ecosystems .They are unlikely to be deployed fully however, until ecosystem services cease to be perceived as free and limitless and their full value is taken into account
- Better protection of natural assets will require coordinated efforts across all sections of government and business and international institutions. The productivity of ecosystems depends on policy choices on investment, trade, subsidy, taxation and regulation among others

Actions now will determine the legacy of natural capital and ecosystem services we bequeath the future generations.

The message ends with a very optimistic note that "it lies within the power of human societies to save the strains we are putting on the natural services of the planet while continuing to use them to bring better living standards to all.

Achieving this however will require radical changes in the way nature is treated at every level of decision making. Resilience and abundance can no longer be confused with indestructibility and infinite supply.

The warning signs are there for all of us to see. The future lies in our hands.”

Ecosystem damage can be slowed and reversed but this will require concerted action.

The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met under some scenarios that MA has considered, but these involve significant changes in policies, institutions and practices that are not currently under way.

The Report acknowledged that past actions to slow or reverse ecosystem decline has proved successful such as the use of protected areas, it concluded that generally this action has failed to keep pace with growing pressures and demands.

The MA also found that degradation can rarely be reversed without addressing one or more of the five indirect drivers of eco system change: population change (including growth and migration), changes in socioeconomic activity (including economic growth and trade patterns) socio political factors (including presence of conflict and participation in decision making, cultural factors and technological change. These factors influence the production and consumption and consumption of eco system services and how sustainable this is. The MA found that action to reduce ecosystem degradation often fails to address these indirect drivers.

Approach to Natural Capital

What should be our approach to Natural Capital? The answer is found in Herman Daly’s farewell speech at the World Bank when he resigned in 1994 to take up academic work. He said stop counting the consumption of natural capital as income. Income is by definition the maximum amount that society can consume this year and still be able to consume the same amount next year. Thus sustainability is built into the very definition of income. But the productivity capacity that must be maintained intact has traditionally been thought of as man made capital only, excluding natural capital. We have habitually counted natural capital as a free good. This might have been justified in yesterdays empty world but in today’s free world it is anti economic. The error of implicitly counting natural capital as consumption is customary in three areas: (1) the system of national accounts (2) evaluation of projects that deplete natural capital and (3) international balance of payments accounting.”

Salah El Sarafy is of the view that “that the treatment of income from renewable natural resources such as forests which have to be maintained through replanting

or fisheries which have to be restocked is more straight forward. Where such replanting or restocking is effected at technologically accepted rates that would keep capital intact these activities can be charged against the gross returns

Pricing Natural Capital

Pricing is the key for regulating the supply as well as the demand of natural capital and the ecosystem services among competing uses. We therefore need to consider how can the stock of natural non-renewable capital be priced and what could be the methodology of prices ecosystem services?

Several methods of pricing natural capital have been devised even before the MA report was published but it was only after the publication of the MA Report that Guidelines for evaluating ecosystem services were published by DEFRA.

We shall first very briefly consider the methodologies of pricing natural capital before the publication of the MA report and then examine the methodology suggested by DEFRA.

The two methods which have been put forward for valuing the environment for valuing the environment were the Travel Cost Method and the Contingent Valuation Method.

The Travel Cost Method has been used for assessing the demand for natural resources such as natural parks which cater to outdoor recreational activities. In order to enjoy the services provided by these natural amenities a person has to travel to these places.

The travel costs depend on the distance to be traveled which means money spent on traveling. In addition to the traveling expenses expenditure is incurred on the entry tickets. The total costs represent the market value of the recreational park.

The Contingent Valuation Method introduces the market via the Willingness To Pay Method.. The Contingent Valuation procedure poses the question how much would people be willing to pay to prevent the loss of some particular environmental constituent and ask what would be the acceptable compensation. Very likely the figure for compensation will be higher than the figure for willingness to pay. It will thus be seen that the Willingness to Pay method is not very useful for formulation of policies or administration of Environmental justice.

Pricing Natural Capital

We shall examine here pricing of natural capital under the following heads::

- (1) Pricing non-renewable resources
- (2) Pricing eco services
- (3) Pricing water
- (4) Pricing air.

Pricing of non-renewable resources

The pricing of exhaustible resources can be traced to the seminal article "The Economics of Exhaustible Resources by Harold Hotelling (1931) The main questions addressed were: How much of the proceeds of a mine should be reckoned as income and how much as return on capital? What is the value of a mine when its contents are supposedly fully known and what is the effect of uncertainty of estimate? If a mine owner produces too

rapidly he will depress the price perhaps to zero. If he produces too slowly his profits though larger may be postponed further into the future than the rate of interest warrants.. Where is his golden mean? And how does this profitable rate of production vary as exhaustion approaches.? Is it more profitable to complete the production within a finite time, to extend it indefinitely in such a way in such a way that the amount remaining in the mine approaches zero as a limit or to exploit so slowly that the mining operations will not only continue at a diminishing rate for ever but leave an amount in the ground which does not approach zero?

Hotelling approaches the problem of pricing under free competition. His logic is that it is a matter of indifference to the mine owner that he receives for a unit of his produce price p_0 now or a price $p_0e^{-\gamma t}$ after time t . According to him it is not unreasonable to expect that the price p will be a function of $p = p_0e^{-\gamma t}$ (1)

Where γ is the market rate of interest. The absolute level or the value of p_0 at time t_0 will depend upon demand and supply of the substance Let us assume that a is the supply, price is p and the quantity taken at time t is q then we have the equation $q = f(p,t)$

For the quantity taken at time t if the price is p we have the equation,

$$qdt = \int_0^T f(p_0 e^{yt}, t) dt = a \dots\dots\dots(2)$$

The upper limit T is the time of final exhaustion. Since q will then be zero we shall have the equation

$$f(p_0 e^{yT}, T) = 0$$

Hotelling points out that the nature of the solutions will depend on the function $f(p, t)$ which gives q. Hotelling assumes that it is a diminishing function of p, and depends on the time so that the equations have unique solutions.

What is the meaning of a continually rising price over time? As the price rises then assuming elastic demand the quantity will continuously fall until such time as the resource is exhausted. The final result of Hotelling's analysis is that the price of a non-renewable resource in a market would rise at the interest rate and the production trajectory would monotonically decline till the resource is exhausted.

The basic features of Hotelling's theory are (i) the rate of increase in exhaustible resource prices should be equivalent to the market rate of interest (ii) in a market with rising prices the rate of extraction should be constant (iii) in markets where demand is stable optimal extraction requires that the rate of extraction should decline over time.

Pricing Eco Services

Methodology of DEFRA for valuing eco services

DEFRA begins by asking the question why do we need to value ecosystem services? Its answers to this question are:

1. Valuing ecosystem services serves a number of purposes. Valuing the benefits—both current and future—from the natural environment illustrates its significant contribution to well being and high dependency of society on its ecological base. In one sense the natural environment is of infinite value since it underpins and supports all human activity. However for policy making, the more relevant application of valuation is to marginal changes in the environment.
2. In a policy appraisal context, valuing ecosystem services can help in determining whether a policy intervention that alters an ecosystem condition delivers a net benefit to society providing evidence on which to base decisions on 'value for money' and prioritizing funding, choosing between competing uses of land

use; assessing liability for damage to the environment and in wider communication eg. To the public and land managers on the value of the environment. Adopting an ecosystem services framework may provide new insights for policy development, for example in understanding how conservation policies in the future can be targeted to deliver our environmental priorities. It may also help in creating markets for services, including payments for ecosystem services as valuation provides evidence to underpin the development of such policy instruments.

3. Although guidance already exists to help capture some of these environmental impacts, using an ecosystem services framework potentially allows the analyst to capture the full range of environmental impacts more systemically, linking ecological effects to changes in human welfare. While many environmental impacts are incorporated within policy appraisal and progress has been made in valuing these impacts, in practice it has proved difficult to incorporate impacts on ecosystems with the risk that the value of these impacts are not fully accounted for in decision making. The use of ecosystem services as a framework is seen as an opportunity to overcome some of these difficulties, but many challenges remain. Regulating services represent one particular category of ecosystem services that is not generally considered within policy appraisal at present

The DEFRA guidelines provide five key steps in the valuation of ecosystem services:

1. Establish the environmental baseline
2. Identify and provide qualitative assessment of the potential impacts of policy options on ecosystem services
3. Quantify the impacts of policy options on specific ecosystem services
4. Assess the effects on human welfare
5. Value the changes in ecosystem services.

Valuation of Ecosystem Services

The DEFRA Guidelines primarily focus on economic valuation because it is consistent with use in a cost benefit analysis context. However non-economic benefits are also considered.

Total Economic Value

The value of natural resources is often considered within the framework Total Economic Value (TEV) and this framework can be used to value ecosystem services.

Total economic value consists of use value and non-use value.

Direct use value arises where individuals make individual make actual or planned use of an ecosystem service. This can be in the form of consumptive use

Indirect use value

Where individuals benefit from ecosystem services supported by a resource rather than directly using it. These ecosystem services are often not noticed by people until they are damaged or lost, yet they are very important. These services include key global life support functions such as the regulation of the chemical composition of the atmosphere and oceans and climate regulation, water regulation pollution filtering, soil retention and provision, nutrient cycling, waste decomposition, and pollination. Measuring indirect use values is often significantly more challenging than measuring . Changes in the quality or quantity of a service being provided are often difficult to measure or are poorly understood.

Option Value the value that people place on having the option to use the resource in the future even if they are not current users. These future uses may be direct or indirect An example would be of a national where people have no intention to visit it may still be willing to pay something in order to keep the option open in the future in the context of ecosystem and their services; option value describes the value placed on maintaining ecosystems and their component species and habitats for future possible uses some of which may not yet be known. Option value can also be thought of as an insurance e.g a wide species mix in a particular habitat can provide an insurance function; as conditions change different species may fulfill key ecological roles.

Non-use value also known as passive use is derived simply from the knowledge that the natural environment is maintained. There are three main components:

- Bequest value where individuals attach value from the fact the knowledge that the ecosystem resource will be passed on to future generations
- Altruistic value: where individuals attach values to the availability of the ecosystem resource to others in the current generation
- Existence value: derived from the existence of an ecosystem resource even though an individual has no actual or planned use for it; for example people are willing to pay for the preservation of whales through donations even if they know that they will never actually see a whale.

- Non-use value is relatively difficult to capture since individuals find it difficult to put a price on such values as they are rarely asked to do so. However in some circumstances non-use value may be more important than use value; for example a study on the value of Nature 200 sites in Scotland found that 99% of the overall value of such sites was non-use
- Quasi-option value refers to the value of information that can be secured by delaying a decision where outcomes are uncertain and where delay results in further information; for example delay in the development of forest land for agricultural use may result in known benefits in terms of crops that can be valued at market prices. The benefits of preserving the same piece of forested land may be unknown. Delaying the decision on the land development may enable us to learn more about the likely benefits of preserving the land (if it provides important ecosystem services such as habitat provision for threatened species). In such a situation quasi option value describes the benefit of the additional information that can be learned by delaying the decision to develop. However, finding examples of estimated quasi option value in environment economics literature is limited and further study is required.

We now examine how the methodology developed by DEFRA has been actually applied for evaluating natural capital.

Counting Canada's Natural Capital-Assessing the real value of Canada's Boreal Ecosystems.

A study on "Counting Canada's Natural Capital –Assessing the real value of Canada's Boreal Ecosystems" was carried out by the Pembina Institute.

The introduction to the report after the completed study states that "Canada's boreal region represents one of the world's most important ecological treasures. It is one of the world's most important ecological treasures. It is one of the last large areas of the world that still supports a full suite of nature species in large connected ecosystems shaped by powerful natural forces like wind and fire. There is growing recognition of the boreal region's natural capital-the resources, living systems, the ecosystem services provided by earth's biosphere including the ecosystems that support life.- and its role in providing for the well being of Canadians and life everywhere on the planet."

"This study is an attempt to bring to light a full account of the state and total economic value of Canada's boreal ecosystem services and natural capital assets. Such an

account of Canada's natural capital for an area as vast and important as the boreal region (which covers roughly 58.5 per cent of Canada's land mass), is vital to ensure the long term sustainability, integrity and prudent stewardship of which tend to favour the boreal region for the wellbeing of both Canada and the world."

Purpose of the study

"The absence of a proper account for the boreal region as a natural capital asset is unfortunate given that the precious network of ecosystems is subject to increasing industrial development pressures. These pressures and to the potential loss and degradation of natural capital based on past human land use and exploitation of resources.

The conversion of ecosystems for other uses, including forestry, mining and energy industries, residential development, roads and other industrial development has led to the loss of ecological connectivity and ecosystem services. Resource management decisions and management decisions are largely influenced by the monetary costs and benefits associated with market values of natural capital which tend to favour forestry, agriculture and mining activities. Unfortunately these activities affect non-market values of ecosystem services. However since ecosystem services have not been given a market value, rarely have they been accounted for in resource policy decisions."

This study addressed the following questions:

- What is the full range of ecological goods and services that Canada's boreal region provides for the wellbeing of Canadians and global citizens?
- What are the total economic values (both market and non-market values) of the boreal region's ecological goods and services?
- How can Canada develop a system to account for and report on the state of natural capital assets and economic integrity of its boreal region?

Methodology adopted for the study

The first step was to develop the Boreal Ecosystem Wealth Accounting System (BEWAS). According to the report this is the first beta model or framework of its kind in the long term development of a natural capital accounting system for Canada's boreal region. The BEWAS considers both the physical state and economic value of the boreal region's natural capital assets.

The BEWAS framework is designed to natural resources stocks and flows (for both renewable and non-renewable natural resources) land ecosystem services (that is the state or condition of ecosystem functions) and the total socio-economic value of these natural capital assets, both market values.

The BEWAS framework is consistent with both the UN System of Integrated of Integrated Environmental and Economic Accounting (SEEA) and the International Guidelines for natural capital and environmental accounting and Canada's Canadian system of Environmental and Resource Accounts.

In the BEWAS framework the natural capital accounts comprise natural capital stocks and flows and their economic values. Although ecosystem services are part of natural capital, in this framework they are reported separately as ecosystem service system accounts. The reason is that accounting for ecosystem services involves primarily a qualitative assessment of the integrity or functionality of various ecosystem functions rather than a physical inventory of stocks and flows. Natural capital is taken as the sum total of renewable and nonrenewable resources.

The boreal land accounts describe the physical area by land type and show how much of the land base is allocated to commercial or industrial development; how much is protected from development under protective legislation and how much remains undesignated. The boreal land included in these accounts are area designated for industrial land use planning, areas under protective designation for wilderness conservation and areas currently occupied or used by the petroleum or mining sector.

In BEWAS the boreal land accounts track the area of land by ecosystem type. To assess the pressures o ecosystem functions using geo coded data and GIS was found useful for estimating some natural capital stocks and flows and ecosystem pressures.

The study makes the following recommendations:

Given the absence of a complete inventory of the stocks and consumption of timber, minerals, carbon, wetlands, marine resources, wild life and fisheries, in the boreal region, a comprehensive inventory should be completed and made publicly available. National, provincial and local boreal region accounts should be developed including physical stock and flow accounts of natural capital assets and ecosystem services. These accounts should include information on the following: annual average growth rate of timber; fires(in terms of both area and volume lost) insect infestation, carbon

sequestration by forests and wetlands, fisheries and annual water flow rates in rivers and ground water aquifers.

1. Finally these accounts should include an account of the state of ecosystem services in in order to measure or track changes in ecosystem functionality and their respective service values.
2. The specific effects of each type of each type of human disturbances be identified, tracked and monitored to determine the change in economic value of the boreal region's ecosystem services
3. The economic values for ecosystem services be further developed and adopted by all jurisdictions for resource and land use planning specially at the municipal and provincial levels where changes in land use and resource planning are made.
4. The study found that the total annual market value of boreal ecosystem services is 2.5 times greater than the net market value of boreal natural capital extraction .Hence a policy be developed to expand the network of protected areas in the boreal region that would serve as an investment in the natural capital of the boreal region for the benefit of the benefit of the current and future generations of Canadians and global citizens.
5. In order to ensure that optimum value of ecosystem services is recognized and conserved, resource management and land use decisions need to account for impacts (i.e costs and benefits) on ecosystem services and the overall state of the region's natural capital.

Cost – Benefit Approach to Ecosystem Services

The above study has just mentioned the need for assessment of costs and benefits of ecosystem services but has not gone into the problems which are likely to be encountered in the application of the cost benefit approach for evaluation of ecosystem services. We therefore need to consider them. Our discussion is in general terms and is not restricted to the boreal region covered by the study.

There are two problems which we shall consider here: first is the availability of the time stream of costs and benefits and second is the appropriate rate of discount.

The traditional literature on benefits and costs has focused largely on evaluation of the time stream of benefits and costs of public sector projects. Generally it has been possible to evaluate the economic benefits in monetary terms and the social benefits have been described in qualitative terms. When we are considering ecosystem

services the first difficulty we encounter in the practical application of the ecosystem services is that we do not as yet have a reasonably acceptable assessment of natural capital and therefore it is not possible to make a quantitative assessment of the flow of ecosystem services. If we do not know the quantity we cannot calculate the price even of those ecosystem services which are not public goods. It follows that quantitative assessment of the flow of ecosystem services and pricing of ecosystem services are preconditions to the application of a cost benefit analysis for the evaluation of ecosystem services. It may be clarified that each ecosystem service must be evaluated separately..

Once the stream of benefits and costs are available two issues need to be considered. What is the time period over which the stream of benefit and costs need to be calculated and what should be the discount rate? The discount rate is the weight that is given to benefits and costs at different points of time. The higher the discount rate the lower the value that is given to future benefits and costs relative to the present one. The evaluation of benefits and costs is therefore highly sensitive to the discount rate and therefore the crucial question is what is the appropriate discount rate? This raises another question, to what extent should intergenerational equity be a concern in determining an appropriate discount rate?

There is no discrete distribution of generations in time. It does not happen that one generation ceases to exist when another generation takes over. In any given period there are persons who have different life expectancies. Some of them may have coexisted in with persons who are now dead and will coexist with persons who are yet to be born.

The present generation may be said to consist of all those who are in a position to choose situations for ensuring that the youngest of them today and those yet to be born would have the necessary resources to care for them when they become independent The greater the resources saved the greater the greater will be the future benefits for the future generation. This means that the future is not less important than the present. If this point of view is accepted then the implications for the choice of the discount rate are clear. The discount rate should be zero.

Eco System Accounting

The United Nations Committee of Experts on Environmental Accounting and Statistics (UNCEEA) was set up in March 2005. The objectives were : (a) mainstreaming environmental-economic accounting and related statistics (b) elevating the System

of Environmental Accounting (SEEA) to an international environmental standard and
© advancing the implantation of the SEEA in countries

At the Conference on Climate Change and Official Statistics held at Oslo in April 2008 the name of UNFCCAS was changed to UNCEEAS in view of the expanded mandate to go beyond environmental-economic accounting and include environmental accounting.

The mandate of the UNCEEAS are:

- (i) to provide strategic vision, direction and coordination to mainstream environmental statistics and environmental economic accounting in national, regional and international statistical systems.
- (ii) to develop normative international statistical standards and supporting methodical documents on environment statistics and environmental economic accounting.
- (iii) to promote the development of integrated data bases at international, regional and national level on environment statistics and environment economic accounting
- (iv) to promote the implementation of international statistical standards of environment statistics and environment accounting in countries and
- (v) to promote the use of official statistics in scientific and policy making communities.

A programme of work has been chalked out for the next five years. This programme includes:

1. The UNCEEAS should foster co-ordination, integration and complementarity of programmes in environmental environment statistics and environmental economic accounting among international and regional agencies and countries. Leadership a single focal point and a coordinated vision among international and regional agencies active in the field of environment are considered necessary to raise the profile of environment statistics and environmental economic accounting.

The UNCEEAS coordinates and provides vision, direction and prioritisation to ensure that existing and newly established groups work in a complementary fashion. These groups include the Advisory Group, the Oslo Group on Energy Statistics, The Inter-Secretariat Working Group (ISWG) on Environment Statistics, The ISWG on Energy

Statistics and other expert groups that might be established within the scope of its mandate.

1. The UNCEEAS is required to encourage strategic planning, coordination and complementarity of programmes at the regional and international levels as well as at the national level.
2. The role of UNCEEAS is to oversee the methodological development of environment statistics as well as environmental- economic accounting. This involves the current and future revisions of SEEA and its elevation to the level of international statistical standard as well as contributing to the international debate on measuring sustainability. It also involves managing and setting the direction for the publications in support of the new SEEA standard as well as publications.
3. Until recently environment statistics and environmental economic accounting have developed in separate tracks. The need for harmonizing them was recognized. This requires linking of environment data with concepts, definitions and classifications of environmental economic accounting. The role of UNCEEAS is that international data collection data activities are carried out in line with standards and accompanying international recommendations and ensure that information is produced in the most efficient and cost effective way. The set standard tables should be used as the reference set of information that countries should compile taking into consideration countries priorities and environmental concerns. The UNCEEAS should promote the establishment of regional data bases in support of evidence based decision based decision making. in particular in the context of sustainable development, climate change and millennium development goals.
- (4) The increased demand by the national, regional and international agenda of environmental information has produced a challenge and an opportunity for the statistical community to mainstream environment statistics and environmental accounting. The elevation of the System of Environmental-Economic Accounting to the level of an international statistical standard and the development of supporting recommendations e.g International Recommendations on Water Statistics and International recommendations on Energy Statistics call for its widespread implementation strategy encompassing basic environmental statistics and their integration in the SEEA in support of decision making at the country level and for international comparisons.
- (5) Environment statistics as well as environment-economic accounting are respectively new areas of statistics which do not enjoy the same priority as other economic statistics or social statistics within the national and global statistical systems in particular in response to the new challenges posed by the user's

community in particular in regard to measuring sustainable development and climate change.

At the same time the statistical community has a role to play vis-à-vis users' community represented by policy makers, academia and scientists. It has to raise awareness of the statistics it produces. The System of Environmental Accounting has proven its potential and added value to many areas of environmental-economic accounting. Building on existing promotion of SEEA for environmental-economic analysis and for formulating international priorities based on users' needs. This is the case, for example, in actively engaging on behalf of the statistical community with the International Panel on Climate Change to promote the use and usefulness of official statistics in climate change, statistics and policies.

The role of UNCEEAS is to promote on behalf of the statistical community, the role of the statistical system in providing good quality, relevant and timely information to address the new challenges posed by the policy agenda.

- (6) The national and international community has placed several emerging issues related to the environment high on their political agenda. They include cross cutting issues such as climate change and sustainable development. Until the present statistical community has responded to these needs in an uncoordinated and ad hoc manner. There is need for the statistical community to engage more prominently in the international debate and articulate a statistical response based on the international statistical standards to better meet the users' needs.

In a note submitted by the European Environment Agency to the United Nations on June 16 2008 the present limitations of national accounts have been pointed out. They are:

- Use of unsustainable use of living natural capital are ignored: the negative effects of over harvesting, forced feeding with fertilizers, intoxication, introduction of species, fragmentation by roads, or sealing of soil by urban development have no direct monetary counterpart in GDP or monetary accounts.
- The natural capital is not even amortised in company's accounting books and in functions and services. The full costs of domestic products is not covered in many cases by their prices.
- This is as well the case of the price of imported products made from degraded eco systems : Their full cost is not covered by their price.
- Actual value for people of free end-use eco system services is not accounted in their final consumption (the market tells: price is zero)

Pricing Water

The issues concerning the pricing water are the costs incurred in the supply of water, the depletion of water and the environmental and health impact of water particularly from the re-use of water. The starting point for the price of water is the cost of water supply. There are the investment and operating costs incurred by a water utility. What does all this imply for costing and pricing of water supply? The answer depends on what is the objective of pricing water? Given that water is in short supply in relation to demand the price of water must be such that it promotes the conservation of water in a study of the pricing of water Pearce and Markandya (1989) have shown a preference for the marginal opportunity costs of capital

$$\text{MOC} = \text{MDC} + \text{MEC} + \text{MUC}$$

Where MDC is the direct cost of the resources used to supply additional water and waste water management facilities. MEC is the external or environmental cost and MUC is the user cost or depletion cost.

Walford and Li (2002) have demonstrated the need for prices well in excess of those necessary to cover the pure financial costs incurred by utilities

Camp Dresser and McKee Inc .have prepared Guidelines for Water Re-use for the US Environment Protection Agency (EPA) and the US Agency for International Development (1992) these guidelines were considered necessary because the demands for water resources for households, commercial, industrial and agricultural purposes are increasing tremendously. These guidelines basically address water reclamation for non -potable urban, industrial and agricultural re-use. The use of reclaimed water for non-potable purposes is to be seen as a new resource that can be substituted for an existing resource.

The Guidelines emphasize that “The overriding consideration in developing a re-use system is that the quantity of reused water be appropriate for its intended use. Higher level uses such as irrigation of public access lands or vegetables to be consumed without processing require a higher level of waste water treatment prior to reuse than lower level uses such as pasture irrigation.”

The technical issues which have been identified in planning water re-use system include

- the identification and characterization of potential demand for reclaimed water
- the identification and characterization of existing sources of reclaimed water that is suitable for its intended applications
- the treatment requirements for producing a safe and reliable reclaimed water that is suitable for its intended applications.
- the storage facilities required to balance seasonal fluctuations in supply with fluctuations in demand
- the supplemental facilities required to operate a water re-use system, such as conveyance and distribution networks, operational storage facilities and alternative disposal facilities and
- the potential environmental impacts of implementing water reclamation

The Guidelines point out that a number of questions need to be addressed in this phase

- What local sources of effluents may be suitable for re-use?
- What are the potential local markets for reclaimed water?
- What public health considerations are associated with re-use and how can they be addressed?
- What are the potential environmental impacts of water re-use?
- How would water re-use fit in with present uses of other water resources in the area?
- What existing or proposed laws and regulations affect re-use possibilities in the area?
- what are the legal liabilities of a purveyor or user of reclaimed water?
- what sources of funding might be available to support the re-use programme?
- What re-use system would affect the public's interest and support?

Pricing Air

If we take a look at the economic literature we find that the classical economists treated air as a free good of nature and much later Paul Samuelson (1955) described air as a public good with the characteristics of non-excludability and non-rivalry. Since no one can be excluded for the consumption of air it followed that air cannot be priced.

The influence of the classical economists and Paul Samuelson the Nobel Laureate has continued to influence policy decisions and attempts have not been made to price air.

Let us examine the two conditions of non-excludability and non-rivalry.. The condition of non-excludability does not arise because it is a free good of nature but because of the compulsions of nature as air is essential for life.

The second condition of non-rivalry is definitely misleading. Non-rivalry in this context means that there is no competition among the users because consumption by one does not affect consumption by another since there are no limits on the supply of air. This reasoning focuses on the quantitative side of supply. Once we include quality as an attribute of supply then we immediately see that the supply is limited and we do not have one aggregate supply curve but a number of supply curves. This means there are as many markets as there are supply curves. Given that demand is inelastic, price determines the quality of supply of air.

What we have just established is air is not a global public good and once we grow out of the concept that air is a public good then we will accept the fact that needs to be priced, it can be priced and must be priced.

Considerable research needs to be done on the characteristics of the markets for air, the possibility however limited of switching from one market to another and the methodology of determining the price of air.

Pricing of natural capital is an essential and most important requirement for moving towards eco efficiency

Eco Efficiency

OECD has defined eco efficiency as “the efficiency with which ecological resources are used to meet human needs.” The European Environment Agency (EEA) looks upon eco efficiency as ‘more welfare from less nature.’ From the definition it follows that eco efficiency requires creativity and innovation in the search of new ways of doing things. In a study by WBCSD ‘why eco efficiency? the business rationale’ business is called upon to achieve more value from lower inputs of materials and energy and with reduced emissions. It applies throughout a company to marketing and product development as much as to manufacturing and distribution. The WBCSD has identified seven elements that business can use to improve eco efficiency:

- reduce material intensity
- reduce energy intensity
- reduce dispersion of toxic substances

- enhance recyclability
- maximum use of renewables
- extend product durability
- increase service intensity

These seven elements may be said to cover three broad objectives

- (1) Reducing the consumption of resources. This includes minimizing the use of energy, materials, water and land, enhancing product durability and recyclability and closing material loops
- (2) Reducing the impact on nature. This includes minimizing air emissions, water discharges, waste disposal and the dispersal of toxic substances as well as well as fostering the sustainable use of renewable resources.
- (3) Increasing product or service value. This means providing more benefits to customers through product functionality, functionality, flexibility and modularity, providing additional services (such as maintenance, upgrading and exchange services) and focusing on selling the customers needs that customers actually want. Selling a service instead of the product itself raises the of the customer receiving the same functional need with fewer materials and less resources; it also improves the prospects of closing material loops because responsibility and ownership, and therefore concern for efficient use remain with the service provider.

CHAPTER 2

RADICALLY INCREASE ENERGY EFFICIENCY

We begin by examining the behaviour of energy efficiency over time and then we shall examine the trends in global energy investment. We use here the World Bank data and therefore it is important to understand the concept of energy efficiency as adopted by the World Bank.

Energy efficiency is measured by the ratio of GDP to energy use. To produce consistent and comparable estimates of real GDP across countries relative to physical inputs to GDP-that is units of energy use-GDP is converted to 2000 constant international dollars using purchasing power parity (PPP) rates. Differences in this ratio over time and across countries reflect in part structural changes in the economy, changes in the energy efficiency of particular sectors and differences in fuel mixes.

Because commercial energy is widely traded it is necessary to distinguish between its production and its use. Generally high income countries are net energy importers; middle income countries have been the main suppliers. Let us take a look at GDP per unit of energy use for the period 1990 to 2003. The data are 2000 ppp\$ per kilogram of oil equivalent.

In the world as a whole the energy efficiency in 1990 was 3.5 and rose to and rose to 4.2 in 2003. In the low income countries the energy efficiency in 1990 was 3.5 but rose to 4.2 in 2003. For middle income countries the corresponding figures were 3.0 and 4.2 and for high income countries the figures for energy efficiency were respectively 4.7 and 5.2

It will thus be seen that energy efficiency is the highest in high income countries. In 1990 the middle income countries had lower energy efficiency in 1990 but by 2003 the energy efficiency of low income countries and middle income countries was the same.

Among the developed countries let us take USA, UK and Japan. In 1990 the energy efficiency of USA was 3.7 and rose to 4.5 in 2003. It will be observed that through out

the energy efficiency of USA remained below the world average.

In 1990 the energy efficiency of UK was 5.9 and rose to 7.1 in 2003. That is throughout this period the energy efficiency of UK remained above the world average

The energy efficiency of Japan continued to be above the world average being 6.5 in 1990 as well as in 2003. This means that at the macro level there has been no improvement in the energy efficiency of Japan from 1990 to 2003.

The question we need to ask is has energy efficiency led to reduction in emissions? To answer this question we examine the total emissions in million metric tonnes of carbon dioxide.

For the world as a whole the carbon dioxide emissions in 1990 were 21254.1 million metric tons and rose to 24355.21 million metric tons in 2003 that is an increase of 3101 million metric tons over the period; of this increase 2031.2 million metric tons were accounted for by high income countries.

Trends in Energy Efficiency Investment

The data for the trends in energy efficiency investment have been taken from the UNEP study on Global Trends in Sustainable Energy Investment. The study points out that the two broad areas of energy efficiency are (1) investment in the providers of the equipment and (2) investment in the use of the equipment.

The study warns that “tracking energy investment is tricky is , due both to definition issues and the fact that most efficiency is financed internally and often as part of the larger industrial process change or capital budgeting activity. However the strong growth in measured external VC/PE investment in energy efficiency- up to 306% between 2004 and 2007- provides a good overall proxy for expected near term efficiency up take.. From the macro perspective the impact of energy efficiency is easier to quantify, although gives less cause for hope.”

The Report further points out that while most analysis expect future efficiency improvements to be in the 1.4-2.2% range although McKinsey has projected that demand growth to 2020 could be cut by a further half by capturing more energy productivity opportunities particularly in cogeneration and electric motor optimization. These opportunities use existing technologies that pay for themselves thereby freeing up capital for investment or consumption elsewhere.

Other important points made by the Report were:

- Energy efficiency companies came to the fore in 2007 as governments and businesses realized that improvements in existing infrastructure and machinery could deliver large reductions in emissions cheaply. A total of \$ 4 billion changed hands but in fewer deals. There were 22 energy efficiency transactions compared with 62 in solar and 38 in biofuels. Interest focused in manufacturing business while \$1.3 billion was invested in technology companies
- Energy efficiency mergers and acquisitions were boosted by a few large deals. Baldor a maker of high efficiency electric motors and generators bought Rockwell Motors and Generators bought Rockwell Automation subsidiary Reliance Electric Electric Company for \$1.8 billion. In another big deal energy management software provider Itron paid \$1.7 billion for its European rival Actaris Metering Systems.

The impact of mergers and amalgamations on energy efficiency needs to be examined carefully from the point of view of the areas in which cost savings may be achieved through realization of scale economies : management, administration, billing. Collection, more efficient use of buildings and service vehicles; scale of economies in operation and reduction in the overall costs of capital relating to increases size and diversities and the consequent lower risk perception of investors.

It is extremely important to assess the environmental policies of the amalgamations and mergers and their actual impact on energy efficiency.

In addition to having general rules governing mergers and amalgamations it is necessary to have a policies and framework for execution that encourage new investment, promote efficiency and foster conservation.

The competition laws of individual countries need to be carefully studied from the point of view of the special conditions that may be required for mergers and amalgamations of energy companies from the point of view of promoting energy efficiency.

The above analysis has shown that while efforts are being made towards promoting energy efficiency they are certainly not enough. because the emissions of CO₂ have continued to grow irrespective of the stage of development of countries.

More concentrated efforts need to be made by the high income countries as they have the largest share in CO₂ emissions.

CHAPTER 3

OPT FOR MINIMAL LIFE STYLES

The Psychological Foundations of Minimalist Life Style

The term life style or style of life was coined by Adler It was the basis of his individual psychological and personality theory. Adler wrote “if we know the goal of a person we can undertake to explain and to understand what the physical psychological phenomena want to tell us, why they were created, what a person has made of his innate material, why he has made it just so and not differently, how his character traits, his feelings, his emotions, his logic, his morals and his aesthetic must be constituted in order may arrive at his goal. If we could infer the individually constituted goal from the ornaments and melodies of human life we could classify a person with almost natural science accuracy.”

According to Adler the life style of a person is the key to his behaviour. His major goal is superiority and compensation for his feeling of inferiority, but he may achieve this goal in a wide variety of ways.

An individual’s life style is determined by his inventive and creative power. And is an expression of his uniqueness .Each person develops his concept of self and of people and of the environment which surrounds him in his own personal way.

The style of life is influenced mostly by the quality of an individual’s social interest. “Social interest is the true compensation for the natural weakness of individual human beings. A normal person with a well developed social interest will develop a useful style of life contributing to the common welfare and thus overcoming his feeling of inferiority.

As one learns to contribute to the common welfare he begins to have a feeling of worth and value and begins to feel at home in life. Social interest enhances ones intelligence, heightens his self esteem and enables him to adjust to unexpected misfortunes. Social interest gives meaning and purpose to life.

Economics and Minimalist Life style

The theory of consumer's choice as it has been developed in economics goes against the minimalist life style. The theory of consumer's choice recognizes that the consumer is one of the most important decision makers in the economy and the most important determination of consumer's behaviour are his tastes or preferences. It is assumed that when confronted with two baskets of goods a consumer can say which one he prefers, or whether he is indifferent between them. Another assumption is that a consumer's tastes are transitive and a commodity is defined in such a way that more is preferred to less.

Given these assumptions the consumer's preferences are represented by a set of indifference curves. An indifference curve must have a negative slope and two indifference curves cannot intersect. The marginal rate of substitution shows approximately how many units of one good must be given up if the consumer after receiving an extra unit of another good is to maintain a constant level of satisfaction.

If we take ordinal utilities then we can attach a number to each basket of goods. Market baskets on higher indifference curves have higher utilities than on lower indifference curves.

Given consumer tastes we assume that he is rational in the sense that he tries to get on the highest indifference curve. In other words he tries to maximize utility. When we go from consumption to production, the production function as it has developed does not consider natural capital and eco services. AC Pigou did consider the impact of industrialization on externalities and recommended the Polluter Pays Principle of taxation and internalization of environmental costs but environmental costs were never linked with market competition.

The theory of comparative costs of Ricardo and the theorem of factor proportions of Hecksher-Ohlin did not consider environment. The focus was on showing that in a static equilibrium maximum economic efficiency will be in the sense of Vilfredo Pareto. In other words in a competitive system it is impossible to make anyone better off without making someone else worse off.

The concept of a minimalist life style is a much misunderstood concept. It is generally taken to mean an ascetic life style. This is definitely a wrong interpretation. A minimalist life style is recommended at the personal level because it leads to contentment, since there is no competitive pressure for keeping up with the Jones.

However, when minimal lifestyles are viewed in terms of the holistic model PROACTIVATE then a minimalist life style needs to be viewed in the context of sustainable development. This immediately highlights the connection between ecology, environment and life styles.

The eight points of the 'Deep Ecology Platform' listed below clearly indicate why a minimalist life style is important from the point of view of sustainable development.

1. The flourishing of human and non-human life on earth has intrinsic value. The value of non-human life forms is independent of the usefulness these have for narrow human purposes
2. Richness and diversity of life forms are values in themselves and contribute to the flourishing of human and non-human life on earth
3. Humans have no right to reduce this richness and diversity except to satisfy vital needs
4. Present human interference with the non-human world is excessive and the situation is rapidly worsening.
5. The flourishing of human life and cultures is compatible with a substantial decrease of human population. The flourishing of non-human life requires such a decrease.
6. Significant change of life conditions for the better requires changes in policies. These affect basic economic, technological, and ideological structures
7. The ideological change is mainly that of appreciating life quality rather than adhering to a high standard of living. There will be a profound awareness of the difference between big and great.
8. Those who subscribe to the foregoing points have an obligation directly or indirectly to participate in the attempt to implement the necessary changes.

PROACTIVATE has directed our attention to the relationship between life styles and deep ecology. It directs our attention to the need for changing our life styles. This can only happen if we can discover our true place in nature.

PROACTIVATE presents an alternative view to the utilitarian theory which has for years occupied a predominant place in our moral philosophy. It is not easy to change the mind set but it is not impossible

CHAPTER 4

ADOPT CLOSED LOOP AND ZERO WASTE SYSTEMS

Closed loop recycling has two connotations (i) closed loop recycling is a production system in which the waste or by product of one process is used for making another product and (ii) where the final product when it becomes a waste is recycled with such technology that its qualities are at par with the virgin materials

In order to understand the economic and environmental benefits of closed loop and zero waste systems we need to adopt a system of environmental accounting. This will help to understand the relationships between environmental problems and socio-economic problems by quantifying the flow of materials between economy and nature. For this purpose a comprehensive input-output table needs to be prepared and sub tables prepared for industries where closed loop recycling has been adopted. The tables must be in physical terms so that the analysis is not vitiated by changes in prices.

The potential environmental benefits are:

- reduced use of finite natural resources.
- reduced quantity of waste and effluent and effluent generated
- reduced air and noise pollution
- reduction in demand for waste disposal sites
- reduced transportation of waste, and
- improved working conditions

The potential economic benefits are;

- reduced raw material, energy and water costs
- reduced waste disposal and transportation costs
- increased returns by selling waste materials for re-use
- reduced potential liabilities, risks and accidents
- Improved corporate image
- Improved employee morale, recruitment and retention

HP's Closed Loop Plastics Recycling Process

HP has developed a closed loop plastic recycling system that incorporates post-consumer recycled plastics, from sources such as water bottles and ink cartridges, into the manufacture of new Original HP inkjet print cartridges. An engineering breakthrough, HP inkjet cartridges made from newly moulded recycled plastic resins still meet HP's high performance standards. It took years of research and development and a team of dedicated engineers, chemists and partners to perfect this complex scientific process, the result of which lessens HP's environmental footprint, while maintaining high standards for design innovation.

HP has used plastic in product development for many years and is committed to developing sustainable end-of-life solutions for those products. For example, HP's Planet partners return and recycling programme makes it free and easy to return HP print cartridges, while ensuring that cartridges returned are never refilled, resold or sent to a landfill

Most cartridges with HP's inkjet portfolio are composed primarily of glass filled polyethylene terephthalate (PET), a highly engineered formulation specially tested for HP's ink jet cartridge performance and manufacturing. Achieving the same reliability with recycled PET (RPET) as with virgin plastics was a critical hurdle, so a team of dedicated engineers, chemists and partners made sure all recycled materials performed on par with virgin materials to meet HP's high performance standards. This is a significant accomplishment because the recycling process diminishes critical material properties

The process was as follows:

- HP combines recycled beverage bottled resin (RBR) and a suite of additives with the PET to offset lower viscosity, as well as thermal and mechanical property changes.
- The additive package also includes chain extenders to create the desired molecular weight, impact modifiers to provide the right amount of resistance for the product drop test, and nucleating agents to restore the crystalline nature of PET.
- HP adds additional glass fiber to account for both the RBR portion of the recycled plastic recipe, which contain no fibers, and fibers damaged in inkjet cartridges plastic recycling.

This highly engineered process creates a “drop in “ RPET resin that is equivalent in performance to virgin materials and can work with existing moulds and manufacturing lines.. The new RPET formulation –which accounts for 70 to 100 percent of the total plastic weight, does not contain simply reground or re-melted plastic. HP and its partners have re-compounded and re-engineered the materials in a way no one has done before. They have “up-cycled” common plastic water bottles and recycled materials from returned HP cartridges and turned them into Original HP inkjet cartridges containing more tha 50% recycled plastic by weight.

Since piloting the project , HP has used enough recycled plastic to fill more than 200 tractor trailers and create more than 200 million HP inkjet cartridges globally. Hp used more than 5 million pounds of RPET in original inkjet cartridges globally in 2007 and targeted twice as much in 2008.

HP’s use of recycled plastic closes the product design loop. The innovative resin formulation is competitive with virgin resins on both price and performance factors.Hp is confident that having such a material will greatly facilitate additional environmental design innovations at HP such as such as incorporating recycled content into HP hardware.

Novelis Recycling’s Closed Loop Aluminium Drinks Can Recycling

Novelis Recycling (formerly Alcan) opened the first dedicated aluminium can recycling plant in Europe at Warrington, Chesire in 1991 with an investment of £28 million. The plant re-melts used beverages to produce ingots, which are rolled into sheets at another mill, and then supplied to can makers to be made into cans again.

The Warrington plant employs the latest re-melt technology to maximize yield and energy efficiency in the production of quality ingots, the largest of which weigh 27 tonnes and are nine metres long.

Aluminium cans arrive either in bales or loose and flattened and are shredded into pieces the size of a walnut in a 1000 horse power shredder with a capacity of 15 tonnes per hour. The shreds are then passed through a double magnetic drum separator to remove steel which is a contaminant to the process

Lacquer from the branded and decorated cans is removed by blowing hot air (around 500°C) through the shreds in a de-coater, on a slowly moving insulated conveyer.

The hot exhaust from the de-coater on a slowly moving conveyer. The hot exhaust from the de-coater, is combusted in an after burner, and the exhaust from the after burner passés over a heat exchanger, which heats the fresh air going into the decoater. By recycling hot air in this way, the need for a separate fuel source for this part of the process is removed, maximizing energy efficiency.

The hot shredded decoated aluminium is fed into one of the two 90 tonne sidewell furnaces, which contain sidewell stirrers that create a vortex in the pool of molten aluminium and drag the shreds quickly down into the melt. The process achieves rapid melting rates and high yields.

The furnaces have state of the art regenerative burners and a burner management system to reduce the amount of energy used. The jet pump stirrers alternate between applying positive and negative pressures blowing out and sucking in the metal to achieve rapid melt and even temperatures.

Dross which is a bye product of melting aluminium, is removed periodically from the furnaces and cooled under a blanket of argon to prevent oxidation. This increases the amount of aluminium that can be recovered from the dross.

The now-molten metal from the 90 tonne holding furnace where accurate temperature control is achieved, the alloy composition is checked and the metal is treated to remove non-mettalic particles before casting

Ingots are cast by tilting the holding furnace and pouring the molten metal –vis-à-vis a two stage process to remove any remaining minute non-metalic particles and gases-into a vertical casting unit. Chemical composition and metal cleanliness are then tested on, each cast.

As the metal flows into the mould, it is chilled by jets of cool water being pumped around the mould and a solidified outer shell is formed

The base of the mould begins to lower hydraulically, the metal continues to flow into the mould and the shell is now directly cooled by a secondary water curtain as the ingot grows to a length of up to 9m.

Te ingot solidifies gradually during the casting process, which takes approximately three hours. The ingots, which each contain which each contain around 1.6m used drinks used drink cans, are then shipped on to a mill for rolling into th sheet from

which the anmakers subsequently produce new cans-and the whole process begins again.

Aluminium Foil Recycling

Aluminium foil is recycled in the secondary aluminium industry, with other aluminium scraps such as window frames and door handles.

The process is similar to the to the closed loop can recycling plant, without the pre-treatment of shredding and de-lacquering. Feedstock is simply fed into the furnace and melted through heat and stirring in a low oxygen environment.

Secondary aluminium is often produced to customers own specification, with alloy adjustments made in the furnace.

The resulting ingots are much smaller than those produced at the Warrington can recycling plant (around 1m long) and most of those containing recycled foil is bought by casting companies, remelted and poured into moulds for car engine components such as cylinder heads.

There is a secure and growing end-market for foil, as aluminium is increasingly used in the automotive industry to make vehicles lighter, and save fuel throughout the lifetime of te vehicle.

Closed Loop Recycling (UK)

Closed Loop recycling managing Director Chris Dow said “interest from manufacturers to use British post consumer plastic in their products has been overwhelming. There is an increased awareness that that if we are to are to create a closed loop plastic waste economy we should use recycled plastic that has been created from the recycled waste streams

We are totally focused on creating centres of excellence for recycling here in London and at all future facilities.”

The plant is just one of six plants around the world that uses technology created by the South Caroline based United Resource Recovery Corporation. The other plants, are in Austria, Switzerland, Germany, the USA and Mexico

Closed Loop has developed long term relationships with Veola Environmental Services for the supply of plastic waste and Nampak Plastics, the UK's largest producer of HDPE milk bottles, to use recycled food grade HDPE produced by Closed Loop

The project has been supported by numerous partners including Mark & Spencer, Coca Cola, WRAP and the mayor of London.

Marks and Spencer Collaboration

IN April 2008 Closed Loop Recycling and Marks & Spencer announced an office recycling and collection service as part of the Food to GO re-launch of sandwiches, salads and Deli snacks. All the new packaging from the range will feature the Closed Loop recycling logo and details on how consumer can sign their office up to the scheme.

The new service addresses the issue of disposing off lunch time packaging waste at work and provides an easy solution for offices across the UK to establish their own recycling scheme. Marks & Spencer sell more sandwiches and lunch time snacks than anyone else on the High Street and aims to make 90% of all Food to Go packaging recyclable

Helene Roberts, Marks & Spencer Head of Food packaging said, "As part of our plan A 'eco-plan,' we are committed to making it easier for our customers to choose greener options. We are all getting better at recycling from home, and this plan gives consumers an easy solution for getting rid of their food packaging at work."

Marks & Spencer pioneered the scheme, which has proved successful.

Coca Cola's Recycle and Win Programme

In February Coca Cola announced its Recycle and win programme. Charlotte based Coca Cola Consolidated, the city of Charlotte and six Mecklenburg County towns (Matthews, Pineville, Minthill, Davidson, Huntersville, Cornelius) and Harris Teeter announced a new partnership designed to increase recycling throughout the area. Recycle and Win is a public private initiative designed to reduce the amount of waste sent to landfills.

The programme will run for a year. Coca Cola has sent educational mailers to all 271,000 single- family households in Mecklenburg that features the do's and don'ts

of recycling along with an opportunity to win a \$50 gift card simply for doing the right thing-recycling and recycling the right way. The educational mailer contains a sticker which residents should place on their red 'curb it' recycling bins in order to win. If they are spotted recycling-and recycling the right way- they could be rewarded.

“The beauty of this programme is its simplicity,” said Jake Williams executive director of programme partner Keep Mecklenberg Beautiful. “All the public has to do is to place the weather-resistant sticker provided by Coca Cola on their recycle bins , recycle materials properly and place the recycle bin with the sticker facing the street. If the Coca Cola Recycling Prize Patrol spots their stickered bin, they could win a \$50 Harris Tester gift card.”

CHAPTER 5

CAPTURE AND SEQUESTER CO2

The Special Report of the IPCC on Carbon Dioxide Capture and Storage defines carbon capture and storage as “a process consisting of the separation of CO₂ from industry and energy related sources, transport to a storage location and long term isolation from the one of the key technologies atmosphere.”

Storage Mechanisms

A study by BELONNA on Carbon Dioxide Storage: Geological Security and Environmental Issues finds that the effectiveness of geological storage depends on a combination of physical and geological trapping mechanisms. The most effective storage sites is those where CO₂ is immobile because it is trapped permanently under a thick, low permeability seal or is converted to solid minerals or through a combination of physical and chemical trapping mechanisms.

The storage mechanism known as physical trapping of CO₂ below low permeability seals (caprocks) such as very low permeability shale or salt beds is the principal means to store CO₂ in geological formations. Sedimentary basins have such closed physically bound traps or structures which are which are occupied mainly by saline water, oil and gas. Structural traps include those formed by folded or fractured rocks. Faults act as permeability barriers in some circumstances and as preferential pathways for fluid flow in other circumstances Stratigraphic traps are formed by changes in rock type caused by variation in the setting where the rocks were deposited. Both these types of traps are suitable for CO₂ storage, although care must be taken not to exceed the allowable overpressure to avoid fracturing the caprock or reactivating faults.

Hydrodynamic trapping can occur in saline formations that do not have a closed trap, but where fluids migrate very slowly over long distances. Where CO₂ is injected into a formation it displaces saline formation water and then migrates buoyantly upwards because it is less dense than water. When it reaches the top of the formation it

continues to migrate as a separate phase until it is trapped as residual CO₂ saturation or in local structural or stratigraphic traps within the sealing formation.

In the longer term significant quantities of CO₂ dissolve in the formation water and then migrate with the groundwater. Where the distance from the deep injection site to the end of the overlying impermeable formation is hundreds of kilometers, the time scale for fluid to reach the surface from the deep basin can be million of years.

Carbon dioxide in the subsurface can undergo a sequence geochemical interactions with the rock and formation water that will further increase storage capacity and effectiveness a mechanism known as geothermal trapping.. First when CO₂ dissolves in formation , water a process commonly called solubility trapping occurs. The primary benefit of solubility trapping is that once CO₂ is dissolved it no longer exists as a separate phase thereby eliminating the buoyant forces that drive it upwards. Next it will ionic species as the rock dissolves accompanied by a rise in the pH. Finally some fraction may be converted to stable carbonate minerals (mineral trapping)the most permanent form of geological storage. Mineral trapping is believed to be comparatively slow , potentially taking thousands of years or longer. Nevertheless the permanence of mineral storage, combined with the potentially large storage capacity present in some geological settings, makes this a desirable feature of long term storage.

Storage Security

Natural geological accumulations of CO₂ occur as gaseous accumulations of CO₂ mixed with natural gas and CO₂ dissolved in formation water.. These natural accumulations have been studied in the United States, Australia and Europe (Pearce et al 1996; Watson et al 2004) as analogues for storage of CO₂ as well as for leakage from engineered storage sites. Production of CO₂ for EOR and other uses provides operational experience relevant to CO₂ capture and storage . Natural accumulations of relatively pure CO₂ are found all over the world in a range of geological settings, particularly in sedimentary basins, intra -plate volcanic regions and in faulted areas or in quiescent volcanic structures.

The storage sites and its surroundings need to be characterized in terms of geology, hydrology, geochemistry and geo mechanics (structural geology and deformation in response to stress changes) The greatest emphasis will be placed on the reservoir and its sealing horizons. However the strata above the storage formation and caprock also need to be assessed because if CO₂ leaked it would migrate through them.(Haidl et al 2005)

The risks due to storage of CO₂ in geological reservoirs fall into two broad categories namely global risks and local risks. Global risks involve the release of stored CO₂ to the atmosphere that may contribute significantly to climate change if some fraction leaks from the storage formation.. In addition if CO₂ leaks out of storage formation, local risks include hazards for human beings, ecosystems and ground water.

With regard to global risks observations and analysis of current CO₂ storage sites, natural systems, engineering systems and models indicate that that the likelihood or probability of leakage in appropriately selected and managed reservoirs is nearly absent or very negligible over long periods of time. The risk of leakage is expected to decrease over time as other mechanisms provide additional trappings.

BP and sequestration

BP's Gardiner Hill Director BP's Alternative Technology Business says, "Ten years ago there were just a few lonely voices out there trying to make a case for carbon dioxide capture and storage (CCS) . Now we have a full CCS choir singing from the same song sheet. Hill uses the analogy to describe the changed perception and increasingly wide perception of CCS that has come about in the past decade"

In 1966 BP became a participant in the successful CO₂ saline aquifer storage project in the Sleipner field offshore Norway which re-injects around one million tones a year of CO₂. Sleipner captures CO₂ separated from natural gas production and injects it back into the permeable rock beneath the rock. In 2000 BP was instrumental in setting up the CO₂ Capture Project a partnership of leading energy companies focused on investigating CCS technology and developing new technologies to reduce the cost of capture. In the same year established the Carbon Mitigation Initiative which is a joint product with Ford Motor Company and Princeton University. The objective was to find sustainable solutions to the climate change problem. In 2004 CO₂ capture and injection began at the BP operated In Salah gas field in Algeria a pioneering project where one million tones of CO₂ continue to be reinjected each year into the deep geological formation below the Sahara desert.

In 2007 BP Alternative Energy formed an independent joint venture with Rio Tinto to undertake 'decarbonized fuel products' The venture has proposed plans for three large scale commercial projects for hydrogen power generation combined with CCS. BP is involved in a number of other regional storage projects in USA and helped to establish the world's first industry association for CCS, the UK based Carbon Capture and Storage With the company's experience growing rapidly and driven by the

environmental need for CCS to be taken forward BP Alternative Energy has built up a dedicated team of engineers, scientists and business managers to promote CCS in the wider world.

“CCS plays directly to BP’s core strengths” explains Hill who is Chairman of both the CO₂ and the Carbon Capture Storage Association and also Chairman of EU’s ZEP technology position.. “The steps involved in CCS-separating CO₂, transporting it by pipeline and storing it in underground formations are all in existing areas of expertise in BP’s energy business. We have the required know how in chemical processing, power generation, pipeline transportation of gases and liquids and in particular leading edge understanding of the geological subsurface. CCS is a natural fit for BP .While the technologies required for CCS are understood individually, they have not yet been integrated together on a large commercial scale. This might appear to be a major challenge, but the scale of operations involved are of the same order of magnitude as our existing oil and gas operations so we do not see the delivery of a full scale CCS plant to be a show stopper.

So what are the challenges of applying the technologies required to make the capture and storage of CO₂ a viable proposition.? When fossil fuels are burned to liberate energy the carbon in the fuel is converted to CO₂ which is emitted in the carbon exhaust gases-a modern 500 megawatt coal fired power station could typically emit three million tonnes of CO₂ a year from the exhaust. stack; with older and less efficient units emitting up to twice this amount. This occurs not only in power generation but also in a wide range of industrial processes requiring heat and power, while other industrial processes produce CO₂ as a by product, for example in the manufacture of ammonia and cement. It is the separation of CO₂ from such high volume gas streams and its subsequent purification and compression if necessary that constitute capture as the first stage of CCS.

A key point to note is that depending on the type of process involved the pressure of the compressed gases and the concentration of CO₂ as a component of the mixed gases can vary widely. “These factors have a major bearing on the cost of capture” explains Jonathan Forsythe who heads the CO₂ capture team. “gas streams can contain CO₂ at near 100% concentration or as low as three per cent. Typically from exhaust gases from fossil fuel consumption CO₂ concentrations range around three per cent from burning natural gas in a gas turbine to fifteen per cent in a high efficiency coal plant. The exhaust gases are usually at atmospheric pressure as the partial pressure of CO₂ is low, which impacts the energy demand of the gas separation process.

This variation makes it difficult to put a price tag on the capture stage as a proportion of the overall CCS cost—indeed so too does the cost of any long distance pipeline that may be needed to transport the CO₂ to the storage site and the storage itself. But in general capture is likely to account for the majority of the cost of a CCS project possibly up to 90%.

The capture stage requires more process plant to be added to the power generation plant, pushing up capital cost and primary energy consumption by 10-40 % which in turn emits further CO₂.

Forsyth further points out that “This is something of a knock for the very masked efficiency improvements gained in coal fired plants over the past two decades. Much of the technical resides in minimizing this knock. However if you design the CCS plant to capture 90% of all CO₂ emissions including those from extra process plant you will still achieve the capture of 85% of the CO₂. that would have come from the power station alone, reducing the CO₂ emitted per megawatt hour of electricity generated from 725 kg to 110 kg. This is a far better result in terms of CO₂ reduction than even conventional power plants fired by natural gas, the cleanest fossil fuel which emit around 350kg of CO₂ per megawatt hour. Hence CCS must be seen as the enabling technology that will allow low cost to be used by power generation on a large scale.”

There are three principal methods for capturing CO₂ from power generation plants, each designed to take the CO₂ from a different stage in the overall generation process. These are termed post consumption, pre-combustion, and oxy fuel combustion.

Post consumption separates CO₂ from exhaust gases created by the burning of fossil fuel. The exhaust gases a mixture of CO₂, nitrogen and some oxygen are first treated to remove particulate matter and the oxides of nitrogen and sulphur, and are then contacted with a liquid solvent, typically typically an aqueous amine solution. The amine selectively absorbs the CO₂ enabling nitrogen and oxygen to be released to atmosphere. The CO₂ rich amine is regenerated by stripping the CO₂ out of the liquid with steam .allowing the amine to be recycled to the absorber while producing a concentrated CO₂ stream.

Forsyth says “Amine absorption for separating CO₂ is well understood and used by BP and others for natural gas sweetening and other processes where CO₂ needs to be removed for process reasons. CO₂ capture is also practiced at a much smaller scale in the food drinks and the fertilizer industries .But for CO₂ capture in power plants

the main challenge is one of scale up and finding solvents which can tolerate the residual oxygen in the exhaust gas and other contaminants that may be present. A power plant of say 500 megawatts capacity could require two absorber columns each twelve metres in diameter and 35 meters high –very large process vessels. Clearly whilst post combustion lends itself well to new built power stations retrofitting the process to an old station could be tricky given possible space constraints.

Pre- combustion takes a different approach by capturing the carbon from the fossil fuel-decarbonising the fuel- before the power generation stage. To do this the fossil fuel is first converted into 'syngas' a mixture of gases containing mainly hydrogen and carbon monoxide achieved by gasification of coal or catalytic reforming of natural gas. By treating the syngas with steam over a catalyst, the carbon monoxide is converted to CO₂ and additional hydrogen is produced in a well known process called the 'water gas shift reaction. The CO₂ is separated from the hydrogen using a liquid absorbent or solid absorbent which can be regenerated to release the CO₂ while the hydrogen gas goes forward to be burned in gas turbines and produce electricity without emitting any CO₂.

“Pre-combustion offers a number of benefits “ observes Forsyth “the presence and concentration of the CO₂ are higher than in post combustion. Making separation easier and giving the chance to apply alternative separation technologies for example using selectively permeable membranes or liquefaction. Syngas itself can also be used as feedstocks for the manufacture of liquid fuels such as clean diesel and other chemicals, and the hydrogen too can be used in hydrotreating processes in refineries to produce cleaner fuels. The overall process is more complex than post combustion, but the ability to choose from a slate of sophisticated products makes it very attractive.

Sufficiently attractive in fact for BP Alternative Technology is the joint venture partnership in 2007 with Rio Tinto known as Hydrogen Energy International which is currently assessing three decarbonised fuel projects namely at Abu Dhabi using natural gas to produce hydrogen for power generation

When the processes and technology involved in gas pre combustion are largely proven, for example in ammonia production, refining, chemical manufacture, and an integrated gasification, it is not the single solution to carbon capture. It is not practical to retrofit pre combustion to existing power plants and as such the other two carbon capture methods will also be required if CCS is to have full impact.

The third of those methods is known as oxy fuel combustion where oxygen rather than air is used for combustion of the fuel, the heat produced being used for steam

raising and electricity generation. The resulting residual gas is mainly water vapour and CO₂ where the latter has a concentration of 80% or greater. The water vapour can be removed by cooling and the CO₂ steam compressed. Large scale oxygen production by cryogenic distillation of air to remove nitrogen is widely practiced in the process industries, but would be costly at the massive scale required for carbon capture. At present oxy fuel combustion systems for power generation are confined to laboratory and pilot scale developments, some investigating the circulation of part of the CO₂ to help regulate the combustion process.

Along side the scale-up challenges for all three capture methods-capture processes may need to be 20-50 times larger than the technologies as deployed in other industries today.-reduction of cost is evidently a key activity to help CCS become more attractive. BP is involved in several research and development projects, among them seeking a novel solvent to the post combustion capture; supporting pre-combustion technology development projects in membrane syngas separation, solid absorbents and CO₂ liquefaction and participation in a UK funded project on oxyfuel. The company is also coordinating the EU's Cachet project, a three year integrated research project funded by the European Commission that aims to develop technologies to reduce greenhouse emissions from power stations by 90% . IN 2007 BP announced a major research programme with Massachusetts Institute of Technology focused on conversion technologies which will also address CCS processes using advanced simulation techniques and in January 2008 BP and China Academy of Sciences agreed to undertake a feasibility study into a proposed Clean Energy Commercialisation Centre joint venture.

Having captured the CO₂ where and how to store it ? Several options for long term storage of CO₂ –sometimes referred to as sequestration –have been proposed including the injection of the gas into deep ocean. A concept which has yet to be piloted and demonstrated. Due to concerns over environmental impact over oceans and the life they sustain. However, at present the clear frontrunners for CO₂ storage locations are deep geological formations underground most notably existing oil and gas reservoirs about which the industry possesses a wealth of knowledge and experience and saline formations. unmineable coal beds and basal and oil shale formations are other possibilities , as is the use of CO₂ to improve recovery of coal bed methane from coal seams.

“Geological storage opportunities exist all around the world, both onshore and offshore” said Brian Williams , leader of BP’s CO₂ storage team . “IPCC estimates that up to 900 gigatonnes of CO₂ could be stored in depleted oil and gas reservoirs. The overall

figure for geological storage is many times the amount. Saline formations have significantly more capacity than oil and gas reservoirs, although this is harder to quantify at present. –IPCC suggests that saline formations may have capacity to hold 10,000 gigatonnes of CO₂. The bottom line is that the potential capacities for geological capacities are huge

Compared to CO₂ emission volumes-many hundreds of times greater than emissions from industrial sources -meaning that CO₂ storage in geological formations could provide a major opportunity for holding down CO₂ levels in the atmosphere and contributing to stabilization of the global climate.

Injecting gas, including CO₂ into oil and gas reservoirs has been practiced in decades as a recognized way to to enhance oil recovery-in Alaska BP is operator of the largest miscible gas enhanced oil recovery (EOR) project in the world at Prudhoe Bay. Extracting additional oil would provide a bonus to the economics of the CSS project.

To store captured CO₂ in such structures the gas would first be compressed and then injected through a well into the appropriate zone of the formation generally lying 800 -3000 metres below the surface

BP's experience gained in the three large scale CO₂ storage projects –in Salah, Stepner, and Weyburn-Midale in Canada –is being extended now with the company becoming a partner in the Ottway Basin storage demonstration project in Australia which began in 2008.This medium scale project which will inject 100,000 tonnes of CO₂ from a natural source into an adjacent depleted gas field pver the next two years is being managed by an Australian organization CO₂CRC, the Cooperative Research Centre for Greenhouse Gas Technologies. In the USA a series of seven demonstration projects is getting under way in the Department of Energy Carbon Sequestration Regional partnership Programme which BP helped to establish. BP is now a participant in four of the projects.

The J-Power Group

The J-Power Group is one of the biggest coal users in Japan, consuming approximately 20 million tons of coal per year at eight coal fired power stations. With a total capacity of 7.95GW, these stations account for approximately 20% of Japan's total coal fired capacity.

The Eagle Project of the J-Power Group is aimed at raising the efficiency of power generation from coal so as to reduce the amount of CO₂ emitted per unit power

generated. Using coal gasification and a combination of methods for generating electric power, much higher efficiency is achieved than the conventional pulverized coal fired thermal power generation system. Whereas a pulverized coal fired thermal power generation system, a pulverized coal power generates electricity only by steam turbines, an integrated coal gasification combined cycle system (IGCC) uses both steam and gas turbines. Moreover, an integrated coal gasification fuel cell combined cycle system (IGFC) has been developed that uses these two types of turbine plus fuel cells as a third mode of generation. IGFC is the ultimate technology for coal utilization to generate electricity and the J-Power Group is the world pioneer in its development. Its commercial implementation could improve generating efficiency by as much as 60%.

Eagle Project Step 1 (2002-2006)

Step 1 of the Eagle Project was carried out by building a pilot plant jointly with the New Energy and Industrial Technology Organization (NEDO) covering the fiscal years 2002-2006.

The J Power Group Japan in its CSR report for 2007 states “we have begun working to establish a technology for capturing CO₂. We will divert some of the gas produced through coal gasification through from our present gasification equipment and use it to carry out CO₂ capture testing. The Eagle project makes use of the oxygen blown method which has the merit of facilitating efficient CO₂ capture. CO₂ capture is going to be one of the key technologies for achieving our ultimate coal use with zero CO₂ emissions.. At this time we are considering the degree of our CO₂ capture system and a testing plan. With Eagle’s oxygen blown method the coal gas has less nitrogen content and consists primarily of CO and H₂. First we’ll use the shift reaction.

Eagle Project Step II (2007-2009)

Hiroshi Yamashita, Eagle Research and Engineering Group said “Having successfully completed step 1 of the Eagle Project, since fiscal 2007 we have been with Step II testing. In summer 2008 we completed we completed equipment modifications and additions so that so that testing could begin in earnest. Step 1 was largely a matter of trial and error for achieving the performance goals. With that out of the way we can now settle down for some stable operations. Step II has its own areas of trial and error as we modify the gasifier and make it applicable to a variety of coal types. Still we have the exciting sense that now we are getting somewhere as we move toward a demonstration plant and then a commercial plant. We intend to carry out test

operation and equipment maintenance more in line with the actual commercial environment. On the way to commercialization we will also study the feasibility of scaling up an oxygen blown coal gasifier. The main reason for verifying whether the gasifier can be scaled up is that the initial aim is to commercialize an IGCC system. This is one step toward future realization of IGFC toward further gain in efficiency and toward achieving the ultimate goal of zero CO₂ emissions to stop global warming.”

In the Japanese venture called “Japan CCS Co. Ltd. there are eleven utilities including Tokyo Electric Power Co, five oil refineries, four engineering firms, two oil and gas developers, one steel maker and one chemical firm. Toshiro Mitsuhashi who handles environment policies for Japan’s Ministry of Economy, Trade and Industry (METI) said “we now have a firm that brings together all the technologies in this field. Another METI official said there was potential to store 150 million tonnes of CO₂ in and around Japan.

Asia –Pacific Partnership

The Asia-Pacific Partnership on Clean Development and Climate includes Australia,

India, Japan, China, the republic of Korea and the United States. It aims to promote the development and deployment of energy technologies, fossil, renewable and new generation technologies such as hydrogen and nano technologies. The work plan has identified CCS as one of the key areas for the Asia-Pacific Partnership. The areas of cooperation for CCS are as follows:

-Build on the range of existing national and international measures and initiatives to develop cleaner fossil energy technology development programmes.

- Identify the potential for and encourage the uptake of CO₂ geo sequestration opportunities in partnership countries
- Build the research and development base and the market and institutional foundations of partners through technology supporting initiatives such as education, training and skills development

CHAPTER 6

TURN TO RENEWABLES

Renewable energy and energy efficiency are the light at the end of the climate tunnel that illuminate the most effective and timely ways to reduce carbon emissions across the global economy. The challenge now is to accelerate efforts to develop the policies and signals that will continue to create the climate for change. Achim Steiner (2008) We examine here the progress towards the development and growth of renewable energy.

Bio Fuels

The production of first generation bio fuels such as sugar cane ethanol in Brazil, corn ethanol in United States and palm oil bio diesel in Malaysia have well developed markets.

The main drivers for bio fuels have been (1) energy supply security (2) support for agricultural industries and rural communities (3) reduction in oil imports and (4) the potential for greenhouse gas mitigation.

Despite the advantages bio fuels have generated several concerns:

- Contribute to higher food prices due to competition with food grains
- Are an expensive option for energy security taking into account total production costs
- Are accelerating deforestation
- Potentially have a negative effect on biodiversity
- Compete for scarce water resources in some regions

Many of the problems associated with first generation bio fuels can be addressed by the production of bio fuels manufactured from agricultural and forest residues and from non-food crop feedstocks.

Low cost crop and forest residues, wood process wastes and the organic fraction of municipal solid wastes can all be used as ligno cellulosic feedstocks. Where the materials are available it should be possible to produce bio fuels with virtually no

additional land requirements and adverse. However in many areas because of limited supplies vegetative grasses or short rotation forest crops will be necessary as supplements. In cases where the potential energy crops can be grown on marginal or degraded land these will not compete directly with food and fibre crops which require better quality of land. The production of biofuels from lignocellulosic feedstocks can be achieved through two different processing routes: (1) biochemical in which enzyme and other micro organisms are used to convert cellulose and hemicellulose components of the feedstocks to sugars prior to the fermentation to produce ethanol. (2) thermo chemical where pyrolysis /gasification technologies produce a synthesis gas (CO+H₂) from which a wide range of long carbon chain fuels such as synthetic diesel or aviation fuel can be reformed .

There is currently no commercial or technical advantage between the biochemical or thermo chemical pathways. For the biochemical route much remains to be done in terms of improving feedstock characteristics to reducing costs by perfecting pre-treatment, improving the efficacy of enzymes and lowering the production costs and improving overall process integration. The potential advantage of the biochemical route is that the costs of production have been successful to date so it could possibly provide cheaper bio fuels than via the thermo-chemical route.

As far as the thermo chemical route is concerned much of the technology is already proven. There is however the problem of securing large enough quantity of feedstocks at reasonably delivered costs at the plant gate in order to operate on an economic scale.

Comparisons between thermo chemical and biochemical routes appear to be fairly contentious within the industry with lack of any published cost data.

Success in the commercial deployment of second generation biochemical technologies will be to focus on:(1) a better understanding of currently available feedstocks, their geographical distribution and costs. It has therefore been suggested that experience should be gained in the production of various dedicated feedstocks such as switch grass , miscanthus, poplar, eucalyptus and willow. This is necessary in order to understand their yields, characteristics and costs. (2) It is necessary to determine the optimal size of a production facility after trading off economies of scale against using local, reliable against local, reliable and cost effective feed stock supplies.

Studies have shown that technology improvements are necessary in terms of feedstock pre-treatment because feedstock pre-treatment technologies are inefficient and

costly. Improvements in physical, chemical, and combinations of these pre-treatments need to be achieved to maximize the efficacy of pre-treatment in opening up the cellular structure of the feedstock for subsequent hydrolysis.

New and improved enzymes are being developed. The effective hydrolysis of the interconnected matrix of cellulose, hemicellulose and lignin requires a number of cellulases those most commonly used being produced by wood rot fungi such as *Trichoderma*, *Penicillium* and *Aspergillus*. However, their production costs are still very and improvement high. The presence of product inhibitors also needs to be minimized. Recycling of enzymes has been suggested as a potential method to reduce costs.

Promotion of second generation biofuels can help to provide solutions to multiple issues including energy security and diversification, rural development, GHG mitigation and help reduce other environmental impacts. Hence policies need to be carefully designed if they are to avoid unwanted consequences and potentially delay commercialization.

A number of factors have to be considered before second generation biofuels can be commercialized.

- production of cost effective second generation biofuels
- increasing performance of conversion technology
- evaluating the costs and benefits of increasing of increasing soil carbon content and minimizing loss of soil carbon via land use change
- increasing crop productivity and improvement of the ecosystem health through management techniques, improved mechanization, and water management.

It is necessary that continued progress be made in addressing and characterizing the environmental performance of biofuels. The environmental performance of biofuels. These will need to cover the production of biomass feedstocks and potential impact from changes in use of land.

Let us take a look at biomass carbon neutrality. Plants and trees remove carbon dioxide from the atmosphere and store it while they grow. Burning biomass in homes, energy processes, energy generation activities or for transport, return this sequestered CO₂ to the atmosphere. New plant or tree growth keeps the atmosphere carbon cycle in balance by recapturing CO₂. The net zero or neutral carbon cycle can be repeated indefinitely as long as biomass is re-grown in the next management cycle

and is harvested for use. The sustainable management of the biomass source is critical for ensuring that the carbon cycle is not interrupted.

The main industry uses of biomass are the wood and wood products industry as well as the pulp, paper and carton industry.

On Dec 30, 2008 Air New Zealand aircraft taxied past the air traffic control tower at Sydney airport. The airline has successfully flown a test flight powered by the second generation biofuel and hailed it as a 'significant milestone' in the development fuels for aircraft.

The Renewable Option

The Renewable Energy Option (RO) of U.K is the key support mechanism for the support mechanism for expansion of renewable energy. It has succeeded in bringing forward major developments of the most economic forms of renewable energy, in particular onshore wind, landfill gas, and co-firing of biomass in coal power stations.. The cost of RO is met by the electricity consumers .It allows renewable energy which is currently more expensive to produce than coal, gas or nuclear to be competitive with them. Its rationale is that as these are new technologies they are yet to achieve the full economies of mature technologies.

The RO is proposed to be strengthened in two ways: At present it is due to rise to about 15% in 2015 and remain at that level till the obligation ceases at the end of 2026-27. The report states "We now plan to ensure that the level of obligation stays above the level of renewables actually installed up to a 20% obligation. This will boost investors confidence in the returns they can make from their projects.

Second we propose to consult on adapting the Renewables Obligation to reflect the fact that some technologies are better established and no longer and no longer need the support of the Obligation so that it begins to provide differentiated levels of support to different renewable technologies."

The Report further points out "This boost for renewables will add carbon savings of around 0.7 -1.5MtC per year by 2020 to the savings the RO is already helping to deliver. Our proposals will not increase the impact of the RO on bills. Additional renewables will also contribute to our security of supply goals for example by displacing gas power stations that might otherwise be built"

Wind Energy

According to The International Energy Agency the energy content of the wind is proportional to the cube of the wind speed, so a slightly faster average speed yields significantly greater output. This has major bearing on the financial viability of a project. It has been estimated that a good wind speed site for an average development is around 7m/s (25kmph, 16mph) and above at a hub height of 80 metres. The importance of high quality wind regime is illustrated by the fact that US produced more wind electricity in 2007 than any other country, even though it does not have the largest installed capacity.

Six countries world wide account for almost all wind turbine manufacturing. Denmark contains only a little over 3% of global installed wind capacity, it was the birth place of modern wind energy and still produces over a third of all turbines sold world wide. Other principal manufacturing countries are Germany, Spain, USA , India and China.

One of the largest planned wind farms in the world , The Shepherds Flat Wind farm which would span Gilliam and Morrow counties in north-central Oregon is proposed to have 303 win turbines with a peak capacity of 909 megawatts (MW) . While not as large as T.Boone Pickens' proposed 4,000 megawatts (MW) Texas wind farm complex (slated for completion in 2014) it would likely be the largest wind farm in the US and potentially the largest in the world if completed by the target date in 2012.

Solar Energy

The World Energy Council Survey of Energy Resources 2007 states that concerns relating to the present energy systems are growing “because of the inherent risks connected with security of supply and potential international conflicts and on account of the potential damage they can do to the natural environment in many and diverse ways. World public opinion, international and national institutions and other organizations are increasingly aware of these risks and they are pointing to an urgent need to fundamentally transform the present energy systems on to a more sustainable basis.”

The World Energy Council estimates that by 2100, oil, gas, coal and nuclear will provide less than 15% of world energy consumption , while solar, thermal and photovoltaic will supply 70%. “

However concerted and continuous research efforts are essential if the estimates are to be reached and such efforts are indeed being made. Yogi Goswami, Past president International Solar Energy Society and editor-in-chief Solar Energy Journal observes that “The promising new technologies which have been identified are continued development of new thin film technologies, nano scale antennas for conversion of sunlight to electricity, biological nano scale PV, new concepts in solar desalinization visible light photocatalytic technologies for PV or environmental applications and new thermodynamics for solar thermal power.”

All the research efforts are likely to be successful if they are supported by strong government policies.

Global Status of Renewable Energy

Prepared by the Renewable Energy Network for the 21st century (REN21) in collaboration with the World Watch Institute The Renewable 2007 Global Status Report paints an encouraging picture of rapidly expanding renewable energy markets, policies. industries and rural applications around the world. In 2007 global wind generating capacity.

Sustainable Energy Investment

Securing energy supplies and speeding up the transition to renewable energy call for radical action by governments at national and local levels and through participation in co-ordinated international mechanisms.

According to the World Energy Outlook 2008 “modern renewable energy technologies grow most rapidly, overtaking gas to become the second largest source of electricity, behind coal soon after 2010. Falling costs as renewable energies mature, assumed fossil-fuel prices and strong policy support provide an opportunity for the renewable industry to eliminate its reliance on subsidies and to bring emerging technologies into the mainstream. Excluding biomass, non hydro renewable energy sources-wind, solar, geothermal, tide and wave energy-together grow faster than any other source worldwide at an average rate of 7.2%”

A study on “Global Trends in Sustainable Energy Investment 2008” commissioned by UNEP and endorsed by Renewable Energy Policy Network for the 21st Century. Achim Steiner Executive Director UNEP writes in the forward to this study writes “The message

from the report is one of confidence-confidence that cheap and meaningful emissions reductions are achievable if clean energy markets are given the oxygen to evolve.

Renewable energy and energy efficiency really are the light at the end of the climate tunnel that illuminates the most cost effective and timely ways to reduce carbon emissions across the global economy. The challenge now is to accelerate efforts to develop the policies and signals that will continue to create the climate for change..”

The key findings of the Report are:

- Asset finance to build (to build sustainable power generation and bio fuels capacity) accounted for 57% of new investment in 2007. Public market investment more than doubled in 2007 with \$ 23.4 billion of new money raised. Convertible bond issuance increased eight fold in 2007, reflecting progressively less stable stock market conditions. Wind continued to attract most investments, mainly for new capacity building, but solar investment took off in 2007-\$28.6 billion of new investment flowed into solar which has grown at an average annual rate of 254% since 2004.
- Wind power continues to dominate renewable energy capacity. In 2007 wind attracted more investment than nuclear or hydro and accounted for more new generation capacity in Europe than any other power source. Interest in clean energy investment surged forward with assets under management in clean energy funds rising to \$35 billion in 2007, and boosting quoted sustainable energy companies valuations. The WilderHill New Energy Index (NEX) rose 57.9% in 2007. Sustainable energy continued to make their mark on the public equity markets, accounting markets in 2007

The WilderHill New Energy Global Innovation Index (NEX) is companies of companies worldwide whose innovative technologies and services focus on generation and use of cleaner energies, conservation and efficiency and generally advance renewable energy. Those companies are also included whose lower carbon approaches are relevant to climate change and whose technologies help reduce emissions relative to traditional fossil fuel use.

- early stage venture capital surged to \$2 billion boosted by interest in emerging renewable technologies, rather than those just on the brink of commercialization as competition for deals intensified. Private equity finance for expansion started strongly in 2007, driven largely by boom in ethanol production in the US but ground to a halt in may 2007 as feedstock prices rose and ethanol prices fell.

Overall venture capital and private equity (VC/PE) investment in biofuels fell by almost one third but investment in biofuel has not dried up altogether shifting to Brazil, India and China. European investment is growing strongly as investors become more willing to take early stage risk.

- Research and Development spending on clean energy and energy efficiency was \$16.9 billion in 2007 including corporate R&D of \$9.8 billion and government R&D of \$7.1 billion. Europe and the Middle East saw the most corporate activity followed by the Americas and then Asia. The governments of Japan, China and India invest heavily in R&D. The US and UK host the most clean energy incubators often supported by public funding. Solar is the most incubated technology with a bias towards service companies, disruptive technologies and large scale generation such as solar thermal electricity generation. (STEG)
- Clean energy companies more than doubled the amount of money they raised on the world's public markets in 2007
- Financing of sustainable energy assets grew by 61% in 2007 to \$108 billion.
- Corporate mergers and acquisition activity increased 52% to \$25.7 billion in 2007 buoyed up by equity financing and diversification activity. Wind led mergers and acquisitions grew. Wind assets are gradually being transferred from developers to utilities. The mergers and acquisitions in biofuels were driven by industry turmoil which shook out weaker players, as well as cost of building new plants, leading developers to acquire existing ones.
- There is a continuing shift from developed to developing countries with its share of new investment growing from \$1.8 billion to \$26 billion in 2007

SMART GRIDS

Once electricity has been generated it needs to be conveyed to consumers using digital technology to save energy, reduce cost and increase reliability. Such a modernized electricity network is being promoted by many governments as a way of addressing energy independence or global warming.

The smart grid consists of two networks. The first is an actively managed transmission network usually operating around 400kV (or more in some countries); the other the distribution network operating at below 132 kV.

A smart grid is an effort to prod consumers of electricity to change their behaviour around variable electric rates or to pay vastly increased electric rates for the privilege of electrical service during high demand conditions. To accomplish this objective, a smart grid incorporates consumer equipment and behaviour in grid design operation and communication technologies. In order to reduce demand during peak usage periods using communication and metering technologies to track not only how much

electricity was used but also when the electricity was used and then to increase the price of electricity used during high demand periods and decrease it during low demand periods. In order to encourage consumers to consume less during high demand periods, means are adopted to indicate to consumers, when the price of electricity is about to go up or to go down and to adjust their electricity demand accordingly so as to take advantage of the prevailing rates.

Following the release of the of the clean energy-friendly US economic stimulus package two smart grid projects have been announced.

National Grids US division is set to develop a \$57million Smart grid pilot project in Worcester Massachusetts. Meanwhile GE digital energy will provide wireless communication to support Texas based Center Point Energys new Advanced Metering System(AMS)- Center Point's first step in developing a Smart Grid. Center Point's AMS is designed to give Houston-area customers the ability to better monitor and monitor and cot in near real time.

Clean Renewable Energy and Economic Development Act 2009

On February 25, 2009 Senator Reed announced that he will introduce a bill which will chart a better path to a cleaner greener and smarter transmission policy, without sacrificing affordability or reliability.

Introducing the Bill as the Clean Renewable Energy and Economic Development Act 2009 Senator Reed said "The country needs a plan that will result in the construction of new transmission lines to those renewable rich zones where the sun, the wind and the heat of the earth are super abundant.

At the other end of those lines the consumers will get affordable and reliable clean power that will help meet our environmental and national security challenges

By connecting these remote locations to the population centers that consume the overwhelming majority of energy we will open up vast new markets for a clean homegrown product that creates American jobs that can never be outsourced.

That is why my legislation requires the President to designate renewable energy zones. Then the Bill stars massive national planning effort to maximize the production of renewables and connect these regions to population centers throughout the country.

Building this national smart grid requires us to reform the current siting process."

CHAPTER 7

INVEST IN GREEN ISSUES

Green investments are investments that are environment friendly. The promotion of green investments require action at three levels (1) Government (2) banks and (3) corporations

Green Investment and Role of Government

The role of government in Green investment has been very clearly brought out in a Report “An Outline Of The Case For a Green Stimulus” (2009 Bowen, Frankheuser, Stern; Zengheles).

Lord Stern, The former treasury economist and now chair of the Grantham Research Institute on Climate Change and the Environment said “With billions about to be spent by governments on energy, buildings and transport, it is vital that these public investments do not lock us for many more decades into a costly and unsustainable high carbon economy.”

Alex Bowen of the Grantham Institute and formerly head of the Bank of England who is the lead author of the Report said, “Our assessment shows that \$4 billion spent globally in the next 18 months on green policies and investments, such as smarter use of electricity will help us to deal with the current economic crisis, create jobs and tackle climate change.” The report emphasizes the need for an appropriate fiscal policy. In addition to a theoretical case for fiscal policy there is empirical evidence in its support. This evidence is provided by research at IMF which has shown how effective fiscal policy has been in responding to downturn economy, particularly recessions.

The IMF review of OECD experience found that for spending increases short run fiscal multipliers tend to be in the short run in the range 0.6 to 1.4 while for tax cuts they tend to be significantly lower lying in the range 0.3 to 0.8.

The Report however points out that (i) tax cuts are likely to have a larger multiplier effect if they are focused on people who are credit constrained. Another consideration

is that tax cuts and increases in transfers are generally easier to implement swiftly than increased public spending on goods and services are generally easier to implement swiftly than increased public expenditure on goods and services, particularly if the latter is to be properly evaluated and monitored. But tax changes alter relative prices and for this reason volatility in the tax rates is generally inefficient.

The Report observes that “targeting is a more difficult issue. One criterion is to focus spending and tax cuts where they would have most effect on aggregate demand—where the fiscal multiplier is the greatest. That is a key consideration at the moment given the urgency of tackling the economic down turn. Spending increases do better on this criterion than across the board tax cuts. Spending increases need to target sectors where there are less likely to be bottlenecks from capacity constraints or scarcity of specialized skills, and tax cuts need to be focused on credit constrained household and firms.”

The second criterion is the impact of the stimulus on well being over the longer term and therefore public spending needs to be considered in the light of cost benefit analysis and not the size of the fiscal multiplier alone

Banks as Drivers of Corporate Response to Climate Change

The banks fund projects and many banks are now examining carefully the environmental impact of projects submitted for financing before they grant the funds. Conditions are also laid down for continuous appraisal of the environmental impacts during the construction of the project.

The Equator Principles

The Equator Principles were developed by private sector banks and were launched in June 2003 These principles were modeled on the environmental standards of the World Bank and the social policies of the International Finance Corporation.

The revised Equator Principles for project finance were issued in July 2006. The preamble to the Equator principles states “Project financing , a method of funding in which a lender looks primarily to the revenues generated by a single project both as a source of repayment and as security for the exposure, plays an important role in financing development throughout the world. Project financiers may encounter social and environmental issues that are both complex and challenging particularly with respect to projects in the emerging markets.

The Equator Principles Financial Institutions (EPFIs) have consequently adopted these principles in order to ensure that the projects we finance are developed in a manner that are socially responsible and reflect sound environmental and management practices. By doing so negative impacts on project affected on project affected eco systems and communities should be avoided where possible , and if these impacts are unavoidable , they should be reduced, mitigated and/or compensated for appropriately. We believe that adoption of and adherence to these Principles offers significant benefits to ourselves, our borrowers and local stakeholders through our borrower’s engagement with locally affected communities. We therefore recognize that our role as financiers affords us opportunities to promote responsible environmental stewardship and socially responsible development. As such EPFIs will consider reviewing these Principles from time to time based on implementation experience and in order to reflect ongoing learning and emerging good practice.

“These principles are intended to serve as a common baseline and framework of each Equator Principle and Financial Institution (EFPI) of its own internal and social environmental policies, procedures and standards related to its project financing activities. We will not provide loans to borrowers where the borrower will not or is unable to comply with our environmental policies and Equator Principles.”

There are 10 Equator Principles which are described below:

The First principle requires a review of the environmental and social policies and the potential impacts and risks in accordance with the environmental social screening criteria of the International Finance Corporation.

The Second Principle requires a social and environmental assessment of projects.

From the point of view of the social and environmental impact the projects have been divided into three categories: (i) category A-projects with potential significant adverse social and environmental impacts that are diverse, irreversible or unprecedented. (ii) category B-projects with potential limited adverse social and environmental impacts that are few in number , generally site specific, largely reversible and readily addressed through mitigation measures and (iii) category C-Projects with minimal or no social or environmental impacts.

The Third Principle describes the applicable social and environmental standards. For projects located in non-OECD countries and designated as high income as defined by the World Bank Development Indicators Data Base. The assessment process

requires compliance with relevant host county laws , regulations and permits that pertain to social and environmental matters.

The Fourth Principle is concerned with the Action Plan and Management Systems.. For all category A and B projects located in non-OECD countries and those located in OECD countries not designated as high income the borrower is required to prepare an Action Plan which describes and prioritizes the actions needed to implement mitigation measures, corrective measures and monitoring measures required to comply with host county social and environmental laws and regulations of the applicable performance standards and EHS Guidelines as defined in the Action Plan. For projects located in High Income OECD Countries, EDFIs may require development of an Action Plan based on relevant permitting and regulatory requirements and as defined by the host country law.

The Fifth Principle relates to Consultation and Disclosure. For all category A and as appropriate category B projects located in non-OECD countries, not designated as high income the government, borrower or third party expert need to consult with project affected communities in a structured and culturally structured manner. For projects with significant adverse effects on effected communities in a structured and culturally appropriate manner. The process must ensure their free, prior and informed participation as a means to establish, to the satisfaction of the EFPI whether a project has adequately incorporated affected communities concerns

It is necessary for the borrower to make available to the public the assessment document in the local language and in a culturally appropriate manner. A reasonable minimum period must be given for the reactions.

The Sixth Principle is the grievance Principle. The borrower needs to ensure that consultation, disclosures and community engagement continues through out the construction and operation of the project. The borrower must, scaled to the risks and adverse impacts of the project establish a grievance mechanism as part of the management system.

The Seventh Principle requires an independent review by a social or environmental expert. This expert should not be directly associated with the borrower.

The Eighth Principle relates to covenants. An important strength of the Principles is the incorporation of covenants linked to compliance. For category A and B projects the borrower is required to covenant the following in the financing document.

- (a) to comply with all relevant host country social and environmental laws, regulations and permits in all material aspects
- (b) to comply with the AP during the construction and operation of the project in all material respects.
- (c) to provide periodic reports in a format agreed with EPF prepared by in-house staff or third party experts that (i) document compliance with AP and provide information on compliance with relevant local, state and host country social and environmental laws, regulations and permits
- (d) to decommission the facilities where appropriate and applicable in accordance with an appropriate decommissioning plan. Where a borrower is not in compliance with its social and environmental covenants EFPIs will work with the borrower to bring it back into compliance with an agreed grace period. EFPIs reserve the right to exercise remedies as they consider appropriate.

The Ninth Principle relates to independent monitoring and reporting. The monitoring needs to continue over the life of the loan. It is necessary to appoint an independent social or environmental expert or to retain qualified and experienced external experts to verify its monitoring information which would be shared with EFPIs

The Tenth Principle requires each EFPI adopting the Equator Principle to report publicly at least annually about its Equator Principles implementation, taking into account appropriate confidentiality considerations.

Policies of Banks who have adopted the Equator Principles

We examine here the project financing policies of HSBC and ABN AMRO both of whom were associated with the drafting of the Equator Principles and therefore are clearly committed to the adoption of the Equator Principles. They are also listed in the Global Dow Jones Sustainability Index.

HSBC

The CSR Report of HSBC for 2006 states, “ Significant sustainability risks can arise in large projects, such as the construction of an airport, a power plant or an oil refinery...Since HSBC adopted the Equator Principles in 2003 they have become a key component of our Project and Export Finance Business, while also forming a core part of our wider approach to managing sustainability risks.”

Project finance: Equator Principles in Practice	2006		2005		2004	
	No	Value US\$ ml	No.	Value US\$ ml	No	Value US\$ ml
Transactions approved	76	5,171	67	4,601	46	3,528
By category						
Category A	1	80	5	809	1	170
Category B	41	2,708	38	1,917	34	2,435
Category C	34	2,383	24	1,875	11	923
By type of facility						
Solely commercial	42	2,921	39	1,995	29	2,091
Solely export credit	29	1,350	21	2,075	13	997
Commercial/ export credit	5	900	7	531	4	440
Transactions declined	4	n/a	7	n/a	12	n/a

The Sustainability Report 2006 the Equator Principles “Remain an integral part of the advice we provide to clients helping to identify both impacts and solutions. As can be seen from the table our Project and Export Finance business has grown significantly in the last three years, partly due to the implementation of the Equator Principle. The majority of our transactions fall into the lower risk categories (B and C). where impacts can be managed in a sustainable manner. We also record the number of transactions which are declined and where failure to comply with the Principles was a contributory factor. This number continued to fall, reflecting the good standards of our clients and the skill of our executives in screening out unacceptable proposals at an early stage before any formal approval is required.

Successful implementation of our policies have been achieved by embedding them in our business units. Project and Export Finance Executives have undergone formal and on-the-job training on the Equator Principles while senior management ensures that that sustainability projects are considered in the review of potential project finance transactions. Our head office gives final approval of our transactions with a higher level of sustainability risk. Training modules on the new principles and the new Performance Standards are now included in our risk management training course.”

ABN AMRO

Equator Principles assessment by project category

	No. of Assessments	Approved with conditions	Approve	Declined
Category A projects	10	2	5	3
Category B projects	19	10	8	1
Category C projects	4	4	0	0

Equator Principles assessment by sector

	No. of Assessments	Approved with conditions	Approve	Declined
Oil and gas	12	4	7	1
Mining and metals	5	2	1	2
Power and Utilities	12	7	5	0
Construction and Building Materials	1	1	0	0
Others	3	2	0	1

The ABN AMRO CSR Report for 2006 states that “NGOs often ask what banks are doing to measure the carbon intensity of their lending book. One particular area of focus is the impact that project financing has on the climate in terms of carbon emissions. This is a complex issue that requires assessment of the risks related to clients and their performance in this field.

The carbon intensity of projects we finance can give rise to risks in many areas. On one level, projects could face policy risk through action by international, national and regional governments. New policies – perhaps involving environmental protection or limitation on emissions- might be passed into law, affecting a project's ability or licence to operate. Other cash flow risks can emerge around input cost rises, or output cost falls including the price/opportunity cost of carbon. Similarly there may be a reduction in demand for carbon-inefficient goods and services. Physical risks are also present around weather events and adaptation to new climate patterns. Assessing these layers of risk is a complex task. Many of them are project-specific and require detailed analysis. To be effective, risk management needs to minimize the overall carbon footprint of the project financing portfolio and to work in the context of the newly emerging carbon markets.

This carbon risk also needs to be reflected throughout the overall life cycle of the project.”

Electric Power

American Electric Power (AEP)

American Electric Power has been recognized as one of the leaders of Climate Change and therefore it is important to consider the measures it has taken to reduce the adverse impact of its activities on climate change.

The Corporate Social Responsibility Report of American Electric Power 2006 was prepared after working with CERES and 17 social and environmental advocacy and labour organizations. In his Forward to the 2006 CSR Report Michael G. Morris, Chairman, President and Chief Executive Officer he writes “Climate change is a significant issue for society and certainly for AEP, as we are one of the largest consumers of coal in the United States. We feel a growing imperative to reduce greenhouse gas emissions and support a reasonable approach to carbon controls. It is critical that such controls are consistent with our obligations to provide reasonably priced electricity to support the economic wellbeing of our service territory and our country. Climate change is a global issue and we will continue to work with our international partners including Asia-Pacific Partnership to encourage the participation of developing countries such as China and India. The United States is in a position to lead change and bring other nations into the process, and we will work with our representatives to do so’

This statement has to be interpreted in the context of the Asia-Pacific Partnership on Clean Development and Climate Change. This is an international non-treaty agreement among Australia, India, Japan, the Peoples Republic of China and the United States .It came into being on July 28, and 2005.canada became a member in August 2007.

Technologies for CO₂

AEP is one of the largest consumers of coal in the country. Since coal is a source of carbon dioxide, a greenhouse gas, AEP has considered various solutions for reducing greenhouse gas emissions. According to the CSR Report for 2006, AEP plans to install carbon capture on two existing coal fired power plants-the first commercial use of this technology. The climate plan of the company also includes wind generation and other renewables, domestic GHG offsets through agriculture, forestry, and other projects: power plant efficiency improvements and energy efficiency programmes with customers. In March 2007 AEA signed a Memorandum of Understanding with world renowned technology providers for carbon capture and storage. The commercial validation project will be conducted at the Mountaineer plant West Virginia. The first of its kind commercial capture project is to begin operating at Northeastern stations at Oklahoma.

The plants will employ a chilled ammonia carbon capture technology. Laboratory testing has shown that this process has the potential to capture 90% of CO₂ at a lower cost than other technologies that could be retrofitted at pulverized coal power plants.

A vendor sponsored project to demonstrate the technology was set up on a 5-megawatt (MW) (thermal) slipstream from a Wisconsin plant. Subsequently the technology will be installed on AEP's 1,300 MW Mountaineer plant as a 30-MW product validation in mid-2008. It is designed to capture up to 100,000 of metric tons of CO₂ per year which will be stored underground in deep saline aquifers.

Once the project is successful at Mountaineer the technology will be installed at the 450MW coal fired units at North Eastern at Oklahoma in late 2011. When in service it is expected to capture 1.5 million metric tons of CO₂ per year, which will be used for enhanced oil recovery. This post- combustion carbon capture system in the opinion of AEP is suitable for existing plants and new plants and uses less energy to capture CO₂ than other technologies currently being tested.

The Paper Industry

The Nippon Paper Group

The Nippon Paper Group consists of Nippon Paper Group Inc which is a pure Holding Company, Nippon Paper Industry Co. Ltd. which handles the business of paper, and Nippon Daishowa Paperboard Company Ltd. which is involved in the paperboard business. Both Nippon Paper Industries Co. Ltd. and Nippon Daishowa Paper Board Industries Ltd. have affiliate companies engaged in the manufacture sale or provision of services related to pulp, paper, sale or provision of services related to paper, pulp and paper business.

The Nippon Paper is taking a number of measures to curb the greenhouse gas emissions. They recognize and state in their Corporate sustainability report for 2006 that in “The pulp and paper industry –the Groups mainstay business- is a large consumer of fossil fuels which are the major source of greenhouse gas emissions .As of fiscal 2004 approximately 5.5 % of the total carbon dioxide emissions by the entire domestic sector or 25.84 million tons were attributed to the pulp and paper industry. The industry’s impact is thus significant.

The Japan Paper Association of which Nippon Paper Industries Ltd is a member, established its “Voluntary Action Program for the Environment” and takes part in the voluntary action program of Nippon Keidanren. The program aims to reduce the specific consumption of fossil fuel energy per product by 13 % and the specific unit of carbon dioxide emissions by 10 % from the fiscal 1990 by fiscal 2010. The industry has been tackling the challenge with a degree of determination that is being praised by the industrial sector.

The pulp and paper industry uses large quantities of non-fossil fuel (biomass energy called black liquor) that is produced as a by-product in the process of manufacturing pulp (the fibre that becomes the raw material for paper) from wood chips .The percentage of this non-fossil fuel use has been declining with an increase of recycled fibre which does not generate black liquor.. Nevertheless, the utilization of non-fuel fuel helps to control the consumption of fossil fuels.

Recognizing this the Nippon paper Group is striving to curb its carbon dioxide emissions by reducing the use of fossil fuels and promoting energy saving measures to achieve the dual objectives of fulfilling the responsibility as a member of society and attaining sustained growth by ensuring over the medium and long term.’

Other measures stated in the CSR Report 2006 are::

Overseas Tree Farms

The Nippon Paper Group started an afforestation project in Chile in 1992 and in 1992 and has since pressed forward with afforestation in accordance with its 'Tree Farm Initiative' under which an amount equal to the annual growth is harvested. Pursuing a target of 100,000 hectares of afforestation by 2008 , the Group has attained 99,300 hectares by the end of 2005

Forest Certification

A Forest Certification System is one under which a third party organization certifies sustainable forest management. The Nippon Paper Group has set a goal of having all of its company owned forests within and outside Japan certified by 2008. As of June 2006, nearly 100 % of the company owned forests in Australia were certified as being sustainable.

Imported Hardwood

In order to ensure sustainable procurement the Nippon domestic pulp and paper mills intend to procure all of their hardwood from lumbar harvested from either tree farms or certified forests by 2008. AS of fiscal 2005 these sources accounted for 80% of total hardwood imports.

Establishment of the Climate Change Office

The Nippon Paper Group has been working on global warming counter measures by focusing on three areas, management of greenhouse gas related data, increasing the usage rate of non-fossil fuels and promoting energy-saving measures and raising awareness within and outside the company. On Nov. 1, 2005 a Climate Change Office was established within the Environment Department of Nippon Paper Industries co. Ltd.

Carbon Dioxide Absorption and Sequestration through Management of Company Owned Forests in Japan

Nippon Paper Industries owns a total of approximately 90,000 hectares of domestic forests. Forests have the function of carbon dioxide absorption sequestration. Trees

absorb carbon dioxide in the process of growing and accumulate cellulose and other types of carbon in their trunks and branches for a number of years. By managing its forests Nippon Paper Industries Ltd. helps approximately 250,000 CO₂ tons of carbon dioxide to be sequestered annually.

Green Distribution

Nippon Paper Industries Co. Ltd targets to lower the distribution energy related consumption by 5% from the levels of fiscal 2002 by fiscal 2004.

Energy consumption by ship, railroad and truck transport during fiscal 2005,

Votorantim Celulose e papel (VCP)

Votorantim Cellulose e papel is one of the leading companies in the paper and pulp sector in Brazil and is one of the largest enterprises of the Votorantim Group.

The CSR Report of VCP for 2006 states, “Climate change and what it leads to can represent both risks and opportunities for VCP. The risks are associated with the impossibility of surveying and inventorying of the emissions and potential for sequestering carbon in the company’s operations. On the other hand they represent opportunities in which it is possible to evaluate potential of projects that complies with the potential of the Kyoto Protocol together with the requirements of the Chicago Climate Exchange.(CCX) Other opportunities that are in evidence are, for example, the preparation of management programmes for optimizing the energy matrix and programs and targets for the reduction of emissions of greenhouse gases (GHG) which are in step with the company’s efforts to increase its commitment to the environmental cause and bring its practices into closer alignment with the hopes and expectations of society.”

The CSR report further points out that “The climate changes could contribute to the occurrence of more frequent extreme natural events as well as more accentuated seasonal differences. Thus forestry management now begins to work with the concept of mosaics and planning that makes use of water basins. Studies regarding the role of planted eucalyptus forests , regarding the sequestering carbon are being conducted by the company, and the results should be incorporates into the mosaic planning process.”

IN 2006 the company invested US\$23.8million for environment. Of this US\$ 23.1 million was for internal projects and US\$ 0.7 millions was for external projects. “The

internal environmental investment was redistributed being given a new focus compared to 2005. The main investment during the previous was for clean up of pollution (4%) and of preservation 39 %.. In 2006 was centered on waste management (50%) of the total invested.

External environmental investment, which includes actions beyond the restricted demands of the Company's business requirements also were redistributed in 2006..VCP's priority investment was related to environmental education actions-including funds intended for the Center for Environmental Education.- different from the previous year when most of the investment (89%) went to waste management.

Use of Energy: The integrated units energy source is based on renewable energy resources and are self sufficient in the generation of electrical energy. This condition reflects the company's efforts to control and reduce the company's emission of greenhouse gases, a critical contributor to the speeding up of global warming. At the end of 2006 84% of the company's energy source was constituted by energy sources.”

CHAPTER 8

VIGOROUSLY PURSUE MARKET MECHANISMS TO PUNISH POLLUTERS

Market mechanisms may be considered as those instruments that guide behaviour through market signals rather than through explicit regulations or directives, The significance of market mechanisms lies in their potential to redefine the agenda of firms to show that environmental outcomes of the firms are in their own interest.

Market mechanisms to punish polluters may be divided into two categories (1) making the polluter pay for the pollution. This is one of the oldest recognized methods and was recommended way back in the 1920s when AC Pigou put forward the Polluter Pays Principle and (2) Promoting innovative technologies via financial incentives.

The two categories recognize that there is a schism between the traditional environmental policies and innovation policies. The traditional approach has been considered as a burden on business because of the restrictions and costs involved. Government policies and companies both have had a reactive approach to environmental policies and pollution taxes, but market mechanisms encourage a proactive approach.

Classification of Market Based Instruments

The market based instruments have been classified into three categories:

- (1) Price-based instruments. These instruments seek to bring about change by bringing about change in existing markets via emission charges, user charges, product charges, performance bonds, non-compliance fees, subsidies and deposit fund systems.
- (2) Rights based instruments which specify new rights and obligations; tradeable permits rights or quotas.
- (3) Instruments which reduce market friction such as via eco labeling, disclosure of information, extension or education programmes.

Designing MBIs

A number of studies have shown the factors that need to be considered in designing MBIs. They are:

1. The greater degree of heterogeneity among firms generally the greater the gains relative to traditional command and control regulations (Newell and Stavins 1999; Stavins 2000)
2. The less site specific the impacts of pollution the more likely that MBIs will be cost effective. (Stavins 2000)

Innovations and Market Based Instruments

For most of the companies the environment is not considered a competitive factor. The signals from the market for eco innovation and corporate social responsibility are weak and unclear though perhaps rising. Few companies however are beginning to recognize as is evident from their CSR reports that corporate strategies need to be built to create synergies between environment and innovation policies. (Kemp and Anderson 2004; Kemp Anderson and Butler 2004).

The support from theories to promote the synergies has been lacking. Environmental policies have been built on a mixture of neo-classical environmental economics, political science, law and insights from the physical sciences. These theories need to be developed particularly in the context of PROACTIVATE.

When we consider market based incentives for innovation, then innovations by companies need to be seen in a larger institutional set. The central factor is innovation which determines a company's competitive position but the political and socio economic conditions should also form part of the analysis.

We need to consider innovation as an integral part of a system. An innovation system has been defined as "those elements and relations which interact in the production, diffusion and use of new and economic useful knowledge (Lundvall (1992)).

Market Based Systems in a Post Kyoto framework

The market based instruments in a post Kyoto framework needs to address issues of (1) innovation in the context of energy efficiency and energy security and (2) moving towards a low carbon economy.

Innovation is the key to energy efficiency as well as energy security. In designing any system of market instruments it is necessary to understand the relationships between innovations, market opportunities in both market and non-market interventions.

The focus on innovations and market opportunities shows that innovation is not a linear flow from R&D. It requires the support of policy and legislation at the government level and development of appropriate strategies at the corporate level. The factors that need to be taken into account are culture, institutional framework and international conventions.

The fact that each country has to devise its own system of market based instruments has been very clearly brought out in the notes which have been submitted by individual countries to the Conference of Parties to the Convention for the ninth meeting at Bonn 19-30 May 2008.

The main points which emerged after a study of the notes submitted by the European Union, and individual countries were:

- The effect of environmental measures on market access, and those situations in which elimination or reduction of restrictions on trade can benefit trade, environment and development . For developing countries it is important that environmental measures do not act as barriers to access the market in the developed countries.
- Perverse incentives in agriculture, fisheries is likely to sustain the intensive exploitation of natural resources and are a major cause of decline in biodiversity.
- Annual studies and analysis could be undertaken on the impact of positive subsidies, with a view to eliminate the latter and ensure that positive measures do not have negative effects on markets or biodiversity
- The implementation of positive incentive measures would present a ‘moving target’ because increasingly open markets, national incentive structures are affected by changes at the global level
- In order to further sectoral mainstreaming more attention should be paid to the programme of work to the concept of ecosystem of goods and services, their valuation their integration into a system of prices and the creation of new markets. Ecosystem goods and services are fundamental to the business case for biodiversity. With such efforts becoming more common, there is need to investigate their potential as well as fall backs.

- Assign clear well defined, secure and enforceable property rights to the environmental resources including further exploration of options such as community property, together with further development of rules/norms based on customary practices, as well as rights for certain uses, or rights without ownership rights, depending on the social context.
- Introduce market based instruments such as taxes, cesses, or subsidies when goods and services are traded or are tradeable
- Introduce environmental considerations into existing tax and subsidy frameworks. For instance introducing tax exemptions for certain organic products
- Undertake additional government interventions when markets are thin or hampered asymmetries, in the form of providing access to market information, lowering transaction costs and fixation of fair prices
- Draw up contractual arrangements with corporate actors or non-governmental organizations, provide long term leases, income tax exemptions or tax rebates on the excise/sales tax in return for the successful execution on sustainable management plan
- Ensure that penalties are higher than from illegal activities, such as poaching of animals, use of mangroves as fuels, cause damage to coral reefs, and felling trees
- Revise or gradually increase prices or fees for environmental resources like drinking water, irrigation water, electricity for pump sets, and certain environmental amenities, with a view to attaining full cost pricing and concessional tariffs targeted to the poor
- Regulate tourism traffic in areas of high ecotourism potential, by way of differentiated entrance fees for viewing wild life in specified areas, sacred groves and other aesthetic amenities. Fees could be used for the provision of basic sanitation and other services and remunerating the tourist guides.

Post 2012 EIB Carbon Fund

An international carbon regime for emission reductions and carbon trading has yet to be evolved. However in March 2008 the post 2012 Carbon Fund was established by the European Investment Bank(EIB) along with three national financing institutions: Instituto de Credito (ICO) KfW Bankengruppe and the Nordic Investment Bank (NIB)

The post-2012 Carbon Fund is designed to underpin the market value of carbon emission reduction units produced after the expiry of the current Kyoto Protocol in 2012. The bank and its partners have designed the Fund to encourage and facilitate investment in projects which will give rise to carbon credits in a longer time perspective

than is currently generally the case. Through the mechanism of the Fund “patient and catalytic public sector capital” will serve to enhance the role of carbon credits as a project finance instrument.

The Fund will support the development of environmentally friendly projects including renewable energy, energy efficiency, forestry and methane capture via the acquisition of carbon credits generated by the mitigation, prevention, reduction and/or sequestration of GHG emissions in the period 2013-22

With its focus exclusively on post-Kyoto credits, the Post-2012 Carbon Fund will be materially different from not only other carbon finance activities of the EIB but also those more generally in the market.

Other EIB Carbon Funds

In addition to the Post-2012 Carbon Fund the Bank has established three other carbon funds. The funds have different regional focuses, target participation and carbon credit types but overall are complementary both mutually and vis-à-vis the Bank’s other climate change initiatives.

- The EBRD-EIB multilateral Carbon Credit Fund (MCCFF) will expand the supply of carbon credits in Central Europe and Central Asia and companies which become members of the Fund can buy carbon credits from emission reduction projects financed by EIB or EBRD. Country participants can also participate via the MCCFF in Green Investment Schemes to facilitate trade in carbon credits between governments
- The Carbon Fund for Europe (CFE) launched in March 2007 with a EUR 50 million Commitment was set up with the World Bank to help European countries to meet their Kyoto commitments. The Fund purchases greenhouse gas emission reductions through the Kyoto Protocol’s Clean Development Mechanism (CDM) and Joint Initiative (JI) from climate friendly investment projects in the EIB’s or World Bank’s portfolios as well as stand alone projects. The CFE purchases verified emission rights that are compatible with the EU ETS to assist companies interested in meeting EU allowance allocation obligations
- 1 The EIB-KfW Carbon Programme launched in May 2007 with Euro 100 million of commitments initially provided equally by EIB and KfW and operational since August 2007 the programme was established to support EU corporates and/or intermediaries acting on behalf of EU corporates with a special focus on small and medium sized enterprises. The fruit of early cooperation between EIB and

KfW the programme presents a number of features not systematically available in the carbon fund market hitherto, in particular offering guaranteed delivery of carbon credits to small and medium sized participants and advance payments to the sellers of carbon credits. Project based carbon credits may be may be acquired from any EIB country of operation that has ratified the Kyoto Protocol and where and where the credits are eligible under the EU ETS (including renewable energy, energy efficiency, forestry and methane) The programme provides an excellent example of cooperative working between the EIB and KfW, clearly drawing on the respective strengths of each organization. The KfW carbon team as the Fund manager will be responsible for the Funds day to day operations including deal sourcing and negotiations. The EIB project finance expertise will be deployed in determining the acceptability of making advance payments for certain individual projects. The two institutions will jointly oversee fund management activities.

Collectively these funds are contributing to the development of a market in carbon rights, helping EU member State, companies and other institutions to meet their carbon emission obligations, supporting the on going development of project based mechanisms such as Kyoto Protocol's Clean Development Mechanism (CDM) and Joint Implementation (JI) , promoting the EU Emissions Trading Scheme (EU ETS) and supporting the financing and implementation of Environmentally beneficial projects.

Other EIB Climate Change Initiatives

In its approach to supporting climate change projects EIB ensures that the investments it finances are compliant with EU environmental principles and standards enshrined in the European Principles for the Environment (EPE). These are endorsed by EIB, EBRO, NIB, NIFCO and CEB with the support of the European Commission and and the Directorate- General for Environment (DG ENV)

The EIB has also established its own more general Climate Change Financing Facility (CCFF) which provides long term finance to EU companies participating in the EU Emissions Trading Scheme and to companies operating outside the EU developing Joint Implementation and Clean Development Mechanism Projects. The facility finances up to 75% of the costs of the projects that lead to significant emission reductions or contribute to climate change adaptation.

Under the CCFF, the EIB has put in place a simplified and accelerated process that is the Global Authorization Mechanism for financing of small and medium scale projects

(public or private) aimed at promoting climate change mitigation and adaptation investments, with special emphasis on carbon credit generating projects outside the EU facilitated by two teams of consultants.

In addition the EUR 3 billion Facility for Energy Sustainability and Security of Supply approved by the Board of Governors in June 2007 is expected to yield a number of carbon credit generating projects, notably through the China Climate Change Framework Facility, for possible acquisition by EIB sponsored Carbon Funds.

ADB Funds for Carbon Credits Beyond 2012

The Asian Development Bank has established a new fund called the Future Carbon Fund that will use carbon credits generated beyond 2012 to finance clean energy projects by the Asia Pacific Region , extending the current regulatory framework set by the Kyoto Protocol.

The Future Carbon Fund with an initial capital of 100 million US dollars will provide financing for ADB supported projects that will continue to develop beyond 2012.

ADB is of the view that that the expiration of the Kyoto Protocol's commitment period on Dec. 31, 2012 will hamper carbon trading in post 2012 period. "This would affect the level of interest in developing new energy projects and other climate change initiatives in developing countries."

CHAPTER 9

ACTIVATE WOMEN AN CHILDREN TO DRIVE CHANGE

We start with the basic question change for what and in which direction? The answer is change is required to achieve the vision of sustainable development. The direction will be the paths which connect with the road to sustainable development.

If women have to lead change then they have to assume a leadership position and the prerequisite for this position is a learning strategy coupled with the authority to implement this strategy. The implementation of the strategy requires confronting the challenge, adjusting values, adjusting, changing perspectives and learning new habits.

Being a good activator or animator as the term is generally used requires the strength of ones conviction and evolving the channels of communication according to the audience. Good communication requires understanding the psychology of the audience and this requires listening more than talking. The audience must be made to see things through a constant interactive process aimed at consensus. This process holds good whether it is directed towards change in a family or community.

A pre condition to activate women to drive change is the empowerment of women. In the introduction to 'A Vindication of the Rights of Women with Strictures on Political Subjects' Mary Wollstronescraft (1891) writes "Contending for the rights of women my main argument is built on this simple principle that if she is not prepared by education to become the companion of man, she will stop the progress of knowledge and virtue; for truth must be common to all or it will be inefficacious with respect to its influence on general practice, and how can women be expected to cooperate unless she knows why she ought to be virtuous. Unless freedom strengthens her reason, till she comprehends her duty and see what manner it is connected with her real good. If children are to be educated to understand the true principles .of patriotism their mother must be a patriot; and the love of mankind from which an orderly train of virtues spring, can only be produced by considering the moral and civil interest of mankind, but education and situation of women shut her out fro such investigations."¹

The UNDP Mission on Women's Rights, Women's Empowerment and Gender Equality reads: "The Millennium of 2000 reaffirmed gender equality and women's empowerment as development goals in themselves (MDG3) and underlined their importance as a means to achieve all other MDGs.

UNDP is committed to supporting capacity development of the national partners to adopt approaches that advance women's rights and take account of the full range of their contributions to development.

Drawing on a vision in which human development guide all policy making and development UNDP supports national parties to accelerate their progress towards the MDGs by identifying and responding to the gender equality of the four interrelated focus area: poverty reduction, democratic governance, crisis prevention and recovery and environment and sustainable development. With strong operations and institutional arrangements for gender equality and in the identification of internal barriers to women's advancement into senior management, including women from developing countries.

UNDP will ensure the implementation of this strategy by dedicating sufficient human and financial resources where needed It will expand and continue to expand the partnerships with UN agencies including through the upscaling of innovative models developed and tested by the United Nations."

An evaluation of gender mainstreaming found in 2005 that " While there many committed individuals and some islands of success the organization lacks a systematic approach to gender mainstreaming. UNDP has not adopted clearly defined gender mainstreaming goals nor dedicated the resources needed to set and achieve them. There has been a lack of leadership and commitment at the highest levels."

It is necessary to particularly emphasize here the role of culture in gender equality .and its analysis However before we take up the role of culture we need to dwell for some time on the concept of culture.

According to Franz Boas (1911) Culture may be defined as the totality of the mental and physical reactions and activities that that characterize the behaviour of individuals comprising a social group collectively and individually in relation to their natural environment, to other groups, to members of the group itself and of each individual himself. It also includes the product of these activities and their role in the life of groups. The mere enumeration of these various aspects of life does not

constitute culture. It is more for its elements are not independent, they have a structure.

Ruth Benedict (1934) states that “culture means the whole complex of traditional behaviour which has been developed by the human race and is successfully learned by each generation. A culture is less precise. It can mean the forms of traditional behaviour which are characteristic of a given society or of a group of societies, of a certain race, or of a certain area or of a certain period of time.”

Max Weber (1904) designates “as cultural science those disciplines which analyze the phenomena of life in terms of their cultural significance. The significance of a configuration of cultural phenomena and the basis of this significance cannot however be derived and rendered intelligible by a system of analytical laws, however perfect it may be since the significance of cultural events presuppose a value orientation towards these events. The concept of culture is a value concept. Empirical reality becomes a culture to us because of the value relevance. Only a small portion of the of existing concrete reality by value conditioned orientation. It is significant because it reveals relationships which are important due to their connection with our values.”

Krober and Kluckhohn (1952) hold the view that “culture consists of patterns, explicit and implicit, of and for behaviour acquired and transmitted by symbols, constituting the distinctive achievement of human groups including their embodiment of artifacts; the essential core of culture consists of traditional (i.e. historically derived and selected) ideas and specially their attached values. Culture systems may on the one hand be considered as products of action, on the other as conditioning elements of further action.”

Talcott Parsons and Edward Shils emphasize that culture has been distinguished from other elements of action by the fact that it is intrinsically transmissible from action system to another (by learning and by diffusion.

The consistency of pattern of such a system will exist to the extent to which the same combination of value judgments runs consistently through actors responses to different situations.”

According to Talcott Parsons “A social system consists of a plurality of individual actors interacting with each other in a situation which has at least a physical or environmental aspect, actors who are motivated in terms of a tendency to the

‘optimization ‘ of gratification and whose relation to their situation, including each other is defined and mediated in terms of a culturally structured and shared systems.”

Amartya Sen (1999) in the role of culture in gender equality observes “the idea of positional objectivity is particularly important for understanding gender inequality. The working of families involves conflict as well as confluence of interests in the division of chores, but the demands of harmonious family living require that conflicting aspects resolved implicitly rather than rather than through explicit bargaining. As a result customary patterns of conduct are simply taken as legitimate. Usually by implication an there is a sharp tendency not to notice the systematic deprivation vis-a vis the males.”

Amartya Sen (1999a) points out that “The more serious issue rather, the source of authority and legitimacy. There is an inescapable valuation problem involved in deciding what to choose if and when it turns out that some parts of tradition cannot be maintained along with economic or social changes that may be needed for other reasons. It is a choice other people have to have to face and assess. The choice is neither closed (as many development apologists seem to suggest) nor is it for the elite ‘guardians’ of tradition to settle (as many development skeptics seem to presume.” If a traditional way of life has to be sacrificed to escape the grinding poverty or miniscule longevity (as many traditional societies have had for thousands of years) then it is the people directly involved who must have the opportunity to participate in deciding what should be done. The real conflict is between (i) the basic value that people must be allowed freely what traditions they wish to follow or not wish to follow. (ii) the insistence that established traditions be followed (no matter what) or alternatively people must obey the decisions by religious or secular authorities who enforce traditions –real or imagined.”

Education and training are required for empowerment of women but empowerment is a complex and dynamic concept. It means that women have the ability to take decisions which affect their lives. This decision is not taken in vacuum but in the context of family and the society where the women live. What is therefore critical to empowerment is that which determines the relationship aspect of empowerment.

Karen Oppenheimer Mason in a study *Measuring Women’s Empowerment: Learning from Cross Sectional Research*” has studied the empowerment of women in India, Malaysia, Pakistan, Philippines and Thailand. The following conclusions emerge from the study:

- (1) The country and community of residence predict women's domestic empowerment better than their personal socio-economic and domestic traits.
- (2) An important source of inter-country variation in reported women's domestic empowerment is community values and norms about gender roles.

A recommendation made by the study is that "Collective action can be used to empower poor women because empowerment is strongly influenced by shared values, norms, beliefs and traditions, that is by culture. Enhancing the capabilities of women is a step in the right direction but may fail to empower them if the surrounding culture remains unchallenged. Collective action is powerful in part because it involves changing ideas about the social order. Some of the interventions may have been designed to increase the opportunities may have been successful precisely because they involved organizing women into pressure groups."

My own field studies support the findings of Mason. Three field studies which I have made and which are relevant here are the Role of Women in Panchayats, Social Assessment for the Haryana Vidyut Prasaran Nigam for the land acquired for the expansion of their electricity programme and for the Rampur Hydro Power project of Himachal Pradesh. The social assessment studies were made because the findings of the study would be an important factor in determining the funding of the projects by the World Bank.

My own experience in the field shows that it is important to distinguish between apparent empowerment and actual empowerment. For example, I found that while women occupied positions in the panchayats they merely echoed what their husbands or older men in the family wanted. In order to get the right kind of information one has to be very careful in asking the questions and the women need to be ensured that their replies will be kept confidential so that there is no tension or disruption in the family.

The empowerment of women is a pre condition for improving social quality because it increases the potential of women to contribute positively towards the development of the economy and society and therefore enhances social well being. The level of social quality is a function of the extent of empowerment, the level of social inclusion and socio-economic security.

A study on "Women's Empowerment: Measuring the Global Gender Gap" was made by the World Economic Forum. According to this study "the past three decades have

witnessed a steadily increasing awareness of the need to empower women through measures to increase social, economic and political equity, and broader access to fundamental human rights, basic health and education. Along with the status of the subordinate status of women has come the concept as an over arching socio cultural variation in relation to other factors such as race, class, age and ethnicity. Gender is not synonymous with women. It is a zero sum game implying loss for men. Rather it refers to both men and women and to their status relative to each other. Gender equality refers to that stage of human social development in which the rights, responsibilities and opportunities of individuals will not be determined by the fact of being female; in other words when women realize their full potential

In the message from the Secretary General United Nations to the Report 'The State of the World's Children 2007, Kofi Aman, Secretary General United Nations states "Eliminating gender discrimination and empowering women and children are among the paramount challenges facing the world today. When women are healthy, educated and free to take opportunities life affords the children thrive and countries flourish, reaping a double dividend for women and children.

In the 27 years since the adoption of the Convention on the Elimination of all forms of discrimination Against Women, much has been done to advance the progress of women. But we have fallen far short of what we need to achieve the Millennium Development Goals. Until there is gender equality there can be no there can be no sustainable development. It is impossible to realize our goals whilst discriminating against half the human race not just the half who are girls –of the chance to reach their potential."

In the foreward to the same report Anne M. Veneman Executive Director, United Nations Children's Fund wrote, " when women are empowered to lead full and productive lives

Children prosper. UNICEF's experience also shows the opposite. When women are denied equal opportunity within a society children suffer.....declarations, conventions and goals are not enough. It is imperative that we move resolutely from the realm of words to the realm of concrete action. ...The day when women and children have equal opportunities to be educated, to participate in government, to achieve economic self sufficiency and be secure from gender violence and discrimination will be the day when the promise of gender equality is fulfilled and UNICEF's mission of a world fit for children will be realized."

The main observations and findings of the report are:

- If poverty is to become history then gender inequality must first be eliminated. Bold initiatives and unflinching determination are required to end individual and institutional gender discrimination. Attitudes, customs and values that are detrimental to women and girls must be confronted. No history, legacy, religion or cultural tradition can justify inequality and disempowerment
- Despite ingrained gender inequality the status of women has improved. By promoting legal and social reforms proponents of gender inequality have begun to reshape the social and political landscape
- Today women and girls have access to opportunities that were previously restricted. Primary school enrolment rates for girls have jumped and educational gender gap is narrowing. Women are entering the labour force in greater numbers; women's political representation is also increasing
- Gains in gender equality notwithstanding far too many girls and women have been left behind and women remain voiceless and powerless.
- Women are the primary care givers for children and thus ultimately shape children's lives. Women's access to power at the household level has the most direct impact on families and children. Here is where decisions are made about the allocation of resources for food, health care, schooling and other family necessities.

When women are locked out of decisions regarding household income and other resources they and their children are likely to receive less food and be denied health services and education

- Empowering women in the political arena can improve state of the world's children and help change societies.
- The status of women is a crucial element for accurately gauging the state of the world's children and assessing what the future holds for them
- The interests of children are best served when the dynamic between men and women in the household is based on mutual respect and shared responsibilities, and both mother and father are involved in the care, nurture and support of their children

In a foreword to the Human Development Report 2007/8 Kemal Dervis and Achim Steiner write "Climate change is the human defining issue of our generation All development is ultimately about expanding human potential and enlarging human freedom. It is about people developing capabilities that empower them to make choices and to lead lives they value. Climate change threatens to erode values and limit

choice. It calls into question the Enlightenment principle that human progress will make the future look better than the past.”

As far as children are concerned a number of programmes can be drawn up for schools and the schools need to be persuaded to put aside one period a week where children actively participate in activities relating to ecology and the environment.

In 1986 Mr.Kamal Meattle formed “Save the Trees Organization.” The objective was to stop the trees from being cut down to make wooden apple boxes for packing apples in Himachal Pradesh”

According to the information received by Mr. Meattle about two acres of land were being chopped to make boxes for apples produced on one acre.

Mr. Meattle conscious of his social responsibility enlisted the help of school children and came up with a corrugated box made of recycled paper and fibres. These were made by adapting designs from manufacturers from New Zealand. According to Mr.Meattle about 100 million trees have been saved since 1986.

This initiative has had a multiplier effect because such boxes are now being used for packing mangoes, grapes and cherries.

Mr. Meattle’s has clearly demonstrated how the power of children can be unleashed to make positive contributions towards sustainable development. The feeling of achievement among children provides a powerful motivation for positive thinking which in turn may lead to innovative ideas and also make them good citizens.

Mr. Meattle that sustainable development requires not rhetoric but action and how every drop does in fact make the ocean.

CHAPTER 10

TRAIN AND EDUCATE CORPORATES AND COMMITTEES TO ECO INNOVATE

The term eco-innovation was first used by Fussler Claude and Peter James (1996).

In a subsequent article Peter James (1997) defines eco innovation as “new products and processes which provide customer and business value but significantly decrease environmental impacts.”

Frederic Morand (2008) of Eco-innovation Networks adds “Eco-innovation should bring greater social and cultural acceptance. The social pillar that we add to James’ definition is necessary because it determines learning and thus the effectiveness of eco-innovations and of policies that promote them.”

The Europe Panel on Eco- Innovation states “eco-innovation means the creation of novel and competitively priced goods, processes, services, and procedures that can satisfy human needs and bring quality of life to all people with a life cycle wide minimal use of natural resources per unit and minimal release of toxic substances.

It needs to be underlined that the social pillar added to eco-innovation makes it an integral part of corporate governance and corporate social responsibility.

Eco-Innovation has been defined by the Systematic Innovation Report (2008) “As the creation of novel and competitively priced goods, processes, systems and procedures that can satisfy human needs and bring quality of life to all people with a life cycle wide minimal use of natural resources (materials including energy carriers and surface area) per unit output and a minimal release of toxic substances.

It further means the development, adoption and transfer of technologies that increase resource productivities, substitute toxic inputs for environmental friendly inputs and reduction in the ecological footprints.” (2008) The drivers of co-innovation are : (1) cost savings as a result of de-materialization (2) cost savings can result in advantages in price competition (3) reduced adverse impact on climate.

Japan's Top Runner Programme 2008

The concept of the Top Runner Programme is that the standards are set higher than the best performance value of each product currently on sale in the market. The setting of standards takes into account the technology developments in the products. Standards have been set for the following products.

- passenger vehicles
- freight vehicles
- air conditioners
- TV sets
- Video cassette recorders
- fluorescent lights
- copiers
- computers
- magnetic disc units
- Electric refrigerators
- electric freezers
- space heaters
- gas cooking appliances
- gas water heaters
- oil water heaters
- electric toilet seats
- vending machines
- transformers
- electric rice cookers
- micro waves
- DVD recorders

The product on the market with the highest energy efficiency (the Top Runner) sets the standard. The Top Runner Programme triggers the race for the top among manufacturers. The necessity of meeting the Top Runner Programme requirements provides the companies with the motivation to accelerate efforts to efforts toward eco innovation and utilize technologies that may have waited to commercialize. Enforcement among the Top Runner Programme relies on Blame and Shame which works well with the Japanese manufacturers as well as importers.

The following penalties are imposed for non-compliance:

1. Recommendation
2. Publication of the name of the company
3. Order
4. Penalty under one million yen

Energy Saving Labelling Programme

The energy saving labeling programme was started in 2002. The purpose of the programme is the popularization of highly energy efficient products by means of providing information to consumers on their energy efficient performance.

Energy Efficient Product Retailer Assessment Programme

The Energy Efficient Product Retailer Assessment Programme has been implemented since 2003. This programme acclaims retailers who actively promote sales of energy efficient products and who provide relevant information on energy savings.

Awards such as 'Ministry of Economy, Trade and Industry Award' and Minister of Environment Award" were established in 2004.

The Top Runner Programme promotes market competition and therefore provides the motivation for eco innovation among manufacturers and retailers.

The Top Runner Programme helps to build value from corporate image and reputation. It is based on the recognition that intangible assets may well provide companies with a more enduring source of competitive advantage than even patents. The programme has clearly demonstrated that eco innovations help in building the long term reputation of a company and therefore in getting a larger market share of the product.

Toyota and Eco-Innovation

In 1993 Toyota responded to the concerns about environment and decided to create a car that would have twice the fuel economy in cars in the same class. After repeatedly exploring ways Toyota decided to adopt a combustion engine and electric motor hybrid system in June 1995. Two years later in 1997 Toyota launched the world's first mass produced hybrid passenger car the Prius. This was conceived as a predecessor to

future vehicles incorporating innovative hybrid technology that is capable of being used with gasoline as well as other fuels such as diesel, bio fuel or hydrogen fuel cells

Hiroshi Okuda Former Toyota Motor Corporation said that the Prius is Toyota's response to the challenge of change. With the launch of Prius and its successors Toyota is determined to extend the horizons of technological innovations to meet society's needs and lead in the race to realize the car that encapsulates of the next the dreams and issues of the next century.

When it came to second generation Prius Toyota sought to solidify its image as an eco conscious manufacturer of hybrid vehicles by creating a car that would have broad appeal. To that end the vehicle was required to have improved environmental performance, but also incorporate additional features such as faster acceleration and better mileage”

Concept planner Satoshi Ogiso said “ It would be difficult to create new appeal by improving the first generation vehicle. We completely abandoned the original concept of Prius and started with a blank slate to create a new one. Our concern was whether we will be able to create a second generation vehicle that could compare with the first generation one.”

Launched in September 2003 the second generation Prius won the Good Design Award 2003, the 2003 American car of the year and 2005 American car of the awards. The Prius is now sold in 44 countries.

The third generation Prius was unveiled in January 2009 at the North American International Auto Show.

Bob Carter, Toyota Division Group Vice President and General Manager said “hybrid components like the inverter, motor and generators are now lighter and smaller. An exhaust heat recovery system , exhaust gas recirculation and an electric water pump contribute to a more efficient hybrid system with a net horse power of 134.

The battery module carries over from tried and true technology from the current Prius. Engineers applied enhancements throughout the throughout the entire vehicle to achieve 50 miles per gallon, more consistent efficiency in real world driving and further reductions in CO2.. Electric power consumption has been reduced through the use of a more efficient air conditioning system and new optional LED head lamp.

Internal tests show that acceleration time has dropped from the previous generations and second range to 9.8 seconds, making it comparable to that of an average mid size sedan with a 2-4 litre engine. This is in response to customer expectations for better every day performance. In short the entire Prius package has been made more efficient from the overall power consumption to output.”

The new Prius also features what Toyota is calling a ‘Solar Moonroof’ , a small array of photovoltaic cells automatically powers a ventilation system on hot days.. The system allows fresh air to circulate into the vehicle, coming down the cabin so that air conditioning doesn’t have to work as hard thereby conserving power.

A larger and more powerful 1.8 liter Atkinson style , four cylinder engine helps improve highway mileage.

Giant Hemu Technology Co. Ltd a pulp and paper maker, is a joint venture company, with capital support from the Asian Development Bank (ADB), The International Finance Corporation(IFC), Capital Steel Group and other domestic investors.

The pulp and paper industry has traditionally caused significant environmental impacts , including from black liquor, a side product of the pulping process.. Untreated liquor is highly toxic to humans and animals in case of ingestion, skin and eye contact and inhalation and has also proved to very harmful for aquatic life forms.. The company currently benefits from a tax exemption measure for developing environmental friendly technologies , and has a patented technology for clean pulping and the comprehensive use of renewable resources in paper making.

The technology allows for clean production in pulp preparation, as well as in producing a multi-element organic compound fertilizer from the recovered substances. This fertilizer can be used, for example to combat desertification and in agriculture. The technology allows a zero discharge of black liquor to be met, and the reduction of the discharge of mill pipe-end of effluent below the legal minimum, thus giving medium or small paper mills an opportunity to survive under the new strict environmental regulations in China.

In total, Giant Hemu calculates that its technology can reduce CO2 emissions by 420,000 tons per year. It turns a highly polluting paper making process into one with useful by products such as fertilizer or water reducing agents while producing pulp without using precious wood. The company plans to to export its neighbouring Asian countries.

Giant Hemu believes that the main reasons for carrying out R&D as a leader in this technology field lie mainly in the need to create products that meet Chinese environmental regulations and in improving the country's image. Second it is important to carry out R&D to comply with regulations abroad, and therefore to be able to export products , to reduce costs for the client and to have excess to new markets.

European Union

In may 2007 the European Commission published a report on trends and developments in eco innovation in the European Union. While confirming the strong growth of eco - industries the report emphasizes that the state of the environment and climate change call for the take up of clean and environment friendly innovation on a massive scale.

EU Environment Commissioner Stavros Dimas said: "Eco-innovation is a central element in the fight against climate change. It will bring us a long way towards meeting our targets of reducing energy consumption by 20% and increasing the use of renewable energy by 20% by 2020. However we have less than 13 years to achieve these goals. It is vital that the full capacity for for eco-innovation be exploited without delay. Only through eco-innovation can we fundamentally change our pattern of production and consumption."

European Science and Research Commissioner Janez Potocnik added "technology is a major part of the answer to our energy and environmental challenges. It has a crucial role in improving energy efficiency, an area in which we must."

Eco industries in the European Union have grown in recent years to become a viable prominent force in the European economy Today they represent about 2.1% of the gross domestic product and account for about 3.4 million jobs. About three quarters of these jobs are found in the water and waste management sectors and the remainder in other areas such as air pollution, remediation, renewable energy and recycling. Internationally the European Union constitutes about one third of the world market share in eco industries.

The European Union's Environmental Technology Action Plan (ETAP) was launched by the Commission in 2004as a way of channeling efforts by the EU and member states common goals and to serve as a catalyst for change. The aim of ETAP is to stimulate eco innovation and encourage the take up of environmental technologies on a broad scale. The focus of the plan is to foster greater demand for environmental technologies and to create a fertile ground for eco innovation.

By 2013 it is expected that ETAP will have been instrumental in channeling over • 12 billion towards eco innovation projects. These projects focus on developing industrial and business practices based on life cycle approach. They also concentrate on developing products which are more environment friendly.

The July 2008 Policy Brief of the Organization for Economic Co-operation and Development emphasizes eco innovation as “A vital means of ensuring that economic development is sustainable. As governments look for effective means to combat climate change and other negative environmental impacts, eco innovation can make it possible to realize environmental objectives at lower cost than otherwise be the case.

At the same time eco innovation can contribute to new business opportunities which could make firms or sectors more competitive. Understanding the role of that eco innovation can play in achieving environmental objectives is therefore an important part of policy debates.”

The policy paper points out that business research and development (R&D) is becoming increasingly international. An important consequence of this internationalization is the outsourcing of R&D in order to bring R&D activities closer to new markets or to tap new knowledge sources that may exist abroad. This means that applied research is being outsourced and this is important for eco innovation since most of the research regarding eco innovation is applied research.

“firms are more likely to invest in innovation if they are exposed to international competitive pressures, or if they have access to new global market opportunities. While this is true of innovation in general , It is particularly true for environmental innovations .

The Eco Patent Commons

In early 2004 IBM took an unprecedented step. It opened up the annual technology and business forecasting processes to the world with first IBM Global Innovation Outlook (GIO).

The GIO is rooted in the belief that the very nature of innovation has changed in the early days of the 21st century. It is increasingly open, collaborative, multidisciplinary and global. This shift means that the truly revolutionary innovation of our times-the ones that will create new markets, re-define old ones and may be even change the world for the better.

According to IBM it require participation and investment across multiple constituencies. The GIO challenges the brightest minds on the planet from the world of business, politics, academia, and non profit organizations to collaboratively address the most vexing challenges on earth. The criteria for GIO focus area are simple. They must represent trillions of dollars in economic activity, have far reaching economic impact and be ripe for innovation. The collaboration begins with a series of open dynamic conversations called “deep dives”

These free form conversations fuelled by a diverse mix of expertise and perspectives are Inevitably candid and spirited. Collectively they result in explosion of ideas that spark new relationships, policy initiatives and market opportunities for all involved.

On January 14, 2008 WBCSD and IBM along with Nokia, Pitney Bowes and Sony created the Eco Patent Commons.

Patents pledged to Eco Patent Commons feature innovations focused on environmental matters and innovations in manufacturing or business processes that provide an environmental benefit. Examples of the environmental benefits expected for pledged patents include:

- conservation or improved energy pr fuel efficiency
- pollution prevention (source reduction or waste reduction)
- use of environmentally preferable materials or substances
- water or material use reduction
- increased recycling opportunity

Bjorn Stigson president WBCSD said “ The Eco Patent provides significant leadership for business to make a difference, sharing their innovations and solutions in support of sustainable development. The Eco Patent Commons also provides opportunities for companies and other entities to identify areas of common interest and establish new relationships that can lead to further development in the patented technologies and elsewhere.”

Dr. John E. Kelley 111 IBM Senior Vice President states that “Innovation to address environmental issues will require both application of technology as well as new modes of sharing intellectual property among companies in different industries. As the leader in US patents for 15 consecutive years with 3125 patents, IBM is excited to bring its patent resources to bear in service of the environment. In addition to enabling new players to engage in protecting the environment the free exchange of valuable intellectual property will accelerate work on the next level of environmental

challenges. We strongly urge other companies to contribute to the Eco Patent Commons.

Daniel O'Connell Director of Intellectual Property Rights Nokia said that "Environmental issues have great potential to help us to discover the next wave of innovation because they force us all to think how we make, consume and recycle products. From Nokia we have pledged a patent designed to safely recycle old mobile phones into transforming them into new products like digital cameras, data monitoring devices, or other electronic items. Recycling the computing power of mobile phones in this way could significantly increase the reuse of materials in the electronics industry.

Angelo Chacias Vice President and Deputy General Counsel Intellectual Property and Technology Law of Pitnes Bowes said "The Eco Patent Commons offers an effective framework to develop and make available technology that helps to combat climate change and reduce the release of carbon dioxide. Our objective for the Eco Patent Commons is to promote the spread of environmentally conscious technologies that make conservation and preservation a priority."

Hidemi Tomita, General Manager of Sony Corporation's corporate social responsibility Department stated that "To more effectively protect the environment it is time for business to join efforts rather than tackling the issue alone. We truly believe this joint effort with our peers will mark a significant step and help transfer innovative ideas and technologies across industries and beyond to developing countries. We are excited to launch this programme to share technologies that will bring about positive changes in the environment.

Bosch, Dupont and Xerox joined the Eco patent Commons in September 2008 Ricoh, Taisei and Dupont joined in March 2009

Membership of the Eco Patent Commons is open to all individuals and companies pledging one or more patents. The selection and submission of each organization's patents for pledging is at the discretion of the Eco Patent Commons

Xerox Patents

Xerox has pledged 11 patents that make it possible to cut the time it takes to remove toxic wastes from soil and water from years to months. Called "2-Phase Extraction "

The technology has been used by Xerox to remove more than 90% of volatile organic solvents from shallow ground water in contaminated sites.

The traditional way to treat where organic solvents have been spilled involves first drilling a well to pump out the ground water and treat it, then applying a vacuum to the soil to remove and treat vapours. The 2-Phase Extraction System uses a stronger vacuum that simultaneously removes both soil vapours and water in the form of mist. With it Xerox has been able to reduce overall remediation times by as much as 80%.

“Xerox has made a long time commitment to environmentally responsible operations. The Eco Patent Commons gives us the opportunity to share what we have learned “ said Patricia Calkins, Xerox vice president of Environment, health and Safety. “We developed the 2-Phase Technology 15 years ago to help us remediate sites more quickly and at less expense . We believe it will be a valuable tool for others , such as the local dry cleaners or gas stations who need to clean up volatile organic compounds.”

Dupont has contributed four patents to the Eco Patent Commons, one of which involves waste reduction technology that uses select enzymes to accelerate the conversion of certain non-recyclable plastics to beneficial fertilizers. Plastics that are designed to be tough and durable for applications such as packaging, appliances, and small durable consumer goods can be more quickly and completely decomposed using this technology, potentially reducing the amount of plastic that remains as landfill solid waste.

The three other DuPont patents involve the company’s LUX technology for pollution detection. When exposed to an environmental stress, such as a pollutant. The patented micro organism will produce light to indicate the presence of a pollutant. This new detection technology is useful in monitoring soil, air and water quality, toxicity screening, pharmaceutical and agro-chemical design; manufacturing and fermentation process control. This technology may benefit many enterprises in the chemical, food and beverage, cosmetics, agricultural, environmental, regulatory and health care industries.

DuPont Senior Vice President and Chief Science and Technology Officer said “Sustainability through science is core to DuPont’s mission and we are proud to be able to provide our technology to others that utilize the latest thinking in areas of bio technology and material science-technologies that can be socialized and adapted to reduce the global environmental footprint of the human population.”

Bosch Patents

Most of the pledged patents from Bosch relate to automotive technology and include applications for energy and engine management in the vehicle, including the manufacture of injection systems and particulate filters. Among other uses, the patent may help lower fuel consumption, reduce emissions, or convert waste heat from vehicles into useful energy.

Peter J. Marks member of the Bosch Board of Management with responsibility for environmental protection said “ The free access allows the broader use of patents previously protected by Bosch. This will benefit the environment.”

Eco Innovation and the Theory of the Firm

The neo-classical view of the firm was that it had a visible production function, had no adaptability problems and its main function was to maximize profits .These assumptions provided for a simple managerial approach to the firm which could be integrated with price theory. However it began to be increasingly recognized that such an approach could not explain the behaviour of firms. Schumpeter (1934), Penrose (1959) Cyert and March (1963), Williamson (1975,1985) U.Dar (1980) and Barney (1986)

Organizational theory took the firm as a unit and attempted to predict firm behaviour with respect to price, output and resource allocation. The behavioural theory of the firm cannot articulate a serious policy proposal for changing the behaviour pattern. It is exactly this articulation which PROACTIVATE requires.

However before this can be done considerable research is required to integrate the theory of the firm with organizational theory.

CHAPTER 11

EXECUTION AND NOT SENSATIONALISATION

A review of the various international conventions, treaties, proceedings of various international conferences and various economic, social, and environmental legislations in different countries create an impression that considerable efforts are being put in towards progressing sustainable development. Does actual performance support this impression?

To answer this question we examined the time series of the World Development Indicators and found that the trends in the indicators do not support the above impression? This naturally leads to the question why is there a gap between the various decisions taken at Conventions and international conferences and actual performance?

The answer is lack of execution at two levels (1) translating decisions at the international level into national policies and legislations (2) weak execution of policies and legislation.

Let us consider the reasons why decisions taken at the international level are not translated into national policies and legislations. Two factors are extremely important in this context: (1) the role of pressure groups and (2) the executive

Pressure groups are formed by people who hold a similar set of views on economic, social or environmental issues. By forming pressure groups people express their shared beliefs and values, and try either to maintain the status quo or influence change. Those who want to maintain the status quo are those who feel threatened by change or represent interest groups who think their positions will be threatened by change

Apart from voicing opinions pressure groups also influence government via public interest litigation. Generally it is easier to yield to pressure than to counter it. Yielding to pressure is a sign of weakness and more often than not this weakness stem from

lack of knowledge either about the subject or about what is happening in the countries of the world with regard to policies, legislation and changing styles of management.

The solution in a large measure lies in organizing seminars for parliamentarians on the subject under consideration or even holding master classes for a couple of days on the subject concerned. It is not enough to inform the parliamentarians about similar legislation which has been passed by other countries but to go deeper into the subject and put before them the arguments that have been put forward in favour as well as against the proposed legislation so that it is possible to understand the relevance and importance of similar legislation for the country for which the legislation needs to be considered.

The executive has an extremely important role to play in influencing legislation. Generally the procedure is that a note for the cabinet is prepared by the executive.. Here again the influence of the pressure groups is important and secondly there is resistance to change because it requires adjustments to the dynamics of new legislation and this calls for a lot more effort than in a situation of status quo.

The next important step for effective execution is the fixing of responsibility for execution and the necessary organizational changes required for implementation.

Merely adding to the number of officers at different levels on the argument that the work load has increased is not enough.

Adding to numbers and taking some procedural steps will not have much meaning unless adequate arrangements are made for capacity building. UNDP defines capacity building “As the creation of an enabling environment with appropriate policy and legal framework institutions including community participation, human resource development and strengthening of managerial systems.”

The above definition clearly shows that capacity building is a lot more than just training. It includes the following:

- Human resource development, the process of equipping individuals with understanding, skills and access to information and knowledge which enables them to perform better.
- Organizational development, the elaboration of management structures, processes and procedures within organizations but also the building of relationships between organizations and stakeholders.

Capacity building also requires a re-look at the issues that have been faced by individual ministries and how they have been faced. In this respect annual reports issued by ministries need to be more critical in giving an account of the work done during the reporting period.

The answers to Parliament questions particularly starred questions and the internal “Note for Pad’ is a rich source of information and should be studied internally to find out the problems which hamper effective execution.

Within the organization team leadership is important. A good team leader is one who among other things keeps subordinates motivated to perform and ensures that the subordinates are sure they know what to do.

In Ultimate Rewards Steven Kerr (1997) gives an executive summary of the “Work of Leadership” by Heifetz and Laurie from which we quote here. Given the needs of sustainable development and changes in the approach to policies and legislation management is faced with adaptive challenges and “The most important task for leaders in the face of such challenges is mobilizing people throughout the organization to do adaptive work.

Yet for many senior executives providing such leadership is difficult. Why? One reason is that they are accustomed to solving problems themselves. Another is that adaptive change is distressing for people going through it. They need to take on new roles, relationships, values and approaches to work. Many employees are ambivalent about the sacrifices required of them and look to senior executives to take problems off their shoulders.

But both sets of expectations have to be unlearned. Rather than providing answers leaders have to ask tough questions. Rather than protecting people from outside threats leaders should let the pinch of reality stimulate them to adapt. Instead of orienting people to their current roles so that new relationships can develop; instead of quelling conflict , leaders should draw the issues out. Instead of maintaining norms, leaders must challenge ‘the way we do business’ and help others distinguish immutable values from the historical practices that have become obsolete.”

Effective execution requires a complete change in attitudes to administration and the realization that execution holds the keys to the gates to sustainable development.

CHAPTER 12

PROACTIVATE-A VISION FOR A LIVING PLANET

Time present and time past

Are both present in time future

And time future contained in time past

T.S Elliot

PROACTIVATE is a holistic model of sustainable development based on the vision of a living planet. It focuses on the study of the present in the context of the future.

PROACTIVATE is an ageless change leader because natural capital is its foundation and efforts towards sustainable development cannot ignore natural capital today or ever.

The importance of natural capital and the way man has behaved towards it has been very clearly pointed out by the geographer John Perkins Marsh (1864). “Man has too long forgotten that nature was given to him for usufruct alone, not for consumption still less for profligate waste... wherever he plants his foot the harmonies of nature are turned to discords. The proportions and accommodations which the stability of existing arrangements are overthrown.”

The natural capital foundation of PROACTIVATE is the key which opens two gates: one of ecological climatology and the second of climate change. Ecological climatology focuses on the role of terrestrial and aquatic ecosystems in improving the quality of the environment. There is a growing awareness of the goods and services provided by ecosystems and also that vegetation provides nature’s technology for environmental problems. Green belts and trees are increasingly being recognized for their environmental value. Forests and wetlands are being used to naturally filter excessive nutrients, pollutants and sediments from sewage and urban run off..(Delaney 1995; Dickey 1997).

Certain plants absorb and tolerate toxic metals such as zinc, cadmium and lead which are among others associated with electronic waste and thus restore contaminated lands by a procedure known as phytoremediation (Comis 1996; Dobson 1997).

Pricing of natural capital is not to be considered in isolation. It is part of the holistic model PROACTIVATE. Why do we call it a holistic model. The answer is that all the eleven components of PROACTIVATE interact with each other and hence rely on one another socially, economically, environmentally and politically.

The most important bond among the individual components of PROACTIVATE is ethics. Central to Kant's ethical theory is that all persons must be respected and therefore "Act in a way that you treat humanity whether in your own person or the person of any other never simply as a means but always at the same time as an end. I will add here that nature also should be treated with respect.

There has to be some objective criterion for assessing respect. This is Jeremy Bentham's Principle of Utility. According to Bentham nature has placed mankind under the governance of two sovereign masters pain and pleasure. It is for them alone to point out what we as well as to determine what we shall do. On the one hand the standard of right or wrong, on the other hand the chain of causes and effects are fastened to their throne. They govern us in all we do, in all we say, in all we think. Every effort we can make to throw off our subjection will serve but to demonstrate it. The principle of utility recognizes this subjection."

The principle of utility as it developed in economic theory took into account only half the definition of economics. According to Alfred Marshall "Political economy or economics is the study of mankind in the ordinary business of life. It examines that art of individual and social action which is most closely connected with the attainment and use of the material requisites of well being."

In the process of development the focus was on only half the definition of economics namely 'ordinary business of life' and the aspect of mankind and social action was completely ignored. PROACTIVATE focuses on the neglected aspect of economics namely mankind and social action by emphasizing the human rights aspect of development.

The study of man was also emphasized by Lionel Robbins who defined economics as "A science which studies human behaviour as a relationship between ends and scarce

means which have alternative uses.” PROACTIVATE extends the scope of scarce means to natural capital.

The focus on ‘natural capital’ and ‘human behaviour’ has tremendous implications for governance both at the level of policy, legislation and execution and for corporate governance and corporate social responsibility. These subjects are too vast to be dealt with here but they will be taken up in a sequel to this work

Carl Menger a prominent Neo-classical economist also emphasized human action as the basis of the theory of value and recognized that the fundamental motives for human behaviour are economic, moral, altruistic and justice. Corresponding with this approach he divided the disciplines into economics, ethics, altruistic and social philosophy. Each discipline would study the functioning of the basic human drives , but each discipline developed independently and did not contribute to what he called ‘social wholes.’

To understand social wholes, we must understand a social system. According to Talcott Parsons “A social system consists of a plurality of individual actors interacting with each other in a situation which has at least a physical or environmental aspect, actors who are motivated in terms of a tendency ‘optimisation of gratification,’ and whose relations to their situation including each other is defined and mediated in terms of a system culturally structured and shared symbols.”

Parsons outlined four basic needs of society (i) adaptation (ii) goal attainment (iii) integration and (iv) latency or pattern maintenance. The latency problem is to make sure that the units have the time and the facilities within a suitable conditioning environment to constitute or reconstitute the capacities needed by the system.

The above analysis shows that PROACTIVATE requires an integration of many disciplines and an understanding of the drivers of PROACTIVATE.

The discipline which integrates economics, psychology, sociology, ecology and political science is Socionomics which is “the science of social analysis based upon socionomic insight,” and socionomic insight as opposed to the conventional insight that social events determine the character of social mood is the understanding that social mood determines the character of social events.

The mechanism for this causality is as follows. There are biologically based psychological impulses within individuals that relate to human interpersonal dynamics. These

dynamics contribute to patterns of fluctuation in collective mood that are formological in that they have consistent Fibonacci-based mathematical properties that produce the Wave Principle. This patterning of social mood creates a sociological imperative that mightily guides and influences the character of individual and social behaviour. The resulting human action in turn causes the trends and events of history.

This process may be called historical impulsion. As opposed to the traditional mechanistic models of aggregate behaviour that are based upon presumptions of multiple exogenous causes and ultimate effects socionomics recognizes that patterns of human aggregate behaviour are endogenous, self causing and reinforcing and to a far greater degree than has heretofore been imagined predictable.”

Prechter lists a number of consequences of the positive and social moods. A positive mood leads to concord, confidence, supportiveness clarity of thinking, and alignment with others.

A negative mood on the other hand leads to discord, lack of confidence, fear, anger and opposition. In addition to a positive and negative mood we should also consider a neutral mood. A neutral mood is not to be understood as ‘affective indifference’. A neutral mood may be seen as a readiness for erasing the earlier mood and being prepared for interaction.

Several studies in psychology have examined in detail the effects of mood in areas of social behaviour and cognition as well as on managerial and business decisions. It follows that mood change is a necessary condition as well as a driver of PROACTIVATE

PROACTIVATE with its programme for concrete action and message of hope and optimism will create a positive mood which will motivate people to undertake the necessary effort required to achieve the goal of a living planet. As the results of such efforts begin to appear the positive mood will become self reinforcing and lead to higher levels of achievement.

The second driver of PROACTIVATE is the recognition of property rights to the environment. The pricing of natural capital is the recognition of property rights to the environment. Policies and legislation which is framed in recognition of these property rights must be congruent with the societal objectives of economic performance, equity and ecological maintenance The objectives for long term use of natural resources must be specified so that expectations of resource users and society in general remain consistent.

Various levels of user participation within government rules and procedures are possible. They range from simple compliance to active participation. At the corporate level it means a complete change in the approach to corporate governance and corporate social responsibility and the development of innovations which reduce the adverse impact on their activities on natural capital.

A much neglected area of natural capital is the oceans. The problem has been recognized at the international level but very little effective action has been taken. The Montreal Declaration on the Protection of the Marine Environment from Land Based Activities

Expressed concern that that the marine environment is being increasingly degraded by pollution from sewage, persistent organic pollutants, radio active substances, heavy metals, oils, litter, the physical alteration and destruction of habitats and the alteration of timing, volume and quality of fresh water inflows with resulting changes with resulting and quality of fresh water inflows with resulting changes to nutrient and salinity regimes.

PROACTIVATE calls for changes in legislation. Justice Christopher G. Weeramantry, Vice President of the International Court of justice speaking at a Symposium on Sustainable Development and the Role of Law stated that “sustainable development is currently one of the most vibrant topics in both domestic and international law. We are at an important transitional phase where the concept is passing from the realm of aspiration into the realm of law.” He further pointed out that ‘we are interested not only in the development but also in the enforcement of environmental law. Law is not a means of keeping peace. This is a passive view of law. Law is a means of active cooperation for the benefit of the community.’”

Justice Weeramantry’s observations has three implications : (1) expanding the scope of the existing law by interpretation (2) enacting new legislation (3) making appropriate organizational changes for execution of policies and legislation.

The Polluter Pays Principle recognizes that the producer is responsible for the externalities generated by it in the process of manufacturing a product. In India the Polluter Pays Principle has been accepted by the judiciary as is seen by the judgment delivered in writ petition no. 6570f 1995. The order dated Feb.4, 2005 of the Supreme Court is as follows:

“ The Polluter Pays Principle basically means that the producer of goods and items should be responsible for the cost of preventing or dealing with the pollution that the

process causes. This includes environmental cost and not just those relating to remedying any damage. The Principle does not mean that the polluter can pollute and pay for it. The nature and extent of cost will differ from case to case..... law has to grow in order to satisfy the needs of the fast changing society and keep abreast of the economic development taking place in society. The Polluter Pays Principle means that absolute liability for harm to the environment extends not only to compensate the victims of pollution but also the cost of restoring environmental degradation. Remediation of damaged environment is part of the process for sustainable development.”

The identification of the need for new legislation and enacting new legislation requires an exhaustive study of the various legislations in different countries and then drafting the legislation to suit the Indian conditions. Examples of laws that may be studied for different countries are the recent legislations in Japan are: Law for the Promotion of Effective Utilization of Natural Resources; Green Purchasing Law and Law for Promotion of Effective Utilization of Resources.

Let us take a look at the essentials of the Law for Effective Utilization of Resources which was enacted in may 2000 and came into force in April 2001. This law aims at establishing a sound material recycle economic system by (1) enhancing measures for recycling goods and resources by collection and recycling of used products by business entities.(2) reducing waste generation by promoting resource saving and ensuring longer life of products and (3) implementing collection and recycling of used products and ensuring longer life of products and (3) implementing measures for re-using parts recovered from collected used products

1. Resource saving industries have been listed in the legislation. They are:

- pulp and paper
- inorganic chemical manufacture(excluding salt manufacture) and organic chemical manufacturing
- iron making and steel making/rolling
- primary copper smelting and refining automobile manufacturing including motorized bicycle manufacturing

2. designated Resource Recycling Industries

- paper manufacturing
- glass container manufacturing

- construction
- rigid PVC pipes and pipe fitting
- copper manufacturing

3. Specified Re-use Promoted Products

Manufacturers and repair business in the manufacturing sector engaged in the following categories of products are required to promote the use of recyclable resources and recovered products (designing and manufacturing products that can be easily re-used or recycled)

- automobiles
- home appliances (television sets, air conditioners, refrigerators, washing machines, micro wave ovens and clothes dryers)
- personal computers
- pachinko machines (including rotary types)
- copiers
- gas and oil appliances (oil heaters, gas cookers with grills, switch on gas water heaters, bath heaters with gas burners and oil filled water heaters)
- bathroom units and kitchen systems
- devices using compact rechargeable batteries)

4. Specified Labelled Products

Manufacturers and importers of the following categories are required to label these products to facilitate sorted collection.:

- steel cans and aluminium cans
- PET bottles
- compact rechargeable batteries
- PVC construction materials
- paper containers and packages; plastic containers and packages

5. Specified by products

Business entities which deal with the following by products are required to promote the use of these products as recyclable resources.

- coal ash generated by the electricity industry
- soil and sand, a slab of concrete asphalt and lumber generated by the construction industry.

Law for Promotion of Effective Utilization of Natural Resources

The Law for Promotion of Effective Utilization of Natural Resources requires the following:

- recycling of recovered resources
- development of structure /material for easy recycling
- labelling products for selective collection

Green Purchasing Law

The Green Purchasing Law was passed in 2000. The objective was to establish a society which can enjoy sustainable development with a lower environmental impact. The act therefore requires the states and other entities in the public sector to procure eco friendly goods and services. This in turn encourages the suppliers to develop eco friendly products.

The Green Purchasing Law applies to states and public agencies to comply it also expects the private sector to follow the rules.

PROACTIVATE and LEGISLATION

We have just seen that regardless of adopting PROACTIVATE legislation which promotes sustainable development is already being passed. How then does PROACTIVATE add value to legislation. To answer this question we turn to the ethical basis of PROACTIVATE which gives direction to legislation for sustainable development.

Translated into operational terms ethics means respect for nature and respect for human beings. This respect in turn generates social awareness which dictates pricing of natural capital, adoption of minimalist life styles, and both of these are drivers of eco innovation.

If the technology for eco innovation has to be transferred fast it requires a change in the Patent laws U. Dar (1978) and possibly transfer of packaged technology which would require training in technical skills. It also requires a reconsideration of the laws relating to Intellectual Property Rights.

The smaller interval between commercialization of eco innovation and its transfer may also require changes in the mode of payment for technology transfer. The

payment will in all probability equity participation rather than license fees and this points to the need for unrestricted transfer of royalty, dividends and where necessary transfer of capital from the host country to the home country.

Before any action can be taken in the field of legislation a careful study is required of the general theory of innovation. A firm's technological capabilities are emphasized by Rosenberg (1974) U. Dar (1978; 1980), Baumol (2002) These capabilities comprise the physical and knowledge capabilities of a firm to develop new products and processes. To build up such a capital stock inputs like R&D investment or further education of the employees is necessary. Highly developed innovative capabilities of a firm may lead to further innovative successes in the future. Baumol characterizes these path dependencies appropriately by the expression "Innovation breeds innovation" (Baumol (2002)

Pricing technology transfer is another area which requires considerable research. The issues which have traditionally been addressed are: equity participation, royalty plus equity participation or only royalty. These issues have traditionally been considered in the context of generating surpluses for the corporation transferring technology and adding to the profits of the corporation. However the message of PROACTIVATE is that since social awareness motivates eco innovation the financial returns must be tempered with social returns.

PROACTIVATE –The Way Forward for Business

PROACTIVATE is an integrated model for sustainable development which not only challenges the traditional way of doing business but shows that there is an opportunity for business to build in social and environmental issues such as poverty and climate change into their business strategy.

It shows the convergence of the interests of business and society and how this convergence can lead to profits for business. This in turn means that shareholder value is not the sole objective of business; in other words shareholder value is not an end in itself.

The value of shares need to be assessed in terms of their contribution to society as is clearly demonstrated by the Dow Jones Sustainability Index.

We give here several examples of how companies have addresses sustainable issues. These examples have been taken from a study by WBCSD.

GrupoNeuva has gone so far as setting a target of making 10% of its sales among low income segments. This requires new ways of doing business with customers.

Delta Cafe is an example of how companies can source their products among poor , communities to promote enterprise and create wealth. Delta Café Portugal's coffee market leader took the initiative of reviving the coffee growing industry of East Timor after 20 years of neglect. This programme has included training farmers and developing the Delta Timor brand which has achieved status as a premier fair trade product among socially responsible consumers in Portugal.

Many companies provide infrastructure to help build markets . For example, Vodacom deployed 22,000 subsidized cellular phones in rural areas of South Africa as a condition of its license to operate. The rural phones have delivered revenues of over US\$ 10 million a year more than the company's conventional pre-planned service.

The few examples cited above show how "large scale and wide- spread entrepreneurship is at the heart of the solution to poverty (C.K. Prahlad 2004)

PROACTIVATE and COMPETITIVE ADVANTAGE

Porter (1990) observes that "Without a new approach to competing the challenger will rarely succeed. Unless the innovator alters the nature of competition, retaliation by established leaders will usually be vigorous and effective." (p45)

The new approach recommended by Porter is the value chain approach. We quote extensively from Porter to see how PROACTIVATE changes the value chain approach to competitive advantage.

According to Porter " Gaining competitive advantage requires that a firm's value chain is managed as a system rather than as a collection of separate parts. Reconfiguring the value chain by relocating, reordering, regrouping, or even eliminating activities is at the root of a major improvement in competitive position."

A company's value chain for competing in a particular industry is embedded in a larger stream of activities which I call the *value system*. The value system includes suppliers who provide who provide inputs (such as raw materials, components, machinery and purchased services for the firm's value chain. On its way to the ultimate buyer a firm's products often passes through the value chain of their buyers who use the products in performing activities of their own.

Competitive advantage is increasingly a function of how well a company can manage this entire system. Linkages not only connect activities inside a company but also create interdependencies between a firm and its suppliers.. A company can create competitive advantage by better optimizing these links to the outside”

The other two important points made by Porter are that (i) a value chain provides a tool for understanding the sources of cost advantage and (ii) the value chain also brings out the sources of differentiation.

The competitive advantage according to PROACTIVATE lies in reducing the inputs of natural capital and reducing the ecological footprints of the firm. This means that the reputation of the firm in being sensitive to natural capital and the environmental impact of its activities is the key to building reputation which in turn is the source of competitive advantage. Frombrun (1996) emphasizes the role of reputation in competitive advantage. “A reputation is valuable because it informs us about what products to buy, what companies to work for or what stocks to invest in. At the same time a reputation is of considerable strategic value because it calls attention to a company’s attractive features and widens the options available to its managers, for instance whether to buy higher or lower prices for the products or services or to implement innovative programmes.”

This means that intangible assets are of tremendous value for gaining competitive advantage..

From burn lists the following points which will shape a unique identity and project a coherent and consistent set of images to the public

- Designing advertising campaigns that promote the company as a whole not just its products and brands
- Carrying out ambitious programmes that champion product quality and customer service with an eye to keeping consumers happy
- Maintaining control systems that carefully screen employer activities for their possible reputational side effects
- Demonstrating sensitivity to the environment, not only because it is socially responsible but because the actions that save the environment also dovetail with marketing programmes to generate sales
- Hiring internal staff and retaining specialized public relations agencies to safeguard communications through the media.
- Demonstrating corporate citizenship through philanthropy and pro bono activities and communal involvement

If a corporation is judged by its reputation via its concerns for natural capital and the environment and not by the surpluses it generates for being transferred to profits and reserves then it follows that the same criterion should apply to Chairman, CEOs and other executives. This means their achievements should also be judged by the same criteria. This will be major change from the traditional criteria of judging efficiency by generating profits. This is exactly what the ethical basis of PROACTIVATE recommends

This calls for tremendous changes in the organizational structure of corporates and the system of corporate governance.

If we look at the history of organizational changes we find a tremendous stickiness and reluctance to change. When changes do take place they are just by enlarging the physical space and adding to the existing personnel. Physical structures however impressive do not represent organizational changes. The two most important factors which influence execution are (1) the culture of the organization and its appropriateness for the execution challenges ahead and (2) inertia and resistance to change

The traditional approach to execution is action at a point of time to implement a decision. Execution is a continuous process and is the result of integrated decisions over time. It involves communication down the organization and across different functions. It also involves communication upwards from the persons responsible for executing the policies and legislation. However, communication by itself is not enough. In addition to communication efforts need to be made to (1) overcome the resistance to change and this requires a complete change of mindset. (ii) respective roles in execution must be defined (iii) responsibilities must be fixed and (iv) execution must be built into policy and legislation

PROACTIVATE and Cost Benefit Analysis

PROACTIVATE will generate a flow of benefits and costs over time. The question is how are these benefits and costs to be assessed? The first step is to determine the time period over which these benefits and costs are to be assessed.

Traditional economic literature has focused largely on policies affecting one or two generations. However, PROACTIVATE has focused on natural capital, eco system services, environmental issues, global climate change, inclusive development ,focus on changes in life styles and quality of life of future generations have time horizons

that span many generations. These issues may be trivialized by the process of discounting.

The crucial question which has been addressed by all authors with cost benefit analysis is the choice of the discount rate. If it is appropriate to discount future costs and benefits what discount rates should be used? There is a vast amount of literature and divergent views which it is not possible to discuss here but we shall focus on two very important areas which are very relevant to PROACTIVATE namely (1) Climate Change and (2) justice

Climate Change and Benefit Analysis

The issue of climate change and the rate of discount has been dealt with extensively by Nicholas Stern. In the Richard T. Ely lecture (2008) Stern points out that much of the discussion in ethics in relation to the Stern Review has been focused on discounting. Some times simplistic approaches to discounting conceal or obscure the underlying structural and ethical logic by shoe horning the issues into a simple discount rate specified entirely externally to the problem. However careful use of theory and concepts is crucial.

Stern points out that the argument “the discount market rate of the Stern Model is too low in relation to market rate of return is thoroughly confused.” The reasons given by Stern are : (i) the basic mistake is to use a marginal concept (discount rates) around a current path for strategic choices and comparison among paths. Policy on climate change means choosing among paths with very different growth patterns for a whole collection of capital goods including those relating to natural endowments. Thus it is simply wrong to look at rates as currently observed, or in historical terms which refer to existing paths. A choice among means also choosing implied set of discount rates associated with the paths. (ii) non-application of modern public economics, ignorance of the multi good nature of the problem and (iii) in some cases ignorance of the difference between a social discount rate and a pure discount rate (for a detailed examination of this issue see U.Dar “The Social Discount Rate and Multi Purpose River Valley Projects” 1978 and The Social Rate of Discount and Social Development Programmes 1979)

Stern points out that “it is absolutely essential for the non-marginal set of choices to recognize that the social discount rates are endogenous, not exogenous. They are determined by ethical values which have to be discussed explicitly and by the paths that result from climate change and investment choices.”

Justice and Cost –Benefit Analysis

John Rawls (1999) in Theory of Justice has laid down two Principles of Justice. They are:

First Principle: each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all.

Second Principle: Social and economic inequalities are to be arranged so that they both.

(a) to the greatest benefit of the least disadvantaged consistent with the just savings principle and (b) attached to offices and positions open to all under conditions of fair equality of opportunity.

According to Rawls “the ethical problem is one of agreeing on a path over time which treats all generations justly during the whole course of a society’s history..... justice does not require that early generations save so that latter ones are simply more wealthy. Saving is demanded as a condition of bringing about a full realization of just institutions and equal liberties. It is a mistake to believe that a just and good society must wait upon a high material standard of life. What men want is meaningful work in free association with others, these associations regulating their relations to one another within a framework of just basic institutions To achieve this state of things great wealth is not necessary. In fact beyond some point it is more likely to be a positive hindrance; a meaningless distraction at best if not a temptation to indulgence and emptiness>” (p257)

Rawls further argues that there is no reason for the parties to give any weight to mere position in time. They have to choose a rate of saving for each level of civilization. If they make a distinction between earlier and more remote periods, because say, future states of affairs seem more seem less important now, the present state of affairs will seem less important in future. Although any decision has to be made now, there is no ground for their using today’s discount of the future rather than futures discount of today” (p259)

If we look at cost benefit analysis in the context of PROACTIVATE then it is very unlikely that the costs and benefits will have a linear format with constant weights. We may well require a concave function that responds positively to benefits and negatively to costs. As Sen (2002) points out “concavity is very often the most plausible

shape of an objective function involving different good things and has been used to derive variable weights at different points and correspondingly variable shadow prices of resources. In fact in general we would expect strict concavity or at least quasi concavity corresponding to diminishing marginal rates of substitution between different kinds of benefits and in this sense the additive form of cost benefit analysis requires careful handling.” (p.562)

We briefly sum up here the main features of **PROACTIVATE**:

- PROACTIVATE is a holistic model of sustainable development which is built on the relationship of human beings with natural capital and the flow of ecosystem services
- It recognizes the fact that human development and development of natural capital are inextricably linked
- It recognizes the need to integrate social choice theory with policy and legislation
- It recognizes that men women and children in their own capacity as well as members of social organizations have a positive role to play in sustainable development
- It generates a positive mood
- It has a sound academic foundation and does not make assumptions that divorce policy and legislation from reality
- It emphasizes an inter-disciplinary approach to sustainable development
- It is a practical guide to policy and legislation
- It is a universal brand . It spells out areas for action but how the action has to be taken depends on the circumstances of each country
- It emphasizes effective execution as the key to success

This extremely brief exposition of the model PROACTIVATE clearly shows the tremendous amount of research that is required to realize the full potential of PROACTIVATE.

I have dealt briefly with the model PROACTIVATE. I would now like to add a few words about the originator of the model Dr. Madhav Mehra.. I can do no better than to quote from John Maynard Keynes about the qualities he believed an economist must possess. He must “possess a rare combination of gifts; he must be a mathematician, a statesman, a philosopher in some degree. He must understand the symbols and speak in words. He must contemplate the particular in terms of the general and touch abstract and concrete in the same flight of thought. He must study the present in the light of the past for purposes of the future. No part of man’s nature or his

institutions must be outside his regard. He must be purposeful and disinterested in a simultaneous mood; as aloof and as incorruptible as an artist and yet sometimes as near the earth as a politician.” Dr. Mehra combines in himself all these qualities besides being a visionary.

BIBLIOGRAPHY

- Afkhmi Mahnaz 1998 "A Vision of Gender in Culture" in Culture in Sustainable Development (eds Serageldin Ismail and Martin-Brown Joan, Conference sponsored by the World Bank and UNESCO
- Ahmad Yusuf J, El Sarafy, Salah and Lutz, Ernzt (eds) 1989 Environmental Accounting for Sustainable Development. A World Bank Symposium Paper Washington D.C
- Anderson Terry L. and Leal Donald R. 2001 Free Market Environmentalism Palgrave, New York
- Annan Kofi, 1997 Global Change and Sustainable Development: Critical Trends, Report of the Secretary General to the Commission on Sustainable Development
- Arrow Kenneth J 1951 Social Choice and Individual values, Wiley, New York
- Athanasiou T. and Baer P. Global Justice and Global Warming, Seven Stories Press, New York
- Atkinson, Anthony B. 1983 Social Justice and Public Policy, Social Justice and Public Policy, MIT Press M.A
- Ayres Robert U. 1988 Optimal Investment Policies with Exhaustible Resources: an Information Based Model." Journal of Environmental Economics and Management
- Ballasa Bella 1964 The Purchasing Power Parity Doctrine: A Reappraisal The Journal of Political Economy 72 (6) :584-96
- Baumol William J. 1986 On the Possibility of Continuing Expansion of Finite Resources, *Kyklos* 39: 167-169
- Bonan Gordon 2002 Ecological Climatology, Cambridge University Press, UK
- Botkin Daniel B. and Edward A. Keller 1998 Environmental Science: Earth is a Living Planet, New York, John Wiley and Sons
- Bovenberg A. Lans and Ruud A de Moij 1994 American Economic Review 84(4);1085-9
- Brett, Craig and Michael and Michael Keen 2000 "Political uncertainty and the earmarking and earmarking of environmental taxes" Journal of Public Economics 75:315-40
- Buchanan, James M 1954 Social Choice, Democracy and Free Markets, Journal of Political Economy, 62:114-123
- Burroughs, William James 1997 Does Weather Really Matter? The Social Implications of Climate Change, Cambridge, Cambridge University Press
- Cairncross, Francis, 1992, Costing the Earth: The Challenge for Governments: The Opportunities for Business, Harvard Business School Press
- Camino, Elena and Carla Calcagno 1995 "An Interactive methodology for empowering students to deal with controversial environmental problems" Environmental education Research 1(1) :59-64

- Carson, Rachael 1962 Silent Spring, Boston MA
- Climate Change Corporation.com 2007 The Climate Change Industry takes Root, Ethical Corporation
- Cline W.1992 The Economics of Global Warming, International Institute for International Economics, Washington DC
- Constanza, R Farber S and Maxwell J 1989 "Valuation and Management of Wetland Ecosystems," Ecological Economics Vol. 1 No4 December pp 335-362
- Crocker, D.A and Lindon T. (eds) 1998 Ethics of Consumption: The Good Life, Justice and Global Stewardship, Rowman and Littlefield, Lanham, MD
- Dar U. 1978 Benefit Cost Appraisal of Foreign Direct Investments, Paper presented to the UN Workshop on Negotiating Foreign Direct Investments (co chair U.Dar; Chair Walter Chudson) IIC New Delhi
- Dar U. 1978 Negotiating International Technology Transfer, UN New York
- Dar U. 1979 Evaluation of Social Development Programmes, ESCAP, Bangkok, Thailand
- Dar U. 1979 The Effects of Multinational Enterprises on Employment in India, International Labour Organization, Geneva
- Dar U. 1979 Foreign Collaborations and Technology Transfer to India, Ministry of Industry, Govt of India, New Delhi
- Dar U 1980 The Rate of Discount in Benefit- Cost Appraisal, IIC New Delhi
- Dar U.1981 Conversion Factors for Non-tradables in Benefit-Cost Analysis, IIC New Delhi
- Dar U. 1982 Domestic Resource Costs of Synthetic Fibres ICRIER New Delhi
- Dar U. 1983 Innovations in the Drugs and Pharmaceutical Industry ICRIER New Delhi
- Dar U 1992 Management of Technological Change: Issues and Challenges in "Management of Technological Change," Eds SP Gupta and K. Venkataraman
ICRIER, New Delhi
- Dar U 2005 Empowerment of Women- Case study of Village Ghasera, Gurgaon IEMSD
- Dar U.2006 a "E-Waste and Climate Change" in Collaborating to Combat Climate Change"(ed) Lt. Gen. Ahluwalia PVSM (retd) World Environment Foundation, MM Publishing, New Delhi
- Dar U. 2006 b Pricing the Environment" in Improving the Quality of Stakeholder Engagement (ed) Dr. Madhav Mehra, MM Publishing, New Delhi
- Dar U 2007 Closed Loop Recycling of Waste Food-A case study of National Airport, Washington, FAST, New Delhi
- Dar U.2008 a PROACTIVATE-A CHANGE LEADER in PROACTIVATE for Delivering a Holistic Response to Climate Change (ed) Lt. Gen. Ahluwalia, PVSM (Retd) World Environment Foundation, MM Publishing, New Delhi

Dar U.2008 US Climate Security Act 2006 and PROACTIVATE in Delivering a Holistic Response to Climate Change (ed) Lt. Gen. Ahluwalia, PVSM (Retd) , World Environment Foundation, MM Publishing, New Delhi

U.Dar 2009 “Corporate Decision Making in an Economy of Surprise,” in Leadership in an Economy of Surprise (ed) Dr. Madhav Mehra, Institute of Directors, MM Publishing New Delhi

DEFRA 2007 An Introductory Guide to Valuing Ecosystem Services, DEFRA, UK

DFID,EC,UNDP and The World Bank, 2002, Linking Poverty Reduction and Environmental Management, The World Bank, Washington D.C 20433

Devarajan, S. and Fisher, A.C.1981 Hotelling’s Economic of Exhaustible Resources- Fifty Years Later, Journal of Economic Literature vol 19 (1) 65-73

European Union 2008 Paper from the High Representative and the European Commission to the European Council “Climate Change and National Security

Faeth, P, Cort,C., Livernash R, 1994 Evaluating the Carbon Sequestration Benefits of Forestry Projects in less Developed Countries, World Resources Institute, Washington

Gore Al, 1992 Earth in the Balance:: Ecology and the Human Spirit, Boston,MA

Goudie, Andrew1993 The Human Impact on the Natural Environment, Oxford, Blackwell

Grossman, Gene M and Alan B.Kreuger 1995 Economic Growth and the Environment, Quarterly Journal of Economics 110(2) :353-377

Hardin, Garret 1968 The Tragedy of the Commons Science 162:1 243-8

Hawkin, P. Lovins, A.and Lovins H..L 1999 Natural Capitalism, Creating the Next Industrial Revolution, Little, Brown and Company, Boston

Hossein Iftekhar 1990 Poverty as a Capability Failure, Swedish School of Economics, Helesinki

Hotelling Harry, 1931 The Economics of Exhaustible Resources, Journal ofPolitical Economy 39:137-175

IPCC 1998 The Regional Impacts of Climate Change : An Assessment of Vulnerability: An Assessment of Vulnerability Watson, R.T. Zinyowera, M.C. and Moss R.H (eds)

Intergovernmental Panel on Climate Change Special Report, Cambridge University Press, Cambridge,U.K

IPCC 2000. Special Report on Emissions Scenarios: Nakicenovic,N. and Swart R.(eds) Intergovernmental Panel on Climate Change, Special Report, Cambridge University Press, Cambridge, U.K

IPCC 2001a Climate Change 2001 The Scientific Basis; Houghton ,J.T Ding Y. Griggs, D.J, Noguer, M., Van Der Linden, P.J.and Xiaosu, D. (eds) Cambridge University Press UK

IPCC 2001b, Climate Change 2001: Impacts, Adaptation and Vulnerability. MCarthy, J.J.Canziani, O.F. Leary,N. Adokken,D.J. and White, K,S (eds) Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge U.K

IPCC 2001c Mitigation, Metz.B. Davidson. Stewart, R. and Pan.J (eds) Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, U.K

IPCC 2001d Climate Change 2001 Synthesis Report, Watson R.T and the Core Writing Group (eds) Cambridge University Press, Cambridge, U.K

IPCC 2000 Special Report, Land Use, Land Use Change, and Forestry and others (eds) Intergovernmental Panel on Climate Change, Geneva

IPCC 2004 Workshop Report: Describing Scientific Uncertainties in Climate Change to Support analysis of risk and Options. www.ipcc.ch

IPCC 2007 Climate Change 2007 Contributions of the Working Group I, II, and III to the Fourth Assessment, Cambridge University Press, Cambridge, UK

Jochem, E, Sathaye, J.A and Bouille, D. (eds) 2002: Society, Behaviour and Climate Change Mitigation, Klower Academic Publishers, Hingham, MA

Kerr Steven, 1997 Ultimate Rewards, Harvard Business School Publishing

KPMG 2008 Climate Changes Your Business –KPMG’s Review of the Business Risks and Economic Impacts at Sector Level, KPMG International

Lomborg Bjorn, 2001 The Skeptical Environmentalist, Cambridge University Press 2001

Mehra Madhav, June 2006, Climate Change, Don’t Just Stand There: Get Wristed, Quality Times

Mehra Madhav, May 2007, Climate Change – The Edge of a New Frontier, Quality Times

Mehra Madhav, July 2007, Change Growth Model to Tackle Global Warming, Quality Times

Mehra Madhav, November 2007, Business models for combating climate change and social inclusion, Quality Times

Mehra Madhav, January 2008, Changing Growth Model to Combat Climate Change, Quality Times

Mehra Madhav, Oct 2008, Driving Capital Markets through Clean and Green Agenda, Quality Times

Mehra Madhav, Nov 2008, Green Bailout for India Putting People First, Quality Times

Mehra Madhav, Feb 2009, Generating Employment and Boosting the Capital Market by Greening the Economy, Quality Times

Markandya A, and Pearce D.W 1998 Environmental Considerations and the Choice of the Discount Rate in Developing Countries, World bank Environment Department, Working Paper No.3

Meadows, Dennis L. 1977 Alternatives to Growth, Houston, Texas

Meadows, Donella, Meadows, Dennis, L.Randers, Jorgen, 1992. Beyond The Limits, Chelsea Green Publishing Company, Post Mills, Vermont

McCulloch Anna, Knox., Meinzen, Dick Ruth, and hazel Peter, 1998 Property Rights, Collective Action and Technologies for Natural Resource Management- A Conceptual Framework, International Policy Research Institute, Washington, USA

Millenium Eco System Assessment Board 2005 Living Beyond Our Means:Natural Assets and Human Well Being, MA Board

Muller b.2002: Equity in Climate Change: The Great Divide, Oxford Institute for Energy Studies; [OxfordClimate Policy.org](http://OxfordClimatePolicy.org)

- Narayan Deepa (ed) *Measuring Empowerment*, World Bank, Washington
- Oberthur, S. and Ott, H. 1999 *The Kyoto Protocol: International Climate Policy for the twenty-first Century*, Springer-Verlag, Berlin, Heidelberg and New York
- Oberthur, S. and Ott, H. 1999 *The Kyoto Protocol: International Climate Policy for the twenty-first Century*, Springer-Verlag, Berlin, Heidelberg and New York
- Pearce David 1991 "The Role of Carbon Taxes in adjusting to Global Warming " *The Economic Journal* 101 (407) :938-48
- Pearce David and Moran Dominic 1995 *The Economic Value of Biodiversity*, IUCN London
- Pernick, Ron, Wilder, Clint. Gauntlett Dexter 2008 *Carbon Free Prosperity*, Clean Edge Inc.Climate Solutions
- Pigou A.C 1920 *The Economics of Welfare*, Macmillan, London
- Pitcock Barrie A, 2005 CSIRO Publishing Australia
- Plumwood, Val,2002 *Environmental Culture*, Routledge, London and New York
- Prahlad C.K. 2006 *The Fortune at the Bottom of the Well*, Wharton School Publishing N.J 07458
- Prechter Robert Jr *The Wave principle of Human Social Behaviour and the New Science of Socionomics*, New Classics Library, Gainsville, Georgia 30503 USA
- Rawls John, 1999 *A Theory of Justice*, The Belknap Press of Harvard University Press, Cambridge, Massachusetts, USA
- Sen Amartya, 1995 *Gender Inequality and Theories of Justice in Martha C. Nussbaum and Jonathan Glover (eds) Women, Culture and Development: A study of Human Capabilities*, Oxford Clarendon Press
- Sen, Amartya 2002 *Rationality and Freedom*, The Belknap Press of Harvard University Press, Cambridge, MA
- Smith, J.B. and others (eds) 1996 *Adapting to Climate Change: An International Perspective*, Springer-Verlag , New York
- Stern, Nicholas 2007 *The Economics of Climate Change: The Stern Review*, Cambridge University Press U.K
- Stern, Nicholas 2007, *Key Elements of a Global Deal on Climate Change*, London School of Economics and Political Science
- Stern, Nicholas 2008 Ely lecture "The Economics of Climate Change," *American Economic Review* 98 (2) 1-37
- United Nations 2005 *Millennium Eco System Assessment Report*. UN
- UNEP 2002 *Convention on Biological Diversity UNEP/CBD/COP/6/20*
- UNEP 2008 *Global Trends in Sustainable Energy Investment*, endorsed by REN 21
- UNDP, 2005 *Adaptation Policy Framework for Climate Change: Policies and Measures*

UNDP 2008 Human development Report 2007-2008 "Fighting Climate Change" UNDP

Lim.B (ed) Cambridge University Press, Cambridge U.K

World Business Council for Sustainable Development 2000 Eco Efficiency-Creating More value With Less Impact, WBCSD

World Business Council for Sustainable Development 2007 Policy Directions to 2050, WBCSD

World Bank World Development Indicators, IBRD Washington

World Resources Institute, 2002 Business and Eco Systems

Woolstonescraft, Mary, A Vindication of the Rights of Women: Strictures on Political and Moral Subjects. Original from Harvard University, published by UNwin in 1891

WCED 1987 Our Common Future (The Bruntland Report) The World Commission on Environment and Development for the General Assembly of the United Nations, Oxford University Press