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# ENVIRONMENT, ENERGY, AND DEVELOPMENT FROM STOCKHOLM TO COPENHAGEN AND BEYOND THE CELEBRATIONS

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Climate change

Renewable energy

Sustainable development

Policy shift

Kyoto protocol

Bali roadmap

Copenhagen

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### ABSTRACT

This paper discusses a historical account of the concern for Environmental degradation in the world and steps taken by UNO, developed and developing countries to address the problem. The outcome of International conferences and the policy adoption by some of the countries to address climate change related to energy use has been highlighted. The concept of sustainable development has been enumerated. The current situation with regard to use of renewable energy, climate change and related aspects has been discussed.

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## INTRODUCTION

Thirty eight years before on 5<sup>th</sup> June 1972 at Stockholm, the world realized the future of mankind is bleak unless we take urgent actions to protect our environment from the colossal degradation and damage we have inflicted on the planet in the last few hundred years and pledged to bring world wide awareness among the people to protect the environment, the mother Earth for our survival. The Stockholm conference led to the establishment of UN Environment Programme and gave emphasis on protection of environment for the future. The World Commission on Environment and Development was established in 1983 and brought out its report 'Our Common Future' in 1987. This report highlighted on poverty, depletion of natural resources faster than exploitation, deterioration of environmental quality and quality of life. These actions led to the organization of the Earth Summit in Rio de Janeiro in Brazil in June, 1992.

The Rio conference gave widespread visibility of the important concept of sustainable development. This concept placed environmental management in a position to address the environmental impacts of developmental projects so that the environment is protected for the present and future generations. The conference in Johannesburg, South Africa in 2002 provided opportunity to review the actions taken and benefits made and to review the different aspects of resource utilization and conservation. Biodiversity conservation received top priority. Besides, the important issue of energy use and climate change and its effect on developmental projects, on human activities and future of mankind was very much focused.

The theme in the World Environment Day on the 5<sup>th</sup>, June 2010 was "Many Species, One Planet, and One Earth. The theme respectively in 2009 and 2008 was "The Earth needs us, Unite to combat Global Warming and save the Earth" and 'Carbon dioxide: Kick the habit for low carbon economy'. The UNO has declared 2010 as the 'International Year of Biodiversity Conservation'. The UNO has also declared 2011 as the 'International year for Forest Conservation'. This shows the growing importance of protecting the environment, conserving biodiversity, especially forests to combat climate change. Combating climate change involves the phasing out of the use of fossil source of energy and switching over to other forms of energy which do not carbonize the world. (Dash, 2010).

These annual sermons, however regarding the state of environment of earth clearly show that our modern way of living is at stake because the present style of progress and mode of development with unsustainable consumerism and energy source from fossil fuels eats away into our basic life supporting system and puts tremendous adverse pressure on environment, and reduces biodiversity, which provides us food, shelter material, raw material for medicines, gases for survival, other ecosystem services like recycling of water and other materials – something like legendary Indian poet Kalidasa, before being blessed by the goddess of learning was cutting the tree branch sitting over it.

Virtually all earth's ecosystems have been significantly transformed through human activities and the changes have been more rapid during last hundred years as the population grew faster and migration to urban centres became a necessity due to top-sided development and management. It is now realized that the present concept of unlimited growth in a limited resource based environment is flawed and sustainable development is necessary.

With huge population increase, especially in underdeveloped and developing countries and new types of ailments looming on the horizon consequent to a synthetic life emptying the natural medicine tool box consequent to extinction of the ecoservers (medicinal plants) is disastrous. Who knows what types of metabolic assaults humanity will face in future in Nature's feed-back loop? In view of this the biodiversity conservation is very important.

### **Energy use**

There is increased need of energy in the farm, industrial and service sectors. Modern way and standard of living demand huge energy from unsustainable consumerism, transport facilities and increased construction

work and other aspects of human use. Energy is the key for survival, continuance and for sustainable development. Excessive consumerism is a factor for global warming. Patterns of consumption, food habits and recycling processes have influenced growth in energy demand and GHG emissions. The specific GHG emissions from food production and processing are much lower in India and other developing countries than in developed countries.

Solar energy is abundantly available but we have not been able to trap it as per our need because of many reasons. The recent thrust is to utilize the renewable to address the environmental degradation.

### India's Energy Source

About 70% of our energy source (1, 53,694.09 MW) is fossil fuels, especially coal and lignite. The distribution is as follows (Fatesingh, 2010):

- 81,355.88 MW-coal based,
- 16,822.85 MW –Gas based
- 1199.75 MW diesel based.

Thermal power plants are not environment friendly as these plants generate huge amount of green house gases and pollutants such as SO<sub>2</sub>,NO<sub>x</sub>,CO<sub>x</sub>,,SPM, Fly and bottom ash, metallic dust, etc. About 120-150 million ton of fly ash is generated annually in India ( Jain, 2010). The utilization is only about 25-30% in brick making, road construction, forest soil fertilization, and in agriculture etc (Jain, 2010). Hence it is a huge problem. One estimate (Paribesh Samachar, 2010) shows that the pollution load from 1 MW Indian coal based thermal power generation amounts to generation of:

- ~ 19 ton of CO<sub>2</sub> per day .MW
- > 136 kg of SO<sub>2</sub> per day.MW
- >7 ton of fly ash per day.MW
- Particulate matter 60kg per day.MW

Since about ~ 1, 53,694 MW electricity is generated the pollution load per day on the environment is huge *i.e.* 2.92 million tons of CO<sub>2</sub>, 20,902 tons of SO<sub>2</sub>, 1 million ton of fly ash and 9222 ton of particulate matter. The pollution potential and the Green House Gas generation by the thermal power plants are huge.

In view of this, there is now a policy shift for energy generation by government of India. More stress is being given to renewable source of energy, especially solar, wind, biomass gasification and nuclear in 11<sup>th</sup> plan and onwards for reduction of green house gas emissions, pollution and for conservation of resources (Prime Minister's eight missions including the solar and energy efficiency missions, 2009). Indigenous technology development and appropriate technology transfer mechanism, collaboration of public sector-private sector in all sectors *i.e.* agriculture, industry, animal husbandry and fisheries, forestry, water resource management, energy generation, environment etc are required in the present juncture of this transition.

In 1947 India had electricity generating capacity of only 1470 MW with about 49% load factor. At present India has the capacity to generate > 1, 53, 694.09 MW (105 times growth) with about 80% load factor. In spite of this increase, India is not able to meet the demand of energy from the farm, industry and service sectors. Hence the situation has become critical. In the 10th and 11th plans, additional 27,283 MW and 78,700 MW could be achieved. It has been estimated that by 2016, the energy production capacity will reach 2, 15,804 MW (Fatesingh, 2010).

In spite of this huge expenditure, per capita energy consumption in India is only about 500 units per year compared to about 2600 units at international level in industrially developed countries. India has 618 districts and 5, 93,732 villages. Out of this, about one lakh villages do not have electricity supply till today. (It is expected that during this plan all villages will have electric supply). Out 13, 82, 71,559 households, only 7, 80, 90,874 household have received electricity supply. In India 43.5% people are deprived of electrical

energy and 30 % people use < 50 unit per year. (Dash, 2010)

### **Climate change: Climate control policies (Kyoto protocol 1997)**

In 1997, the global community met in Kyoto in Japan to work out mechanism for controlling Green house (GHG) emissions. Policy decisions taken during this conference have been termed as *Kyoto Protocol*. According to the mandate of this Protocol, all countries were grouped into two categories. Those consuming energy above the global average mostly the industrially advanced countries like European countries, USA, Canada, Japan, Australia, and Russia, are called Annex-1 countries (Developed) and the rest are called Non-Annex-1 countries (Developing). According to Kyoto Protocol, Annex-1 countries have to bring down their GHG emissions to less by 5.2 % average from the base level of 1990 keeping in mind their economic development, population growth, etc. If for some reason they are not in a position to bring down the emission to below 1990 level, they are allowed to go and reduce the GHG emission in the developing countries where the efficiency of energy consumption is also lower and there is a need to consume more energy for ensuring their development. Any reduction made in the specific green house gas (GHG) emissions can be considered as being reduced in the respective country providing the monetary benefit.

Any organization or industry in the Non-Annex-1 country reducing the GHG emissions can trade those emissions with the Annex-1 countries. The Kyoto Protocol further stipulated that the time period allowed for GHG emission reduction commences from January 2000 and ends up by 2012. The accounting for Annex-1 countries begins from 2008 and ends up with 2012 (first crediting period). The process is controlled by the respective governments and the UNO.

To reduce the global warming potential (GWP) from the GHG, industries can undertake any of the following CDM projects: Increase in methane gas (biogas) consumption, Increasing the use of biomass in place of fossil fuel for energy generation, Fuel switching from coal to biomass (biomass gasification), Switching over to hydroelectric power, Energy efficiency projects, Fuel switching from coal to gas, Improving energy efficiency at the user end, Improved Agriculture practices and to increase carbon sink potential.

This financial instrument of selling GHG emission is called carbon trade under Clean Development Mechanism. Kyoto protocol does not necessarily reduce industrial GHG emissions in the world taken in whole, although it aids to afforestation and forest conservation.

Carbon Trading essentially means exchanging points earned by the reduction of GHG for money. This has emerged as a huge opportunity for Developing countries where GHG emissions are much below the quota fixed. Developing Economies are not expected to meet emission targets during this period. Companies in Developing Countries can earn carbon credits by investing in Clean Technology. The principle is based on the fact that climate change is a global problem that requires a global solution. Global cooperation on technology transfer is important and developing countries need access to climate-friendly technology. Global Environmental Facility (GEF) has a critical role to play in the co-development and transfer of technology and it can be made through several different channels. Technology transfer must be accompanied by capacity building. Though UNFCCC has made substantial progress in evolving the mechanism for inter-state sale of carbon emission credits, there are still some gray areas, which are being resolved from time to time.

Carbon trading is in full swing in many developing countries like Brazil, Mexico, China and India despite the fact that USA and Australia did not ratify the Kyoto Protocol.

Carbon trading is moving across all the countries in a very rapid way and expected to involve 1000 billion dollars trading by 2012. The organizations can reduce energy consumption or release of any of the six GHG gases by adopting cleaner options (Clean Development Mechanism) and claim reduction in GHG emission. Renewable and methane captures are at the top of the list and energy efficiency at lower end. As the accounting period approaches (2012) the prices may increase further. Size of the project is determined based on the total emissions saleable over accrediting period.

Developed nations, especially USA, Japan and Australia wanted that large economies like China, India,

Brazil, and Mexico should take some steps to control carbon emission although they are listed under Annex-2 countries. This was the scenario before 2007.

### **Bali road map (2007)**

UNO organized the conference in 2007 at Bali. The slogan was 'NO TIME LEFT- ACT NOW'. There were 10000 Participants, 187 Govt. Representatives and the conference was held from December-3-14, 2007 and the conference adopted Bali Road Map: a new negotiating process was to be concluded in 2009 and will lead post 2012 and lead to international agreements. USA agreed for Bali Road Map of December, 2007. The salient Features were:

1. Lanching adoption fund (AF)
2. Reducing GHG emissions
3. Technology Transfer is to made simple
4. USA and Australia agreed for post 2012 agreement and they argued for some commitment from developing countries, especially from China, Brazil and India for reduction of GHG.
5. The Message was 'The World can not afford to wait'.

Countries are to address the question of a shared vision of long term cooperative action-carbon emission reduction taking into account social and economic conditions and other relevant factors.

Countries must negotiate the question of 'Enhanced action on technology' but countries shrink when clarifying what they wish to do mitigate climate change.

### **Poznamn, poland-climate change conference (December 1-12, 2008)**

UNFCCC-14th Conference of Parties (COP) to solve the problem of erosion of trust between developed and developing countries on implementation of Bali Road Map was held at Poznan. Over 3000 delegates from 186 countries participated in the conference. Developing countries need huge amount of money every year till 2015 to adapt to climate change effects according to the Human Development Report of UNDP, 2007. At present the availability of the fund is meager and developed countries are not contributing as expected. GEF has been handling money disbursals. Least developed countries (LDC) found the process too much cumbersome. Besides UNFCCC has found that CDM process can not properly account for energy efficiency projects in the building sector.

### **Policy shift by USA**

There was a policy shift in USA with regard to Climate Change after Mr. Barack Obama became President and Mrs. Hillary Rodham Clinton was appointed as Secretary of State. I quote some of the portions of the address of the Secretary of State Mrs. Clinton delivered at 17 major Economies forum on Energy, Climate on 17 April, 2009.

'It is an environmental issue, a health issue, an economic issue, an energy issue and a security issue. It is a threat that is global in scope, but also local and national in impact.' Desertification and rising sea level generate increased competition for food, water and resources. But we also have seen increasingly the dangers that these transpose to the stability of societies and governments. We see how this can breed conflict, unrest and forced migration. She stresses on four points. These are:

1. Climate change is a clear and present danger to our world and demands immediate attention, the science is conclusive.
2. The US is determined to make up for lost time, both at home and abroad and the USA is committed to address this issue and to act.
3. The countries should pull together and work towards a successful out come of the UN climate negotiations later in the year at Copenhagen,
4. We all must cooperate and new policy and new technologies are needed to resolve this crisis. The USA has made budget provisions for funding and for providing loan for clean energy development, targeting to double supply of renewable energy.

The international business on CDM will be huge, their priority area is to make the homes and buildings

more energy efficient.

On one hand it is very encouraging but there is an element of business interest which makes developing countries worried. They feared that the developed countries may vouch for imposing restrictions on carbon emissions. (Times of India dated 23 May 2009).

Every nation wants its enhanced economic development, although shows concern for global warming and emissions.

### **Bonn, Germany conference**

The first draft for negotiations on the Climate change policy beyond 2012 released on 19th May 2009 at Bonn, Germany included two options for developing economies like India to deviate their emissions from the current base line by 15-30% by 2020 or reduce by 25% from 2000 level by 2050. This generated lot of heat in the negotiations. This provision deviates from UNFCCC's original text and also the spirit of Kyoto protocol.

The 20 nation Major Economic Forum (MEF) met in London on 19th and 20th October, 2009 and suggested that International monitoring of GHG should be mandatory and the proposal was not accepted by the developing countries.

### **Copenhagen: December 7-18, 2009**

The Copenhagen conference was attended by 193 countries and 120 Heads of States. The deliberations resulted in developing the following:

- No specific emission targets set for the developed countries
- Consensus was to keep temperature rise to below two degrees Celsius by 2050, but no strong commitment was made.
- Emphasis was on mobilization of financial resources for supporting reforestation efforts of developing countries
- Scaled-up funding for poor countries, including long term cooperative action (fast-tracked fund) of \$30 billion during 2010-2012. USA will take initiative to mobilize \$100 billion by 2020.

### **Summary of Copenhagen Conference- Proceedings**

- Most of Annex-1 countries wanted a new deal replacing Kyoto Protocol (5.2% cut of 1990 level). Non-Annex countries insisted of retaining Kyoto and action in 2008-2012. Kyoto Protocol survived-discussions to continue
- Consensus (120 out of 193 countries) agreed to allow up to 450 ppm CO<sub>2</sub> and 2°C rise in temp by 2050.
- Outcome was voluntary emission cuts by BASIC countries and retention of Kyoto. (A political agreement was signed- neither supported by UNO not a legal document)
- International monitoring was not accepted.
- Consultations yield a political accord not a legally binding treaty.
- UNO-UNFCCC meeting in Mexico in 2010 may introduce punitive measures for violation of International agreements. (?)
- Rich nations to take on internationally-binding commitments on reducing GHG (Kyoto, Bali protocols) and Developing countries to take domestic action to cut the GHG emissions.
- UNO to play more active role in the governance of flow of finances to help developing countries counter climate change.
- Countries agreed to scale up public finances significantly for GHG reduction.

### **India's voluntary policy shift**

Considering 8% GDP growth rate per annum in 2002-2010, the estimate of GHG from all sources in 2000 in

India was about 1485 million ton, per capita emissions about 1.1 ton. This was about 3% of total global emissions. An assessment of the current and projected trends indicate that green house gas emissions grew @ 4% annum during 1990 and 2000 and projected to grow further due to developmental needs. The absolute level will not be less than 5% of global emissions in 2020. (Sharma *et al.*, 2006; Shukla, 2006; FSI, 2009). In India, the estimate is 2115 million ton of GHG emission in 2010 and >2800 million ton of GHG emission by 2020. Indian government in Parliament has announced 25% cut in emission level by 2020 taking 2005 as the base year before the Copenhagen meet. It means that the dependence on energy from coal to renewable will receive priority.

Prime Minister's council on climate change has approved eight missions (solar, energy efficiency, sustainable habitat, water, Himalayan ecosystems, green India, sustainable agriculture and knowledge acquisition for climate change) under India's National Action Plan on Climate Change. The policy centers on:

- (i) achieving energy efficiency; 'Perform, Achieve and Trade' (PAT) mechanism
- (ii) promoting Renewable energy
- (iii) promoting sustainable development especially through clean technology development and transfer
- (iv) promoting afforestation, and enhanced forestation( from 20.6% to 33% of land cover) to increase sink factor
- (v) promoting sustainable agriculture
- The PM's Office has announced that by 2015, India will save about 5% of annual energy consumption and nearly 100 million ton of CO<sub>2</sub> emissions per year.
- The National Solar Mission has approved enhancement of solar energy generation.
- On 21st October 2009, India and China have signed a MOU for collaborating on climate change issues at mutual and international level.
- India launched 83Kg small observation satellite (IMS-I) in April 2008
- On 18th October 2008, Mr.G.Madhavan Nair announced further actions to be taken: India plans to launch two climate satellites (One 50 Kg micro satellite for climate study and the Second satellite (Remote sensing) will monitor GHG (CO<sub>2</sub>, and CH<sub>4</sub>) emission in polar orbit
- The Satellite will contain 2 optical instruments-
  - (i) a multispectral camera,
  - (ii) a hyper-spectral camera to operate in visible and near infrared regions.
- These actions indicate India's concern and positive voluntary actions.

### **Sustainable development**

Sustainable Development is the development which meets the needs of the present without compromising with the necessities of the future generations (Brundtland Commission, 1987). This concept developed as the present model of unlimited growth in a limited environment is not the right answer to the complex of the problem that every country face. This is indeed a tall order to achieve. It also means redistribution of resources as it will reduce inequalities. Redistribution may include technology transfer, financial aid and compensation to prevent environmental degradation, resource conservation etc.

How did the concept of sustainability come about?

In 14th century, "sustainable" forestry was practiced in India based on the principle of not cutting down more trees than the growth rate for replacement allowed. In India the concept is very old and linked to Vedic times.

In Europe, the concept of sustainability can be traced back to 18th century. In 1795, the economist GeorgeLudwig wrote that the forests are to be used in such a way that "future generations will have just as

many advantages as the present generation does”. The concept of sustainable development was first introduced by the International Union for Conservation of Nature and Natural Resources (IUCN) in 1980. A definition of sustainable development was first given by the World Commission on Environment and Development (popularly known as Brundtland Commission) in 1987 as a development process that “meets the needs of the present without compromising the ability of the future generations to meet their own needs. The Brundtland Commission considered population control, food security and energy supply as critical components of sustainability. Since the Rio Summit in June 1992 and the adoption of Agenda 21 by the global community, many nations have set sustainability as a key goal of their development. According to the World Resources Institute, the four dimensions of sustainable development are social, economic, environmental and technological well being. These dimensions provide a framework within which one can specify details for countries at a given stage of development.

The environmental laws, the application of science-technology and creation of public awareness are defining factors for the success of sustainable development.

Concern over the state of the environment started building up since 1960s due to decline in environmental quality and deterioration in living conditions. UNO became concerned and it was reflected at the UNO-conference on the Human Environment held in Stockholm from 5th June to 12th June, 1972; Rio conference, 1992; Review of Progress in Johannesburg, 2002. Government of India actively participated in 1972 conference and follow-up conferences and the then prime minister presented a thought provoking paper on poverty and environment and strongly voiced concerns in 1972 conference.

Several measures were taken in India for Environmental Protection before the Stockholm conference but there was no general legislation on a holistic manner to protect the environment. In India the existing laws dealt directly or indirectly with several environmental issues like forest conservation, wild life conservation etc but no general comprehensive law existed to deal with pollution prevention, control and abatement. India has witnessed manifold increase in Industrial sector and the increasing tendency of industrialization and urbanization is growing very fast.

In 42<sup>nd</sup> amendment of the constitution, two articles were inserted and these have direct bearing on Environment:

Article 48A: The state shall Endeavour to protect and improve the environment and to safeguard the forests and wild life of the country.

Article 51 – (g) of the Constitution states that:-

‘It shall be the duty of every citizen of India to protect and improve the natural environment including forest, lakes, rivers and wildlife and to have compassion for living creatures’.

As per Article 21, ‘No person shall be deprived of his life or personal liberty except according to procedure established by law’ The Apex court has interpreted this article to include the rights of a ‘ living environment congenial to human existence’ while disposing the Vellore tannery case in 1996 and ordered for implementation of ‘Polluter pays’ principle. It shows the concern of the Hon’ble Supreme Court to Environmental Pollution and Suffering of the people.

Public Interest Litigation provision was introduced under article 39A (42<sup>nd</sup> amendment) (equal justice and free legal aid). As per Article 47, ‘The state to ensure as its primary duty of (i) Raising standards of living of its people; (ii) To increase the level of nutrition of the people and to bring improvement in public health.

Science and Technology has also advanced and methods are available to control pollution and prevent environmental degradation.

The hindrance in proper implementation of laws in India is non availability of adequate public awareness, weak environmental governance and corruption. Legal matters on environment protection are not addressed on time, due to many reasons etc.

Max Muller, the celebrated German Scholar once wrote '*if we were to look over the whole world to find out the country most richly endowed with all the wealth, power and beauty which nature can bestow - in some parts a veritable paradise on earth - I should point to India*'.

What he wrote of India, in fact, is truer for the Rural India which is a unique repository of all those beautiful things that God and human hands created for the posterity to draw inspiration for a better tomorrow. India is a country of villages (618 districts and 5, 93, 732 villages- 2001 census).

The livelihood options and rural economy are largely bio-resource based, especially on

Agriculture and horticulture	(crops and fruits)
home garden	(vegetables, fruits, flower)
Diary	(milk, cow dung, ploughing)
Fishery	(fish, prawn, turtle)
Goatery	(meat, milk, skin)
Poultry	(meat ,egg)
Piggery	(meat, skin)
Forestry / Gramya Jungle	(firwood,fruits,honey,ayurved)

Artisan work is based on bamboo, cane, wood and other bio-resources.

Traditional ecological knowledge and bio- resource management is important.

Recent thrust on industrialisation, especially in resource rich but economically poor states like Orissa, Jharkhand, Chhatisgarh, Madhya Pradesh, and some other states threaten the traditional livelihood options. Therefore there is a need for implementation of EIA, EMP and Bio-safety protocol very strictly and judiciously. The forest provides firewood, house building material, fodder, fruits, medicinal plants and other utility materials to the villages with some control by village Panchayat. The runoff water from the slopes of the mountain forest / Gramya jungle is stored in the water harvesting village ponds.

The villagers depend upon the buffaloes and cows for milk, goat and sheep, poultry for meat and eggs and use the bullocks and buffaloes in the crop field for ploughing. The goat rearing and poultry is a profitable business for many village households. The village forest and grasslands are also used extensively for grazing of domestic animals of the villages.

In the changed situation of industrialization, the reduction/complete loss of grazing lands, villagers have problems of providing grazing land and unable to afford stall feeding for domestic animals.

However, employment opportunities for villagers in the changed scenario have increased their income, which help to partially stall feed the animals. The home gardens are also productive resources and are to be managed well. Ecosystem people ( Dash, 2009) are largely forest and bioresource dependent. The livelihood pattern in villages varies according to cast, ethnicity and financial condition of the families. Since the livelihood pattern is largely bio-resource based, government schemes should protect these resources and funding should be done to enhance bio-resource productivity and management.

The income from these occupations is subsistence level and do not meet the family expenditure. In view of this migration to urban centers inside the states or to distant places in search of work to augment family income happens.

Since 1994 EIA study has become mandatory for all new projects or expansion or modernization of existing projects which have substantial stake on environment. As per September 2006 notification of Ministry of Environment and Forests of Government of India, the generic structure of environmental impact assessment document and check list of environmental impacts have been stipulated. The purpose is to assess the expected

impacts and to address them through an environmental management plan if the developmental project is allowed to operate. However there is a big gap between the EIA stipulations and implementation. The sustainability concerns of Indian villages are yet to be adequately addressed. The judicious implementation of EIA provisions is need of the time.

The natural resource management or furtherance of traditional livelihood options conserving 'traditional ecological knowledge' available in village systems is to be focussed and managed well. Sustainable development in Indian villages should largely centre on creating facilities to enhance the existing livelihood options, adopting effective community participatory approaches, and sustainable management of bio-resources. This does not prevent opening of new avenues which should have minimum environmental impacts and can be addressed by application of science and technology. This will create additional livelihood options for educated youth.

*The integration of Science-Technology, Traditional Ecological Knowledge, and Judicious application of EIA protocol can make significant contribution to protect bio-resources for rural livelihood options for sustainable development.*

For a baby, Mid-wife does not substitute a mother, nor do parks and gardens in city substitute natural forest. Even a tractor is considered to be a poor substitute environmentally to a pair of cattle on the plough, because, the tractor consumes fossil fuel brought from outside, generates pollution, needs repair and spare parts and unlike the cattle does not produce dung which goes into the socio-agricultural system of India. Cattle are a bioresource and have a life cycle to sustain the population. No wonder, since history began this bovine animal has been catalysis in stabilizing the Indian society in general and families in particular. Whereas, the tractor or any such mechanical equivalence of modern endeavor is found to breed a series of unrest in ecosensitive societies. I do not advocate replacing the tractor by a pair of cattle on the plough, but how much ecofriendly it would be to run the tractor not by fossil fuel but by renewable energy.

It is our sacred duty to protect the environment, the natural ecosystem services, conserve biodiversity handed over to us by the Mother Earth and practice sustainable development in all our activities including our day to day living is call of the hr.

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