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Energy Conservation and the Paradigm of Sustainable Economic Development

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Abstract – Energy is the Life Blood of economy and Oxygen for the very existence of mankind, therefore the entire universe is the manifestation of energy in various forms. Energy plays a very crucial and pivotal role in the sustainable development of the economy. The present paper precisely provides the present and future status of the potential of energy conservation, energy conservation strategies and measures adopted by Government of India, corporate and society as a whole.

Keywords: Energy, Types of energy, Sources of energy, Energy conservation, Sustainable Development, Economic Growth, SWOT Analysis.

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INTRODUCTION

It is not said to be exaggeration that the entire universe is the unique manifestation of energy in various forms. The utility of energy is indispensable to the very existence of mankind on the earth. Therefore, the availability of energy is critical to our modern societal, personal and professional lifestyle. And, as continuing technology advancements are made, our dependence on energy is increasing.

But, now in the race of rapid development of the economy and emergence of consumerism the existence and availability of the environmental resource obviously energy is in the stake due to over exploitation of the scarce and valuable resources (non-renewable energy) of the environment by the past and present generations. Energy is the prime mover of economic growth and development (Ramaswamy and Kumar, 2012) therefore, it is imperative for any, particularly developing, economy to use energy in an economic and judicious manner to cope with the increasing consumption. There is a complex linkage between sustainable economic development and energy conservation. The pivotal role of the energy can be clearly explained with the help of the two propositions: economy requires development and development requires energy. The adequate and cost effective supply of clean energy is the vital requirement for the acceleration of the economy on the sustainable growth path. While, the production and consumption of the energy damage the ecological resources and jeopardizes the natural environment. The tendency of degradation in the environment adversely affects sustainability of the nature which threatens the survival of the mankind. This problem give the birth to the concept of sustainable development in the national as well as international arena (Ramaswamy and Kumar, 2012).

To create the tradeoff among the society, economy and environment the paradigm of sustainable development surfaced or emerged. On the stake of environmental degradation the growth achieved would be lopsided and skewed to the materialism and consumerism which is radically detrimental to the mankind. So, keeping in mind the vitally conservation and preservation of the ecology and the limited energy resources it's time to think about sustainability of production and consumption of the energy in the economy. In the drastic economic slowdown sustaining the growth is also major challenge for the developing economies. Energy conservation is the cheapest and clean source of the energy.

Introduction to Energy and its Resources

In the literal sense energy means the source of power and the ability to put effort into an activity. While, in the scientific term it is the ability of matter or radiation to work because of its mass, movement, electric charge etc. as kinetic energy and potential energy. But in the perspective of the present study and in the terms of ecological and environmental perspective:

"Energy means any form of energy derived from fossil fuels, nuclear substances or material, hydro-electric and includes electrical energy or electricity generated from renewable sources of energy or biomass connected to the grid."

-Section 2(h), Energy Conservation Act 2001.

From the above definition we have two types of energies comprised in the present study as below:

1. Renewable energy or Non-conventional source of energy.

2. Non-renewable energy or conventional sources of energy.

Features of Renewable energy or Non-conventional source of energy as following:

(i) The resources which are in the process of development over the last few years. It includes solar, wind, tidal, biogas and, biomass and geothermal.

(ii) They are inexhaustible.

(iii) They are generally pollution free.

(iv) Less expensive due to local use and easy to maintain.

Features of Non-renewable energy or conventional sources of energy are as following:

(i) The sources of energy which have been in use for a long time e.g. coal, petroleum, natural gas and water power.

(ii) They are exhaustible except water power.

(iii) The cause pollution when used, as they emit smoke and ash.

(iv) They are very expensive to be maintained, stored and transmitted as they are carried over long distances through transmission grids and lines.

Energy can undoubtedly be a driver of economic growth. India is seeking to expand their renewable energy capacity to be at the forefront of this growing sector and to achieve sustainability goals. India's energy-mix comprises both non-renewable (coal, lignite, petroleum and natural gas) and renewable energy sources (wind, solar, small hydro, biomass, cogeneration bagasse etc.). They facilitate in devising effective conservation and management strategies for optimal utilization of these resources.

Significance and need of Energy Conservation

Energy conservation not only reduce the energy consumed per unit of good/services produced but also improve energy security of the country to ensure the sustained availability of resources at affordable prices. India is facing a chronic fuel shortage. In such a scenario, imports hold the key. In the 12th plan India will need to import 185 million tonnes of coal in 2016-17.

The recent trends indicate that India's energy consumption has been increasing drastically in the world due to population growth and economic development. Hence, the challenge is to ensure the adequate supply of clean energy at the least possible or affordable cost.

Potential of Energy Conservation in various sectors of Indian Economy

There are six major sectors which have a fairly energy conservation potential in India, includes: Industry, Agriculture, Transportation, Commercial, Domestic and Others. The table given the potential share of energy conservation by each sector compiled from various sources as projected potential energy conservation in the coming years as follow:

Table 1. Energy conservation potential in various sectors of Indian Economy

Sr. No.	Sector	Consumption of Energy in %	Potential of energy conservation in %
1.	Industry	32	Up to 35
2.	Agriculture	19	Up to 30
3.	Transportation	12	Up to 25
4.	Commercial	05	Up to 25
5	Domestic	26	Up to 20
6.	Others	06	Up to 20
7.	Economy as a whole		Up to 25
Total		**100**	

Source: Ministries of Energy and Power.

Among them industry have large potential for energy conservation potential. The following table given the brief data of the government selected 9 industries targeted as huge energy conservation potential, energy savings and energy efficiency. The data is collected or compiled from different sources particularly from the Research Report on "India's Clean Revolution-March 2011", Economic Survey 2014-15 and internet.

Table 2. Energy Conservation Potential in the selected Industries

Industry	Conservation Potential in %	% Share in the industrial sector
Iron and Steel	08-10	24
Fertilizers and Pesticides	10-15	08
Textile	20-25	01
Cement	10-15	13
Pulp and Paper	20-25	02
Aluminium	08-10	03
Power	30-35	47
Sugar	25-30	02

Industry is the largest consumer of the energy as well it has the highest percentage share of energy along with the saving potential of around 35 percent

including the highest share of the power sector 47 percent followed by iron and steel at 24 percent. The World Bank's study of report of energy efficiency on 2003-04 shows that the energy efficiency in all sectors of the Indian economy could be as highest as 50 TWh (Terawatt hours) annually. While all sectors offer huge opportunities or potential for energy saving and conservation, industry alone accounts for around 35%.

Target and Projection of Energy saving and conservation in 12th Five Year Plan 2012-17

Projected electrical energy saving potential at the end of 12th Five Year Plan i.e. during the year 2016-17 is 44.85 BU and an additional energy saving equivalent of 21.3 mtoe (million tonnes of oil equivalent) in the industrial sector (including Thermal Power Stations (TPS) and Small and Medium Enterprises), Transport Sector and Energy Conservation award scheme. The share of target energy saving for various proposed schemes under 12th Plan is given below:

In addition to the electricity saving, total thermal energy saving equivalent to 21.30 mtoe in the Industries & SME, Transport sector and Energy Conservation (EC) award is also expected to be achieved in the terminal year of 12th Plan. The details of target of energy saving during 12th Plan as well as corresponding fund requirement for various programmes initiated by BEE are summarized in following table.

Table 3.Energy Saving Targets for 12th Five Year Plan

Sr. No.	Sectors	Targeted Saving Electricity BU	Targeted Saving Thermal MTOE	Total fund Requirements in Cr.
1.	Industry	13.79	13.00	4222
2.	Residential	04.40	-	6
3.	Equipment and	17.00	4.30	1653
4.	Agriculture	0.70	-	393
5.	Commercial	5.07	-	65
6.	Municipal Sector	0.47	-	45
7.	State Designed	-	-	210
8.	National Award	3.42	5.00	100
9.	Utility Based DSM	-	-	300
10.	Innovative Tech.	-	-	200
11.	HRD	-	-	288
Total		44.85	21.30	7482

Source: Working Group on Power for 12th Plan.

Energy Conservation Measures of India up to 11th Plan

The strategy developed to make power available to all by 2012 includes promotion of energy efficiency and its conservation in the country, which includes the following measures:

Energy Conservation Act, 2001

The Act provides for the legal framework, institutional arrangement and a regulatory mechanism at the Central and State level to embark upon energy efficiency drive in the country. Five major provisions of EC Act relate to Designated Consumers, Standard and Labeling of Appliances, Energy Conservation Building Codes, Creation of Institutional Set up (BEE) and Establishment of Energy Conservation Fund.

Energy Efficiency/Conservation Measures

- Standards and Labelling (S&L) Programme
- Energy Conservation Building Code (ECBC)
- Bachat Lamp Yojana (BLY)
- Strengthening Institutional Capacity of State Designated Agencies (SDAs)
- State Energy Conservation Fund (SECF)
- Energy Efficiency in Small and Medium Enterprises (SMEs) and Designated consumers
- Professional Certification and Accreditation
- School Education Programme
- Indo-German Energy Efficiency Project (Phase-II)
- Energy Conservation Awards
- Painting Competition on Energy Conservation, 2010
- National Mission for Enhanced Energy Efficiency (NMEEE)
- Partial Risk Guarantee Fund (PRGF)
- Venture Capital Fund for Energy Efficiency (VCFEE).

SUSTAINABLE DEVELOPMENT

Sustainable development has been defined in many ways, but the most frequently quoted definition is from **Our Common Future**, also known as the Brundtland Report:

"Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs". It contains within it two key concepts:

- The concept of **needs**, in particular the essential needs of the world's poor, to which overriding priority should be given; and

- The idea of **limitations** imposed by the state of technology and social organization on the environment's ability to meet present and future needs."

The issue of development versus environment has lead the concept of sustainable development which encourage the paradigm of shift in which exploitation of natural resources, the direction of investment, the orientation of technological development , and institutional change are all must be in harmony with environment protection, preservation and conservation. Hence, development should not endanger the natural system that supports life of biosphere on the planet.

Dimensions of Sustainable development

The concept of sustainable development has three principle dimensions given below:

(1) Social (2) Economic (3) Environmental

The social aspect refers to a socially sustainable system based on distributional equity, uplifting the welfare of the people, improving access to basic health and education services, gender equity, political accountability and participation. The economic dimension is the principle that society's well-being would have to be maximized and poverty eradicated through the optimal and efficient use of natural resources. Environmental dimension on the other hand, is concerned with the conservation and enhancement of the physical and biological resource base, avoiding over exploitation of renewable resources and depletion of non-renewable resources. Sustainability could only be achieved by creating the tradeoff among the three dimensions of the sustainable development. The guiding principles for sustainable development are equity and social justice, economic efficiency and ecological harmony.

Energy and Sustainable Economic Development

Energy is the prime mover of the economy. The energy industry significantly influences the vibrancy and sustainability of the entire economy from job creation to resource efficiency and environmental fragility at large. Energy has been universally recognized as one of the most important input for economic development. There is strong relationship between energy conservation and economic development. On one hand, growth of an economy, with its global competitiveness, hinges on the availability of sustainable energy to all at the affordable cost. On the other hand, the level of economic development has been observed to be reliant on the energy demand. Energy is one of the major drivers of a growing/developing economy like India and is an essential building block of economic development.

Growing energy imports like crude oil, coal, natural gas and nuclear energy and the cost of energy efficiency have an inflationary impact on the economic growth. Hence it is imperative for the government and the business leaders to seize the opportunity for green growth by conserving the energy.

The global community met at the UN Conference on Sustainable Development that took place in Rio in June 2012, also marking the 20th anniversary of the landmark first Earth Summit held in 1992. The Conference reviewed the progress made, identified implementation gaps, and assessed new and emerging challenges, which resulted in a political outcome called the 'The Future We Want'. In India, the Twelfth Five Year Plan was launched with a focus on sustainable growth.

FINDINGS

Modern society is greatly reliant on energy for commercial, industrial, and residential uses and for travel and transportation and every activity of the life. Vast majority of modern facilities and comforts are directly or indirectly related to the use of energy in various form and quantities.

Sources of energy used in modern commercial, industrial and residential uses include:

- Renewable sources, such as solar, geothermal, wind, and wood;

- Non-renewable sources such as coal, propane, and various petroleum products; and

- Hybrid fuels such as biodiesel and ethanol blends.

There is very a large gap in the production and consumption of energy. This is the imminent opportunity to the economy in the coming years.

Greater dependence on the imports of energy, particularly the oil and petroleum. The vibrations and the escalations of oil prices adversely impact the growth rate of the economy. There is huge potential for energy conservation and saving in the various sectors of the economy. Government of India has taken various initiatives to promote the energy efficiency and conservation policies and strategies to achieve the sustainable development.

CONCLUSION

The energy sector constitutes a relatively modest share of GDP in most countries. For this reason, stable and reasonable energy policy is imperative to reigniting, sustaining and expanding economic growth. Promoting sustainable energy may also provide a

foundation for future growth and job creation. Saving energy and growing the economy are equally important, and we must do both. The production and consumption of energy requires the various natural resources which consequently contaminate or harm the ecology. Hence, to live a decent and prosperous life on the earth it is imperative to conserve, preserve and protect the environment and to achieve the sustainable development of the economy by creating a tradeoff between the consumption and conservation of the energy, and which can only be achieved through the savings and conservation of the energy. It is not only government's duty but it is a social responsibility, moreover the ethical duty of individual. Conserving energy will provide a sustainable basis for long-term, resource-efficient growth.

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