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ENERGY CONSUMPTION AND ENVIRONMENT QUALITY IN INDIA: TRENDS AND PORTENTS

R Bharathi

Ph D Research Scholar Department of Economics PSG College of Arts and Science Coimbatore

ABSTRACT

Energy consumption pattern of each country depends on its economic activity, whether it is based on industry or agriculture. Another major factor that determines the level of energy consumption is population. India is a populous country accounting nearly one-sixth of the world's population. Due to this the country became the fourth largest consumer of primary energy. The major sectors like agriculture, industry, and transport and house hold sector drive the country to a higher economic position with massive energy at consumption. At the sametime it has been an established fact that pollution emitted by the use of energy has degraded the quality of natural resources like water, air and forest and also gave rise to energy related environment concerns such as climate change and global warming which leads to health conflicts. Hence, the nations should have a great concern on environment, which is the only asset that we leave for our future generation. An analysis on the energy consumption and environment quality in India reveals that the nation's thirst for development demands more energy and in future the energy demand will increase many fold. Though development of nation is the positive trend but this may lead to heavy pollution emission, resource degradation and decrease in quality of air and water. Not only India, all the nations of the world are witnessing the same trend for energy demand which points out the potential danger that we place on environment and its sustainability.

KEYWORDS : Community Medicine, Career profile

Introduction

Energy has been considered as the basic building block of economic development. Among the various sources of energy electricity is the most flexible form of energy that constitutes one of the vital infra-structural inputs in economic growth. Energy consumption pattern of each country depends on its economic activity, whether it is based on industry or agriculture apart from the size and composition of its population. India is a populous country accounting nearly one-sixth of the world's population and quite naturally the demand for electricity has been growing at a compound annual rate of growth (CARG) of nearly 8 per cent. Due to this the country became the fourth largest consumer of primary energy. The major sectors like agriculture, industry, transport and house hold sector drive the country to a higher economic position in high speed with massive energy consumption. As a corollary to this trend the issue of environmental quality crepts in.

Energy and Environment

As per an estimate by Maria Figueroa et.al.,(2014) the energy demand will continue to grow with the steady high per capita level in developed countries and the impulse fostered by economic and population growth in developing and emerging countries. This requires interventions that integrate effects from activity, structure, intensity, and fuels towards achieving increased sustainability and the trends are highly challenging. Increasing income and population have major influence on three faster and high energy intensity modes of transport – passenger cars, freight trucks and planes. So there should be advancement in managing the transport energy demand growth towards reducing the deep inequalities in access to transport services that currently affect the poor worldwide. The current and projected energy scene of five countries namely China, India, Russia, UK and USA by Asif and Muneer (2007) revealed that these countries depend heavily on import of fossil fuels to meet their energy demand. All their local fossil fuel reserves are close to exhaustion that will last to 9, 6, 7 and 4 years respectively. In this situation all the nations have increased their capacity of renewable energy production to bring down negative environmental impacts. Switch over to renewable energy source is not only the need of the hour but it is also quite achievable.

Even at the household level an econometric estimation by Pachauri (2004) shows that total household expenditure or income level is the most important explanatory variable causing variation in energy requirements across households.

Researchable Issue

High levels of economic development with increasing energy consumption have given rise to many security issues on whole environment. This turned the world's attention towards managing environment quality. The exhaustibleness of available resources and pollution emitted by the usage of resources are the problems which have to be concentrated on to find out the solution. As the situation is alarming there is an urge to study the current energy consumption trends and their environmental impacts.

Objectives

1. To study the sector wise energy consumption trends (industry, agriculture, transport and household) in India.
2. To examine the environmental impacts of energy consumption at the macro level.

Sources of Data

Data were collected from the published sources like The Energy and Resource Institute (TERI) Energy and Environment Data Diary and Yearbook, Central Electricity Authority (CEA), Ministry of Petroleum and Natural Gas (MoPNG), Ministry of Coal (MoC) and Central Pollution Control Board (CPCB).

Sector-wise Energy Consumption

The increase in final energy consumption over the last three decades as given in table 1 reveals that the transport and industrial sectors consumed more energy when compared to other sectors. The total energy consumption in 2010-11 is 314.4(in Mtoe- million tonnes of oil equivalent) and it has increased to 353.01 Mtoe in the year 2011-12. The total final energy consumption has increased to 38.61 Mtoe in one year. Among the sectors agricultural sector steadily consumed more energy over the 31 year period due to the fact that food grain production increased from 51 million tonnes in early 1950's to 259.29 million tonnes in 2011-12. That is, massive increase in food grain production in India clearly shows the greater usage of energy both in direct and indirect ways.

Table1: Final Commercial Energy Consumption (in Mtoe) in India by sector

Sector	1980/81	1990/91	2000/01	2010/11	2011/12
Agriculture	1.6 (20.3%)	4.9 (3.9%)	15.2 (7.9%)	18.70 (5.9%)	21.79 (6.17)
Industry	36.9 (53.7%)	62.9 (50.4%)	77.4 (40.4%)	146.72 (46.7%)	160.09 (45.35%)
Transport	17.4 (25.3%)	28 (22.4%)	33.5 (17.5%)	63.39 (20.2%)	76.46 (21.66%)

Residential and commercial	5.6 (8.1%)	12.6 (10.1%)	24.1 (12.6%)	44.09 (14%)	48.7 (13.79)
Other energy uses*	1.9 (2.8%)	3.9 (3.1%)	13.4 (7.0%)	14.33 (4.6%)	15.07 (4.27%)
Non – energy uses**	5.3 (7.7%)	12.6 (10.9%)	28 (14.6%)	27.17 (8.6%)	30.9 (8.75%)
Total	68.7 (100%)	124.9 (100%)	191.6 (100%)	314.4 (100%)	353.01 (100%)

*This comprise energy spent in miscellaneous uses and mining.
**Non- energy uses exist only for naphtha and natural gas sectors, since both these fuels are consumed as feed stock in fertilizers and petrochemicals

Mtoe-million tonnes of oil equivalent.
Note: Figures in parentheses indicate the percentage share of each sector.

Source: TERI (various years); CEA(2012); MoPNG (2012a); MoC (2014)

In 2000-01, the total electricity consumption was 316 600 GWh and electricity consumption for agricultural purpose was 84729 GWh and it has increased to 153116 GWh in the year 2012-13 as given in table 2. This shows the increase in electricity consumption in Indian agricultural sector due to high subsidies provided by government, the usage of power tillers, irrigation pumps and tractors have also increased which results in high consumption of energy. At the same time the share of agricultural sector in the energy consumption has declined from 26.76% in 2000-01 to 17.95% in 2012-13.

Table 2: Electricity Consumption in the Agricultural Sector

Year	Consumption for agricultural purposes(Gwh)	Total consumption (Gwh)	Share of agricultural consumption(%) of total consumption
2000/01	84729	316600	26.76
2001/02	81673	322459	25.33
2002/03	84486	339598	24.88
2003/04	87089	360937	24.13
2004/05	88555	386134	22.93
2005/06	90292	411887	21.92
2006/07	99023	455748	21.73
2007/08	104182	501977	20.75
2008/09	109209	553995	19.79
2009/10	119492	658031	18.16
2010/11	129051	710673	18.16
2011/12	140960	785193	17.30
2012/13	153116	852900	17.95

Source: CEA (2014)

Industrial sector consumes energy sourced through coal and lignite, petroleum and natural gas, power and renewable energy sources. The disturbing point, however, is among these coal is a predominant source of energy which is a massive polluter of environment.

A slow but steady increase in coal consumption by the electricity sector, growth of the total number of registered vehicles in India (from 81.5 million in 2005 to 159.5 million in 2012)which mainly use high- speed diesel oil, light diesel oil and furnace oil for their activities are also have portents of air pollution. The consumption of high- speed diesel oil have declined from 2011-12 to 2012-13 in road transport , aviation and in shipping but railways show an increased usage from 2429.26('000 tonnes) to 2538.31('000 tonnes) in the year 2012-13 and the furnace oil consumption also shown increasing trend.

Electricity for lighting and the percentage of dependency on both the rural and urban households have increased from 43.6% in 2001 to 55.3% and from 87.6% in 2001 to 92.7% in 2011 respectively leading to a decline in the consumption of kerosene. A positive note is that the rural household's dependencies on solar energy source have increased while the percentage of increase in urban households on solar energy source remains same which calls for a strategic support on a massive scale.

The trends in the energy use pattern of all the sectors clearly portents the future energy demands in India. Not only India, all other nations in the world is witnessing the same trend and promotes higher energy demand because of their thirst for development. All these imply one thing: heavy burden on environment quality and its sustainability.

Energy use and Environmental Impact

It has been an established fact that pollution emitted by the use of energy has degraded the quality of natural resources like water, air and forests and also give rise to energy related environment concerns such as climate change and global warming. The health conflicts due to such pollution have put forth a few significant energy challenges before the human community. To come out of this alarming situation all the nations target towards the usage of renewable energy source to control co2 emissions, to find the characteristics of pollutants and also to have joint management systems with public in order to have control over these environmental security issues. Renewable energy resource usage is gaining more importance across all the nations because it is abundant and inexhaustible in nature. A greater quest for cleaner production alone will solve the problem, at least in the long-run.

Use of fossil fuels as an important source of energy (in the form of coal, fuel oils and natural gas) leads to large scale industrial development. The Energy Information Administration estimated in 2007 itself that the primary sources of energy consisted of petroleum 36.0%, coal 27.4%, and natural gas 23.0% amounting to an 86.4% share for fossil fuel in primary energy consumption in the world. It is a common knowledge that fossil fuels when burnt emit higher level of carbon dioxide, which is a major green house gas that affects the atmospheric temperature that leads to global warming, climatic change and health conflicts. In this juncture it can be noted that India, China and US are considered as major emitters as per their level of Co2 emission. (Table 3)

Table 3: Carbon dioxide emission in India, China and US (in Million Tonnes)

Sl.No	Year	India	China	US
1	2000	952.8	3429.9	6377.0
2	2001	959.2	3502.8	6248.4
3	2002	1007.2	3706.1	6293.4
4	2003	1040.9	4344.2	6343.5
5	2004	1116.3	5102.0	6473.3
6	2005	1180.0	5573.9	6494.0
7	2006	1246.5	6159.1	6412.8
8	2007	1341.2	6515.6	6521.5
9	2008	1443.9	6753.5	6332.1
10	2009	1569.4	7214.0	5908.2
11	2010	1640.7	7953.5	6142.7
12	2011	1699.8	8674.1	6001.3
13	2012	1854.2	9166.0	5780.8
14	2013	1931.1	9524.3	5931.4

Source: TERI Energy and Environmental Data Diary and Yearbook 2014-15

A steep increase in Carbon-dioxide emission level in India has been observed: from 952.8 (MT) in 2000 to 1931.1 (MT) in the year 2013. Likewise China also showed an increasing trend from 2000 to 2013 i.e. from 3429.9 (MT) to 9524.3 respectively. In US the Carbon-dioxide emission was 6377 (MT) in the year 2000 and it gradually

increased to 6521.5 in the year 2007. From 2009 to 2011 it showed a fluctuating trend and in 2013 it decreased to 5931.4.Overall India and China showed a steady increase in Co2 emission and US showed a relatively decreasing trend on this count.

World carbon dioxide emissions are expected to increase by 1.9% annually between 2001 and 2025 due to the development of modern sectors. Further increases in these emissions are expected to occur in the developing world including emerging economies such as China and India.

Emission of Co_2, So_2, Nox (oxides of Nitrogen) and also dust particles which are called as particulate matter led to decline in air quality. Vehicles have dramatic increase in number because of industrial development and growing population and hence is the result. There is also increased volume of industries which result in increase in employment and living condition of poor. This ultimately leads to higher energy use and leading to lowering of air quality.

Urban growth and air quality in India

Major cities in India mainly face poor air quality because of over crowd as the rural population move towards cities seeking employment and higher standard of living and industrial development. The data on the ambient air quality in major cities of India in the year 2012 reflects this trend. (Table 4).

Table 4: Ambient air quality in selected cities (2012) of India

(µg/m3)			
City	**So_2Sulphur dioxide**	**No_x– Oxides of nitrogen**	**RSPM Respirable Suspended Particulate Matter**
Ahmedabad	12	24	82.7
Bengaluru	14.4	29	121
Chennai	13	26	57.3
Delhi	6	57	237
Hyderabad	5	28	79.3
Kolkata	12	69	135
Mumbai	5	20	117

Source: Central Pollution Control Board

Technological innovations in all fields and high investments on energy conservation alone would help to reduceCO_2emission. As firms with financial strength are moving towards cleaner production, the support and guidance from governments and other nations may lower the CO_2 emissions. These efforts can only promote a protected environment with sustainable development.

Sustainability: Need for collective action

The developmental experience shows that sustainability cannot be achieved individually by a district or by a state but it is a universal concern because sustainability is a huge step taken towards safe guarding the nature.

By realising this 2015 U.N Climate Change Conference also known as COP_{21} held in Le Bourget, Paris from November 30 to December 11, 2015 aimed to achieve a binding and universal agreement on climate from all the nations of the world. The International Trade Union Confederation has called for the goal to be "Zero Carbon, Zero Poverty". France serves as a model country for the delegates attending COP_{21} because it is one of the only developed countries in the world to decarbonize electricity production and fossil fuel energy while still providing a high standard of living. As of 2012, France generated over 90% of its electricity from Zero carbon source including nuclear, hydro electricity and wind by producing fewer green house gases. France's advanced technology, mostly powered by nuclear power systems have demonstrated one of the safest and cleanest energy system in the world. This is an example that use of energy in the cleanest way may be possible to all nations. For this nations should set Sustainable Development Goals to balance man's need with the environment. Indian government, in this direction, have introduced many goals focussing on environment broadly on all major sectors.

The major problem towards environment is generation of large scale hazardous wastes by the industrial sector. Proper waste management practices are to be adopted to save environment. For example, some combustible wastes like scrapped tyres, municipal solid wastes, plastic wastes, paint sludge and bio fuels are used as alternative fuels in Indian cement industries. There are some green initiatives taken in transport sector also. Indian railways is working with the Ministry of New and Renewable Energy (MNRE) to evaluate the potential of renewable, which will save on power consumption and obtain electricity at stable rate over next twenty five years. Apart from this, the railways have also replaced wooden sleepers on main lines with reinforced composite sleepers made of a polymer matrix, typically polyethylene to save trees. Also during 2011-12 around 0.48 lakh hectares of vacant railway lands were brought under green cover and about 75.96 lakh saplings were planted.

Likewise for household sector also government of India have launched the "Unnat Chulha Abhiya (UCA) and Deen Dayal Upadhyaya Gram Jyoti Yojana(DDUGJY) to have a green focus. A shift from electric energy to solar energy can reduce the electricity consumption. Government provides subsidy to solar heaters and generators in order to encourage public to have a shift from electricity usage to solar energy usage. These are all some major green initiatives taken by Indian government towards sustainability. Individuals can voluntarily take initiatives like avoiding plastic bags, purchasing in bulk quantities, rational use of electricity, and planting trees around their own places to save environment. The latest missions like "Swachh Bharat Abhiyan" or the " Clean India Campaign" and Smart Cities would lead the development of cities with low carbon footprint.

Conclusion

Like India many nations have already set their goals to save environment and to attain sustainable development. International cooperation with perfectly designed sustainable goals will surely lead the world in a sustainable path. In broader sense,today' sconsumption should not affect tomorrow's basic necessities. Along with development goals, every country should have a concern about the environment which is the only asset that we leave for our future generation.

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