UNFURLING THE INTRICACIES OF THE OPTIMUM USE OF RENEWABLE ENERGY SOURCES: AN INSIGHT TO CONSERVING ENERGY BY DIVIDING INDIA INTO RELEVANT TIME ZONES

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NTRODUCTION

Energy conservation is the reduction in the quantity of energy that is used for different purposes through elimination of waste and rational use. It is essential to conserve energy in order to reduce costs and promote economic, political and environmental sustainability. The day to day rise in demand for power has led to considerable depletion of these resources which also has an adverse effect on environment. India can save a total of 25,000 MW by implementing end-use energy efficiency measures. India's coal reserves are said to last for more than 200 years but the oil and natural gas reserves may last only for 18-26 years. The increasing use of petroleum fuels will lead to an increased dependency on imports. Therefore, there is a need for a change in our approach to the prevailing energy policies.

A lot number of people have started understanding that the real energy problem lies in the fact that the governments and energy suppliers are expanding non-renewable energy resource consumption which is unable to solve the problem of depletion of energy resources. In order to get out of the problem of dependency on these non-renewable resources, many countries have started developing programs to get out of their own energy problems.

One such example is ENERGY STAR which is a national program of the U.S Environmental Protection Agency and the U.S Department of Energy. This program rates major electronic appliances based on energy savings and carbon emissions. In many other countries, there are energy or carbon taxes to reduce energy consumption. The state of California has an energy tax which gives every consumer a baseline of energy usage that carries a low tax. As the usage increases above the recommended baseline, the tax increases. This is meant to protect poorer households and at the same time creating a larger tax burden on high energy consumers.[57]

In India, the Government of India enacted the Energy Conservation Act, 2001 which provides for the legal framework, institutional arrangement and a regulatory mechanism at both the Central and State level considering the benefits of energy efficiency. Also, the Petroleum Conservation Research Association (PCRA) created in 1977 is engaged in promoting energy efficiency and conservation. An alumni of IIT Bombay, Global Alumni Business Forum 2014 (GABF) shared some of the energy conservation ideas with Goa Chief Minister, Mr. Manohar Parrikar about sensors that can automatically switch off lights in offices when there in no one in

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[57] ZEHNER, OZZIE, GREEN ILLUSIONS, Lincoln And London: University Of Nebraska Press. Pp. 179–182; (2012)

the room, and roads that will make travel economical by planning shorter routes. Tata Power's nationwide energy and resource conservation movement, Club Enerji, has been persistently working towards spreading awareness on energy conservation across the country for many years.

It is often seen that the consumers are poorly informed about the energy efficient products. For example, retailers believe that bright lighting encourages the consumers to purchase. Whereas, the studies show that over- lighting is the cause of headache, stress, blood pressure and fatigue in many workplace.[58] It has also been proved that natural daylight increases productivity in workers.[59] Energy conservation can also be done by 'energy audit' which inspects and analyses energy use and flow in a building. In passive solar building design, the windows, walls and floors are made to collect, stock and distribute solar energy in the form of heat in winters and eliminate solar heat in summers.

In this research paper, the authors would discuss about energy conservation by dividing India into two time zones. Till now, we have a standard time for the whole of India. Dividing India into two time zones will result in a difference of two hours between the Eastern India and the Western India. The main aim should be to utilize maximum amount of Sunlight and consequently reduce the use of Artificial Lights.

ENERGY CONSERVATION: WHY IS IT IMPORTANT?

Energy has an important role in our lives. It is the basis of all activities going on in our day to day life, be it productivity or be it leisure. Each one of us uses energy in some form or the other. Energy is needed in every small thing we do, from cooking to transportation to lighting, cooling and even entertainment. Energy resources are limited. We use energy faster than it can be produced. The most utilized sources which include coal, oil and natural gas take thousands of years to form.

Energy use per person is strongly co-related to standard of living in each economy. Higher per capita energy consumption means a higher per capita gross national product. Energy is a crucial part of industrial growth, economic growth, environment and comfort. The gap between demand and supply is increasing day by day despite making huge expenditure in energy sector. This gap can be bridged with the help of energy conservation. Energy conservation is cost effective and can be considered as a new source of energy which is environment friendly. There is a good scope of energy conservation in various sectors such as industry, agriculture, transport and domestic.[60]

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58 Scott Davis, Dana K. Mirick, Richard G. Stevens *"Night Shift Work, Light At Night, And Risk Of Breast Cancer"* JOURNAL OF THE NATIONAL CANCER INSTITUTE 2001 At 93

59 Lumina Technologies Inc., Santa Rosa, CA., Survey Of 156 California Commercial Buildings Energy Use, August, 1996

60 *"Energy Conservation : An Effective Way Of Energy Utilization" Available At* Http://Www.Ijmra.Us/Project%20doc/IJMIE_MAY2012/IJMRA-MIE1184.Pdf (Last Visited On October 22, 2014)

To understand why energy conservation is crucial we need to first understand the kinds of energy resources we depend upon. There are two such kinds- renewable energy resources and non- renewable energy resources. Renewable energy resources are those resources which are non- exhaustible and can be replenished such as wind, water, solar etc. non- renewable energy resources are exhaustible and cannot be replenished such as gas, coal, oil etc. Non renewable energy sources constitute 80% of the fuel use. It is said that our energy resources may last only for another 40 years or so. Therefore the consumption of the latter needs to be controlled because the supply of such resources of energy is limited. Fossil fuels are a non-renewable resource which means that one day last chunk of oil will be mined from earth and last drop of oil will be drained from earth.

Almost all the vehicles run on gasoline which is a fossil fuel. Once the reserves of fossil fuels are exhausted, these vehicles will stop working. Trade and commerce would come to a standstill because it will almost become impossible to deliver the manufactured goods. Houses will not be heated or cooled without electricity. Also, the businesses will suffer because of these factors.

There is a huge amount of expenditure involved in extraction of fossil fuels. These expenses not only affect the manufacturer but also affect the consumers who pay higher prices for goods and services. By saving this money of consumers, the economy can be strengthened because people will have more money in pockets rather than to spend on energy needs. Also, researchers will get more time to come up with solutions and alternatives of energy when we conserve energy.

Energy conservation is vital from different perspectives and not just because saving energy means saving our money by lowering our monthly energy bills which can be considered as the economic importance of energy conservation. Energy conservation methods are also very significant from the environmental viewpoint because we are still greatly dependent on fossil fuels, and by making a small reduction in our energy needs we are also reduce a great deal of greenhouse gas emissions that add to climate change and global warming.

PREVALENT METHODS FOR ENERGY CONSERVATION

Indian Government is giving top priority to reach the goal of nation's long term energy security. India currently ranks 6th in the world in terms of energy demand. As per the Planning Commission's Integrated Energy Policy Report (Planning Commission 2006), if India perseveres with sustained economic growth rate of 8% of GDP per annum through 2031-32, its primary energy supply will need to grow by 3 to 4 times, and electricity generation capacity by 5 to 6 times compared to 2003-04 .

Energy survey conducted by Ministry of Power in 1992 revealed that there is requirement of improvement in energy generation efficiency, improvement in energy transportation (transmission & distribution systems) and enhancing the performance efficiency of use end apparatus . Study of 'Energy strategies for Future' evolved

two things - efficient use of energy, energy conservation and use of Renewable Energy. Energy conservation emerges out to be the first and least cost option.

To achieve results in the field of energy conservation in the country, the Indian Government enacted the Energy Conservation Act (EC Act) in the year 2002. Under this act, the government established a statutory body under the Ministry of Power named as the Bureau of Energy Efficiency (BEE). The EC Act has empowered both the Central and the State Governments to establish a legal framework to promote energy conservation in the country. This act also helps in monitoring the efforts of energy conservation techniques.

One step taken by the Government under the EC Act is by launching Energy Conservation Building Code (ECBC). ECBC sets the minimum energy performance standards for "large commercial buildings" after taking into account the five major climatic regions of India. The Bureau of Energy Efficiency has taken steps to put into operation capacity building programs and in developing several technical documents and training material to create awareness about ECBC and to boost the professional skills of building design professionals.

The cost of generating 1MW power generation is Rs 4.5 to 5.25 crores and the cost of Transmission & Distribution is Rs.2 crores. But the cost of saved power is Rs.1 Crore/Mw. The important thing to be noted here is that the time period to set a power plant is 5 years; to set up transmission line 1 year and to plan energy conservation is only 1 month. It is of prime importance to save electrical energy because it is proved to be an ideal energy in all sorts of energy available in nature. Some of the methods used to save electrical energy include:

- Locating transformers at proper place, especially close to the load center. This helps to reduce distribution loss in cables.
- Using thick conductors in transformers to reduce load losses.
- Using energy efficient transformers.
- Conventional fluorescent lamps are being replaced by energy efficient fluorescent lamps.
- Mercury/sodium vapor lamps are being replaced by halides lamp.

The project of Energy Conservation has been successfully implemented by the Thane municipal Corporation (TMC) in the year 2001. TMC identified a few basic areas for this purpose- municipal building and hospital, street lights, pumping station sewage pumping station. Through energy conservation cell awareness program, periodical maintenance program, utilization of alternative energy sources, energy generation (methane gas), quality control & use of in-house man power, TMC obtained the success in all its energy conservation programs. TMC received first prize in "State Level Award for Excellence in Energy Conservation &

Management" for the year 2004 & 2006 and first prize in "National Energy Conservation Award" for the year 2005.

Another such example of adoption of energy conservation measures include the Tata Power Company which has achieved the goal of energy conservation in power utility by operating the equipment at maximum efficiency and reducing the auxiliary power consumption.

OUR PROPOSAL FOR ENERGY CONSERVATION

DIVIDE INDIA IN TWO TIME ZONES

One of the ways to conserve energy is by dividing the country on the basis of time zones. The main aim should be to utilize maximum amount of Sunlight and consequently reduce the use of Artificial Lights.

Since the early 1980s studies have been undertaken to evaluate various time-based measures for energy conservation[61]. These included adoption of DST for six months (April-September), advancing IST by 30 minutes (i.e. GMT+6 hours) during the summer.[62] The possibility of demarcating the country into two time zones was also studied.[63]

As a matter of fact, Earth is divided into two parts on the basis of latitudes i.e. the Northern Hemisphere and the Southern Hemisphere. In the same way there is a division of Earth on the basis of longitude i.e. Eastern Hemisphere and the Western Hemisphere. Now, each Time Zone is theoretically 15 degrees wide, corresponding to a 1 hour difference in mean solar time. Geographically, India extends from 68°7' West to 97°25' East which means that there is difference of approximately 29° resulting in a 2-hours difference in Sunrise compared with the Far East and the Far West of Indian Subcontinent. Thus, when the sun sets at 4 p.m. in Kohima, it sets at 6 p.m. in Porbundar.

This difference of two hours results in postponing working and sleeping hours in the north-eastern states. Office begins in the northeastern states six hours after sunrise whereas it begins four hours after daybreak in the rest of India. As a result of which daylight hours are wasted leading to higher power consumption. If we have two time zones in our country, office will start two hours earlier in, let's say, Kolkata than any city in Gujarat and subsequently there will be proper use of daylight in eastern parts of the country.

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61 Taken From "*Can Shifting India's Clocks Save Energy?*" TERI *Available At* Http://Www.Teriin.Org/Index.Php?Option=Com_Ongoing&Task=About_Project&Pcode=2010CP01 (Last Visited On October 26, 2014)

62 *Ibid*

63 *Supra* Note 8

The researchers found out that during the year of 2011-12, the net per capita electricity consumption for the eastern and north-eastern states was 779.1 kWh.[64] Also, as per the report of Central Electricity Regulatory Commission, New Delhi, the cost of generating 1 MW of electricity comes to approximately 5.08 Crores.[65] Calculating further, it can be derived that the cost of electricity generation in the eastern and north-eastern states for 2 hours comes to approximately Rs.2,80,992.10 Crores. This means that if we can save electricity for 2 hours we would save approximately Rs. 2,80,992.10 Crore for 2 hours per day and around Rs.84,29,763 crores could be saved in a month. This money can be utilized by the government to promote public welfare.

People from the northeastern states have been demanding creation of a separate time zone for the seven states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura so that they can utilize daylight to the maximum.[66] This demand got momentum when Bangladesh advanced its time one and half hours ahead of IST.[67] In India, the British colonial rulers had set local time one hour ahead of IST for tea gardens, coal mines and the oil industry of Assam[68]. Some of the tea gardens still follow that time which is also known as "Bagaan Time". This system is also used by the United States of America which is known as Daylight Saving Time (DST). Other countries like Russia and Canada also have multiple time zones. Russia has the most time zones (11), followed by the U.S. with nine (six for states and three for territories), and Canada with six.[69]

In this regard, the Indian Government has set up a committee which is chaired by Ajay Mathur who is the director general of the Bureau of Energy Efficiency (BEE). The committee has been formed to examine the proposition of another time zone in the country. The panel will primarily report on energy savings for which various options are being considered.[70] Eminent filmmaker Jahnu Barua has worked out a model to calculate the monetary loss incurred in the Northeast because of following the IST.[71] According to his calculations, every year, there is a loss of at least Rs. 94,900 crore in the region because of redundant power consumption.[72]

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64 Rajya Sabha – Starred Question No. 241, Ministry Of Power, Govt. Of India, August 29, 2013 *Available At* Http://Powermin.Gov.In/Loksabhatable/Pdf/Raj_27082013_Eng.Pdf (Retrieved On October 26, 2014)

65 Annexure II Of Report No. L-1/103/CERC/2012 Dated 4.6.2012 Published By Central Electricity Regulatory Commission.

66 Baruah Sanghamitra, "*Seven Sister's Demand For Separate Time Zone Gains Momentum*" Available At Http://Timesofindia.Indiatimes.Com/India/Seven-Sisters-Demand-For-Separate-Time-Zone-Gains-Momentum/Articleshow/5879491.Cms (Last Visited On October 26, 2014)

67 *Ibid*

68 *Ibid*

69 Taken From "*Time Zones Origins*" Available At Http://Www.Infoplease.Com/Spot/Timezones.Html (Last Visited On October 26, 2014)

70 *Supra* Note 11

71 Taken From "*North-East Mps Bridge Political Divide For Separate Time Zones*" Available At Http://Www.Hindustantimes.Com/India-News/North-East-Mps-Bridge-Political-Divide-For-Separate-Time-Zone/Article1-1173112.Aspx (Last Visited On October 26, 2014)

72 *Ibid*

USE OF SOLAR BOTTLE BULB

When it comes to utilizing the Daylight effectively, the major issue arises with congested localities where sunlight is either negligible or not available. Many residential and commercial buildings are not designed to optimally utilize the available sunlight.[73]

The solar bottle bulb is an innovative instrument developed by the student of MIT, USA that is helping poor people in developing countries.[74] It is a simple 1 liter soda bottle that is filled with a solution of purified water and bleach.[75] The bottle is then inserted halfway through a hole drilled in the metal roof and its sides are sealed.[76] The bottle then looks as a bulb through the sunroof and it provides very good amount of light by deflecting sunlight into gloomy interiors.[77]

In this setup what actually happens is that, the chlorine and the bleach poisons the pure water in order to keep molds from developing so that the solution can last up to five years. The purified and clear water helps to disperse the light through refraction technique, so the light is not concentrated. It hardly cost Rs.60 to develop this solar bulb.[78]

Furthermore, focusing on the limitations, we found out that the water in this bottle needs to be replaced every five year and also that this bulb is only useful during the day time.[79] Nevertheless, the advantages are overwhelming for the localities that are deprived of sunlight.[80] This solar bulb does not produce any harmful pollutants and also reduces the dangers from electrical connections that might cause fire.[81] Lastly, the best part is that the bulb produces energy equivalent to 40-60 watts.[82]

USE OF GLAZING GLASSES FOR EFFECTIVE USE OF SUNLIGHT

One another way to conserve electricity is by the use of Glazing Glasses instead of normal glasses in Universities and Corporates. We can see the implementation of Glazing Glass in CEPT University who has won several awards for this new infrastructure. The Green features of the implementation are:-

1. Huge Overhangs on the glazing side to reduce the direct heat gain of the glazing.[83]

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73 *Supra* Note 5

74 *An Innovative And Cheap 'Solar Bottle Bulb' Solution Lights Homes In Manila* Available At Http://Ecopreneurist.Com/2011/09/14/An-Innovative-And-Cheap-Solar-Light-Bulb-Lights-Homes-In-Manila/ (Last Visited On October 30, 2014)

75 *Ibid*

76 *Ibid*

77 *Ibid*

78 *Infra* Note 26

79 *Supra* Note 18

80 *Supra* Note 18

81 *Infra* Note 26

82 Gibby Zobel, *Alfredo Moser: Bottle Light Inventor Proud To Be Poor*; Taken From BBC World Services *Available At* Http://Www.Bbc.Com/News/Magazine-23536914 (Last Accessed On October 30, 2014)

83 Taken From "*CEPT University Projects Wins Award*" *Available At* Http://Cept.Ac.In/72/Cept-Research-Development-Foundation-Crdf-/News/141/Cept-University-Project-Wins-Award (Last Accessed On October 30, 2014)

2. Helps in reducing the direct heat gain on the glazing surface.[84]
3. Orientation based on solar analysis.[85]
4. Minimizing the use of glass in the buildings and also orienting through Visual Deo helps in reducing the direct heat gain on the glazing surface.[86]
5. High insulation on roof and wall materials to reduce heat gain inside the building.[87]
6. Natural Lightning & Courtyard to reduce lightning energy demand & for natural ventilation.[88]
7. Landscaping the water body used to reduce heat gain on the façade.[89]

These glasses helps in spreading sunlight inside the building without allowing heat to pass through. This results in lower energy demand and higher energy conservation.

ISSUES RELATED WITH IMPLEMENTATION OF THE PROPOSAL

TIME STANDARDRIZATION OF INDIAN RAILWAYS

Our proposal of dividing India into two time zones has one big issue regarding what time will be followed by the Indian Railways. Two time zones for the railways of one country can result in confusion and chaos.

Today Indian Railways follow Indian Standard Time (IST) which is 5 hours and 30 minutes ahead of UTC (formerly known as GMT). There is only one time zone for India. It does not observe DST or any other adjustments to the time.

Many countries like USA, Russia and Canada have multiple time zones. In the early days, India also observed local time at each large cities as was prevalent in many other big countries. Originally there were two Time Zones, the Bombay Time and Calcutta Time.[90] Bombay continued to have a different time (39 minutes behind IST) until 1955.[91] Bombay time and Calcutta time assumed special importance because of their importance as commercial and economic centers, and were followed for many official purposes in the late 19th century forming two time zones for British India. Calcutta time was 5 hours, 30 minutes, and 21 seconds in advance of GMT, while Bombay Time was 4 hours and 51 minutes ahead of GMT.[92]

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84 *Ibid*
85 *Ibid*
86 *Ibid*
87 *Ibid*
88 *Ibid*
89 *Ibid*
90 Taken From "*Indian Time Zones*" Available At Http://Wwp.Greenwichmeantime.Com/Time-Zone/Asia/India/Time/Indian-Time-Zones.Htm (Last Visited On October 30, 2014)
91 *Ibid*
92 *Ibid*

In India, if we have two different time zones, the first thing we need to do is to fully automate Indian Railways which at present is semi-automatic. Secondly we need a single standard time for railways to avoid confusion and any accidents resulting from the same. Thus two different time zones will not affect Indian Railways timing.

TIME SYNCRONIZATION WITH BANKING & FINANCIAL SERVICES

Financial transaction is again one of the issues resulting from the division of time zones. As a matter of fact, Banks in India operate from 10 AM till 5 PM, however, for citizen the timing is till 3 PM. The remaining two hour from 3 PM till 5 PM, bank does its back end work. Now, if the country is divided in two time zones obviously there will be some issue with time synchronization between banks in East India and banks in West India. Keeping his thing in mind, the author would like to propose few suggestions to avoid this:-

1. Banks can give some leverage to the Managers and Senior Officials. They can be allowed to come two hours late and then finish off the work that is left out for the last 2 hours of the operations.
2. Cash transfers from Money transfer services like Money Gram & Western Unions can be asked to issue directions and awareness to its consumers regarding the withdrawal timings in the destination cities.

CONCLUSION

Hence, the researchers would like to propose that India should be divided into two time zones as this will help us in conserving energy and help us to utilize daylight optimally. This would also prove to be a boon to India's finance as it would help save a lot of money which was otherwise wasted due to not utilizing daylight.

The issues which can arise due to this proposal have also been discussed. The main issue is of managing time of Indian Railways. As it is known, many big countries follow multiple time zones and maintain large network of railways without any confusion or accidents resulting from the same. India also have followed different time zones in the earlier days without any problems arising out of such time zones.

We have further proposed that Indian Railways can follow one standard time as is followed in many other countries having multiple time zones. Also, there is the problem of automation of Indian Railways Time which in many parts of the country is still manual. We need to fully automate our railways before implementing the division of India in to two time zones. Furthermore, we can use the glazing glasses and solar bottle bulbs to reduce the consumption of electricity.