Innovations in Effective Management of Energy using Green Technology

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Abstract— **We know from the universal law that the energy can neither be created nor be destroyed. It can be changed from one form to another form. The world is enriched with energy in many forms which are known to us or not. In most of the cases the energy like sun light, heat, wind blow etc. are in the form which are not getting used for the productive purposes. The form of energy is used by the human being is insufficient to fulfill the requirements. This results in the increased cost of production and usage. The important form of energy required for the human being is the electrical energy. The demand for electricity is increasing in such a way that it is not possible to meet the requirements. This leads to the continuous hike in the price. In this paper we are using the innovative methodology for the effective management to minimize the wastage, lower the usage cost and lower the maintenance cost of energy. The discussion in this paper is limited to Domestic electricity.**

Keywords- Green technology, Eco friendly energy management

I. INTRODUCTION

The energy can neither be created nor be destroyed. It can be changed from one form to another form. The world is enriched with energy in many forms which are known or not or useful to human being or simply getting wasted. The energy available in the world for human activities are classified into primary and secondary energy, non conventional energy and conventional energy and renewable and non-renewable energy [1]. The energy stored in nature are considered to be the primary energy. The energy sources are oil, coal, biomass(such as wood) and natural gas. Others include nuclear energy generated from radioactive substances, thermal energy which is stored in earth's interior, and potential energy which is due to earth's gravity. The major primary energy sources are coal, natural gas, LPG, petrol, diesel and other petrochemical byproducts. The secondary energy sources are steam energy, thermal energy, electricity etc. The industrial utilities convert the primary energy sources into secondary energy sources; for example steam and electricity are converted from coal, oil or gas. Primary energy can also be used directly.

The energy sources which are not available in the market are classified as non-conventional energy. This nonconventional energy includes fuels like firewood, agricultural wastes and cattle dung which are gathered traditionally, and not for sale. These sources are very much seen in rural areas where the people look after the cattle and they possess a large area of land where they can gather the firewood for their daily needs. These methods are popularly known as traditional fuel burning system. Example: Firewood, agro waste in rural areas etc. The conventional energy whose offshoot is known commercial energy is the energy source which is available in the commercial market for a definite price. The important commercial energy forms are electricity, refined petroleum products and coal. These energy forms are required for agricultural, industrial, commercial and transport services. In the countries, where industrialization is given priority the commercialized fuels are predominant source for production, and used for any household tasks of general population. Examples: Electricity, oil, coal, lignite, natural gas etc. Renewable energy is the current potential energy resource yet to be tapped fully as the technology is still developing. These energy sources are obtained from sources that are not exhaustible. The renewable energy resources like solar power, wind power, tidal power, geothermal energy and hydroelectric power [2]. These energy resources are called green because they are not at all pollutant. Non-renewable energy is extracted from the conventional fossil fuels such as oil, coal and gas which are very much limited and the use of the same contribute to the environmental pollution.

II. ENERGY SCENARIO IN INDIA

In India Coal dominates the energy mix. This energy mix contribute 52% of the total primary energy production. Over the years, there is a remarkable increase in the share of natural gas from 10% in 1994 to 19% in 2014. Similarly the percentage of oil in the energy mix is 30% as on 2014 and natural gas accounts for about 10% of energy consumption in the country. The reserves of natural gas in India as on during 2014 is 1,354.76 Billion Cubic Meter. The total potential for renewable power generation during 2014 is 94,125 MW which include the wind power potential of 49,130 MW (52.2%), small hydro power (SHP) potential of 19,750 MW (20.98%), biomass power potential of 17,538 MW (18.63%), power from cogeneration in sugar mills is 5,000 MW (5.31%) and energy from waste is 2,707 MW (2.8%). The total installed capacity of electricity generation in the country is increased from 1,45,755 MW during 2006 to 2,66,644 MW during 2014. The installed capacity of electric power generating stations in India under

utilities is 9,63,722 GW during 2012-13, which is the collective generation of 1,13,626 MW- hydro, 32871 MW- nuclear, 8,17,225 MW - thermal and 1,48,000 MW from non utilities [3]. The actual final energy consumption is given in Table 1.

Table 1 : Demand for Commercial energy for final consumption.

Source	**Units**	**1994-95**	**2001-02**	**2005-06**	**2012-13**
Electricity	Billion Units	289.36	480.08	411.887	852.9
Coal	Million Tonnes	76.67	109.01	407.04	570.23
Lignite	Million Tonnes	4.85	11.69	30.23	46.41
Oil & Natural Gas	Million Tonnes	63.55	99.89	139.95	219.21
Source: Planning Commission BAU: Business As Usual					

Nearly 45% of the total energy consumption is done at Industrial level, 2% of the energy is used for traction and railways, 22% of the energy is used for residential purpose, 18% of the energy is used for agriculture, 8% of the energy is used for commercial purposes and 5% of the energy is used for other purposes. The figure 1 shows the energy distribution in India.

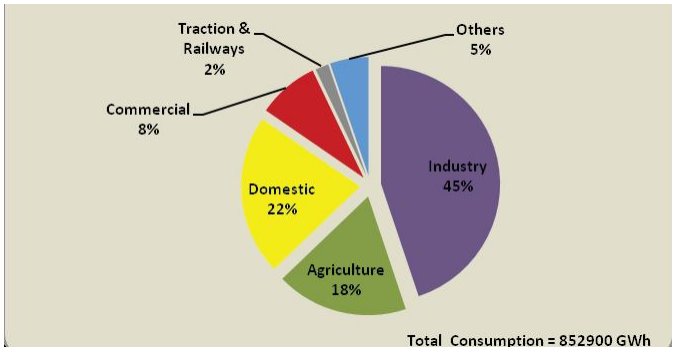

Fig. 1: Sector wise Energy Consumption during 2013-14.

III. Objective of the Work using Green Technology

The objective of this paper is to propose the innovative methods of production of electricity and effective management of the same at the domestic level using green technology. The proposal is limited only to the domestic level because the percentage of consumption of electrical energy is only 22% as seen in the figure 1.

IV. Methodology

We propose a new innovative method of production and management of energy for the domestic purpose, The methodology used here is conceptual methodology because the new concept used here should be experimented before the use.

Table 2 : The electrical consumable items in a normal house.

Sl. No	Room	Dimension	Electric Equipment	Number	Power Consumption
1	Hall	300 sq.ft	Fans	3	75W
2	Hall	300 sq.ft.	Lights	3	120W
3	Hall	300 sq.ft	TV CRT	1	25W
4	Master Bed Room	150 sq.ft	Fan	1	25W
5	Master Bed Room	150 sq.ft	Light	1	40W
6	Master Bed Room	150 sq.ft	Air Condition (optional)	1	1500W
7	Master Bed Room	150 sq.ft	Iron box	1	1000W
8	Bed Room	150 sq.ft	Fan	1	25W
9	BED Room	150 sq.ft	Light	1	40W
10	Bed Room	150 sq.ft	Air Condition (optional)	1	1500W
11	Reading Room	100 sq.ft	Light	1	40W
12.	Reading Room	100 sq.ft	Fan	1	25W
13	Reading Room	100 sq.ft	Table Lamp	1	12W
14	Kitchen	100 sq.ft.	Fan	1	25W
15	Kitchen	100 sq.ft	Exhaust Fan	1	25W
16	Kitchen	100 sq.ft	Refrigerator	1	350 W
17	Kitchen	100 sq.ft	Microwave Oven	1	1000 W
18	Kitchen	100 sq.ft	Induction coil	1	1000 W
19	Kitchen	100 sq.ft	Light	1	40W
20	Kitchen	100 sq.ft.	Water purifier	1	100 W
21	Toilet/Bath Room	50 sq.ft	Geezer	1	800 W
22	Toilet/Bath Room	50 sq.ft	Lights	2	40W
23	General		Water Pump	1	1000 W

The domestic equipments can be classified into two categories

- Heavy electric equipments
- Light electric equipments

The heavy electric equipments that are used inside the house are [4] :

- Air condition consuming 1500 W per hour
- Electric geezer consuming 800 W per hour
- Iron Box consuming 1000 W per hour
- Microwave Oven consuming 1000W per hour
- Induction coil consuming 1000W per hour

The light electric equipments that are used inside the house are [4] :

- Light (CFL consuming around 20W/ LED consuming around 9W)
- Fan consuming 25W
- Exhaust Fan consuming 25W
- TV (LED/LCD) consuming around 25W.

The electrical consumable items in a standard house are listed in Table 2. The daily consumption of power at the domestic level, (Light Electric Equipments) are shown in Table 3. The daily consumption of power at the domestic level, (Heavy Electric Equipments) are shown in Table 4.

Table 3 : The daily consumption of power at the domestic level (Light Electric Equipments).

Sl. No.	Item	Number of hours used	Power Consumption
1.	Lights (10 Numbers)	5	2000W
2.	Fans (3 Numbers)	10	750W
3.	TV	3	300W
4.	Exhaust Fan	3	75W

Total Power :3.125KW.

Table 4 : The daily consumption of power at the domestic level (Heavy electric Equipments).

Sl. No.	**Item**	**Number of Hours used.**	**Power Consumption**
1	Air Condition	5	5000W (seasonal)
2	Microwave oven	1	1000W
3	Refrigerator	5	1000W
4	Induction coil	2	2000W
5	Electric geezer	1	800W
6	Water Pump	1	1000W
7	Iron Box	1	1000W

Total Power : 19 KW. Altogether the total power consumption in a house could be 22.125 units per day.

V. PROPOSED MODEL

The block diagram of the proposed model is given in figure 2. As shown in the figure the electricity from the commercial suppliers can be directly used for heavy electrical equipments. Since the heavy electrical equipments require large amount of current we need to depend on the commercial electric suppliers. Production of such a large amount of electricity using green technology is very costly. In a house the essential electrical equipments are light electrical equipments like fans, lights, TV, music systems etc. These equipments can run using Solar energy with the help of the solar panels at an affordable rate plans. As per our model the commercial electricity and Solar energy should be connected to specially designed equipment called a grid. This grid will select the electricity from the Solar Energy during a bright day and selects from commercial electricity during night. Also if the amount of current generated by the solar panel during day time is less than required then the difference amount of current will be taken from commercial supply. This grid functions automatically that the entire amount of electric energy thus produced from solar will be used efficiently. The grid even maintains a battery backup so that if there is any power failure during night will be substantiated by the battery backup. Here we are free to install the solar panel as per our needs so that the complete solar energy will be used and after that the electrical energy is taken from the commercial supply [5].

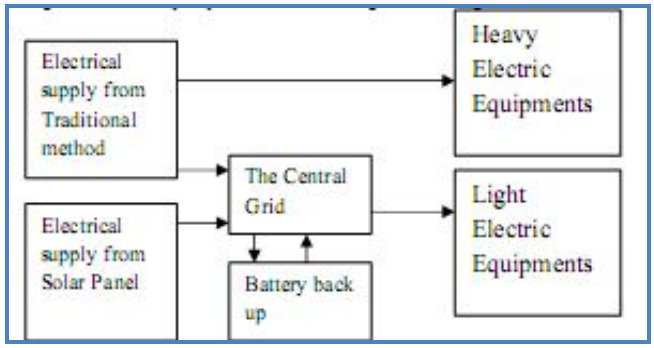

Fig. 2: Block diagram of the proposed electrical connection for a house.

The Power consumption using the proposed equipments is shown in the table 5.

Table 5 : The Power consumption using the proposed equipments.

Sl. No	**Item**	**Power Consumption/item**	**Number of Hours used**	**Power consumed/ day**
1	LED Lights-10 numbers	5W	5	250W
2	Fans (3 numbers)	25W	10	750W
3	TV LED	50W	3	150W
4	Exhaust Fan	25W	3	75W
Total Power Consumed				1225W

The Comparison between the power consumption using the traditional based electric equipment and the new proposal is shown below.

The Total Power consumed /day considering only the light electric equipments = 1.250 KW. Without the use of LED bulbs and LED TV the daily power consumption is nearly 3.125 KW. Thus the consumption of power is reduced by almost 1/3.

VI. ABCD Analysis of the Model

We would like to analyze the model in production section and utility section as per the ABCD model [6].

A. Advantages of the model :

In the production section the Advantages are

- The user is free to install the solar energy or wind energy or biomass energy.
- The user can decide the amount of energy need to be produced and his budget.
- The user also can use the commercial supply.

The Benefits in the production section are

- The user is free to select the green energy based on geography.
- The amount of power thus generated will be mixed with the commercial energy thus the user will not be having the problem of change over from green energy to commercial energy.

The Constraints in the production section are

- Service providers knowledge in the set up.
- Lack of service knowledge by the user.
- Initial investment may be seem to be at a higher end.
- Safety.

The Disadvantages in the production section are

- Connectivity issues with commercial supply.
- Statutory permissions and regulations.
- Continuous change in the climate may result in differences in production.

The Advantages of using the proposed model at utility section are :

a. Most of the time the electric consumption at home will not be efficiently used. We find the wastage in the current in the form of lights or fans without use. To minimize these type of wastage in the electricity we propose the following :

- Use the sensors which will sense the presence of human being and automatically switch on the required electric equipment thus effective use of current.
- Use the LED bulbs during night that will reduce the consumption of current to maximum extent. (The Table 4 shows the difference of LED bulbs and CFL bulbs).
- During day time use the natural light and wind blow by opening the windows and doors.
- Modify the kitchen in such a way that use of solar light is maximized to generate heat so that one can use the solar heat for at least keeping the things hot.
- Avoid the use of microwave oven or induction coil by using bio gas plantation or solar cooker. This will reduces the consumption of electricity to a maximum extent [7].

B. Benefits of the model :

The Benefits of using the proposed model at utility section are :

In order to minimize the power consumption of Heavy electric equipments we propose the following suggestions.

- Usage of biogas in the place of Induction coil for food preparation should be entertained.
- Usage of solar cooker should be entertained.
- Avoid using microwave oven.
- While constructing the kitchen identify a place in the kitchen where sun light can be concentrated to maintain the food item hot.
- Use the air conditioner sparingly only when required.
- Keep the windows open to get the natural air.
- Plant the green plantations to improve the availability of oxygen.
- Use the solar water heater to avoid the geezer.

If we avoid the usage of induction coil, microwave oven, geezer we can save 3.8 KW of energy per day. By using the solar energy we can produce the electrical needs of light electrical equipments saving 1.25 KW of electricity. So with all these efforts we can reduce the electric consumption from 22.125 KW to 15.2 KW. Totally we will be able to save around 7 KW of electricity per day. The above information on power consumption clearly shows that using this model will drastically reduce the power consumption [8].

C. Constraints of the model :

The main constraint is the lack of knowledge. The user will not be updating his knowledge in the latest information in green technology which limits him in implementing. The availability of the necessary items for implementing may be another challenge. Servicing is another constraint as this model is not very popular and still it is under experimental basis.

D. Disadvantage of the model :

The disadvantage of this model includes the latest less energy consuming devices which are presently costly in the market. The present generation is not in a position to accept this model because of the lack of knowledge. This model is suitable for only researchers to come out with different results. This model still needs to be standardized.

VII. Conclusion

The model proposed here suggests the various methods to be implemented to reduce the consumption and minimize the loss of electrical energy. The ABCD analysis of production

section and utility section informs that the implementation of this model will surely reduce the scarcity of energy at the domestic level. This model strongly recommends the usage of green energy in the place of available commercial energy. This model entertains the usage of solar light, solar cooker, solar water heater in the place of geezer, induction coil and microwave oven. Using this model improves the health as the system is more and more using natural energy. The limiting factor for the implementation is the cost of the equipments which will come down to the affordable price over the period of time. The LED bulbs were costly in the beginning and now the rates are affordable. Similarly now the sensors are costly but if the demand is increased the price will come down. This paper suggests the maximum utilization of the green energy which is around us in the place of commercial energy source.

REFERENCES

[1] D. P. Kothari, K. P. Singal and Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies" Second Edition, Eastern Economy Edition.

[2] K. K. Goyal, 2009, "Renewable Energy", First edition, Published by Mahaveer and sons.

[3] Pradeep Chaturvedi, "Sustainable Energy Supply in Asia" World Energy Council.

[4] Shonali Pachauri "An Energy Analysis of Household Consumption: Changing Patterns of Direct and Indirect use in India" Springer.

[5] Tushar K Gosh and Mark A Prelas, "Energy Resources and Systems" Volume 2: Springer.

[6] P. S. Aithal, et. al., A New ABCD Technique to Analyze Business Models & Concepts, Accepted in International Journal of Management for publication. March 2015.

[7] Clarisse Frass-Ehrfield, "Renewable Energy Sources", KLUWER LAW INTERNATIONAL.

[8] Gilbert Held "Introduction to Light Emitting Diode Technology and Applications" 2009, Auerbach Publications.