



Cultivation of Home Energy Usage: A Study of Factors Governing Energy Habit

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ABSTRACT—

Energy consumed by a residence is always variable and its usage is governed by number of factors. This paper finds the critical factors that significantly affect the home energy consumption, taking the surveys as reference carried out by researchers, worldwide. Continuous depletion of conventional resources of energy leads to the energy conservation. Improving energy awareness among the members of the residence may lead to significant amount of saving in energy. The research at the home end user level must be carried out to determine the sensational parameters.

Keywords—*Household, Home energy, Energy responsiveness, Energy consumption, Residential energy awareness.*

1. RESIDENCE- as an energy consumer

According to the usage of primary and secondary energy, the consumers may be broadly classified into following categories.

1) Residential 2) Transport 3) Service 4) Industrial 5) Agriculture. The residential sector accounts for 25 to 30 per cent of primary energy use in the developed countries and a higher share in the developing countries.

The average home pollutes more than the average car, if we calculate the carbon footprints for controlled conditions. The pollution of home is not observed, because of which it is ignored. This is the environmental factor of residential energy consumption, which should be considered.

The household energy consumption in the western countries is showing a trend towards saturation; whereas in the Asian countries the household energy consumption will continue to rise [1].

Electricity consumption of Chinese residents has been increasing at an annual rate of 10-15 percent, which is much higher than total electricity consumption increasing rate of the country. Household appliances have become a large user of energy as China has over 340 million families. By 2005, the total number of TV sets had reached 350 million, refrigerators 130 million and washing machines 170 million [2].

As compared to the developed countries, Japanese house consumes almost half of the energy than that consumed by USA or UK house.

Energy consumption per household in rural China is high. Because 80% of this is wood or agricultural waste, with a low efficiency of conversion, a rural Chinese household uses more energy than does an urban one.

2. Universal Picture of Home Energy Awareness

The world is moving towards an impending energy crisis, hence promoting public understanding and awareness about different kinds of energy generation, dissemination and their consumption has become very important. Due to limited amount of non renewable energy sources on the earth, it is necessary to conserve our current supply or to use renewable sources so that our natural resources will be available for future generations.

It is said that one unit saved is equivalent to the two units generated. Household energy saving has become a big concern all over the world. Several policies have been developed, almost by all the nations; still the required output is not obtained.

Indian Government is implementing the policies to use energy efficient products, in which BEE [Bureau of Energy Efficiency] is playing major role.

European governments have been implementing policies that encourage the adoption of energy efficiency in the home through incentives and regulations. UK's legislative changes "28-day rule" in 2003 which facilitated consumer investment in domestic- scale energy efficient generation system and the Netherlands government has been seeking further adoption of green energy products [2].

Here is the snapshot taken among various research studies all over the world.

a. Energy Responsiveness in Rented apartments of Sweden

The questionnaire was formed by three groups of questions which concerned **resident's characteristics, type and usage of electrical appliances, and attitudes towards energy consumption**. The results show that electricity consumption profile of individual household can be mostly related to a given parameter. For example, the total **household's income** resulted one of the important factors determining the consumer behaviour and as a rule it was related to higher electricity consumption.

It was recommended that energy companies and municipal corporations should include individual behavioral approach to households' energy consumption when developing energy saving strategies and measures. It was also recommended to recruit energy advisor to work for individual house separately [3].

b. Energy STAR label awareness in USA

The study examined the factors associated with consumer awareness about the energy star label of recently purchased white major appliances and the factors associated with the choice of energy star labeled appliances. Research found that household characteristics have a much stronger association with consumer awareness of labels than with the choice of Energy Star appliances. Study revealed that the devils behind loss of \$164 million per year and associated carbon emission of about 1.1 million metric tons per year were renting the home, Hispanic ethnicity, being poor or near poor etc [4].

c. Energy awareness in the sample cities of Japan & Norway [5]

The survey was conducted to check the knowledge and awareness regarding energy usage. Both the samples were aware of their **seasonal swings** of energy costs. **Size and capacity** were the main **influencing characteristics**, when both the samples were purchased their last **refrigerator**.

Energy intensive space heating and lighting habits have become an integral part of the presentation of the Norwegian home, Japanese space heat and light habits are **more disciplined and less culturally significant**.

d. Household energy behavior in Sweden

In June 2009, a survey was conducted in Sweden to analyze Swedish households' **willingness** to increase their **daily efforts** to save electricity. That analysis was built on a broad theoretical framework, which embraced both economic and norm-based motivations in explaining household behaviour. The paper paid particular attention to the **role of information** about the availability of different behavioural changes that can be undertaken at the household level.

The result indicated that the cost, environmental attitude and social interactions were the important determinants of electricity saving activities [6].

e. Household energy awareness in Liaoning Province of China

In order to determine the barriers to energy efficiency in China, questionnaire survey was carried out in 2009 in Liaoning region of China. A series of straightforward questions were asked regarding **electricity bills, knowledge about energy efficiency, and knowledge about appliances**. Study concluded that, despite electricity being **pre-paid**, and requiring more direct involvement than the automated billing found in other countries, the **general knowledge** and **awareness** about electricity was low. Only 2% of the samples were reported that, it was possible to reduce energy consumption by receiving and reading the brochures on energy saving and energy efficiency [7].

f. Energy Conservation tools in Saudi Arabia

Energy and Public Awareness, Energy Regulations, and Energy Information & Programming are three supportive tools [fig.1] suggested, conserving the energy in Saudi Arabia by S. A. ALAJLAN, M. S. SMIAI and U. A. ELANI [10].

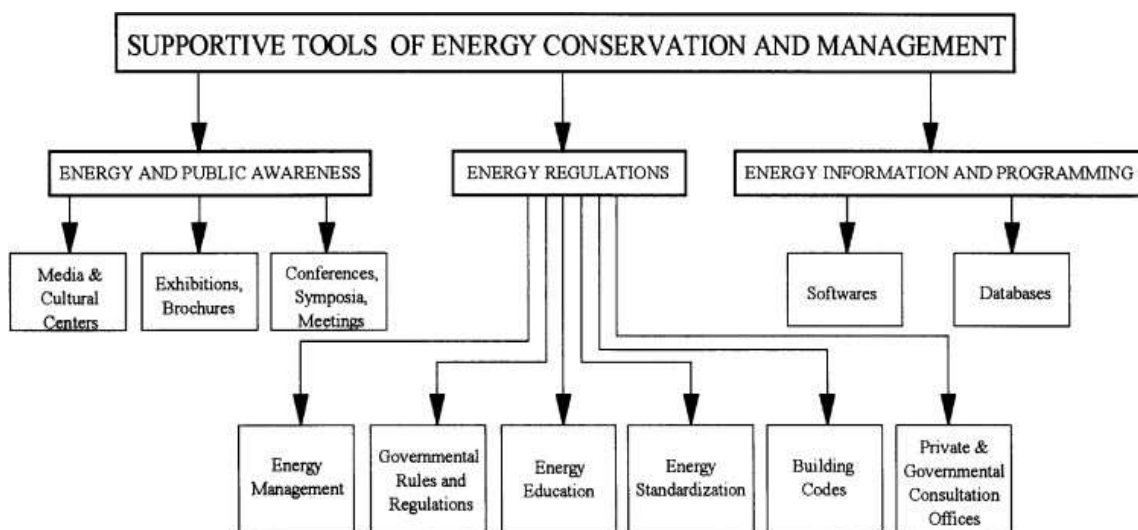


Fig.1 Supportive tools and methods for EC and EM

It was also suggested to use available methods and techniques, like video films, radio and TV, communication and networking, posters and advertisements in public facilities, i.e. cultural centres, for energy conservation [EC] and energy management [EM].

3. Evaluation of Critical Factors

We have summarized the factors governing the responsiveness of residential energy use as follows.

g. Attention in Energy inspired by House

It is important whether the house is interested in knowing the amount of energy consumed. In fact the interest of household in the area of energy must be checked. Most of the times the house pays the electricity bill, without knowing the number of units consumed. It is just interested in monetary part of electricity bill.

The Energy Crisis as in Juneau, Alaska [8] may create energy interest among the populace and reduce the electricity demand by 25%.

h. Common Acquaintance of Energy

Irrespective of the education level the unit of electricity must be known to every house member. It leads to huge amount of electricity saving as the Unit kWh, includes the time part as well as the unit of power. Even though it is a technical aspect, the non technical house may take part to enhance its general knowledge of energy. Energy literacy, which encompasses broad content knowledge as well as affective and behavioural characteristics, will empower people to make appropriate energy-related choices and embrace changes in the way we harness and consume energy [10].

i. Way of Operation & Continuance of Appliances

There household appliances like Refrigerator, Air-conditioner contributes to around 50% of the monthly electricity bill. Filters of the air conditioner and coils of the condenser of the refrigerator must be cleaned at least once in month. In case of the refrigerator the meticulous study may reveal that the houses do not know the condenser and thermostat of the refrigerator. One of the reasons for amplified household energy consumption is the reprehensible method of operation and negligence towards maintenance.

j. Buying and Use of Energy efficient Appliances

No doubt, the energy star label program is the most significant effort taken by government. But, still it is question that whether the low income house can afford the five star rated appliances. Our suggestion is to give subsidy for low income houses to purchase energy efficient appliances.

While paying the electricity bill, the house may produce the report once in five year. The report should contain the type, star rating, and year of purchase of appliances.

k. House Character

The house is taking initiative to switch on the appliances whenever required, but often it happens that it is not energetic to switch off the same. The household feel indolent to make a practice to reach to plug point after the demand is over. Most of the times the appliances are controlled by multiple members in the house, simultaneously or intermittently.

The automation may be the only way to control such type of tone of the home.

l. Government Part

The government obviously may promote the energy usage awareness in residences, by using electronic media and print media.

The past, current and future energy picture must be shown to every house through the advertising on televisions, radios.

The print media will help to spread news of energy awareness programs, energy awareness campaigns among the residences of particular region.

m. Energy Price

The house should know the price of primary or secondary energy it is using. There is a tariff structure designed by electricity suppliers, which may be unknown to the house.

The ultimate solution to control the surplus use of energy is to hoist its value. But it is an opinionated decision. Hence, again the rural and semi urban area will suffer from load shedding.

3.1 Summary of the Critical Factors

The readiness of houses to be energy aware is thus shown to be constrained by a mesh of interconnected barriers as shown below.

TABLE T1

| Sr. No. | Factor governing Energy Responsiveness | Solution | Barrier |
|---------|--|-------------------------|---------------------|
| 1 | Interest | Motivation, rewards[14] | Attitude |
| 2 | Energy Acquaintance | Energy Education | Interest, Time |
| 3 | Behavior with appliances | Training, education | Knowledge |
| 4 | Purchase of EEA | Subsidy, incentives | Income |
| 5 | House tone | Automation, TPC | Behavior, lifestyle |
| 6 | Energy value | Tax credits | Politics |
| 7 | Government role | NGO | Initiative, support |
| 8 | Public engagement | Fiscal terms | Interest |

4. Discussion

The residential energy consumption is growing at fast rate due to high living standards, and lifestyles. Developed countries have been promoting the production of energy efficient appliances. At the same time attention must be given towards improving the awareness of usage of energy among populace. Rating of houses according to their energy usage, incentives for energy efficient houses in their energy bills, energy audit of houses are the few suggestions to condense the residential energy consumption.

Environmental aspect can't be neglected in improving energy awareness. The house may be ranked on basis of number of carbon footprints of house.

The International Energy Agency estimates India needs an investment of at least \$135 billion to provide universal access of electricity to its population. The enhanced energy awareness in only residential sector may reduce this investment to some extent and it will be further reduced due to latching effect between residential, transport, commercial and industrial sectors in India.

The upper limit of energy frenzied by house may be optimized by setting the benchmark for the particular type of home.

Disparities in household energy use exist between rural and urban populations, between high and low income groups within a country, and among countries. The major factors contributing to these differences are levels of urbanization, economic development, and living standards.

Other factors are country or region specific, such as climate or cultural practices. In rural areas, due to slow process of urbanisation the energy infrastructure has not yet been completed, there are the opportunities to encourage acquisition of innovative energy systems.

5. Conclusion

There is a broad scope to save the energy, by improving the energy usage awareness in all sectors of developing countries like India. The corporate must attempt to inculcate the end users to make energy literate, simultaneously by selling their energy efficient products. There are large numbers of problems faced by Empirical Researchers in India. In energy sector the energy corporate should provide their database to the researchers, in such a way that their contribution for energy conservation will reach to peak.

Indian Electricity Sector provides enormous opportunities for energy service companies and also for those who manufacture energy efficient equipment's, gadgets and devices. It may established that energy efficiency projects, when appropriately implemented in households, could lead to a saving of as much as 20% of primary energy consumption.

In OECD [Organization for Economic Co-ordination & Development] countries like Sweden, Greece, UK, US, Japan, Norway, Netherlands, France and some of the non OECD countries like China, the research studies regarding household energy awareness is promoted by their governments. But the developing countries like India require the initiative for such purpose.

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