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Energy Saving Opportunities in Domestic Electricity Consumption in Indian Scenario

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Abstract: *The developing country like India is facing the acute shortage of Power due to huge demand supply gap. The installed capacity in India was 1, 43,061 MW in 2008 generating almost 722626 GWh as against the requirement of 968000 GWh, which is capable to feed only 80% of the population. Power demand is likely to increase up to 1392000 GWh by the end of 2017. There is planning to add 60000 MW up to 2017.*
One of the solutions is reducing the power use without compromising the comfort by practicing various simple but effective steps. Authors discuss such practices expected to be followed, which are easy to adopt in Indian scenario. Being the tropical country, the extreme temperature and environment is faced with vide variation across the country. Even when we are able to reduce energy requirement to the extent of 5%, will be able to feed the power to remaining 20% of the population of the country. It doesn't need any specific education, but only awareness about the wastage, which is responsible for loading to the energy bill and environment. Because of globalization, every latest and energy efficient technologies are available at our doorstep. Our inclination to use cheap but inefficient product is costing more during its life cycle than the costly, but efficient products. Increased use of sub standard product also leads to add the heat to the environment in the form of losses and simultaneously loading to the pocket and weakening our economy. Author also indicates the impact of each suggested practice to be followed and prove that it will not affect the requirement adversely but helps in reducing specific energy consumption in domestic use. If followed, scrupulously, it is possible to help nation to reduce Burdon of capacity addition, energy bill and the supporting infrastructure and helps to remain nation green.

Keywords: *Star Rating product, specific energy consumption, LED, PIR sensors, Induction lighting, Light pipe, Eco ventilator.*

I. INTRODUCTION

The average monthly consumption of electricity in India is @ 75 Units/capita (2nd least power consumption in world) ranging from @50 units in urban area to @ 113 Units/capita in urban area. The total share of domestic power consumption to the total power consumption is @ 21% in 2008 and likely to increase its share up to 30% in 2017[1]. This is mainly because of increasing population and increasing habit of using electrical appliances.

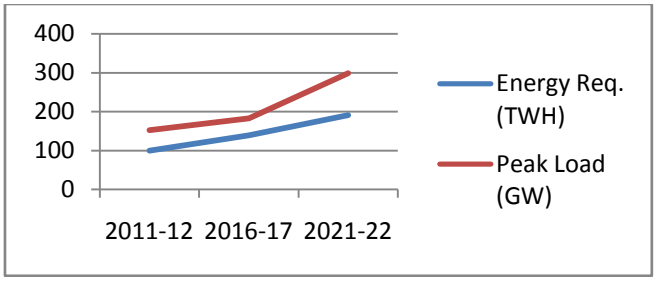

Fig: Existing and expected rise in electricity demand up to 2021-22[1]

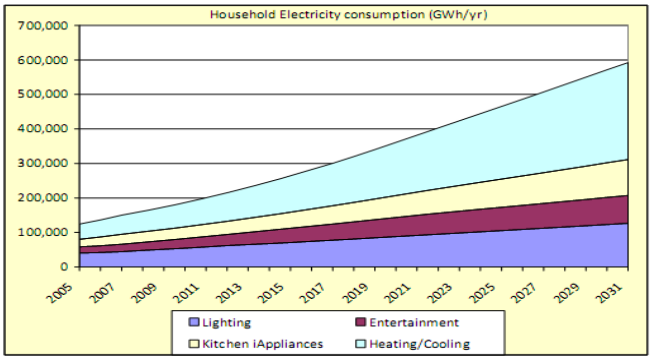

Fig: Contribution of various domestic appliances and its consumption[2].

There are two possible solutions to mitigate the problem. First to increase power generation and another to reduce power use i.e. consumption. Increase in power generation will add to increase in carbon emission, deforestation, depleting precious natural resource, environmental degradation, increasing health issues, stressing the supporting infrastructure such as transport and manpower. Another solution is reducing the power use without compromising the comfort by practicing various simple but effective steps.

PRACTICE CAN BE FOLLOWED WITHOUT ANY FINANCIAL IMPLICATION

Use of appropriate size of cooker for cooking. Soaking of ingredient in water before cooking. Cover the utensil with lid to avoid loss due to evaporation[3]. 15% energy can be saved through such effort.

Use of optimum energy control by adjusting temperature and time for microwave and induction cooking system. The energy will be automatically comes to minimum after completion of the task.

Let hot utensil come to normal room temperature prior to keep it in the Refrigerator for preservation. Similarly cold utensils come to normal temperature before heating it.

Don't set the temperature colder than necessary. Set the refrigerator and freezer at appropriate temperature. Avoid unnecessary opening of Freezer or Heater door. This will lead to loss of energy to bring it back to rated temperature.

Clean the equipments once or twice in a year. Clean equipments works more efficiently due to effective heat transfer.

Unplug the equipments when they are not in use. Keeping the equipment on sleep mode consumes power to keep it alert. The energy from 5 to 20 Watts consumed in sleep mode.

Place the refrigerator and freezer away from direct sunlight and other heat sources such as ovens. Heat will cause consume more energy to stay cold. There shall be sufficient distance of refrigerator rear from wall for effective cooling of condenser and maintain higher efficiency.

Electrical appliances doors should seal tightly. Loose seals cause unit work hard and consume more energy.

Cook food and boil water in a covered container this traps energy and consume less energy.

Resist the urge to open the oven door while baking. When you peek, the temperature drops and requires additional energy to bring the temperature back up.

Always run a full load in your equipments. Running a partial load uses same amount of energy as that of full load – but less work done.

Wash laundry in cold or warm water. Use hot water only when greatest cleaning is needed. Avoid drying the cloth in Machine, because the same result can be obtained naturally with any energy requirement, if not urgently requirement.

Rinse in cold water as cold water do not affect cleaning. Dryer having electronic sensor should be used so that it automatically shut when clothes are dry. Don't dry clothes excessively. Drying excessively takes more power.

Install your water heater near kitchen where the hot water required. Due to this, hot water doesn't have to travel as far and less heat is loss. Insulate hot water pipes to reduce convention and radiation loss.

Use a humidifier. Humidity makes you feel good in colder months. It is also useful in summer season specifically in dry and hot environment.

Use natural lighting. Open curtains and shades during the day instead of using lighting.

Plan your lighting within a room to provide general background lighting and supplementary task lighting. Turn off lights when not in use

Drain a bucket of water from bottom of water heater once or twice in a year to reduce mineral deposits and sediment building up.

Avoid long-life incandescent light bulbs. These type of bulbs consumed multifold energy than that of lighting system such as fluorescent lighting of LED lighting.

Use AC only in those rooms which are in use. Set the plug-in timer or PIR sensors to turn off the air conditioner when you leave home and to turn it on just before you return.

Use a room air conditioner with fan speed control. This allows faster cooling. Don't set the thermostat at high initial temperature. Close the fresh air vent so that outside air should not enter the vent. Set the ceiling fan direction to blow air down. This will be useful for maintaining uniform temperature in the room and extract hot air from top of the roof.

Don't let the computer run all day. Only power on the computer, monitor, printer and fax machine when you need them. Don't leave them on after you're finished working.

Use home UPS with at most care and only when, it is needed. Because even though the efficiency of electronic part of the UPS is @95%, the efficiency of the battery is not better than 20%.

Use copper wiring and ISI mark switches and sockets while replacement / new wiring to reduce loss due to higher resistance and loose contacts in circuits.

PRACTICE CAN BE FOLLOWED WITH SMALL INVESTMENT

Installation of PIR sensors to switch off the equipment in absent of the human activity. This will save 41% to 48% energy requirement[7].

Procurement of star rated electrical equipments while replacement or new purchases. It gives its pay back of high cost during its life cycle. This will save 10% to 20% energy requirement[8].

Select a proper size as per our household's needs before purchasing refrigerator. One that is too large wastes energy[6].

Proper repairing should be done to remove faucets and poor performing gadgets.

Install a heat loop or in-line trap in heater. These mechanisms keep hot water from moving into the piping system when you are not using hot water[5].

Install a water softener, if water is hard to prevent heater from mineral deposit. The loss of heat transfer coefficient is @ 8% to 10%, which will increase the heater / cooler load[9].

Use several low-watt bulbs instead of a single, high-watt bulb to obtain uniform distributed lights and operative with PIR sensors to get lights, only where our activities are carried out. This will optimize the lighting energy with loss of lux level.

Use lugs at the termination of wiring of proper size to avoid heating due to adequate contact in connections.

Use color combination of walls to optimize lighting in day time as well as night time with minimum artificial lighting[4].

PRACTICE CAN BE FOLLOWED WITH RELATIVELY HIGH INVESTMENT

Installation of light pipes[10] and eco-ventilators[11] to obtain sufficient light during daytime and natural ventilation of the air, so that energy consumption during the day can be minimize up to 32%.

Installation of Solar water Heaters for hot water consumption, It will be useful to utilize the hot water throughout the day, when required[5].

Purchase an energy efficient star rated electrical equipments. The initial cost may be more but operating costs are less in long run.

Consider LED (Light Emitting Diode) lighting[13]. LEDs for indoor lighting and induction lighting[12] for outdoor lighting are becoming more common for can, track, under-cabinet and holiday lighting. Initial cost is more, but the lights use 60% times less energy and last 6 to 10 times longer than incandescent lights.

To maximize efficiency, change the indoor and outdoor compressor coils when replacing an older central air conditioner.

Insulate the walls and ceiling to minimize conduction loss[4] . Painting the outside walls and roof with special paint available for reducing heat loss and maintaining low temperature during summer, thus reducing heat load on Air conditioner.

Use tinted and infrared-ray resistant window glass pans on the wall to reduce heating of the room by sun rays[4].

If possible, south facing wall of house / offices shall be insulated to reduce cooling load on air conditioner.

Use double door system at entrance to reduce temperature gradient and heat loss while opening of the doors.

Use of Instant water Heater or cooler instead of storage type heater or cooler, because wastage of energy will be reduce for heating/cooling of stored water, when not in use. Instant water heater / cooler utilize energy source only if, it is needed.

Use of Variable frequency drives in Air conditioners, Washing machines, Refrigerator (Equipment with inverter) to optimize power requirement at varying condition[14] .

POSSIBLE SAVING BY ADOPTING ABOVE PRACTICES

We have discussed simple but effective way to reduce specific energy consumption without any compromise the requirement. The energy intensive applications are space cooling / heating or other heating / cooling gadgets such as cooking, refrigerators heaters etc. Thus energy efficiency measures adopted for such application will reduce the energy consumption almost by 40% by adoption suggested solutions. Second best saving potential is in electronic gadgets, where we can adopt the practice of purchasing star rated product to minimize specific energy consumption. This will contribute to reduce almost 25% of energy requirement. Next saving potential is lighting, where simple behavioral practice and correct product selection will help us to reduce further energy requirement to the additional reduction of @ 15% energy consumption. All solutions are easily possible to adopt in Indian scenario to minimize the Energy Burdon, and yet to get maximum comfort.

II. CONCLUSION

Definitely, our living style is changing day by day and use of electrical gadgets is un avoidable, still by adoption above discuss practices will help to reduce specific energy consumption without compromising the need. Because saving of one unit means saving of 800 gm. of coal, saving of 350 gm. of generation of ash, generation of @ 10 M^3 of flue gas and avoiding wastage of 6 liters of water. Only we have to keep in mind of changing our behavior and alert during selection of construction material and of energy intensive equipments. Being the tropical country, the extreme temperature and environment is faced with vide variation across the country. Even when we are able to reduce energy requirement to the extent of 5%, will be able to feed the power to remaining 20% of the population of the country. It doesn't need any specific education, but only awareness about the wastage, which is responsible for loading to the energy bill and environment.

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