ADOPTING ENERGY CONSERVATION MEASURES FOR SUSTAINABEL DEVELOPMENT

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ABSTRACT

The prime objective of electric energy generation is to satisfy customer needs economically with emphasis on Safety, Reliability and Quality. Most of the conventional energy generation technologies employ exhaustible sources like coal, oil and nuclear fuel. Recent events have posed a setback to the sector of conventional power generation, the reasons for which include Higher fuel prices, Societal pressures to conserve resources, Environmental awareness, Increase in production cost and Concern for safety related to certain technology (like the Nuclear). Hence in present day energy scenario, for meeting the ever-increasing energy demand, efforts have come into focus with a view to develop new generation technologies. The major goals of these approaches are to have Reduced Environmental damages, Conservation of energy, Exhaustible sources and Increased safety Overall reduction & effective usage of electricity, Economic benefits such as reduction in monthly energy bill, Given for the same wattage better illumination

Key words: *Conventional energy, Illumination,* electrical energy.

1. INTRODUCTION

Electricity is scarce commodity in developing countries. It is therefore most important to save electrical energy by avoiding wasteful consumption; which does not mean sacrificing, but maintaining standard services by consuming less energy with the help of energy efficient practice/ equipment. All possible steps needs to be identified and adopted to conserve energy and reduce energy cost. This will reduce energy cost in municipal utilities. The saved electricity can be allotted to other needy consumers. Thus, it will solve electric scarcity up to a certain extent. Saving of electricity will not only saves financial resources but also it will help to reduce fossil fuels consumption at power generating stations and reduce Green House Gases (GHG) generation.

2. WHAT IS ENERGY CONSERVATION ?

Conservation means using optimum energy for carrying out a specific work without affecting the quality of work. Energy Efficiency & Green Energy are two sides of the same coin of conservation. Conservation is the

simplest, easiest, and most economical way of energy generation. Energy Conservation is needed because of Damage to the Environment and Limited availability of Fossil Fuels.

2.1CONSERVATION OF ENERGY INCLUDES:

- Improving Energy Efficiency by opting for Energy Efficient Technologies, Processes, Equipment, and Appliances etc.
- Reduction of Wastage by change of attitude, habits, practices and following the principles of REUSE, REDUCE &RECYCLE strictly.
- Adoption of Renewable Sources of Energy like the SUN for Water Heating (Solar Water heating), Cooking (Solar Cooking) and Lighting (Solar Emergency Lantern).
- ENERGY CONSERVATION is an objective, to which every citizen can contribute whether it is a household, factory agriculture, transport or a shop.

2.2 ENERGY CONSERVATION BILL:

To deliver a sustained economic growth rate of 8% to 9% through 2031-32 and to meet life time energy needs of all citizens, India needs to increase its primary energy supply by 3 to 4 times and electricity generation capacity about 6 times. As a result energy service demand growth rates will keep on increasing because of accelerates industrialization, urbanization, and an emerging consumer society.

- To promote conservation of energy to facilitate its efficient use and the least cost option to mitigate the gap between demand and supply in various sector of our economy,
- It has been felt to provide statutory authority, Energy Conservation Bill was introduced on 29th September 2001 in the 52nd year of republic of India.
- And established Bureau of Energy Efficiency (BEE), BEE has certain powers to enforce the said measures for efficient use of energy and its conservation.
- Energy is a major cost component for organizations across various sectors of economy .
- Industries, public utilities, commercial buildings and other establishments, which are large consumers of energy, can realize substantial savings in energy bills by adopting Energy Efficient (EE) technologies and systems in their plants, processes and facilities. And there exist immense potential for energy savings in small and medium enterprises as well.

2.3 ENERGY CONSERVATION ACT, 2001 (52 OF 2001):

The Energy Conservation Act, 2001 came into force with effect from 1st March, 2002. The Act empowers the Central Government and in some instances the State Government to;

- Notify energy intensive industries, other establishments and commercial buildings as designated consumers.
- Establish and prescribe energy consumption norms and standards for designated consumers.
- Direct designated consumers to:
  a) Designate or appoint certifies energy managers in charge of activities for efficient use of energy and its conservation.

b) Get an energy audit conducted by an accredited energy auditor in the specified manners and intervals of time.

c) Furnish information with regard to energy consumed and action taken on the recommendation of the accredited energy auditor to the designated agency.

d) Comply with energy consumption norms and standards, and if not so, to prepare and implement schemes for efficient use of energy and its conservation.

e) Prescribe energy conservation building codes for efficient use of energy and its conservation in commercial buildings.

f) State Governments to amend the energy conservation building codes to suit regional and local climatic conditions.

g) Owners or occupiers of commercial buildings to comply with the provisions of energy conservation building codes.

h) Direct mandatory display of label on notified equipment and appliances.

i) Specify energy consumption standards for notified equipment and appliance.

j) Prohibit manufacture, sale, purchase and import of notified equipment and appliances not conforming to standards.

2.4 ENERGY CONSERVATION ACT 2001:

OBJECTIVES: THE BROAD OBJECTIVES OF THE ACTION PLAN INCLUDE

1. To proactively fulfill all the mandates of EC act in co-ordination with BEE and State Government, and others stakeholders.
2. To promote the cause of energy efficiency addressing all commercial energy sources. (Coal, Oil, and Electricity)
3. Reduction of energy consumption in generation, transmission, distribution, and end use through efficiency improvements and rational use.
4. To address the concerns of utilities such as demand shortage as well as energy shortages through focused Demand Side Management (DSM) initiatives will serve as an alternative toll to offshoot the peak demand.
5. To promote reduction of GHG emission.
6. To promote use of energy efficient technologies, equipment, processes, and devices.
7. To promote awareness in respect of EC act, energy efficiency, standards, best practices, etc.
8. To promote about Energy Conservation Building Code and standards & Labeling.
9. To reduce fuel consumption in Transport Sector by way of Efficiency Improvement.
10. To reduce energy consumption in Domestic Sector by way of educating the users.

2.5 ESTABLISHMENT OF BUREAU OF ENERGY EFFICIENCY (BEE):

Established on 1st March, 2002 the mission of the Bureau of Energy Efficiency is to assist in developing policies and strategies with a thrust on self –regulation and market principles. Within the overall framework of the Energy Conservation Act - 2001.

Functions of BEE

1. Develop and recommend to the Central Government the norms for processes and energy consumptions standards.
2. Develop and recommended to the Central Government minimum energy consumption standards and labeling design for equipment and appliances.
3. Develop and recommend to the Central Government specific energy conservation building codes.
4. Recommended the central Government for notifying any user or class of users of energy as a designated consumer.
5. Take necessary measures to create awareness and disseminate information for efficient use of energy and its conservation.

2.6 BUREAU OF ENERGY EFFICIENCY GUIDELINES:

The following activities can be undertaken to promote the efficient use of energy and its conservation with the guidelines and assistance of the Director General of the Bureau of energy Efficiency, New-Delhi.

- Constitute a state level energy conservation award scheme on the lines of the National Energy conservation Award.
- Constitute a special Award scheme at state/ UT level for small and medium industries.
- Use of CFL and LED as more efficient lighting devices in government and PSU buildings and offices may be made compulsory replacing the Incandescent lamps. The life time economy be kept in mind.
- Energy Audit and implementation of its recommendations in state/UTs Government buildings as is being done by the ministry of power through Bureau of Energy Efficiency for large Central Government buildings in the national capital.
- Introduction of Time of Day (TOD) metering and approaching Regulatory Commission for Differential Tariff where it is not yet operative.
- Campaigns for energy conservation at state Level, Utilities and states/UTs through state funding. An EC fund could be constituted.
- Local bodies be asked to install energy efficient water pumps.
- Automatic switching On and OFF of street light.
- Finalization of State Energy Conservation plans and annual targets
- Positive fiscal incentives in annual State Budget for Energy Efficiency.

2.7 ENERGY EFFICIENCY:

- Compared to an ordinary lamp that gives the same amount of light , a compact fluorescent light (CFL) saves about 50 % - 75 % of energy.
- Fluorescent lamps are about four times more efficient than incandescent lamps, but their use in residences has been limited by their higher first costs, unattractive light, and inability to fit in incandescent fixtures.
- From Industrial, Commercial, Agricultural and Domestic sectors by promoting energy efficiency and conservation - ENERGY SAVING POTENTIAL OF OVER 15000 MW.

- Energy efficiency helps in generating additional source of revenue.
- Energy efficiency helps in Conserving Environment and reducing pollution.
- Government and Corporate Citizens should take hard decisions that are not really hard. It is the attitude. It is the will.

a. REDUCTION IN SPECIFIC ENERGY CONSUMPTION
b. RESORCE OPTIMIZATION
c. WASTE MINIMIZATION
d. REDUCTION IN POLLUTION
e. GREENING SUPPLY CHAIN
f. USE OF RENEWABLE ENERGY SOURCE OF ENERGY mainly Solar energy is utilized in three different forms i.e., There are many options for making use of solar energy for de-centralized Applications. By spreading this technology, we can achieve.
   - Conservation of fossil fuels.
   - Conservation of Electrical energy,
   - Reduction of GHG emissions
   - Improving the living standards in rural areas
   - Creating self-employment/livelihood opportunities in rural areas
   - Improving per capita energy standards
   - Developing hygienic processes and environmental conditions
   - Providing energy to remote area communication systems.

2.8 . RENEWABLE ENERGY DEVICES / SYSTEMS& ENERGY CONSERVATION MEASURES THAT CAN HELP TO BRING ABOUT REDUCTION IN CONSUMPTION OFCONVENTIONAL ENERGY:

- Solar water heating systems,Solar cookers (Box and dish type) and Schaffer cookers for indoor cooking
- Solar steam generating systems and Solar drying/air heating systems, Solar refrigeration and air conditioning plants
- Solar concentrators for process heat applications
- Solar lanterns and Solar home lighting systems
- Solar generators, Street light solar control systems and Solar power packs, Solar hoardings , Solar street light /garden lights
- Solar traffic lights, Solar blinkers and Road studs
- Building Integrated Photovoltaic (BIPV).
- SPV power plants for decentralized applications.
- Wind turbines for power generation
- Power projects based on Municipal and Urban Waste and also on industrial waste through combustion/bio-methanisation technologies.
- Power projects based on methane available from STPs

- Bio-mass gasification and Co-generation projects in industries
- Biomass gasifiers based crematoriums
- Projects on methane utilization for thermal & electrical applications in industries

2.9 ENERGY CONSERVATION MEASURES:

a. LEDs/CFLs instead of incandescent bulbs
b. LED traffic lights
c. Electronics chokes and fan regulators
d. Sensors for automatic on/off of street lights
e. Automatic speed regulating fans/motors
f. Plugging of leakages in the water supply system and use of efficient pumps and motors
g. Energy efficient electrical appliances such as Fans, Refrigerators, Air conditioners, Coolers, Room Heaters, Water pumps etc.
h. Use of insulating materials and low-energy / energy-efficient building materials ex. fly ash bricks, hollow bricks, stabilized mud blocks, etc. in building construction.

2.10 LIGHTING: GENERATE AT HOME FREE POWER SAVE ENERGY AND REDUCE ELECTRICITY BILLS:

Lighting accounts for about 18% of all electricity consumed in the country. The majority of the lamps and fixtures used are Incandescent Light Bulbs or General Lighting Systems (GLS), with low efficiency.

- 90% of electricity consumed by GLS is wasted as heat and only 10% gets converted into visible light.
- Energy efficient lamps such as Fluorescent Tube Lights (FTL) and Compact Fluorescent Lamps (CFL), consume much less energy, offer the same light and are cool to touch.
- Replacement of GLS with CFLs- A 60 watt(W) Bulb, replaced with 15 W CFL,
- Give the same light, offers the following savings.

Power Saved is Power Generated

Sl. No.	**Consumption and Specification**	**Bed Lamp**	**CFL Lamp**	**LED Lamp**
1	**Power rating of Bulb - Watts**	15	5	0.1
2	**Energy Consumed for bulb using 8 Hrs a day - Watts**	120	40	0.8
3	**Energy Consumed for Month -- Watts**	3600	1200	24
4	**Energy Consumed for Month - Units**	3.6	1.2	0.024
5	**Amount we pay to Electricity Department for a Month (if Rs. 3.50 / Unit) - Rs.**	12.60	4.20	0.084
6	**Amont we pay to Electricity Department for a year (if Rs.3.50 / Unit) - Rs.**	151.20	50.40	1.008

NOTE:				
	1. If We use C F L lamp we save Rs / Year		**100.80**	
	2. If We use L E D lamp we save Rs / Year			**150.19**

2.11 ENERGY MANAGEMENT: Excellence in Energy Efficiency

"canbe achieved by".

a) Effective utilization of energy resources viz. Natural gas and Naphtha through improved operational practices, higher capacity utilization and use of appropriate technology.

b) Identifying and eliminating wastages of energy.

c) Adopting Energy Efficient and Eco friendly technologies.

d) Identify Energy Conservation measures and implementing energy Conservation activities.

e) Optimizing Process and Utilities.

f) Continual Improvement in the process for most efficient consumption of energy in each section.

g) Implementation of Newer technology in the plant wherever feasible,

h) Benchmarking and best practices.

i) To carryout regular internal and external energy audits to identify areas for improvement.

j) To be energy efficient always., improve energy conservation in all processes, judiciously in all our activities, at all levels , products and services thus transforming energy conservation into a strategic business goal. as a mass movement through participation from grass root level, meeting Energy Consumption Targets.

k) Improvement overall capacity utilization of the plant.

l) ENERGY Conservation & optimal utilization & utilities implementing of natural resources by adopting reduce, reuse and recycle methods, process and related activities be efficient use to preserve Environment and Conserve fossil fuels through enhanced use of renewable energy/recovered waste energy.

m) To create awareness on energy conservation among all employees through training, and natural resources. and efficient use of energy. By exchange of ideas with other group unit and energy audits by internal and external teams.

n) Always comply with energy conservation act and other revel event regulation & legislation. Benchmarking. Speedy execution of ENCON projects

3. STATE GOVERNMENT INITIATIVE AND AVAILABILITY FOR ADOPTING ENERGY CONSERVATION MEASURES

3.1 STATE GOVERNMENT INITIATIVE:

RENEWABLE ENERGY IN KARNATAKA

As on 31-1-2017

Sl No.	Renewable Energy Source		Tariff by KERC	Potential in MW	Capacity Allotted in MW	Capacity commissioned in MW
1	Wind		Rs. 4.50	15403.22	15403.22	4244.59
2	Small Hydro		Rs. 4.16	3000	3020.86	843.46
3	Cogeneration		Rs. 4.83	1916.85	1916.85	1317.05
4	Biomass	Air Cooled Condenser	Rs. 5.15	1000	369.98	134.03
		Water Cooled Condenser	Rs. 5.19			
5	Solar	SPV	Rs. 6.41	10000	1100	531.11
		ST	Rs. 10.85			
		SRTPV	Rs. 7.08-5.20			
		SRTPV (with 15% capital subsidy)	Rs. 6.03-4.43			
6	Waste to Energy		...	135	25.5	0
	Total		...	29618	23998.59	6067.08

Fig 1: Renewable Energy In Karnatka

3.2 POTENTIAL AREAS IN GOVERNMENT / COMMUNITY CENTRES TO IMPLEMENT RENEWABL ENERGY (WIND & SOLAR) SYSTEMS AND ENERGY CONSERVATION MEASURES:

POTENTIAL AREA FOR RE AND EE IN KARNATAKA			
SL	AREAS		TOTAL Nos.
1	COLLEGES	Engineering Colleges	186
		Polytechnics	248
		ITI	1003
		Union colleges	29
		Dental	44
		International schools	47
		Medical colleges	41
2	HOSPITALS	Major	100
		Taluka	176
3	NURSHING HOMES		100
4	ALL HOSTELS		1000
5	UNIVERSITIES		20
6	RELIGIOUS INTITUTIONS	Temples	19
		Mutt	1800
7	CMC/TMC		85
8	PRISIONS(JAILS)		80
9	DC/AC/TAHSILDAR OFFICE BUILDINGS		206
10	TALUK PANCHAYAT		176

11	ZILLA PANCHAYAT BUILDINGS		30
12	SP/DSP OFFICE		206
13	DISTRICT / TALUK COURTS		206
14	POLICE STATIONS		903
15	GUEST HOUSE		200
16	DEGREE COLLEGE		500
17	PUC		200
18	HIGH SCHOOLS		250
19	SUB REGISTER OFFICE		206
20	BJ/ KJ LIGHTING		1921679
21	PARKS		2000
22	KMF CENTERS	13 CENTERS	13
		MILK COLLECTING CENTERS	9600
23	BUS STANDS		206
24	ALL GOVERNMENT BUILDINGS		618
25	GRAM PANCHAYAT BUILDINGS		5600
26	IT COMPANIES		2156
27	MNC's		743
28	R & D CENTERES		103
29	HOTELS		250
30	DVC/DGP		8
31	DCF/ACF		206
32	FIRE STATIONS		188
33	FARMERS CENTERS		747
34	AGRICULTURAL DEPARTMENT	DISTRIC TRAINING CENTERS	23
		LABORATORES	48
		JOINT DIRECTORS	30
35	NAMMADI KENDRAS		700
TATOL			1952979

4. WORK DONE:

As part of My project work which is being carried out in one state government building in Bangalore, it is noted that there are electrical appliances which are pretty old and consume more energy!

The Energy Bill per month for buildings is approximately in lakhs.

Therefore, to reduce this amount of bill which is a result of usage of old electrical appliances it is proposed to replace all fluorescent tube lights with LED lights and other appliances like ceiling fans, wall mounted fans, heating coil electrical stoves, Air filters which are more than 10 years old

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- Total number of rooms in building are 39 and its of 3 floors.
- The entire building has 1 elevators
- Energy consumption is periodical because all rooms aren't occupied for an entire year.
- Even then due to the excess usage of all loads at once and uninterrupted power supply it is noticed that there is no limit to usage of loads and many equipment like fans, exhaust fans and lights are left ON for a longer period of time during the day.

Now the main concentration is on Tube lights.

For example: if a Tube light of 50 watts is used for 12 hours – 50x12 = 600 (total power in watts).

Now consider there are 14 fixtures in one house; then 14 fixtures * 50 watts each * 12 hours used = 8400watts/1000 = 8.40 kWh per day.

This will be the power usage for a single day.

Multiply this for 30 days it will be 3066 kWh.

This itself shows how large the power consumption by a lighting equipment which is meant to consume less electricity!

But, here in this case lighting equipment itself is consuming large amounts of Electrical Energy.

Therefore, to curtail this issue,

An order was issued to carry out a survey work of all Tube lights in the entire complex and an Estimation Report has to be submitted stating that –

- Just by replacing Tube Lights with better illumination fixtures; how much Energy can be saved?
- Given for the reduction in wattage what will be its benefits?
- Will it help economically?
- What will be the payback period?
- Also, for the same power consumption; given the roof area of buildings how many kilowatt capacity Solar Panels can be installed so as to make the entire complex Energy independent.

In the following tables it is shown how much power can be saved for an entire year and how much beneficial it'll be if we implement efficient electrical systems including lightings further more power consumption can be brought down.

Table 1: Comparative statement of Energy Savings for the existing systems with modified systems

Sl.No.	Details	kWh per day for existing load	kWh per day for proposed modified load	kWh energy saved after modification per day	KWh energy saved after modification per month
1	corridor	29.4	10.58	18.82	564.6
2	1st Floor	43.8	15.77	28.03	840.9
3	2nd Floor	46.8	16.63	30.17	905.1
4	3rd Floor	43.8	15.77	28.03	840.9
Total		163.8	58.75	105.05	3151.5

Table 2: Economic Analysis for modified lighting loads

Sl.No.	Area	No. of fittings required	M.R.P per fixture in Rs.	Investment required in Rs	KWh energy saved after modification per day	Amount saved @Rs.5.85/unit for energy reduced per day	Amount saved @Rs.5.85/unit for energy reduced per year	Pay Back Period in Years	Total Power saved in kWh/Year
1	Corridors	49	450	22050	18.82	110.10	40185.41	0.54870668	20183.04
2	1st Floor	73	450	32850	28.03	163.9755	59851.0575	0.54886248	33182.88
3	2nd Floor	77	450	34650	29.57	172.98	63139.34	0.5487862	32096.64
4	3rd Floor	73	450	32850	28.03	163.98	59851.06	0.54886248	38123.52
5	Total	272		122400	104.45	611.03	223026.86	0.54881281	123586.08

Table 3: Reduction of Socio Environmental Impacts after using Energy Conservation Measures

Sl No	Details	Annual Energy Saving in KWh	Coal at 1kg per unit in kg	water saving Litre at 3.3Ltr/unit	Co2 +GHG at 1kg/unit
1	corridor	6869.3	6869.3	22668.69	6869.3
3	1st Floor	10230.95	10230.95	33762.135	10230.95
4	2nd Floor	11012.05	11012.05	36339.765	11012.05
5	3rd Floor	10230.95	10230.95	33762.135	10230.95
Total		38343.25	38343.25	126532.725	38343.25

5. CONCLUSIONS:

- Overall reduction & effective usage of electricity
- Reduction in emission of GHG
- Economic benefits such as reduction in monthly energy bill
- Given for the same wattage better illumination
- It is the responsibility of the society to conserve energy, energy resources and protect the environment and save the mother land.

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