

# **LAL BAHADUR SHASTRI MEMORIAL FOUNDATION**

National Seminar on  
Energy Conservation – Energy Security  
26-04-2012

**“Total Energy Management,  
Energy Audit  
&  
Responsible Energy Governance  
For  
Energy Conservation - Energy Security in India”**

*A Comprehensive Approach*

*An Outline Presented by*

**Dr V Aravind**

697 Junction Road, Vriddhachalam – 606 001. Tamil Nadu.

**Energy conservation** refers to efforts made to reduce energy consumption. Energy conservation can be achieved through increased efficient energy use, in conjunction with decreased energy consumption and/or reduced consumption from conventional energy sources. An energy conservation act was passed in 2001. Energy conservation can result in increased financial capital, environmental quality, national security, personal security, and human comfort. Individuals and organizations that are direct consumers of energy choose to conserve energy to reduce energy costs and promote economic security. Industrial and commercial users can increase energy use efficiently to maximize profit.

Energy conservation, by reducing emissions, is an important part of combating climate change. Energy conservation facilitates the replacement of non-renewable resources with renewable energy. Energy conservation is often the most economical solution to energy shortages, and also an environmentally friendly alternative to increased energy production.

### **Energy conservation issues**

- The use of telecommuting by major corporates is a significant opportunity to conserve energy, as many work from home instead of commuting to work place each day.
- Electric motors consume more than 60% of the total electrical energy generated and are responsible for the loss of 10 to 20% of the total electrical energy converted into mechanical energy.
- Consumers are often poorly informed of the savings out of energy efficient products. The research one must put into conserving energy is much time consuming and costly when there are cheaper products and technology available using today's fossil fuels. Some governments and NGOs are attempting to reduce this complexity with ecolabels that highlights the differences in energy efficiency making shopping easier.
- Technology needs to be able to change behavioral patterns, it can do this by allowing energy users, business and residential, to see graphically the impact their energy use can have in their workplace or homes. Advanced real-time energy metering is able to help people save energy by their actions.
- People need practical and tailored advice on how to reduce energy consumption in order to make change easy and lasting. This applies to both efficiency in investments, such as investment in building renovation, or behavioral change, for example turning down the heating. To provide the kind of information and support people need to invest money, time and effort in energy conservation, it is important to understand and establish a link to people's topical concerns.
- Some retailers are of the view that bright lighting stimulates sales. However, health studies have demonstrated that headache, stress, blood pressure, fatigue and worker errors generally increase with the over-illumination present in many workplaces and retail settings. It has been shown that natural day lighting increases productivity levels of workers, while reducing energy consumption.

**Energy Security** is a term for an association between National Security and the availability of Natural Resources for energy consumption. Access to cheap energy has become essential to the functioning of modern economies. However, the uneven distribution of energy supplies among countries has led to significant vulnerabilities.

Threats to **Energy Security** include the political instability of several energy producing countries, the manipulation of energy supplies, the competition over energy sources, attacks on supply infrastructure, accidents, natural disasters, rising terrorism, and dominant countries reliance to the foreign oil supply.

Recent years have seen increasing attention to the issue of Energy Security. There are a number of concerns and fears though not limited to:

- Oil and other fossil fuel depletion (peak oil, etc)
- Reliance on foreign sources of energy
- Geopolitics (such as supporting dictatorships, rising terrorism, “Instability” in Nations that supply energy)
- Energy needs of poorer countries, and increasing demands from advancing developing countries such as China and India
- Economic efficiency versus population growth debate
- Environmental issues, in particular climate change
- The slow progress in utilization of Renewable and other alternative energy sources /sector.

### **Security Threats**

The modern world relies on a vast energy supply & fuel for everything from transportation, communication, security and health delivery systems. For every calorie of food produced in the industrial world, ten calories of oil and gas energy are invested in the forms of fertilizer, pesticide, packaging, transportation, and running farm equipments. Due to their vital roles energy sources are logical targets for attacks that seek to weaken infrastructure.

One of the leading threats to Energy Security is the significant increase in energy prices, either on the world markets – as has occurred in a number of energy crises over the years – or by the imposition of price increases by an oligopoly or monopoly supplier, cartel or country.

Rather than manipulating prices, such suppliers might go beyond this by suspending or terminating supplies. This is done to apply pressure during economic negotiations.

Energy plays an important role in the National Security of any given country as a fuel to power the economic engine. Hence, threats to Energy Security can also result from physical damage to the energy infrastructure either of the supplier, or of the importer as a result of natural events, misfortune, terrorism, or warfare. The political and economic instability caused by war or other factors such as strike action can also prevent the proper functioning of the energy industry in a supplier country.

New threats to energy security have emerged in the form of the increased world competition for energy resources due to the increased pace of industrialization in countries like India and China making the possibility of price rises resulting from the peaking of world oil production.

Increased competition over energy resources may also lead to the formation of security compacts to enable an equitable distribution of oil and gas between major powers. However, this may happen at the expense of less developed economies. A rise in inflation and a global economic slowdown may have a bearing.

### **Energy sector**

The energy sector fuels the economies. The energy infrastructure is divided into three interrelated segments: electricity, petroleum and natural gas. Natural gas although very efficient is in decline and becomes very hard to harvest and very dangerous to store. Electricity when produced is very harmful to the environment due to all the greenhouse gases leaked into the atmosphere.

### **Achieving Energy Security**

Long term measures to increase energy security center on reducing dependence on any one source of imported energy, increasing the number of suppliers, exploiting native fossil fuel or **renewable energy resources, and reducing overall demand through energy conservation measures.** Entering into international agreements / international energy trading relationships, such as the Energy Charter Treaty in Europe, can be done.

**For achieving total Energy Security,** Energy Conservation as an immediate remedy and further Fresh utilization of Renewable Energy sources as solution have become vital. Energy Conservation – Energy Security for India needs to be Managed, Audited, Monitored and Governed effectively, efficiently and responsibly.

### **Energy Management – What? Why? & How?**

"Energy management" is a term that has a number of meanings, but we are mainly concerned with the one that relates to saving / conserving energy in businesses, industry /agriculture / public-sector/government organizations and homes.

### **Why is it important?**

Energy management is the key to saving energy in your organization. Much of the importance of energy saving stems from the global need to save energy - this global need affects energy prices, emission targets, and legislation, all of which lead to several compelling reasons why you should save energy at your organization specifically.

### **The global need to save energy**

Globally we need to save energy in order to:

- Reduce the damage that we're doing to our planet, Earth.
- Reduce our dependence on the fossil fuels that are becoming increasingly limited in supply.

**When it comes to energy saving/conservation**, energy management is the process of monitoring, controlling, and conserving energy in a house, building, campus, public places, industry, business, agriculture or in any organization. Typically this involves the following steps:

1. Metering your energy consumption and collecting the data.
2. Finding opportunities to save energy, and estimating *how much* energy each opportunity could save. You would typically analyze your meter data to find and quantify routine energy waste, and you might also investigate the energy savings that you could make by replacing equipment (e.g. lighting) or by upgrading your building's insulation.
3. Taking action to target the opportunities to save energy (i.e. tackling the routine waste and replacing or upgrading the inefficient equipment). Typically you'd start with the best opportunities first.
4. Tracking your progress by analyzing your meter data to see how well your energy-saving efforts have worked. (And then back to step 2 and the cycle continues...)

"Energy Management" also includes and not limited to those energy-saving efforts that focus on making better use of existing buildings and equipments. Strictly speaking, this limits things to the behavioral aspects of energy saving (i.e. encouraging people to use less energy by raising energy awareness), although the use of cheap control equipments such as timer switches is often included in the definition as well.

### **Home energy management**

Whilst energy management has been popular in larger buildings for a long time, only recently it has started catching on in homes. Most homeowners aren't even aware of the term, and take more of a haphazard, flying-blind approach to reducing their energy consumption. But the monitoring- and results-driven approach used by professional energy managers is just as effective in the home as it is in larger buildings.

### **Controlling and reducing energy consumption at your organization**

Energy management is the means to controlling and reducing your organization's energy consumption. Controlling and reducing your organization's energy consumption is important because it enables you to:

- **Reduce costs** – this is becoming increasingly important as energy costs rise.
- **Reduce carbon emissions** and the environmental damage that they cause - as well as the cost-related implications of carbon, your organization may be keen to reduce its carbon footprint to promote a green, sustainable image and promoting such an image is good for the triple bottom line growth – Profit-People & the Planet.
- **Reduce risk** – the more energy you consume, the greater the risk that energy price increases or supply shortages could seriously affect your profitability, or even make it impossible for your business/organization to continue. With energy management you can reduce this risk by reducing your demand for energy and by controlling it so as to make it more predictable.

## How best to manage your energy consumption?

### 1. Metering your energy consumption and collecting the data

The more data you can get, and the more detailed it is, the better. The modern approach to energy-data collection is to fit interval-metering systems that automatically measures and records energy consumption at short, regular intervals such as every 15-minutes or half hour. Detailed energy consumption data makes it possible to see the patterns of energy wastes that it would be impossible to locate otherwise.

### 2. Finding and quantifying opportunities to save energy

The detailed meter data that you are collecting will be invaluable for helping you to find and quantify energy-saving opportunities. The easiest and most cost-effective energy-saving opportunities typically require little or no capital investment.

And one of the simplest ways to save a significant amount of energy is to encourage staff to switch equipment off at the end of each working day. Looking at detailed interval energy data is the ideal way to find routine energy waste. You can check whether staff and timers are switching things off without having to patrol the building day and night, and, with a little detective work, you can usually figure out who or what is causing the energy wastage that you will inevitably find.

And, using your detailed interval data, it's usually pretty easy to make reasonable estimates of how much energy is being wasted at different times. For example, if you've identified that a lot of energy is being wasted by equipment left on over the weekends, you can:

- a. Use your interval data to calculate how much energy (in kWh) is being *used* each weekend.
- b. Estimate the proportion of that energy that is being *wasted* (by equipment that should be switched off).
- c. Using the figures from a and b, calculate an estimate of the total kWh that are wasted each weekend.

Alternatively, if you have no idea of the proportion of energy that is being wasted by equipment left on unnecessarily, you could:

- i. Walk the building one evening to ensure that everything that *should* be switched off *is* switched off.
- ii. Look back at the data for that evening to see how many kW were being used *after* you switched everything off.
- iii. Subtract the *target* kW figure (ii) from the *typical* kW figure for weekends to estimate the potential savings in kW (power).
- iv. Multiply the kW savings by the number of hours over the weekend to get the total potential kWh energy savings for a weekend.

### 3. Targeting the opportunities to save energy

Just finding the opportunities to save energy won't help you to save energy - you have to take action to target them.

It can be a hard work, but, if you can get the people on your side, you can make bigger energy savings without investing anything other than time.

#### **4. Tracking your progress at saving energy**

Once you've taken action to save energy, it's important that you find out how effective your actions have been:

- Energy savings that come from behavioral changes (e.g. getting people to switch off their computers before going home) need ongoing attention to ensure that they remain effective and achieve their maximum potential.
- If you've invested money into new equipment, you'll probably want to prove that you've achieved the energy savings you predicted.
- If you've corrected faulty timers or control-equipment settings, you'll need to keep checking back to ensure that everything's still working as it should be. Simple things like a power cut can easily cause timers to revert back to factory settings - if you're not keeping an eye on your energy-consumption patterns you can easily miss such problems.
- If you've been given energy-saving targets from above, you'll need to provide evidence that you're meeting them, or at least making progress towards that goal.
- And occasionally you might need to prove that progress isn't being made (e.g. if you're at your wits' end trying to convince the decision makers to invest some money into your energy-management drive).

#### **Managing your energy consumption effectively - an ongoing process.**

At the very least you should keep analyzing your energy data regularly to check that things aren't getting worse. So at a minimum you should take a quick look at your energy data once a week, or even just once a month, to ensure that nothing has gone horribly wrong... It's a real shame when easy-to-fix faults such as misconfigured timers remain unnoticed for months on end, leaving a huge energy bill that could have easily been avoided. Managing your energy consumption doesn't have to be a full-time job, but you'll achieve much better results if you make it part of your regular routine.

#### **We have to exercise effective Energy Management, Energy Audit and Energy Governance in Energy Conservation initiatives and ensure Energy Security for India, supplementing the initiatives of the Government.**

The huge imbalance in the Demand & Supply position of Energy coupled with high cost factors in different kinds of fuels and energy having a great bearing in economic development of the country and directly affecting the life style and per capita income and savings of the people ,requires to be set right.

The elites of the society and the NGOs have a great role to play in this regard and the issue has to be taken on a broad scale, Nation wide, in a responsible manner in all the sectors and activities where energy is involved either in consumption or in production/ generation. To give shape to this lofty ideal the subject Energy Management, Audit and Governance is taken up in a broader spectrum involving a complete analysis of the scenario, facts, capacity and planning for the future, resulting in conservation and ensuring security for the Nation for a lasting change.

**Energy Management** involves data, performance sheets, assessments, planning, implementation, control and monitoring which necessarily includes Audit. The first step being taking stock of the resources available in non renewable as well as the renewable energy sectors for better clarity in the management functions. Some important aspects on each sector and functional area of the management are mentioned below for analysis. We have to define, analyse, manage, innovate, promote, monitor and control the process in our respective areas and in the society at large.

## **1. Non-Renewable Energy Sources & Energy Supply Scenario in India**

- o Primary Energy Consumption in India
- o Indian Current Energy Scenario - Coal, Oil & Gas & Electricity
- o Sector wise Energy Consumption & Economic Growth / Growth Rate, in India
- o Long Term Energy Scenario for India
- o Energy & Development of the Country
- o Present Mix of Non-Renewable Energy Sources
- o Trends in Energy Demand & Supply
- o Supply & Demand Shortages
- o Energy Intensity
- o Availability of Fossil Fuels – Coal & Lignite, Petroleum Products & Natural Gas
- o Availability of Electrical Energy –Thermal, Hydro & Nuclear Energy
- o Energy Pricing in India
- o Import of Energy

## **2. Renewable / Alternate Energy Sources Scenario**

- o Solar Energy – Thermal & Photo-voltaic, Solar Collector Technologies
- o Solar Thermal - Solar Water Heating Systems
- o Solar Thermal Power Plants
- o Solar Photo-voltaic Systems & PV Technologies
- o Present PV Scenario in India
- o Government Incentives for Solar Systems
  
- o National Solar Mission
- o Wind Energy Generation & Present Status of Wind Technology in India
- o Wind Power Generation in India
- o Hydro Energy / Hydrogen Energy Development
- o Bio-mass Energy, Characteristics of Bio-mass or Organic wastes, Energy Plantation, Bio-mass Generation & Utilization, Biomass Management, Characteristics of Briquettes and their Use, Biomass Pyrolysis, Biomethanation, Bio-methanation Plants, Thermo Chemical Process, Biomass Power Generation
- o Bio-fuels – Characteristics of Bio-diesel, Importance, Production & Applications, Government Policy, Status of Bio-fuel Technologies
- o Fuel Cells Development
- o Energy From Solid & Liquid Waste
- o Wave Energy Development in India
- o Tidal Energy Development in India
- o Geothermal Energy Development



### **3. Present Electricity Tariff & Thermal Energy Pricing**

#### **4. Energy Supply - Coal Sector in India**

- o Recoverable Coal Reserves
- o Indian Coal Classification, Grades & Quality
- o Technology Improvements in Coal Sector
- o Uses of Coal & Advantages of Usage of Coal
- o Coal Demand
- o Indigenous Production & Import of Coal
- o Coal Distribution Policy
- o Coal linkages & Policies
- o Coal Washing & Clean Coal, Coal Gasification, Coal beneficiation
- o Coal for Electricity Power Generation
- o Role of Coal in Power Generation in India
- o Coal Pricing
- o Coal Sector Reforms
- o Organizations involved in Coal Sector in India
- o Environmental Effects of Coal

#### **5. Energy Supply - Oil Sector in India**

- o Oil Reserves & Oil fields in India
- o Overview of Petroleum Industry in the Country
- o Petroleum Composition & Products
- o Uses of Oil, Advantages & Problems in Usage of Oil
- o Demand and Supply of Oil
- o Problems in Growth of Oil Sector
- o Oil Exploration in India & Exploration Policy
- o Oil Refining Industry in the Country
- o Crude Oil Imports and Problems of International Availability & Pricing
- o Pricing of Petroleum Products
- o Challenges in Oil Sector Development in India
- o Oil Sector Reforms in India and Government Initiatives
- o Organizations involved in Oil Sector
- o Indian Overseas Ventures for Securing Oil
- o Equity Oil
- o Environmental Effects of Oil

#### **6. Energy Supply – Natural Gas Sector in India**

- o Natural Gas Reserves & Gas fields in India
- o Gas Industry in India
- o Natural Gas as an Efficient Fuel
- o Usage of Gas, Advantages & Problems in Usage of Gas
- o Gas based Power Generation
- o Demand & Supply of Natural Gas
- o Natural Gas Exploration in the Country
- o Gas Exploration Policies & Strategies
- o Gas Distribution Policy

- o Gas Imports
- o Problems in Growth of Gas sector
- o Problems of Gas Availability & Pricing
- o Challenges in Gas Sector Development in India & Remedial Measures, Government Initiatives
- o Highlights of Natural Gas Sector, Gas Sector Reforms and Government Initiatives
- o Organizations Involved in Gas Sector
- o Environmental Effects of Natural Gas

## **7. Electrical Energy Supply & Power Generation**

- o Growth & Break-up of Installed Power Generation Capacity in India
- o Shortfalls in Achieving Power Generation Capacity Targets in Various Plan Periods
- o Shortfall in Electricity Generation
- o Issues Related to Power Generation Capacity Building
- o Present Sector wise Power Generation Capacity in the Country
- o Growth of Thermal Power Generation – Coal based, Oil based & Gas based Power Generation
- o Combined Heat and Power Plants, Co-generation, Tri-generation, Hybrid power Generation
- o Ultra-Mega Power Plants
- o Super Critical Power Generation Technology
- o Environmental Effects of Thermal Power Plants
- o Hydro Power Generation
- o Nuclear Power Generation
- o Captive Power Generating Capacity in the Country
- o Electricity Demand & Power Generation Capacity
- o Establishment of New Power Generation Capacity
- o Long Term Power Generation Scenario in India
- o Development of Thermal, Hydro and Nuclear Power Generation

## **8. Renewable Energy Sources Power Generation in India**

- o Solar Photo Voltaic Power Generation
- o Solar Thermal Power Generation
- o Wind Energy Generation

## **9. Transmission & Distribution Sector Developments in India**

- o Development of National Electricity Grid
- o Accelerated Power Reforms & Development Programs (APRDP)

## **10. Energy Needs & Energy Intensity in India**

- o Energy Needs for Growing Economy
- o Energy Intensity in India
- o Energy Intensity on Purchasing Power Parity

## 11. Material & Energy Balance

- o Need of Material and Energy Balance
- o Classification of Processes
- o Material Balance- Levels
- o Energy Balance - Conservation of Energy, Heat Balance

## 12. Energy Efficiency in Electrical & Thermal Utilities

### Energy Efficiency in Electrical Systems and Major Electrical Equipments

- o Electrical Power Supply Systems
- o Industrial Electrical Power Distribution System
- o Electricity Billing
- o Electrical load and Load Management
- o Maximum Demand & Maximum Demand Control
- o Power Factor, Power Factor Improvement, Capacitors,
- o Losses in Industrial Distribution Systems
- o Demand Side Management (DSM)
- o Transformers – Types, Ratings, Location of Transformers, Transformer Losses & Efficiency, Parallel Operation, Energy Efficient Transformers, Energy Labeled Transformers
- o Electric Motors – Motor Efficiency & Losses, Energy Efficient Motors, Energy Labeling
- o Pumps and Pumping Systems – Factors Affecting Pump Performance Efficient Pumping System Operation, Energy Conservation Opportunities
- o Compressors & Compressed Air Systems – Compressor Performance, CA System Components, Efficient Operation of Compressed Air System, Compressor Capacity Assessment, Energy Efficiency in CA Systems
- o Fans & Blowers – Performance Evaluation, Efficient Operation, Performance Assessment, Energy Saving
- o Air Conditioning & Refrigeration Systems-AC & Refrigeration Systems, Compressors, Factors Affecting Performance& Energy Efficiency of AC / Refrigeration Plants, Performance Assessment of AC Plants, Energy Saving Opportunities
- o Cooling Towers- Types, Cooling Tower Performance, Efficient Operation, Energy Saving Opportunities
- o Illumination / Lighting System- Control gear, Day lighting, Interior Lighting, Exterior Lighting, Commercial Lighting, Industrial Lighting, Lighting & Air Conditioning, Recommended Illumination Levels, Energy Saving Opportunities, Energy Efficient Lighting Control, Energy labeling for Lamps
- o Diesel Generating Sets – Proper Selection & Operation, Assessment of Energy Performance, Energy Saving Measures
- o Energy Efficient Technologies in Electrical Systems

## **Energy Efficiency in Buildings & Energy Conservation Building Code**

- o Energy Efficient Buildings, Green Buildings, Eco-friendly Buildings & Intelligent Buildings
- o Energy use and Energy Efficiency in Buildings
- o Green Building Design Strategies – Energy use, Factors affecting energy use, Building Orientation, Shading, Types of Shading Devices.
- o Thermal Comfort in Buildings
- o Energy Conservation Building Code (ECBC)
- o ECBC Guidelines on Building Envelope
- o ECBC Guidelines on HVAC
- o ECBC Guidelines on Service Hot Water
- o ECBC Guidelines for Pumping System
- o ECBC Guidelines for Lighting
- o ECBC Guidelines for Electric Power System, Transformers & Motors
- o ECBC Guidelines for UPS Systems, Escalators & Elevators
- o Modeling of Buildings
- o Building Management Systems
- o Energy Efficiency Rating Systems for Buildings – BEE Star Rating System, Leed System, TERI-GRIHA System

## **Energy efficiency in Thermal Utilities**

- o Fuels & Combustion – Combustion, Combustion of Coal, Oil, Gas & Biomass
- o Boilers - Boiler Systems, Types, Classification of Boilers, Boiler Efficiency, Performance Evaluation, Water Treatment, Blow down, FBC Boilers, Energy Conservation Opportunities
- o Steam Systems- Properties of Steam, Steam Distribution, Efficient Steam Utilization, Proper Selection, Operation & Maintenance of Steam Traps, Efficient Steam Utilization and Energy Conservation Opportunities
- o Thermic Fluid Systems
- o Furnaces & Ovens – Types & Classification of Furnaces, Performance Evaluation, Fuel Economy Measures in Furnaces & Ovens, Effect of Utilization on Energy Consumption
- o Insulation & Refractory- Purpose, Application, Cold Insulation, Refractories, Properties of Refractories & Selection, Heat losses from Furnace Walls, Energy Saving Measures
- o Waste Heat Recovery Systems – Applications & Types, Benefits, New Developments, Heat Recovery Devices
- o Heat Exchangers – Basics & Concept, Types, Applications for Processes and Energy Efficiency Improvement
- o Energy Efficiency in Thermal Power Generating Stations
- o Co-generation and Tri-generation

## **13. Energy Conservation & Energy Efficiency**

- o Need for Energy Conservation and Its Importance
- o Energy Conservation & Energy Efficiency
- o Short Term, Medium Term & Long Term Energy Strategy for India

#### **14. Energy Conservation Measures – Creation of awareness**

- o Energy Audit Study Reports – Importance, Contents, Report Writing & Presentation
- o Energy Costs
- o Benchmarking
- o Energy Performance Matching Energy Use to Requirements
- o Maximizing System Efficiencies
- o Fuel & Energy Substitution
- o Instruments & Metering for Energy Audit
- o BEE Regulation for Energy Audit - 2008

#### **15. Energy Security**

- o Energy Security – Coal, Oil, Gas & Electricity
- o Need & Objectives
- o Curtailing Dependence on Import of Energy
- o Action Plan & Strategy for Achieving Energy Security
- o Removal of Barriers in Implementation

#### **16. Energy Management & Audit**

- o Energy Audit Definition as per EC Act 2001
- o Need of Energy Audit
- o Types of Energy Audit and Approach – Walk through Audit, Preliminary Audit, Targeted Audits, Detailed Energy Audit, Internal Audit, External Audit, Investment Grade Audit, Industrial Energy audit, Utility (Services) Energy Audit, Commercial Energy Audit, Residential Energy Audit
- o Basic Components of Energy Audit – Preparation for Audit Visit, Instruments, Data collection, Analysis, Safety considerations
- o Instruments for Energy Audit
- o Methodology & Approach for Energy Audit
- o Important Survey Items – Buildings, HVAC, Furnaces & Ovens, Boilers & Steam lines, Air Compressor & CA System, Pumps & Pumping System, Fans & Blowers, Cooling Towers, Chillers & Chilled Water Distribution lines, Process Water lines, Electrical Distribution lines, Transformers, Motors, Waste Heat Sources, Material Transport.
- o Post Audit Analysis
- o Identification of Opportunities for Energy Saving, Techno-economic Analysis of

#### **17. Energy Management – (Energy Action Planning)**

- o Obtaining Top Management Commitment & Support
- o Fixing Key Elements for Successful Energy Management
- o Energy Policy for Nation and States
- o Energy Policy for Central and State Energy Nodal Agencies
- o Energy Policy for Industries – Purpose, Contents, Formulation, Formats
- o Assessing Energy Profile & Establishing Baseline
- o Energy Conservation Team, Role & Responsibility of Energy Manager
- o Appointing Energy Manager
- o Organizing Effective Energy Management – Energy Management Committee, Motivation of Employees

- o Implementation - Communication & Training
- o Energy Management Tools for Effective Implementation – SS, Keizen, TPM, TQM & ISO 50001
- o Evaluating Energy Performance & Recognizing Achievements
- o Energy Management Information System – Need, Contents, Approach & Methodology
- o Financing of Energy Saving Project and Payback Analysis
- o Concept of Sustainability

### **18. Energy Governance and Compliance.**

Total Energy Management and Energy Audit in order to be successful, should be supplemented and supported by responsible governance. The style of governance should cover all the functional areas of the management and audit. The legal and statutory obligations should be met and the compliance should be ensured. There comes the necessity to have the basic knowledge of various Acts/Laws/Policies of the Govt. in the subject and the connected activities. An over view of certain points will be helpful.

- o Energy Conservation Act 2001 – Brief History, Aims & Objectives, Salient Features
- o Energy Conservation (Amendment) Act 2010 – Need, Salient Features
- o Opportunities Created by Energy Conservation Acts 2001 & 2010.
- o Role of Nodal Agencies – Bureau of Energy Efficiency (BEE)
- o Role of State Designated Agencies (SDAs) in Implementation of ENCON Acts
- o Energy Conservation Acts at A Glance
- o Prevailing Acts in Electricity Sector in India
- o Energy Conservation Act 2003 - Aims & Objectives, Salient Features
- o Opportunities Created by the Act
- o Electricity Act 2003 at a Glance

### **Implementation of Energy Related Acts & Regulations**

Being responsible citizens we can be helpful to the Govt. through voluntary action.

- o Present Status of Implementation of Energy Conservation Act 2001 & Energy Conservation (Amendment) 2010.
- o Related Policies, Implementation
- o Role of Central Agencies (BEE) & State level Agencies
- o Various Schemes of BEE – ECBC, S & L, DSM, SME, BLY, National Certification Examination for Energy Managers & Energy Auditors.
- o Present Status of Implementation of Electricity Act 2003
- o Impact of Implementation on Power Sector
- o Environmental Laws & Regulations (Related to Energy Sector)
- o Environmental Laws & Regulations (Related to Energy Sector)
- o Laws & Regulations Related to Renewable Energy Sector
- o Renewable Purchase Obligation (RPO/RPS)
- o Framework of Central Electricity Authority (CEA), Central & State Electricity Regulatory Commissions (CERC & ERCs) – Functioning & Powers
- o National Mission for Enhanced Energy Efficiency
- o National Electricity Policy
- o Integrated Energy Policy & Renewable Energy Policy