Narayanan A.M

Narayanan is the Head of Energy Efficiency Division of Energy Management Centre, Government of Kerala, India. His efforts since 2008 in formulating, realizing and executing Programs and Projects in efficient use of energy and its conservation supplemented in securing three times National award to the State in the implementation of Central Act of Energy Conservation.

In 2009, as Director of the State Government Agency for Renewable Energy Development he contributed to the organization strengthening and stream lining technical functions. He commendably dealt with the generation, distribution, and trading related activities, in the capacity of Deputy Director, with State Electricity Regulatory Commission during 2004-2007. In 1994-2004 he was Operations Manager and Chief Operating Officer of a LLC, and accomplished critical and prestigious projects in Oil and Gas and Utility sectors in Middle with Western and European principles. During 1987-2004 he was Deputy Director - Energy Management with one of the Government of India organizations; he was team leader and field member in conducting Energy Optimization Consultancy Projects for large Industries and Utilities and set several normative benchmarks and drafted energy audit manuals. From 1981 to 1985 he has executed ten medium Industrial Electrical Installation projects as a Licensed Engineer in a Private Limited Company.

Narayanan's domain knowledge includes Process and Engineering Industries, Water, Power and Communication Utilities, Industrial Equipments and Systems, Techno-economic analysis, Energy Optimization Studies, Training, Applied Research, Energy Efficiency Improvements Projects, Renewable Energy and Electricity Regulatory Functions.

Narayanan is Electrical Engineering Graduate (1981) and Masters in Energy Management (1987). He is also a certified Energy Auditor and Manager (2011). Since 2011 he is carrying out PhD in Power System.

Contact: **Narayanan AM**
Head-Energy Efficiency Division
Energy Management Center
(Department of Power, Government of Kerala, India)
Mob: +91-8281093119
Alternate e-mail: narayan@keralaenergy.gov.in

Abstracts

1. Energy Efficiency Consideration in Electricity Supply Chain

Background

Since the enactment of Electricity Act, 2003 in India, the power sector has undergone major structural changes. The Act is based on the philosophy that consumers benefit from growth of competitive markets. The Act has de-licensed generation, encouraged captive power without any license requirements and invoked 'Open Access'. The trading platform of Exchanges has also started.

The Energy Conservation Act, 2001 provides for the legal framework, institutional arrangement and regulatory mechanism at the Central and State level to embark upon energy efficiency drive in the country. Measures include, pilot phase programmes for energy efficiency, preparation of action plan for wider dissemination and implementation of Energy Efficiency and Conservation, energy conservation building codes(ECBC), Standards and Labelling Program to identify energy efficient appliances and equipment, setting up DSM (demand side management) Cell by electric utilities, formulation of energy efficiency codes, norms and standards. The Act mandated the setting up of a Bureau of Energy Efficiency (BEE), introduction of energy conservation norms and make aware of the economics and efficacy of the conservation of energy.

Electricity Supply Chain (ESC) consists of Generation, Transmission, Distribution and End-Use Applications. The cascade energy efficiency of ESC is the product of energy efficiency of each stage.

Objectives

- Cascade Energy Efficiency Concept
- Energy Efficiency Considerations in each component of the ESC
- Monitoring and verification of Energy Efficiency of each component of the ESC
- Regulatory provisions and significance

Expected Outcome:

Comprehension of energy efficiency consideration and cascade energy efficiency of Electricity Supply Chain is expected to lead to the insights of technical, economical and regulatory studies of Power system.

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2. Energy Efficient Commercial Buildings –Energy Conservation Building Code

Background

Indian commercial building floor space is expected to double by 2050, with retail establishments and large private offices showing the largest increases in new floor space.

Growth and developmental needs, increasing demand for commercial building services and comfort levels and the rise in time spent inside buildings, usher the upward trend in energy demand by commercial buildings. Building services such as HVAC systems, lighting,

innumerable number of appliances and equipments, entertainment, automation, problems associated with water and waste management and land use make the commercial building sector energy and environment intensive.

Many studies over the past decade analysed the potential energy conservation opportunities and pointed out the wide band width of Specific Energy Consumption in terms of Energy Performance Index of commercial buildings. Many formats, ratings, codes, guidelines and technologies and systems have emerged. "Zero energy" and "Energy plus buildings" are being realised in many parts of the world.

The Energy Conservation Building Code (ECBC) was launched by Government of India in May 2007, for promoting energy efficiency in the building sector. It is estimated that the nationwide mandatory enforcement of the Code will bring down the energy intensity of the commercial buildings, yielding considerable savings in annual energy and demand savings.

ECBC cover the following components of buildings:

- Building Envelope (Walls, Roofs, Windows)
- Lighting (Indoor and Outdoor)
- Heating Ventilation and Air Conditioning (HVAC) System
- Solar Hot Water Heating
- Electrical Systems

Objectives:

- Overview of Energy Performance Index of Commercial Buildings
- Technical insight to the factors influencing the energy consumption of commercial buildings
- Review of energy efficiency consideration at design stage with reference to important components
- ECBC Compliance matrix

Expected outcome:

Deliberations are expected to provide the fundamentals of energy efficiency considerations that could lead the participants to identify potential research activities in Energy Efficiency in Building sector.

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3. Thrust Areas in Energy Conservation in India and enabling provisions

Background

Considering the vast potential of energy savings and benefits of energy efficiency, the Government of India enacted the Energy Conservation Act, 2001 (Central Act 52 of 2001) with effect from 1st March, 2002. The Act provides for the legal framework, institutional arrangement and a regulatory mechanism at the Central and State level to embark upon energy efficiency drive in the country.

Some of the salient thrust areas include the following:

<u>Standards and labelling programme</u>:

In addition to the objective of informed choices to consumers, this program leads to huge energy savings, reduces capital investment in energy supply infrastructure, enhances the product quality, strengthens the competitive markets, builds position for domestic industries to compete in such markets where norms for energy efficiency are mandatory, removes indirect barriers to trade, reduces carbon emission and helps meet climate change goals.

Demand side management

The Demand Side Management and increased end use efficiency can together mitigate energy shortages to a certain extent and drastically reduce capital needs for capacity expansion.

Energy Conservation Building Code (ECBC)

Harmonization of ECBC with National Building Code (NBC) and notification of ECBC at State level is under progress

Financing energy efficiency

State Energy Conservation Fund (SECF) is a statutory requirement as per the Energy Conservation Act 2001

Professional certification and accreditation

Creating a cadre of professionally qualified energy managers with expertise in energy management, project management, financing and implementation of energy efficiency projects, and policy analysis is going on. Passing of the National level certification examination as the qualification for a Certified Energy Manager & Certified Energy Auditor is in place.

Expected outcome

The insights are expected to lead the participants to areas such as Energy Use and Technology Analysis, Identification and Implementation of Energy Efficiency Enhancement Projects, Capacity Building, Implementation of Energy Efficiency measures and Facilitation of Innovative Financing Mechanisms.

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4. Energy Efficiency and Economy

Background

Efficient use of energy results fewer resources to achieve the same goals, thus reducing costs, preserving valuable natural resources, addressing energy security and environmental impact , while meeting growth and development needs , gaining a competitive edge in an increasingly tough global marketplace. The inefficient energy management means tremendous waste of energy resources and money and adverse impacts on environment

Germany comes in first in a new energy efficiency ranking of the world's major economies, followed by Italy, the European Union as a whole, China, and France; new to the rankings are four nations: India, Mexico, South Korea, and Spain. (American Council for an Energy-Efficient Economy, ACEEE, 2014)

The metrics for energy efficiency and economy analysis include primary energy resource recovery policy, primary energy to secondary energy conversion, equipment level and system level energy efficiency enhancement, efficient end-use applications in socio-economic sectors, water efficiency policy, fuel efficiency standards and penetration of renewable energy resource. Energy Efficiency improvements calls for benchmarking energy efficiency and energy savings targets, strengthening codes and standards, supporting education, training and research, and prioritizing energy efficiency in design, construction and operations.

To reduce energy intensity of the Indian economy, developing policies and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act, 2001, ensuring participation of all stakeholders is showing accelerated and sustained adoption of energy efficiency in all sectors. India aims at higher penetration of energy efficient technologies and renewable to meet energy demands and environmental challenges.

The market for energy efficiency is growing, with aggregate annual investment reaching USD 300 billion in 2012 – equal to investments in coal, oil and gas generation. The resulting savings have been larger than the energy provided from any other fuel, making energy efficiency the “first fuel” for many countries. An International Energy Agency (IEA) analysis shows that the uptake of economically viable energy efficiency investments has the potential to boost cumulative economic output through 2035 by USD 18 trillion – larger than the current size of the economies of the US, Canada and Mexico combined.

Objectives and expected outcome

It is expected to lead the participants to identify potential areas for further research and to integrate the available knowledge in engineering and technology to strengthen the energy efficiency and economic linkage.