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# Smart Grid - Demand Response, Energy Storage, and Enhancing Energy Efficiency— Pankaj Batra

NATIONAL CONFERENCE

# INCLUSIVE CLEAN ENERGY SOLUTIONS IN ADB OPERATIONS

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# Definit

- The first official definition of Smart Grid was provided by the Energy Independence and Security Act of 2007 (EISA-2007) of the USA.
- This provides a description, with ten characteristics, that can be considered a definition for Smart Grid, among them, the first two being (1) Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid. (2) Dynamic optimization of grid operations and resources, with full cyber-security.
- The IEEE defines a smart grid as an electrical grid that uses information technology, automation, and communication systems to monitor and control power flow.

# History of Smart Grid in India

- The **India Smart Grid Task Force (ISGTF)**, an inter-ministerial group, was launched in May 2010. The Indian government established the task force to accelerate the implementation of smart grids in India and to provide policy guidance for smart grid initiatives in India. It was created under the Ministry of Power (MoP).
- The **India Smart Grid Forum (ISGF)** was another organization established in 2011, a public-private partnership to advise the government on smart grid policies and programs. The ISGF also worked with national and international agencies to develop standards, and helped utilities, regulators, and industry with technology selection, training, and capacity building.
- The **National Smart Grid Mission (NSGM)** was established in 2015 to accelerate the deployment of smart grids in India. The India Smart Grid Task Force (ISGTF) Secretariat was merged with the NSGM Project Management Unit, and housed at POWERGRID.

# Importance of Smart Grid

- Helps modernize energy systems,
- Helps integrate renewable sources of energy,
- Optimizes operation of the power system resulting in reduced cost of supply, and reduced emissions.

# Phasor Measurement Units – stethoscope for

- The Indian power grid has over 1,700 Phasor Measurement Units (PMUs) installed across the country, one of the first countries in the world to cover the entire Indian grid.
- There are more than 2,500 phasor measurement units (PMUs) installed across the United States' bulk power systems.

# Largest grid scale battery system in the world -California

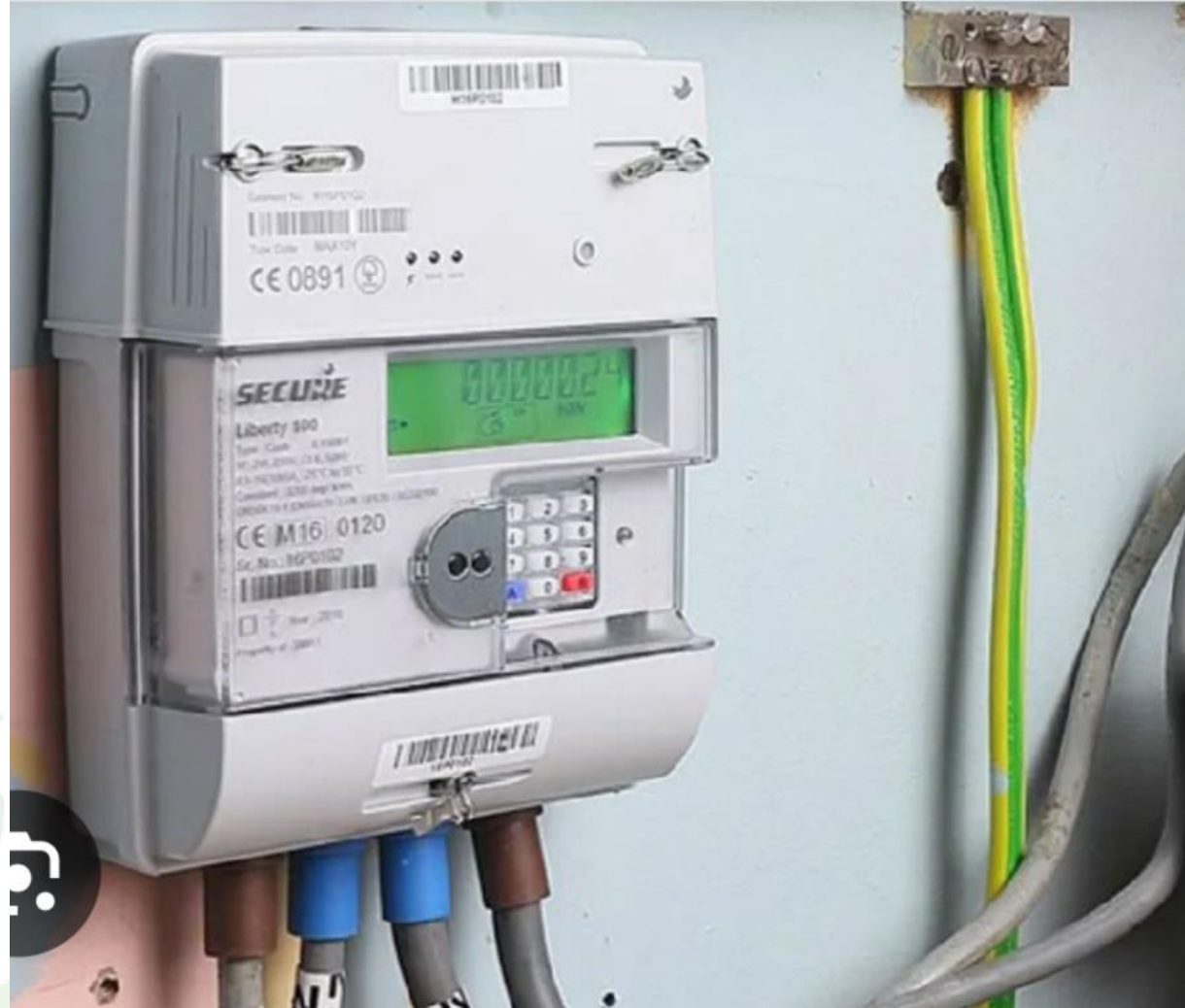
750 MW / 2,000 MW



# World's largest sodium-ion battery – China, 100



# Smart meter





# EV charging



# Electric Cooking



# Industrial Revolution 4.0

- Industry 4.0 is the fourth industrial revolution and is characterized by technological innovations that support organizational efficiency.
- Some of the innovations of Industry 4.0 include:
  - Cloud computing
  - Internet of things (IoT)
  - Additive manufacturing
  - Augmented reality
  - Artificial intelligence (AI)
  - Robots
  - Digital twins
  - Block chain Technology

# Thank



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