National Smart Grid Mission
Ministry of Power
Government of India

2nd National Summit on 100 Smart Cities India 2016

Smart Grids

National Smart Grid Mission-PMU
Ministry of Power, GoI

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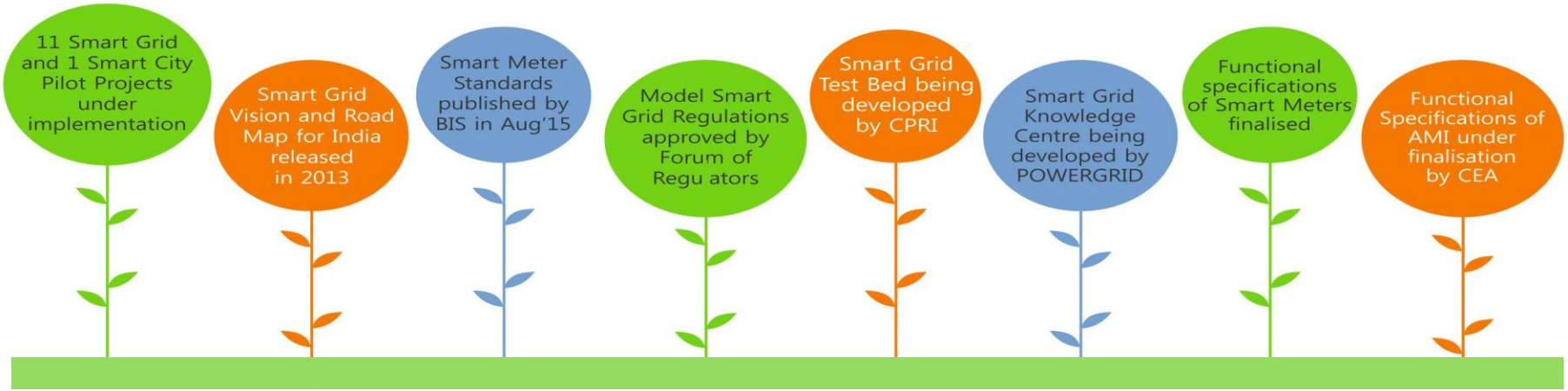
Smart Grid Vision for India

"Transform the Indian power sector into a secure, adaptive, sustainable and digitally enabled ecosystem that provides reliable and quality energy for all with active participation of stakeholders"

Smart Grid Journey of India- till Date



- First 3 day training program for Utility personnel completed with support of USAID
- 3 National level Brainstorming sessions conducted for Smart Grid Development
- Indo-Japan conference on Smart Grid held in Aug'16
- Regular participation in ISGAN teleconferences for Knowledge exchange

National Smart Grid Mission

The Government of India approved the establishment of a National Smart Grid Mission (NSGM) in Power Sector. (OM issued on March 27, 2015)

NSGM to plan and monitor implementation of policies and programmes related to Smart Grid activities in India.

NSGM will have its own resources, authority, functional & financial autonomy.

NSGM - Project Management Unit (NPMU) housed in POWERGRID - Single point contact for GoI's views on Smart Grid.

The total outlay for NSGM activities for 12th Plan: **Rs. 980 crore with a budgetary support of Rs. 338 crore.**

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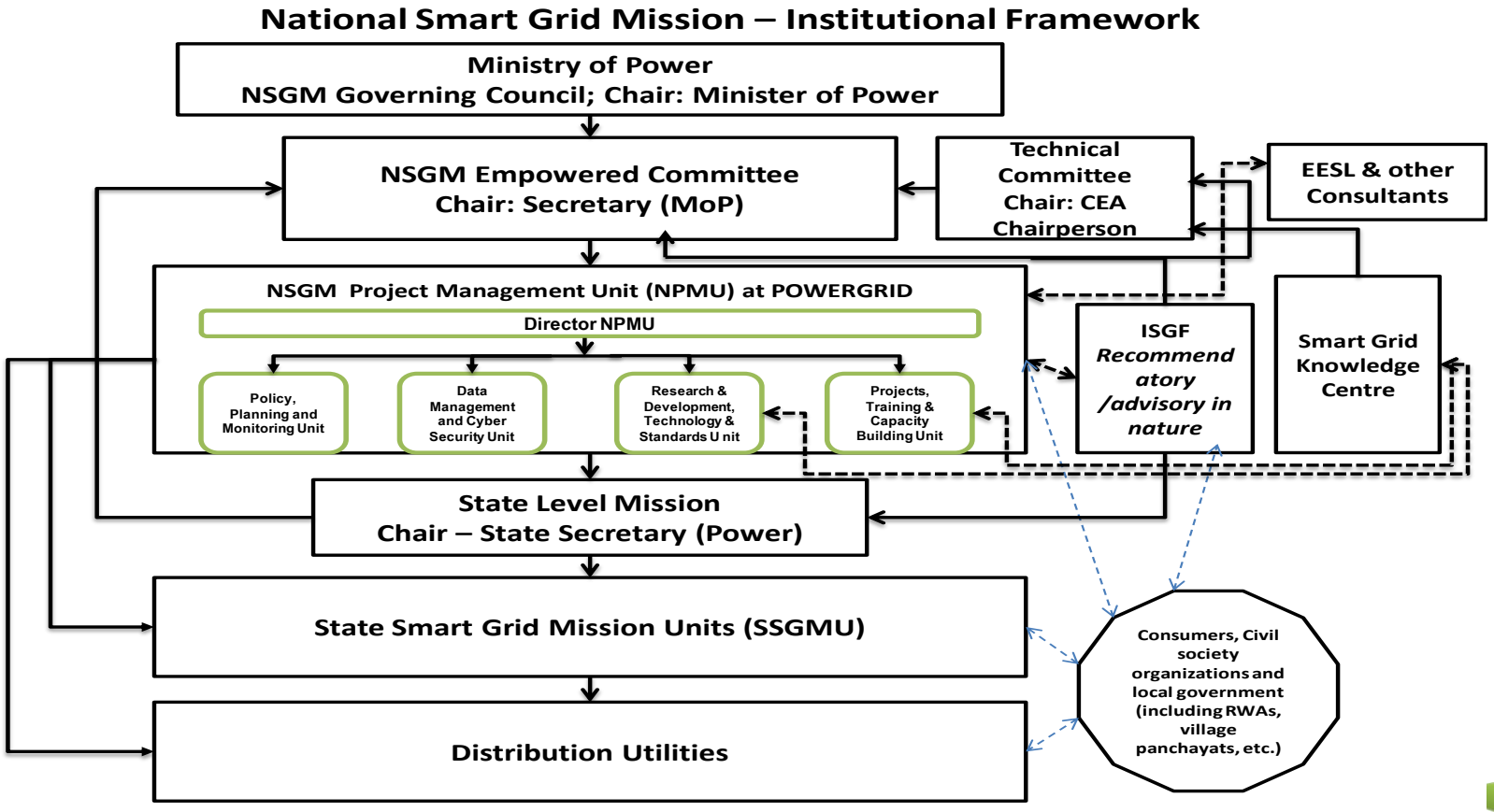
NSGM – Three Tier Structure



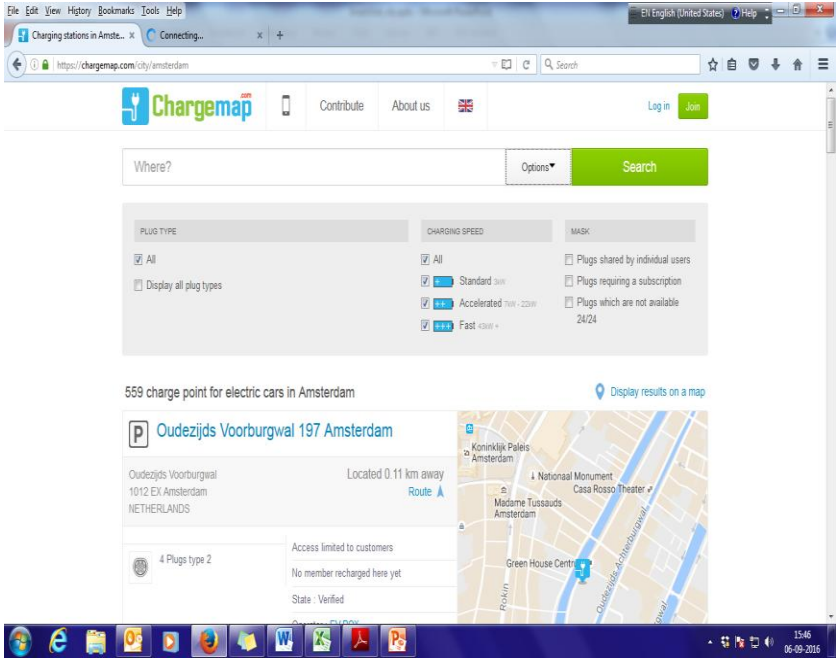
Smart City has ample space and facilities to make people living there happy

Smart City

Affordable Quality Power 24X7

Rapid Transport Systems

Consumer Empowerment



Location and distance of EV charging stations is available online

Consumer knows the daily consumption pattern of electricity to plan monthly budget

ILLUSTRATIVE LIST

Smart Solutions

E-Governance and Citizen Services

1. Public Information, Grievance Redressal
2. Electronic Service Delivery
3. Citizen Engagement
4. Citizens - City's Eyes and Ears
5. Video Crime Monitoring

Waste Management

6. Waste to Energy & fuel
7. Waste to Compost
8. Waste Water to be Treated
9. Recycling and Reduction of C&D Waste

Water Management

10. Smart Meters & Management
11. Leakage Identification, Preventive Maint.
12. Water Quality Monitoring

Energy Management

13. Smart Meters & Management
14. Renewable Sources of Energy
15. Energy Efficient & Green Buildings

Urban Mobility

16. Smart Parking
17. Intelligent Traffic Management
18. Integrated Multi-Modal Transport

Others

19. Tele-Medicine & Tele Education
20. Incubation/Trade Facilitation Centers
21. Skill Development Centers

Smart Grid in Smart City

- the purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development
- assured electricity supply with at least 10% of the Smart City's energy requirement coming from solar

Relevance of Smart Grid

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The implementation of smart grid would act as an enabler to transform the existing distribution grids to become more efficient, self-healing, reliable, safer and less constrained, thus benefiting all stakeholders

Generation	Transmission	Distribution	Consumer
• Managing distributed generation • Forecast and monitor RE availability and potentially use energy storage • Dispatch of power to match grid conditions • Integration of RE into the grid	• Increasing the capacity of transmission corridors through SVC • WAMS for enhancing transfer capability in real time, advanced automatic corrective actions, better visualization	• Improved electricity access, quality and reliability of supply, reduce losses, • Improvement in distribution sector financial viability through optimal resource utilisation	• Consumer empowerment thru availability of information • Consumer participation for Demand Side Management • Prosumer Enablement

Smart Grid – Concept Definition of Smart Grid

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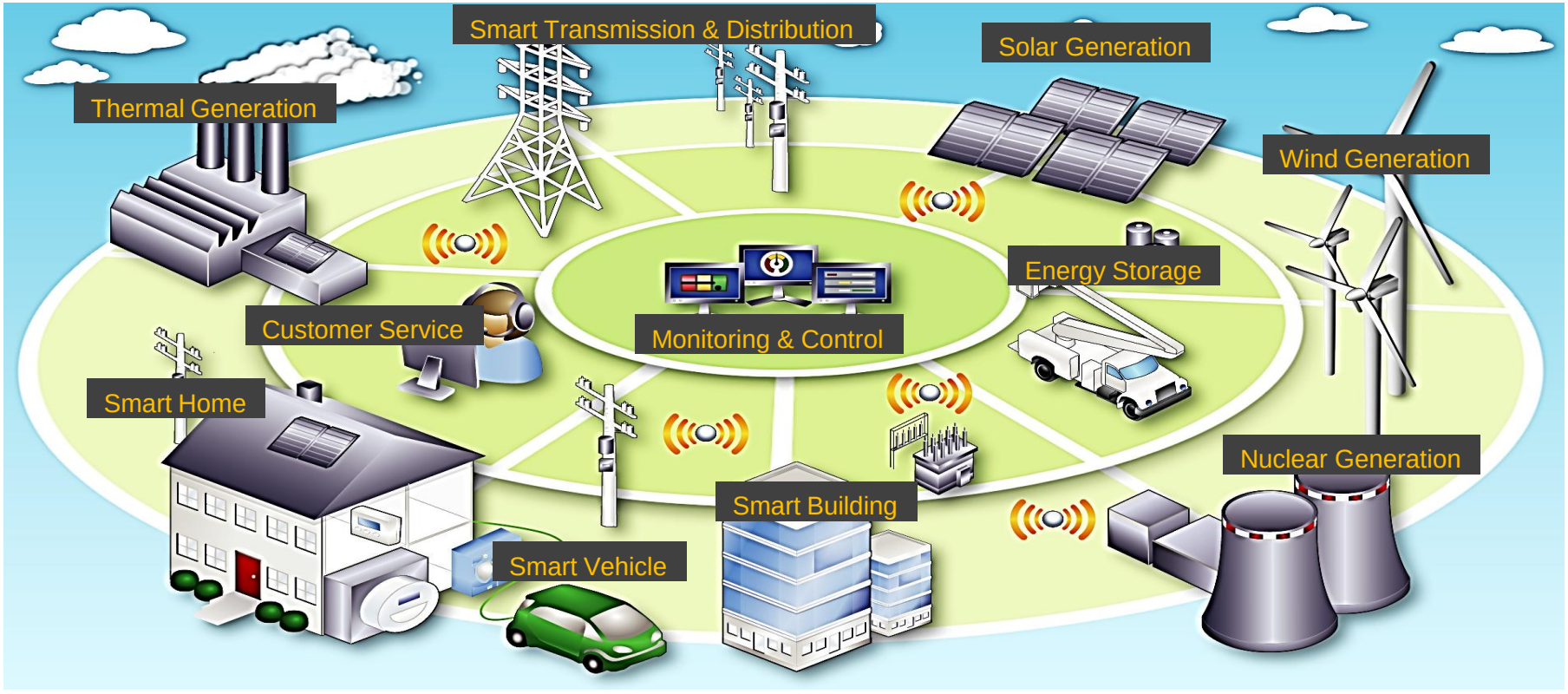
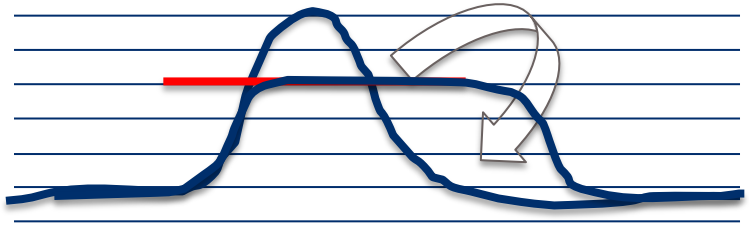
Smart Grid can be defined as an electricity network that uses information and communication technology to gather information and act intelligently in automated fashion to improve the efficiency, reliability, economics, and sustainability of generation, transmission and distribution of electricity*



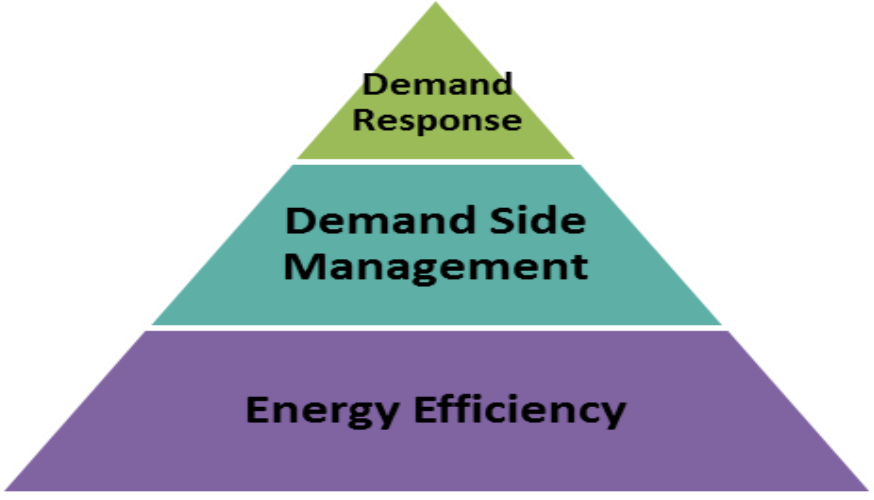
Stakeholders – What Will They Gain?

Generators (IPPs and/or state undertakings)	• Enabling consumers to become prosumers => distributed generation • Better integration of renewable energy sources => increased efficiency • Minimization of AT&C losses will ensure profits
Distributors (Presently SEBs)	• Monitoring consumption of electricity => variable rates => optimum income • Minimization of AT&C losses will ensure profits • Integration of digital technology => better demand-side management
Government (central and state)	• Economic benefits – a payback 3 to 6 times greater than the amount invested, and grows with each sequence of grid development • Increased employment in industrial sectors, high GDP multiplier
Consumers (Industrial, Commercial, or Domestic)	• Reduced frequency of power disturbances and outages • Ability to measure monitor their consumption of power • Paving the road for Electric Vehicles
Environment	• Reduced emission of greenhouse gas emissions by allowing better integration of renewable energy sources • Reduced energy wastage => conservation of resources

Peak Load Management



Reducing/shifting load from peak to off-peak times- it leads to generation of Negawatts 'Negawatt' is a unit of power that is no longer needed at one place, and hence can be used to reduce the load on specific, more critical part of the grid.

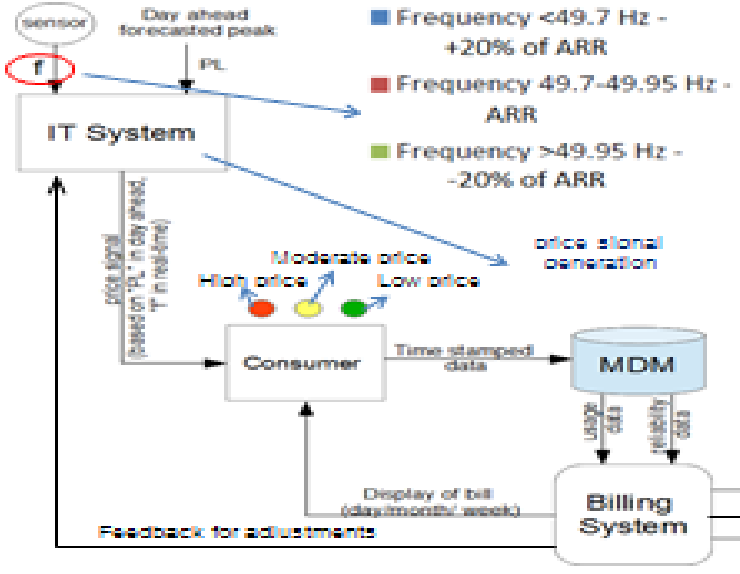


Peak Load Management Options

Singapore Intelligent Transportation

- As part of ITS, the city has pioneered a variety of transport technologies, including one of the world's first Electronic Road Pricing systems. The ERP acts as a de facto congestion charge.
- The ERP uses a short-range radio communication system to deduct charges from smart cards inserted in all vehicles, and charges varies according to traffic flows and the time of day

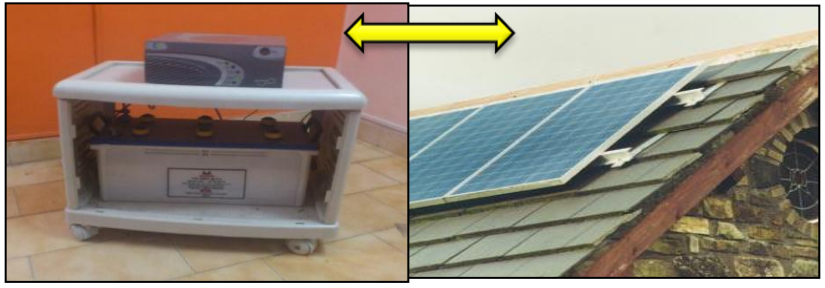
Details of Proposed Dynamic Tariff



- Consumer benefit
  - Saving in bills
- Utility benefits
  - Shift in peak and move towards cost reflective tariffs

✓Revenue through ARR
✓Revenue through Reliability
✓Revenue through frequency linked tariff

Storage of electricity:
Inverter batteries



Local Storage (Inverter/Battery)

1. The consumer does not have any storage.
2. The consumer has inverter & battery to meet household demand during power cuts.
3. The consumer has excess capacity of inverter & battery and can also supply to a few neighbours during power cuts.
4. The consumer can enter into contract with DisCom to supply stored energy back to the grid to meet the peak demand.
5. The consumer also adds local renewable generation to the inverter & battery to achieve self sufficiency and have limited exchange with the grid.

- Initial cost high, but RoI can be better if we consider increasing cost of grid power

Inverter Efficiency: 50% (approx.)

2 units consumed for 1 unit supplied

- Utilities can mandate use of roof top solar panels with inverters, provide subsidized rooftop panels to the consumers or can lease out roof top Solar panels.

Currently 30% subsidy provided by MNRE on roof top solar

Key Regulations, Legislation & Guidelines

Electricity Act 2003

- Section 62(3) guides SERCs to incorporate ToD tariff:
  - *"The Appropriate Commission shall not, while determining the tariff under this Act, show undue preference to any consumer of electricity but may differentiate according to the consumer's load factor, power factor, voltage, total consumption of electricity during any specified period or the time at which the supply is required or the geographical position of any area, the nature of supply and the purpose for which the supply is required." (Electricity Act, 2003, p.49)*

Smart Grid Solutions
System Balancing

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Better forecasting:	***Smart inverters:***	***Demand response:***	***Integrated storage:***	***Real-time system awareness management:***
• Widespread instrumentation and advanced computer models allow system operators to better predict and manage RE variability and uncertainty.	• Inverters and other power electronics can provide control to system operators, as well as to automatically provide some level of grid support.	• Smart meters, coupled with intelligent appliances and even industrial scale loads, can allow demand-side contributions to balancing.	• Storage can help to smooth short-term variations in RE output, as well as to manage mismatches in supply and demand.	• Sensors across networks allows system operators to have real-time awareness of system conditions, and the ability to actively manage grid behavior.

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References:-

1. ISGAN Whitepaper on Renewable Integration
2. NSGM Paper on People, Process and Policy

According to Census 2011, 31 per cent of India's total population lives in urban areas — a marginal increase of a little over three percentage points from the previous Census of 2001. In absolute numbers, however, India added about nine million people to the urban areas, bringing the number of urban residents in India to a total of 377 million. Additionally, for the first time since Independence, the growth in total urban population is higher than the absolute rural population growth.

There are multiple policies for urban India: the Swachh Bharat Mission which is gearing up to make urban areas clean; Housing for All which promises universal housing by 2022; the National Urban Livelihoods Mission; the National Urban Information System; and the Heritage City Development and Augmentation Yojana (HRIDAY)