



Smart Grid



Seminar Links

What is Smart Grid ?

Hardware

+

Management

+

Reporting
Software

Intelligent Communications Infrastructure

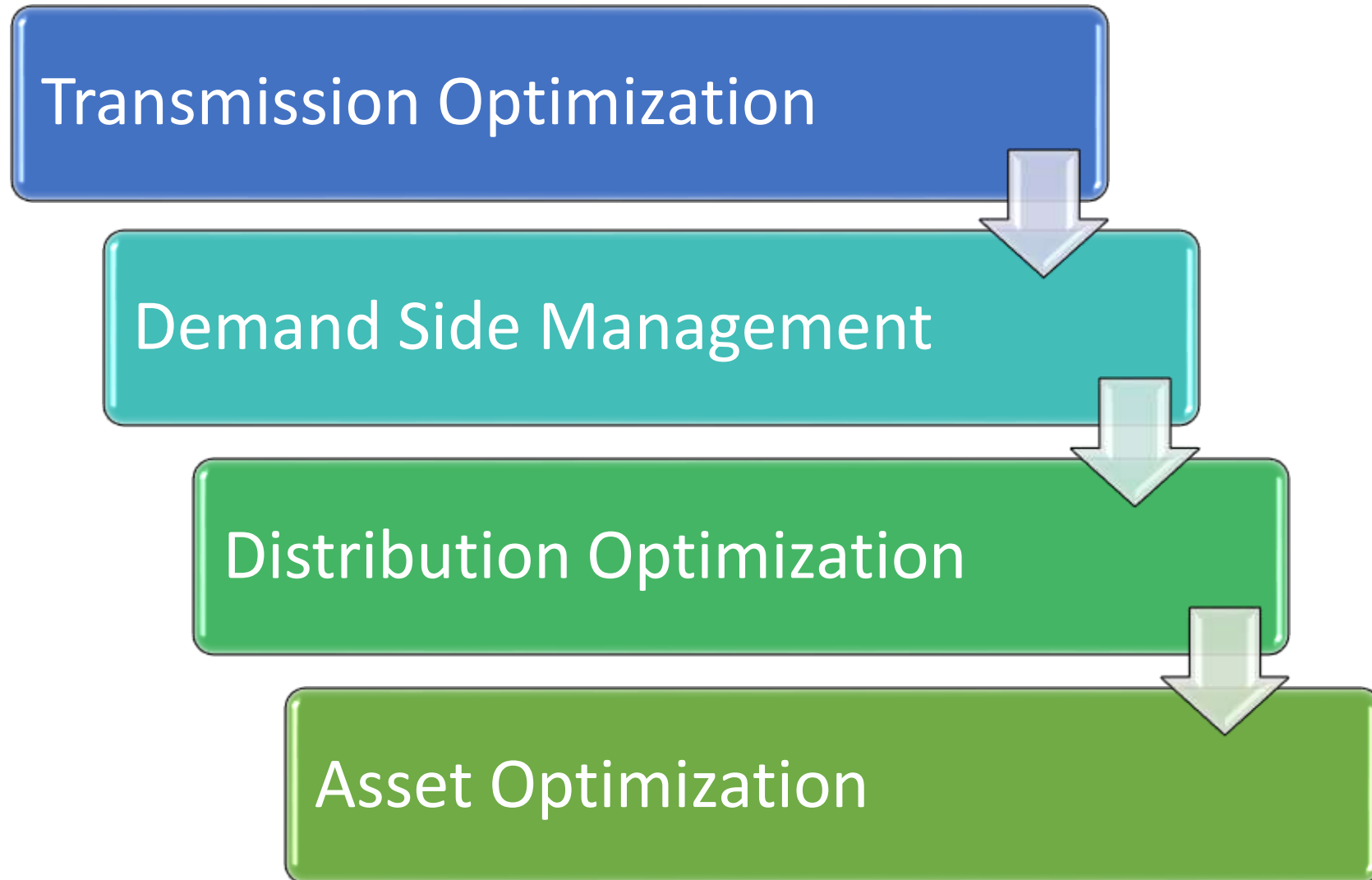
What is Smart Grid ?

- In the world of the Smart Grid, consumers and utility companies alike have tools to manage, monitor and respond to energy issues.
- The flow of electricity from utility to consumer becomes
 - A two-way conversation
 - Saving consumers money
 - Energy, delivering more transparency in terms of end-user use
 - Reducing carbon emissions.

What is Smart Grid ?

- Modernization of the **electricity delivery** system so that it
 - **Monitors**
 - **Protects**
- Automatically **optimizes** the **operation** of its **interconnected elements** – from the **central** and **distributed** generator through the **high-voltage network** and **distribution system**
 - to industrial users and building automation systems
 - to energy storage installations
 - to end-use consumers and their thermostats, electric vehicles, appliances and other household devices
- The Smart Grid in large, **sits at the intersection of Energy, IT and Telecommunication Technologies.**

Steps involved in Smart Grid



Technology Integration & Grid Management

Need for development in future

- Phasor Measurement Technique
- Wide Area Measurement (WAM)
- Flexible AC Transmission System (FACTS)
- Adoptive Islanding
- Self healing Grids
- Probabilistic and Dynamic Stability Assessment
- Distributed and autonomous Control

Benefits of PMU

- Time synchronized sub-second data
- Dynamic behavior observing
- Directly provides the phase angles (State **Estimation** to State **Measurement**)
- Improve post disturbance assessment
- High data rates and low latency due to computation

GENERATION

Grid-based
renewables

Wind farm

Nuclear
power plant

Natural gas
transmission

CO2 transport for
sequestration

Grid-based
storage

Coal and gas
plant with CCS

TRANSMISSION AND DISTRIBUTION

Super grids

High temp
super
conductor

HVDC link to
neighbouring
grids

Smart
T
substation

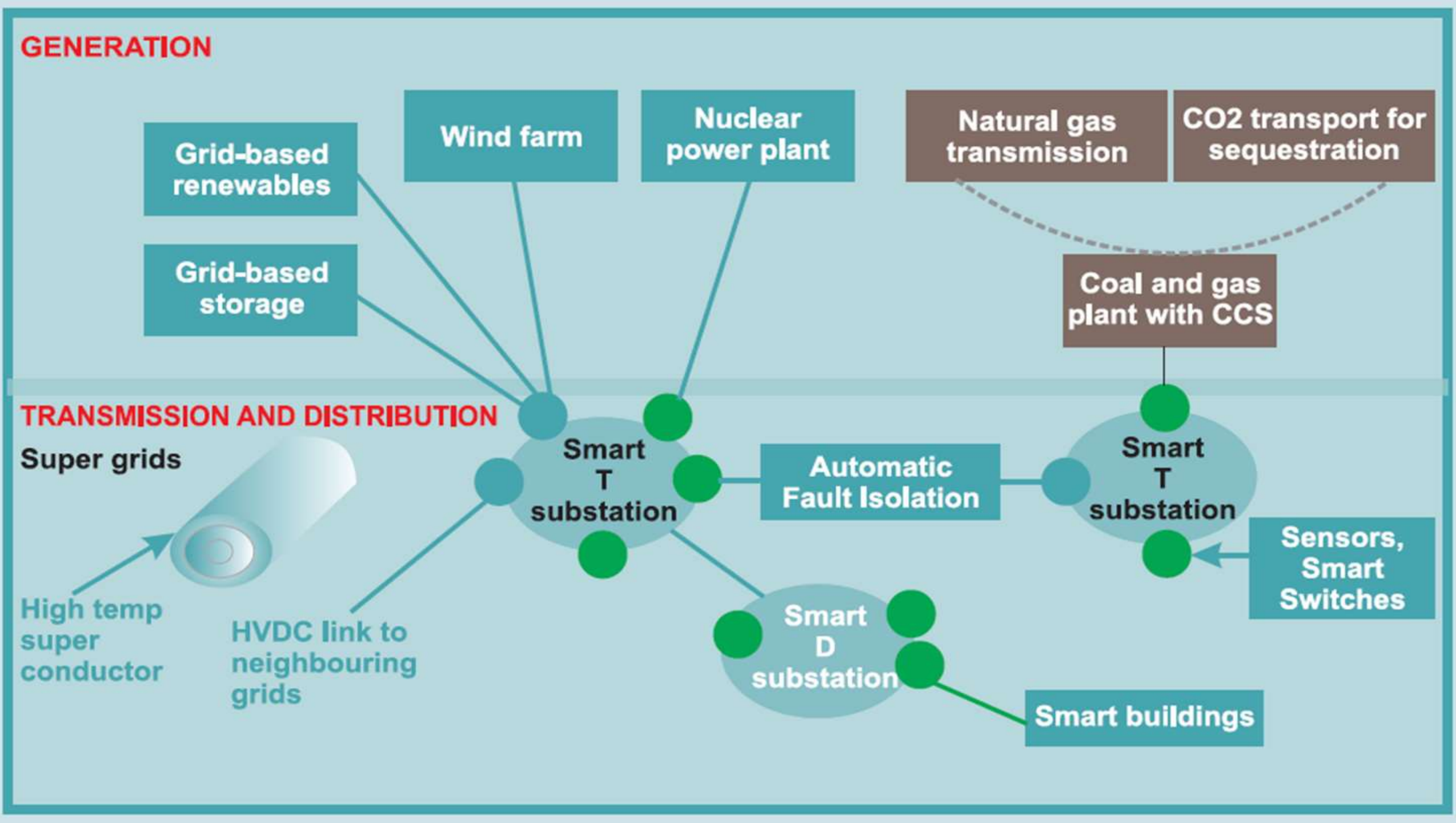
Automatic
Fault Isolation

Smart
T
substation

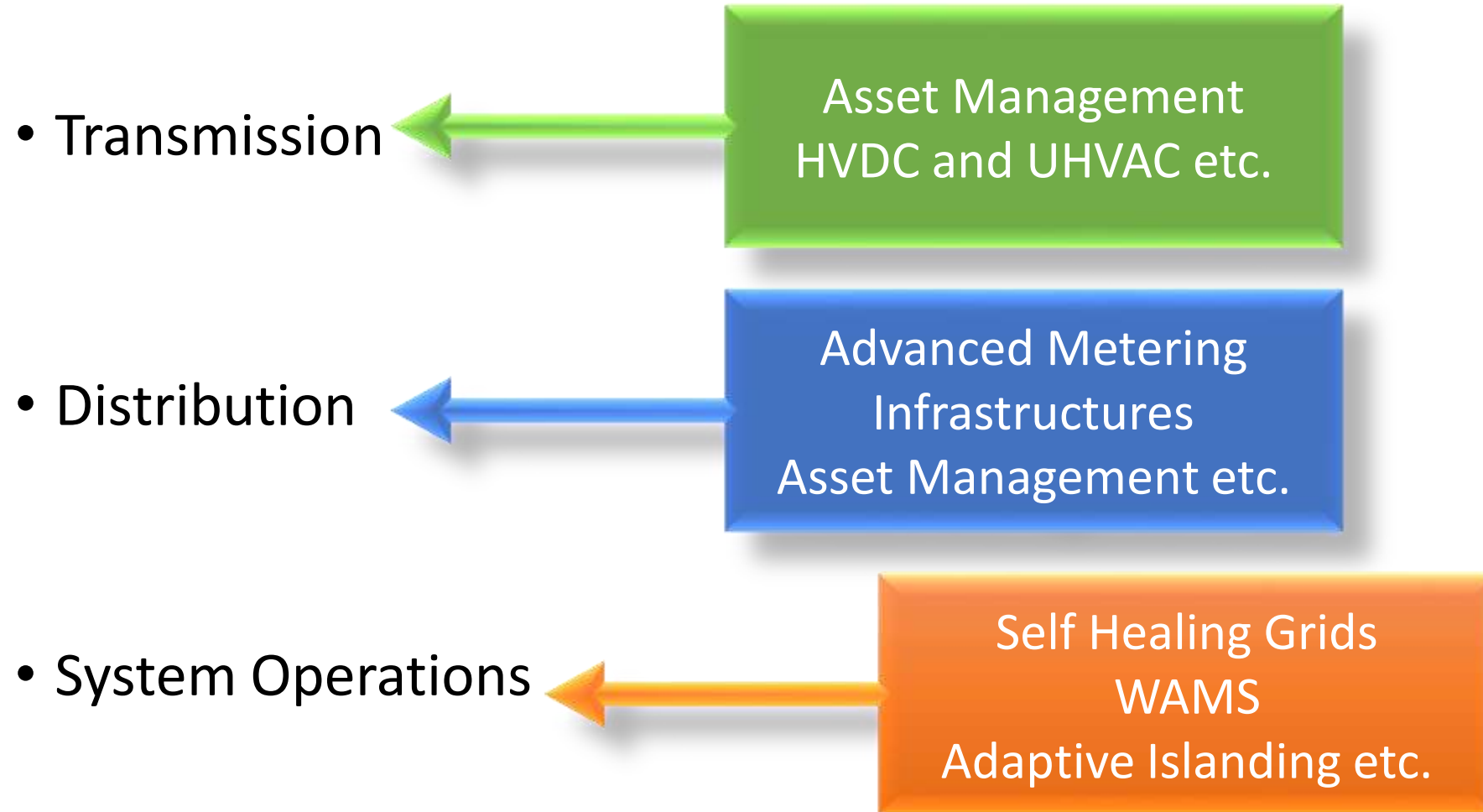
Sensors,
Smart
Switches

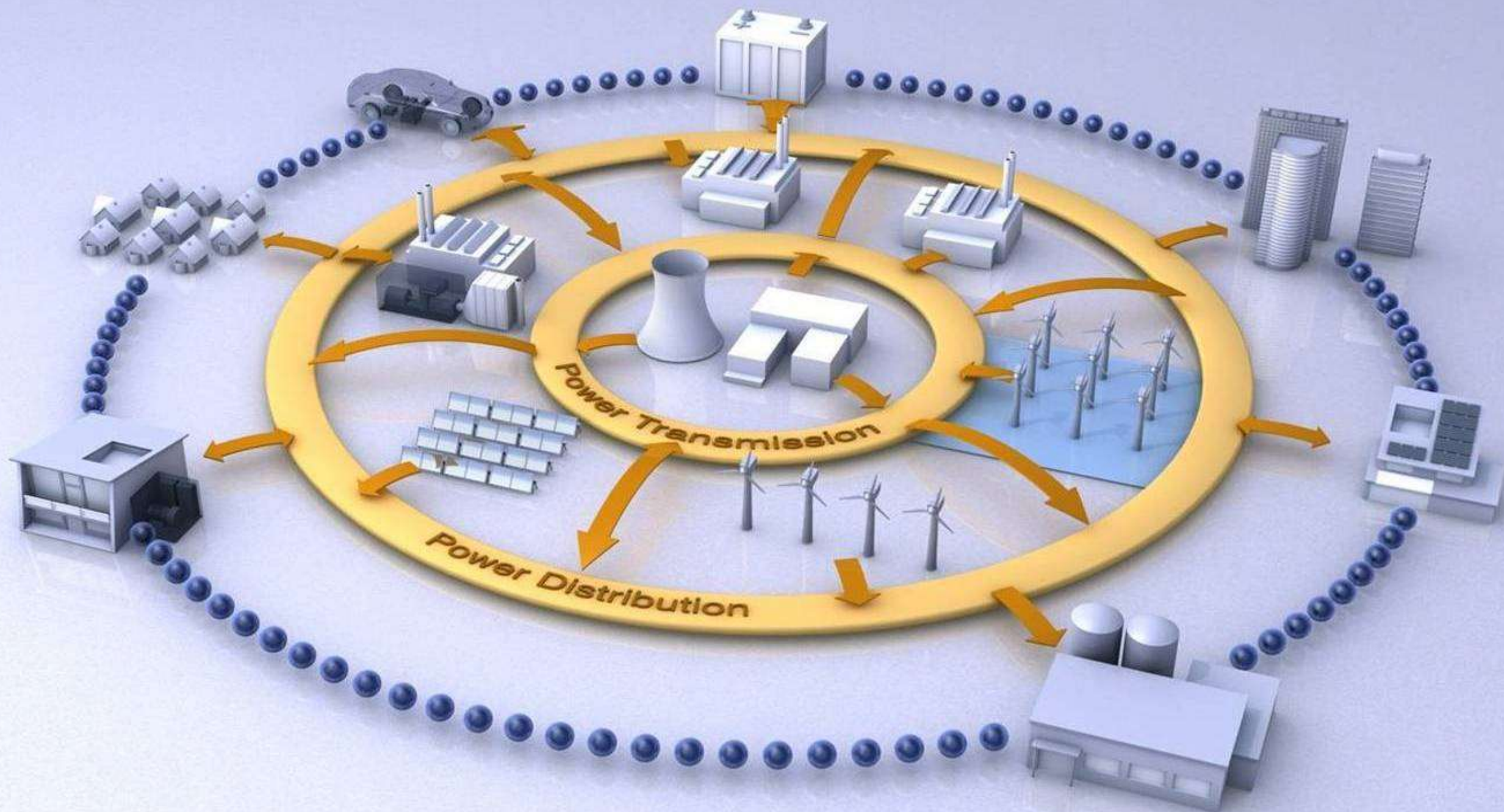
Smart
D
substation

Smart buildings



Smart Grid in Power Sector





Smart Grid in Distribution

- Distribution Automization
- Demand Optimization - Selective Load Control
- Operation –Islanding of Micro-grids

Distribution Automization/Optimization

- Managing Distribution Network Model
- Outage management and AMI Integration
- DMS & Advanced Switching Applications
- Integrated Voltage / VAR Control

Demand Optimization

- Demand Response – Utility
- Demand Response – Consumer
- Demand Response Management System
- In Home Technology enabling

Demand Optimization

- **Smart Metering –**
 - Automatic, Time of Use, Consumer Communication & Load Control
- **Communications** : Automated Metering Infrastructure (AMI) – LAN, WAN, HAN
- **DRMS (Demand Response Management)**
- **In Home enabling technology**
 - **Demand in three category:**
 - Immediate, Deferrable, Storable
 - **Customer aggregation & De-aggregation required for Peak shifting**

Demand Optimization

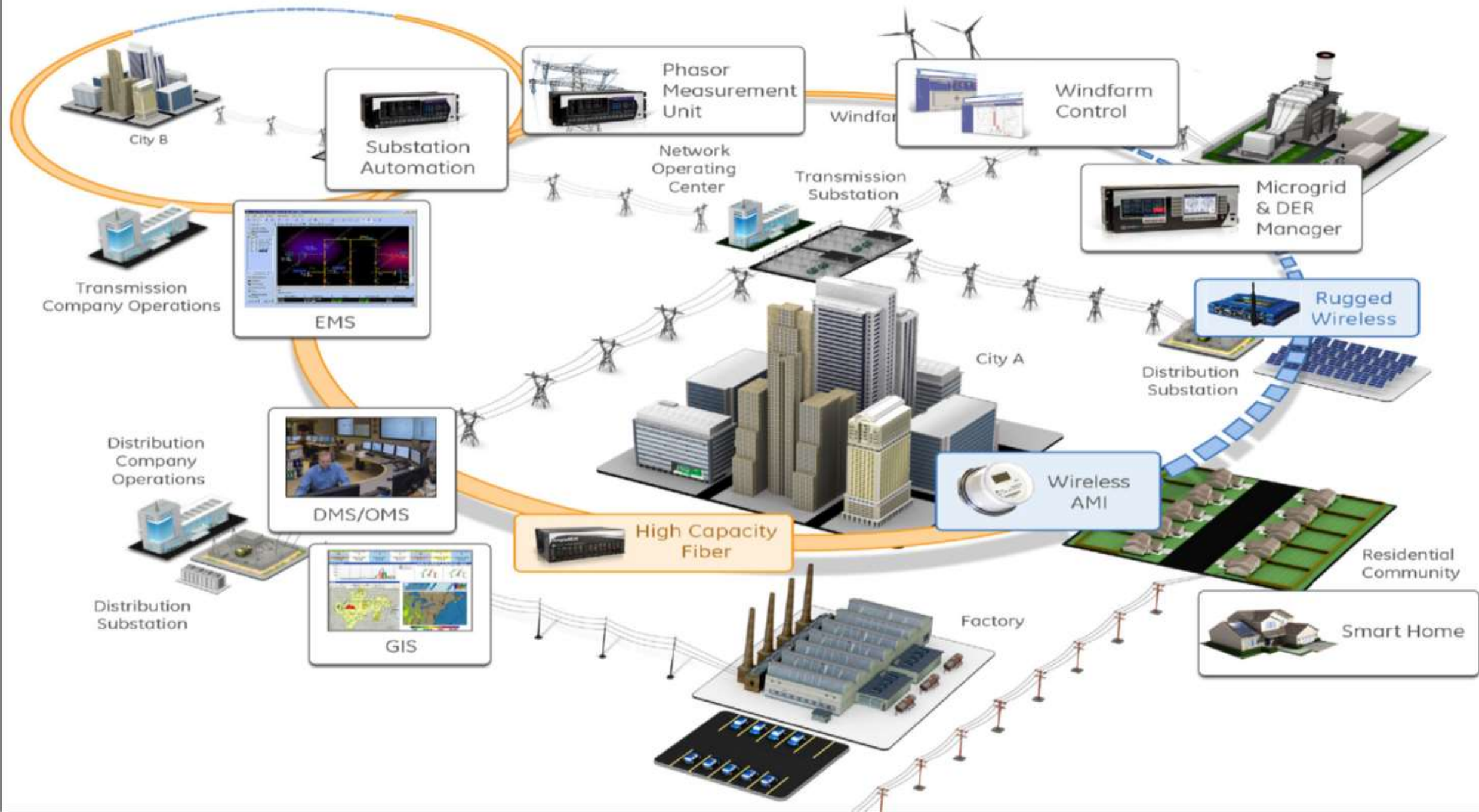
- Energy Usage Information
- Utility Communication
- Consumer Enrollment in DR programs
- In Home Technology- Availability & Purchase , Device Provisioning

Control Center with Service Oriented Architecture (BUS)

- Having
 - GIS (geo-spatial Information Systems),
 - AMI,
 - SAP (ERP),
 - OMS (Outage management System),
 - DMS (Distribution Management System),
 - EMS (Energy Management System),
 - DRMS (Demand Response management System).
- Model manager synchronizes GIS data with OMS, DMS & EMS.

Why Smart Grid?

- Proactive management of electrical network during emergency situations.
- Better demand supply / demand response management.
- Better power quality
- Reduce carbon emissions.
- Increasing demand for energy : requires more complex and critical solution with better energy management



Drivers of Smart Grid

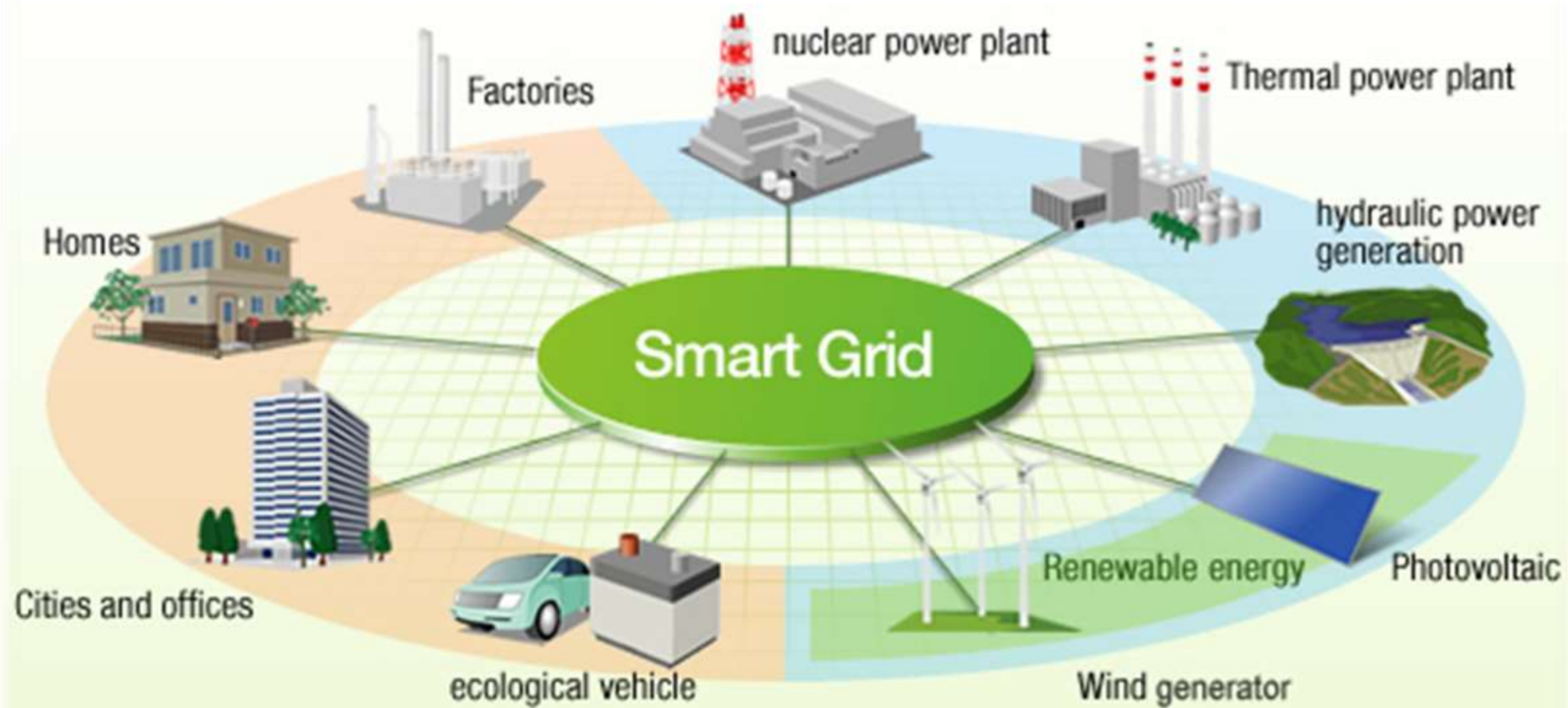
- Increasing demand:
- High Aggregate Technical & Non Technical, Losses:18%-62%
- Ageing assets...transformers, feeders etc.,
- Grid to carry more power: Need for, Reliability and greater Security
- Billing and collections: Profitability of distribution companies
- Energy mix: Need for Renewable to reduce carbon footprint

Implementation leads to

- Deliver sustainable energy
- Increased efficiency
- Empower consumers
- Improve reliability
- Smart Grid

Challenges in Smart Grid

- Present Infrastructure is inadequate and requires augmentation to support the growth of Smart Grids.
- Most renewable resources are intermittent and can not be relied on (in its present form) for secure energy supply
- Regulatory Policies to deal with consequences of Smart Grid; like off peak, peak tariffs and other related matters.
- Grid Operation : Monitoring & control





Thank You



Seminar Links