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# BASICS OF SMART GRID

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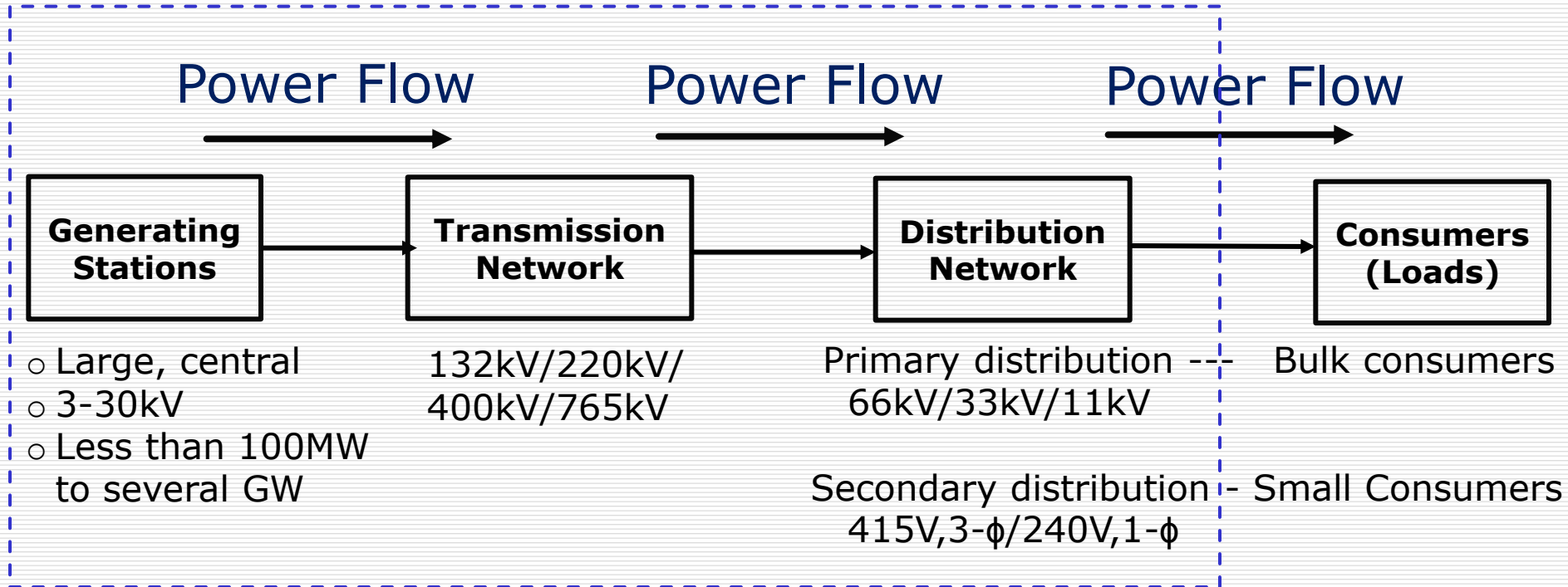
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# CONTENTS

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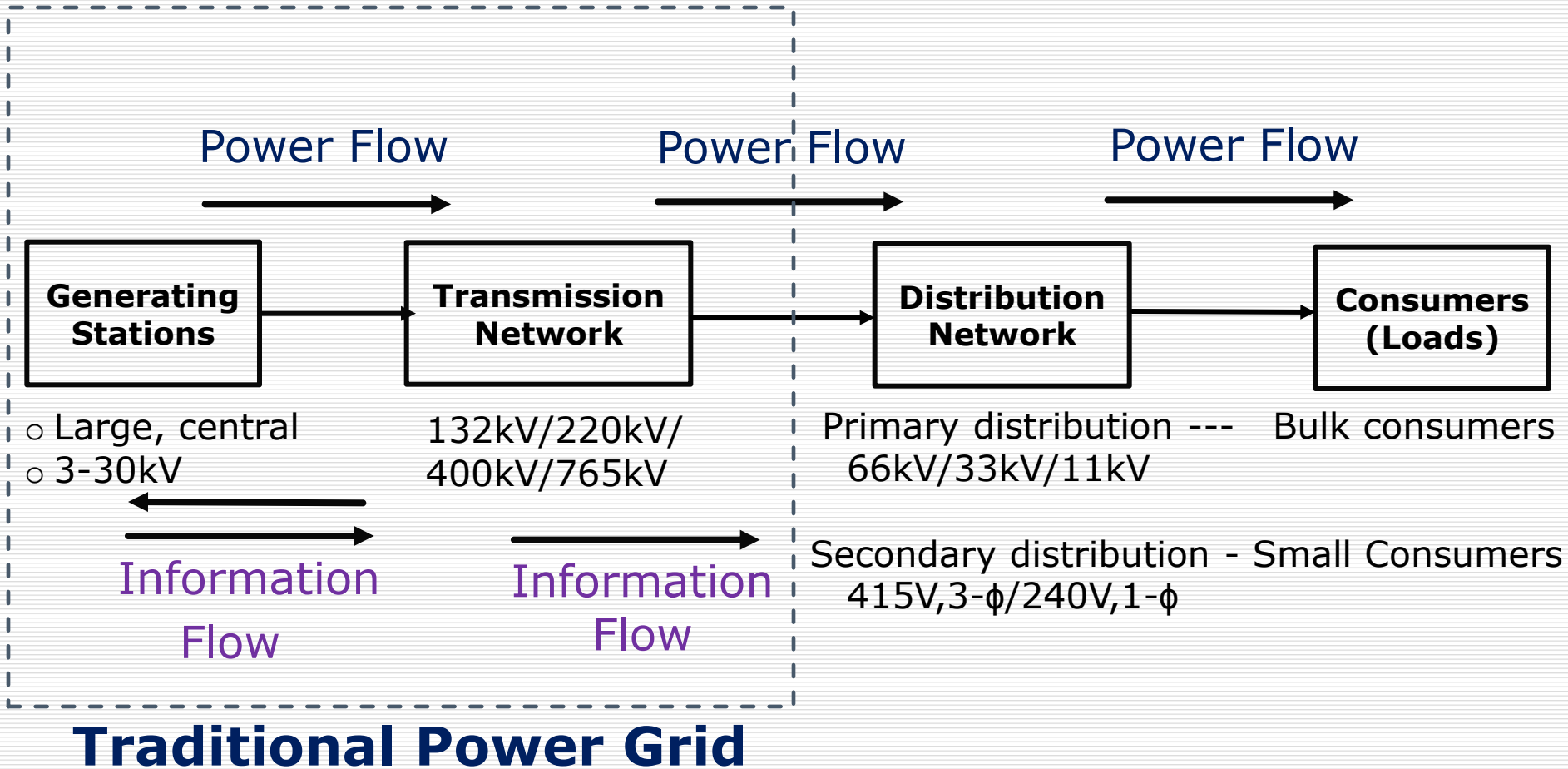
- ❑ Electricity Supply Chain
- ❑ Traditional and Smart Power Grids
- ❑ Definition & Objectives of Smart Grid
- ❑ Components of Smart Grid
- ❑ Enabling Technologies for Smart Grid
- ❑ Smart Grid Solutions
- ❑ Stake Holders in Smart Grid Development

# Electricity Supply Chain

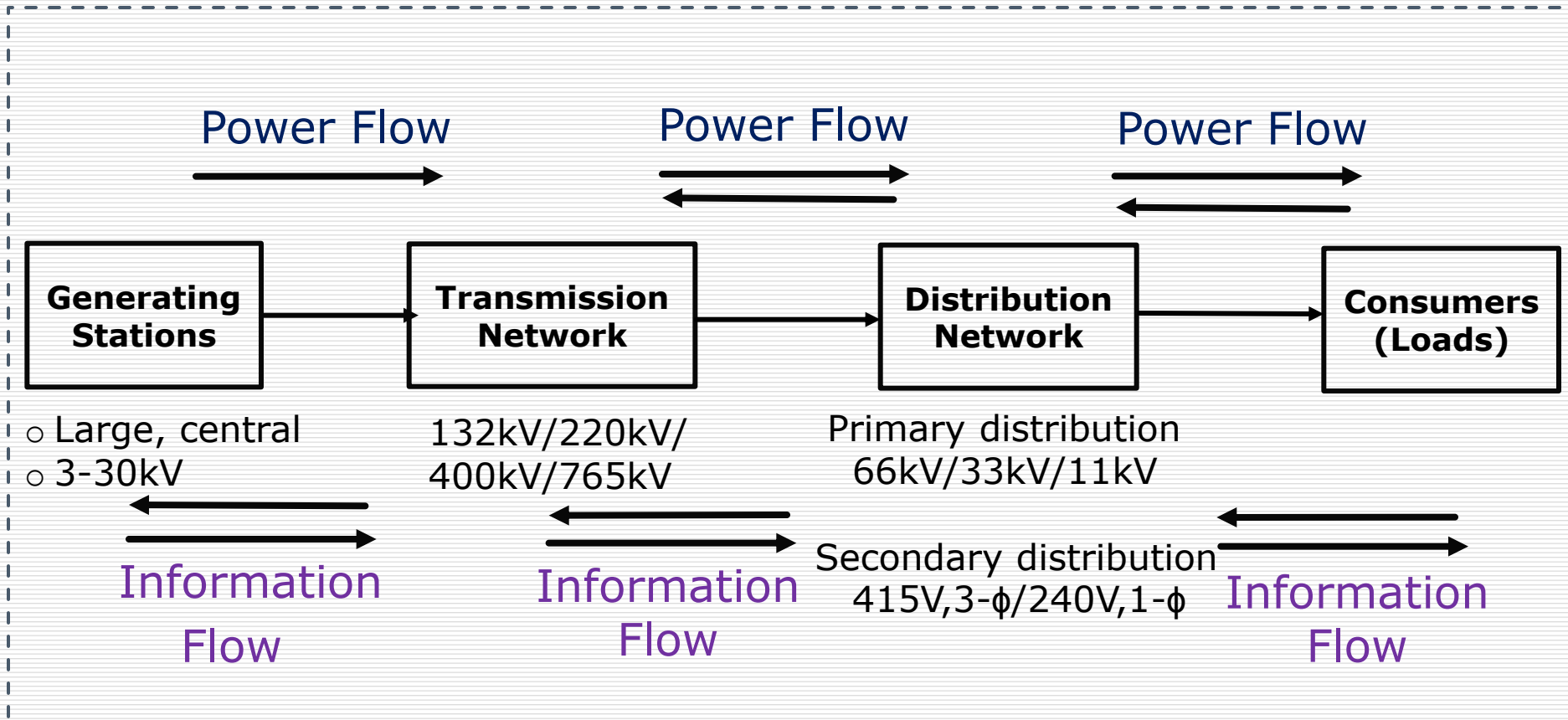


## Electrical Power System

# Traditional Power Grid



# Smart Power Grid



## Smart Power Grid

# Difference between Traditional and Smart Power Grid

Characteristics	Traditional Power Grid	Smart Power Grid
Scope	G+T only	G+T+D+C (bulk)
Involvement in the operation of Power Grid	G+T mainly D: small extent C: no involvement	G+T+D+C (bulk)
Power Flow	$G \rightarrow T \rightarrow D \rightarrow C$	$G \rightarrow T \leftrightarrow D \leftrightarrow C$
Communication	Two way: $G \leftrightarrow T$ One way : $T \rightarrow D$ No comm. with C	$G \leftrightarrow T \leftrightarrow D \leftrightarrow C$
Automation	G and LDC	At all levels
Renewable Energy	No encouragement	Encouraged at the D & C levels
Distributed Generation	No encouragement	--do--
Energy Storage	Very little	--do--
G : Generating stations, T : Transmission network, D : Distribution network, C : Consumers, LDC : Load despatch centre		

# Objectives of Smart Power Grid

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1. To increase efficiency of whole electricity supply chain including consumer end or demand side.
2. To improve reliability of service.
3. To improve quality of power.
4. To encourage competition amongst electricity suppliers.
5. To help consumer to control their energy consumption pattern to minimize electricity bill.
6. To reduce impact of electricity generation and its use on the environment.

# Definition of Smart Power Grid

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Smart power grid (or, smart grid) is a **concept** *aimed at integrating* the generation, transmission, distribution and consumption of electricity, *while encouraging participation of consumers* in the operation of the power grid and reducing the overall **impact of producing and using electricity on environment**, *with the ultimate objective of* **efficient, reliable and high-quality** electricity to consumers **at competitive prices**, **and characterized by** **two-way flow of energy and information.**



# Components of Smart Power Grid

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1. Power system (generation, transmission & distribution)
2. Smart distribution
3. Distribution automation
4. Advanced metering infrastructure
5. Two-way communication infrastructure
6. Micro-grid
7. Distributed renewable energy generation
8. Distributed energy storage
9. Smart transmission
10. Substation automation

# Enabling Technologies for Smart Grid

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Important enabling technologies are placed under three heads:

A. Electrical and Electronic Technologies

B. Measurement, Control and Automation Technologies

C. Information and Communication Technologies

# A. Electrical and Electronic Technologies

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1. Power system operation and control
2. Power grid operation and management
3. High voltage DC transmission and systems
4. Flexible AC transmission system (FACTS)
5. Energy storage
6. Embedded systems

# B. Measurement, Control and Automation Technologies

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1. Sensing, sensors and smart sensors
2. Hydraulic, pneumatic and intelligent actuators
3. Control engineering and controllers
4. Programmable logic controller (PLC)
5. Supervisory control and data acquisition (SCADA )
6. Intelligent electronic devices (IEDs)

# C. Information and Communication Technologies

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1. Electrical communication engineering
2. Digital / data communication
3. Data network technologies
4. Information technology
5. Data security
6. Modelling and simulation

# Stake Holders in Smart Grid Development

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1. Policy makers
2. Utilities
3. Power equipment manufacturers
4. Technology companies
5. Industry standards developers
6. Researchers and research laboratories