

# Managing Grid Stability during RE integration

Session: Smart Grids - Ensuring a Continued RE Development and Integration



# Challenges of modern grid

Increasing use of power electronics in RE generation

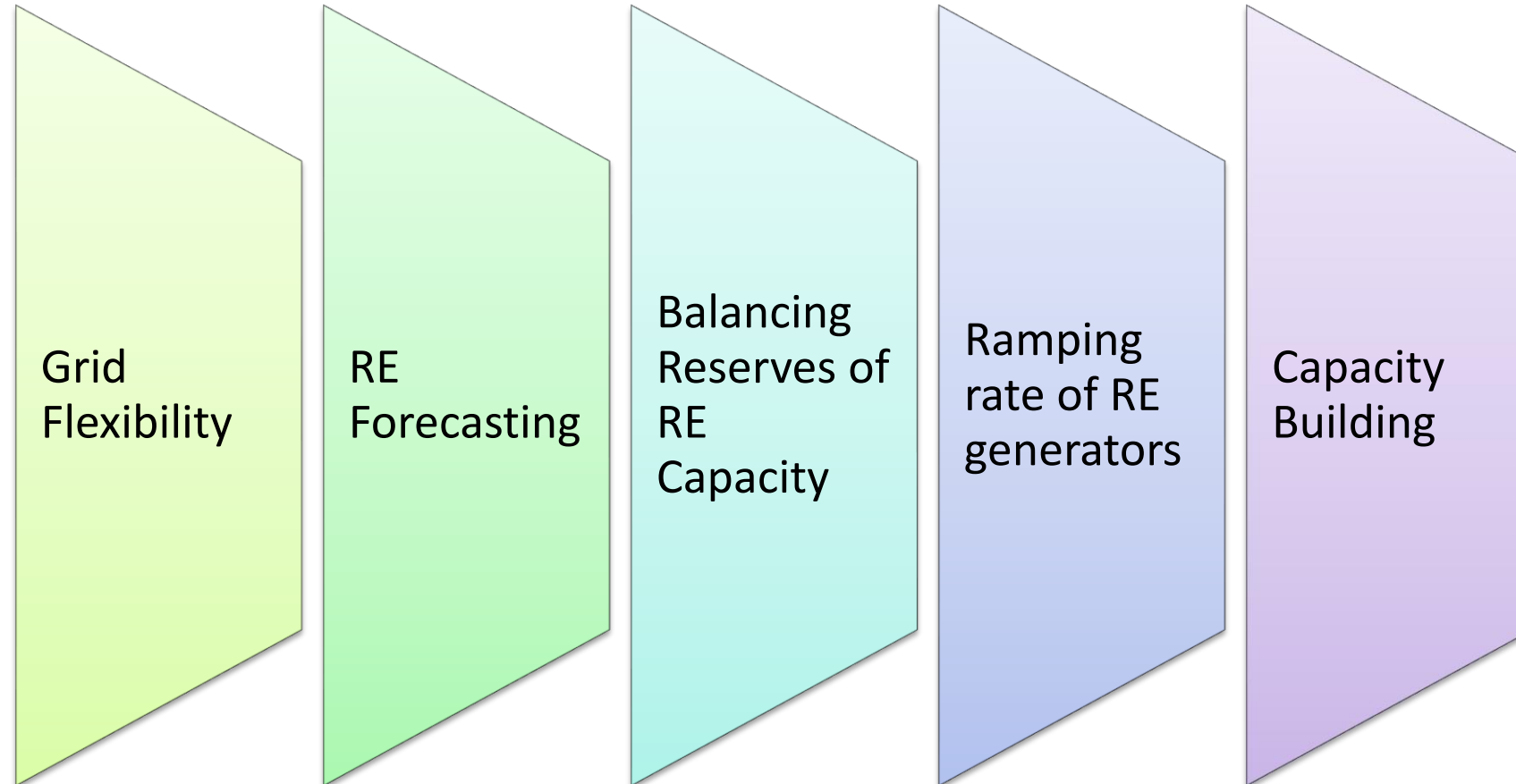
Interoperability of communications, controls, data and information

Integration of new technologies: Electric vehicles (EVs), Distributed energy storage, flexible loads

RE is highly distributed, volatile with control complexity



# Managing RE Connections



# Stabilizing RE connections & PQ Issues

## Challenges:

- **Transient and dynamic stability**
  - Loss of system inertia could reduce ability to respond to disturbances
- **Frequency regulation**
  - Primary, secondary, and tertiary response from variable RE
- **Volt/VAR regulation**
  - Ability to keep voltage within nominal limits

## Methods employed:

- Smart inverters with advanced functionality
- Active/ Reactive Power, Voltage and Frequency control
- DERMS/ Active Network Management
- Power Systems Stability

# Bringing flexibility in generation

Automatic Generation & Frequency Control

Maintaining RE reserves

Forecasting & Scheduling

Balancing & Settlement mechanism

Strengthening of Transmission systems

Compliance with RE Regulations & Standards

Smart Grids – DERMS, ADMS, Peak Load/ Power Quality Management, etc.

# Actions for managing grid stability – 1 of 3

## Regulatory Framework for handling Inter-State deviations

- Framework for intra-state deviation, metering, balancing & settlement mechanism
- Deviation price linked to market linked mechanism with suitable price discovery process
- Communication Framework for real-time data transfer between RE pooling stations, SLDCs & Renewable Energy Management Centres (REMCs)

## Forecasting and Scheduling

- Framework for Forecasting & Scheduling RE generation at both inter-state and intra-state level

## Demand Aggregators to coordinate with RE generators

- Real-time scheduling, balancing, settlement and pooling with RE generators

## Deployment of RE Reserves

- Identified and kept available for the system operator to maintain grid reliability and security
- Necessary incentives to RE generators for maintaining and deploying reserves
- Market based Framework for identification and utilization of generation reserves

# Actions for managing grid stability – 2 of 3

## Transmission System Augmentation and Strengthening

- Augmenting transmission corridors from RE-surplus states with coordinated planning
- Static VAR Compensator (SVC), Static Synchronous Compensator (STATCOM) etc. for reactive power control

## Ancillary Services

- Framework for operationalizing the spinning reserves (Scheduling, metering and settlement)
- RE Optimization, Integration & Active network management

## Balancing Requirements

- Coordinated multilateral despatch model
- Each DISCOM/ SLDC is required to commit adequate resources to meet anticipated demand and RE generation
- Ability to forecast and ensure RE availability on day-ahead basis

# Actions for managing grid stability – 3 of 3

## Frequency Control

- Proper frequency regulation brings out the need for primary control supplemented by secondary control and tertiary control
- Regulatory framework for compliance monitoring and enforcement

## Incentivizing Flexibility

- Flexibility in existing fleet of conventional and RE generation
- Demand Side Management to balance load profile and maintain system stability
- Flexible RE Planning specifying minimum/ maximum generation level and ramp up/ down rates

## Market-based business models

- RE market clearing and despatch through real-time power exchanges
- Multiple iterations in Day Ahead segment

## Capacity Building of SLDCs

- Develop System Operators to acquire skill-sets for planning, operating and maintaining power systems with increasing RE share
- Exposure to international benchmarks and best practices in RE management



# Connecting RE systems to Smart Grids

Enables better control of RE connections while improving power quality and reliability

Enables Demand Response with consumers as participants

Reduces demand peaks, improves energy efficiency and reduces carbon footprint

Allows better voltage regulation and load management

Facilitates energy savings and optimizes cost of operations

# Enabling Framework for RE Integration

Renewable Purchase Obligation and Renewable Energy Certificates

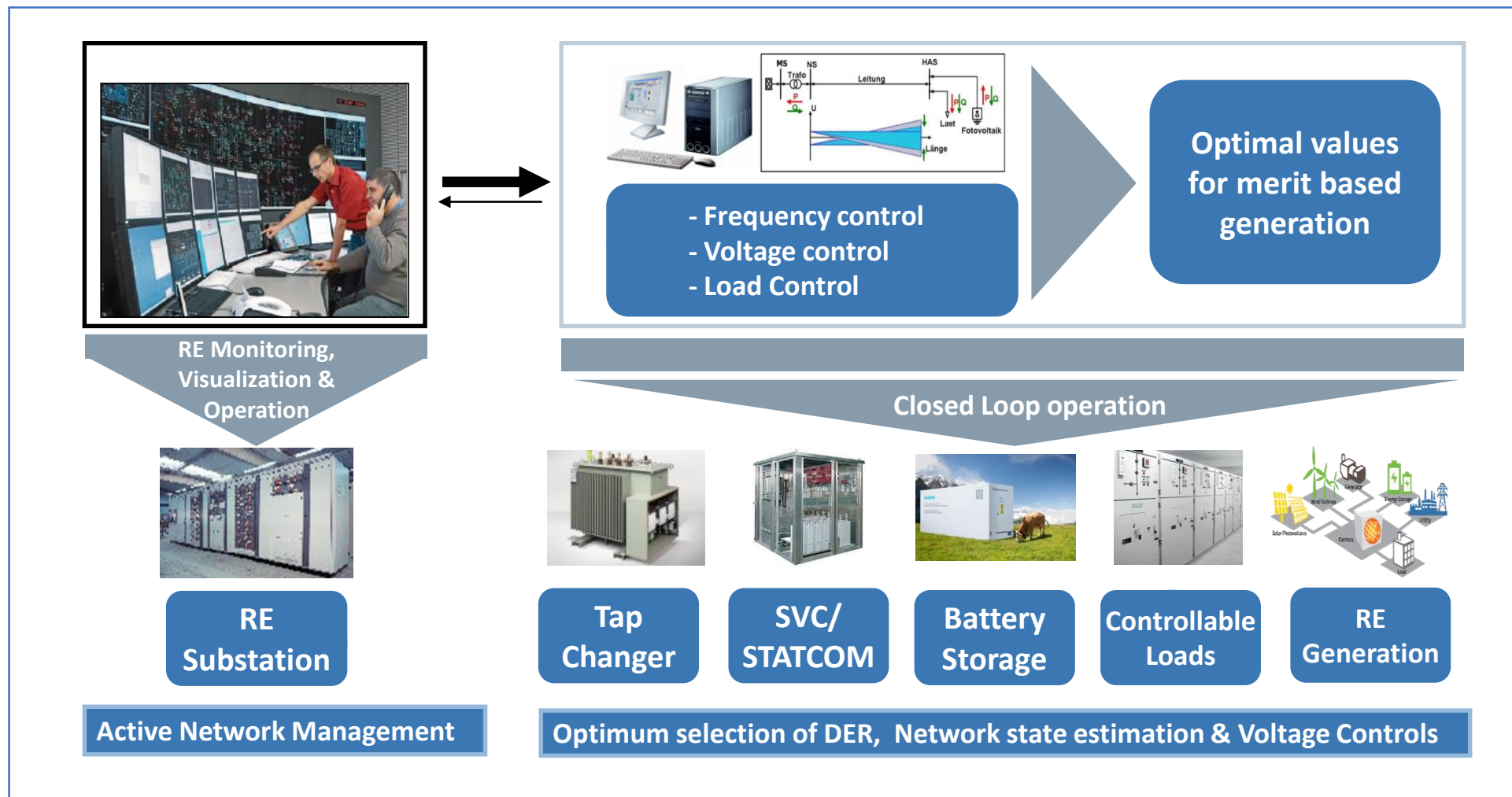
Implementation for frequency response Regulation

Regulatory framework for Forecasting, Scheduling and Deviation Settlement

Regulatory framework for Reserves

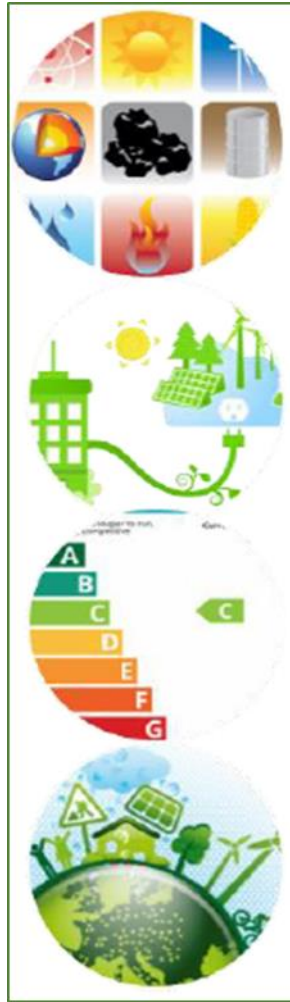
Regulatory framework for Ancillary services operations

# PQ interventions for Grid Stability



# About Asia Power Quality Initiative (APQI)

- Program initiated in Asia with the background of the European Experiment (LPQI) – Continuing Professional Development
- *A neutral collaborative platform* shared by National Support Network (NSN) Partners to promote education and awareness and facilitate policy changes.
- Objective:
  - help industries in Asia address Power Quality issues as a means to enhance their competitiveness in terms of better production output quality, reduced production costs, reduced production line interruption and batch losses.
  - Building up capacity of industry / service sector in identifying and addressing PQ issues as a means to enhance their continuous quality delivery
  - Facilitate policy changes and market transformation towards ‘Safe and Quality Power for All’.
- Developed a white paper – “Power Quality Regulations in India”
  - <http://www.apqi.org/download/download20161014070633.pdf>
  - <http://www.forumofregulators.gov.in/Data/Achievements/apqi.pdf>



# Thank You

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