



**DISTRIBUTION
UTILITY MEET**

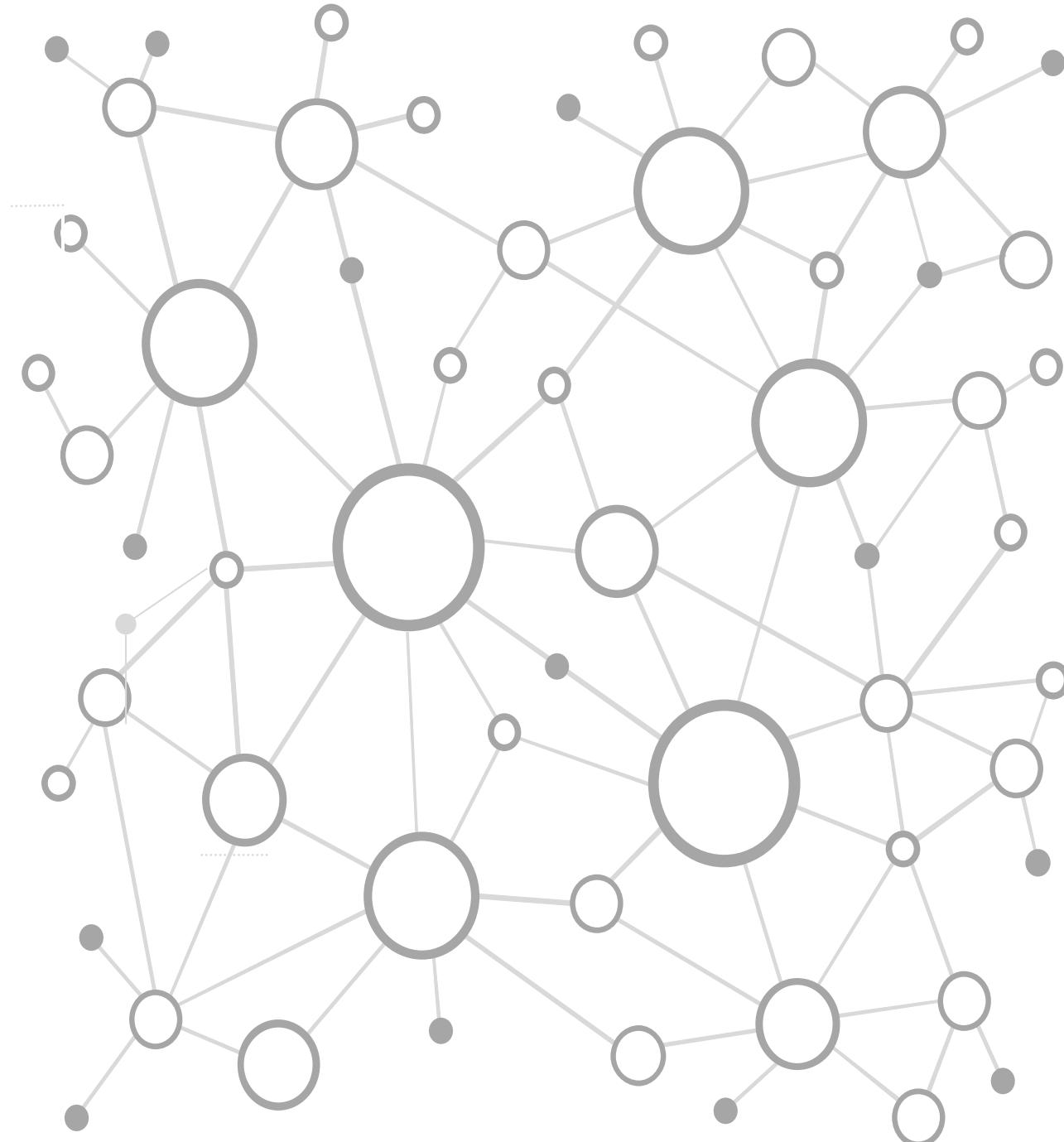


**SESSION 5:
GRID INTEGRATION OF
DISTRIBUTED Renewable Energy
(DRE)**

PRESENTATION

**Distributed Solar
Integration**

Mr. Yogesh Gadkari
Director Commercial, MSEDC



Agenda

- 1 | Distributed Solar Context: Maharashtra
- 2 | AI/ML Driven Forecasting
- 3 | Advanced Field & Automation Techniques
- 4 | Flexible Grid Solutions & Capacity Building





Distributed Solar Context: Maharashtra

DRE is not an add-on; It is the new architecture of power distribution

Distributed Solar is receiving high visibility and support at all levels & enabling **millions of distributed solar injection points**

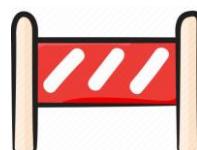
Planning lens shifting from centralized adequacy to local hosting capacity at feeders and substations



**Rooftop
Solar**



**Feeder
Solarization**



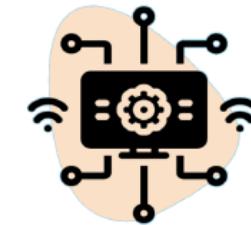
DRE forces **multidirectional flows** that existing systems cannot manage efficiently

- Reverse power flows from multiple injection points
- Voltage fluctuations beyond statutory ±6% limit
- High variation in day-night load curve and uncertainty in solar output
- Emphasis on dynamic planning tools with predictive & real-time attributes



AI / ML Driven Forecasting

*Forecasting through Univariant
and Multivariate time series
models - utilizing*



Forecast

Optimize

Automate

1

Historical Demand Data

- ❖ Integrated with advanced analytics and forecasting tool and AI based methods.

2

Special Events

- ❖ Scenario formulation based on future demand

3

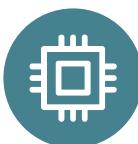
Time Factor

- ❖ Provides the schedule which optimally satisfy the constraint of technical minimum, ramp, MOD dispatch, special cases for Hydro, PSP & Interstate plants.

4

Weather Data

- ❖ Integrated with outage management, Zero Scheduling module providing the real-time cost optimized dispatches



MSEDCL is integrating an **AI/ML-driven module** to enhance grid stability and mitigate disruptions caused by large-scale deployment of Distributed Renewable Energy (DRE) sources.



Advanced Field & Automation Techniques

Advanced Field Technique- Substation Monitoring

A low-cost, indigenous automation solution to enhance substation operations and business process efficiency

System Capabilities

- Real-time monitoring & situational awareness of remote substations
- Strategic planning
- Preventive maintenance & Corrective actions
- Transparent information transfer
- Substation equipment analysis & diagnosis

Data & Decision Support

- Integrated dashboard at Central Control Centre
- Consolidated insights on grid performance and solar energy integration
- Data-driven decision-making
- Feeder demand monitoring, Energy accounting
- Load balancing

Voltage Regulation- Reactive Compensation

Its proper management ensures voltage stability and prevents power quality issues

Challenges

- Intermittent solar causes unpredictable reactive power demand changes
- Design limits of solar inverters constrain capacity
- DRE generation requires grid-code reactive-power standards for safe operation

Solutions

Installation of supplementary equipment such as switched capacitor banks, static VAR compensators (SVC), or STATCOMs provide additional dynamic reactive support

Integration with DRE Projects

Maintaining grid stability through developers -

- Maintain grid stability by means of installing capacitor bank
- Must pay all reactive-power charges and grid-drawn power charges per regulations
- Maintain the power factor within the limits of 0.95 lagging to 0.95 leading at Delivery Point
- Inject reactive power equal to 30% (thirty percent) of the active power generated in a month – penalty for shortfall @ 25% of tariff



Flexible Grid Solutions & Capacity Building

Battery Storage

MSEDCL actively developing **large-scale energy storage projects**, primarily using BESS –

- First BESS tender of 750 MW/1500 MWh floated in August 2024 – 10 / 20 MWh commissioned
- Second tender of 2 GW/4 GWh floated in July 2025
- Features - VGF Support, Land provisions, Technology agnostic, etc.

MSEDCL has conducted technical feasibility studies through Optimization scheduling software running various scenarios based on production cost analysis and identified optimum Energy storage scenario

MSEDCL & GEAPP collaborated to focus on integration of BESS to stabilize supply and manage peak demand, and management of DRE assets leveraging AI & ML;



- Emphasis on real-time asset monitoring, predictive maintenance, load flow analysis, and demand forecasting

Capacity Building



With the emphasis on skill requirement of local support for the project developers, **Maharashtra Saurya Kaushal Yojana (Maha-SKY)** was spearheaded by the *Energy Department, GoM, & MSEDCL*

- **Skill Council for Green Jobs (SCGJ)** identified as the agency to design and implement capacity building program.



Thank You