

**School of Electrical, Electronics and Communication Engineering**

**Course Code : BEEE4001**

**Course Name: Smart Grid and Energy Mngement**

# **UNIT 1**

# **Challenges in Renewable Generation and Integration**

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**Name of the Faculty: Dr. Shagufta Khan**

**Program Name: B.Tech**

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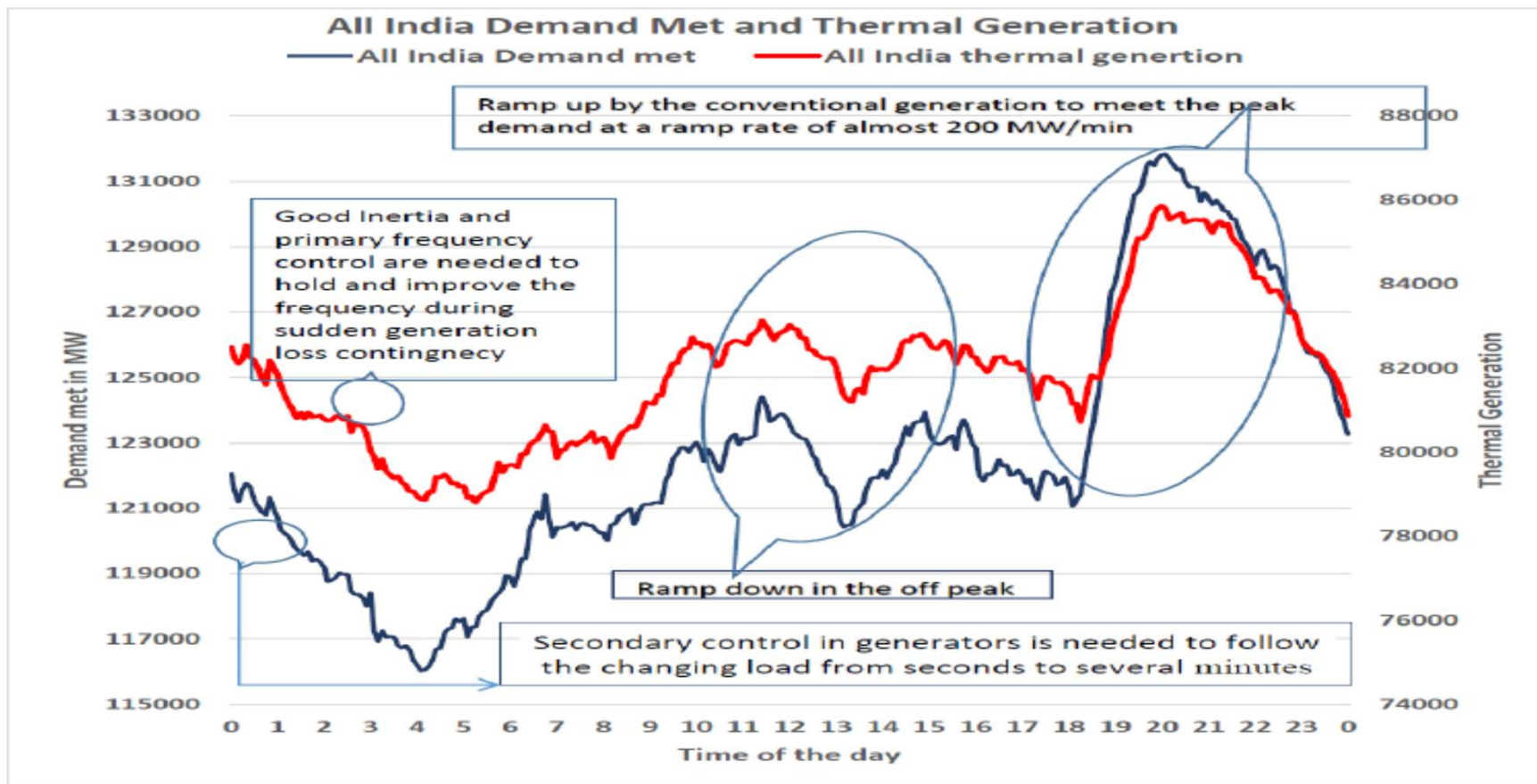
## Renewable Generation: Few Technical Challenges

- ✓ *Intermittent* generation, dependent on weather, season, time of day – Need accurate forecasting & Power balancing .
- ✓ Voltage and frequency control; Many of these sources do not have *reactive power* generation.
- ✓ Sudden generation loss can lead to system instability. Also *inertia less* generation, e.g. solar.
- ✓ Power Quality issues-Harmonics, flicker, under voltage ride through capability (IEEE & IEC std.)
- ✓ Power management and Maximum power point tracking. Requires proper converters and controls.

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Ref: POSOCO Report on "Flexibility Requirement in Indian Power System", January 2016.

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## Transmission Grid: Challenges and Few Measures

Challenges	Measures
Right-of-Way	<ul style="list-style-type: none"><li>• UHVAC, 1200 kV, 765kV, +- 800kV HVDC</li><li>• HTLS Lines, Multi Circuit Tower, Compact Tower</li><li>• FACTS Controllers, VSC based HVDC</li></ul>
Land Acquisition	<ul style="list-style-type: none"><li>• GIS substation</li><li>• Automation of Substation, Digital Substation</li></ul>
Renewable Integration	<ul style="list-style-type: none"><li>• Transmission to lead generation</li><li>• Strong Interconnection for large Balancing Area</li><li>• Renewable Energy Management Centres for Renewable forecasting &amp; Scheduling</li><li>• Balancing reserves, Power Market, Ancillary Services, Energy Storage</li></ul>
Grid Management	<ul style="list-style-type: none"><li>• Smart Grid- Real time monitoring System with Self-healing</li><li>• Synchrophasor based WAMPSC</li><li>• Advanced Metering Infrastructure (AMI), Demand Side Management, Consumer Participation</li></ul>

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## **Few Major Challenges in the Smart Grid**

**Reliable and Fast Communication, Big Data, Cyber Security.**

**WAMS integration with EMS, SCADA/DMS implementation in the existing networks.**

**Suitable Converter Topology and Controls for RES Integration.**

**Optimal Siting, Sizing and Controls of Energy Storage Systems.**

**Dealing with Intermittent Generation- Flexible Generation (High ramp rate), CHP and Thermal storage.**

**Adaptive Protection in Active Distribution Network, Microgrid protection (DC more challenging)**

**Regulatory Changes.**

**Customers' Acceptance to RES Deployment and Demand Side Participation- Social survey**

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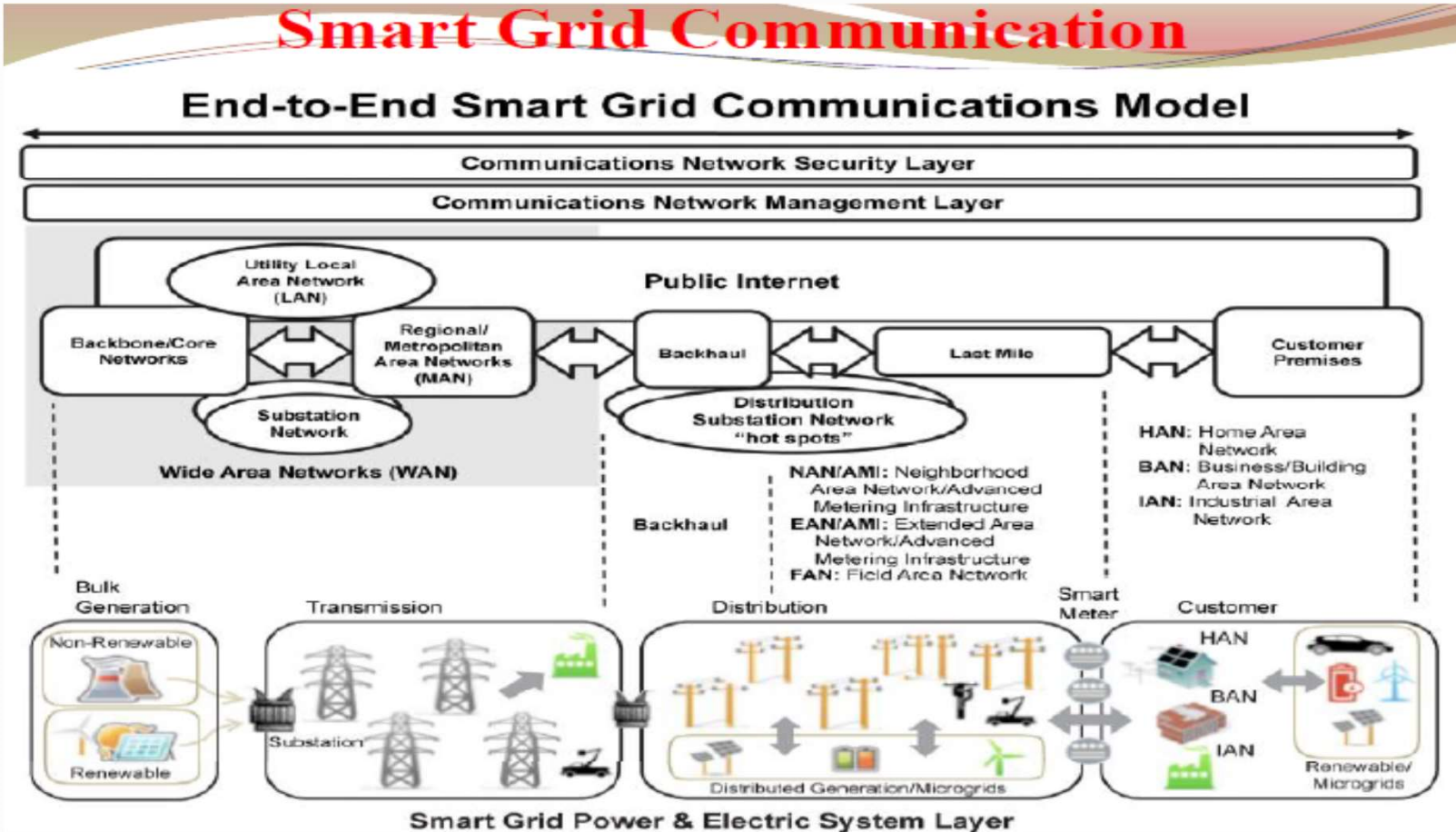
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## Smart Grid Communication



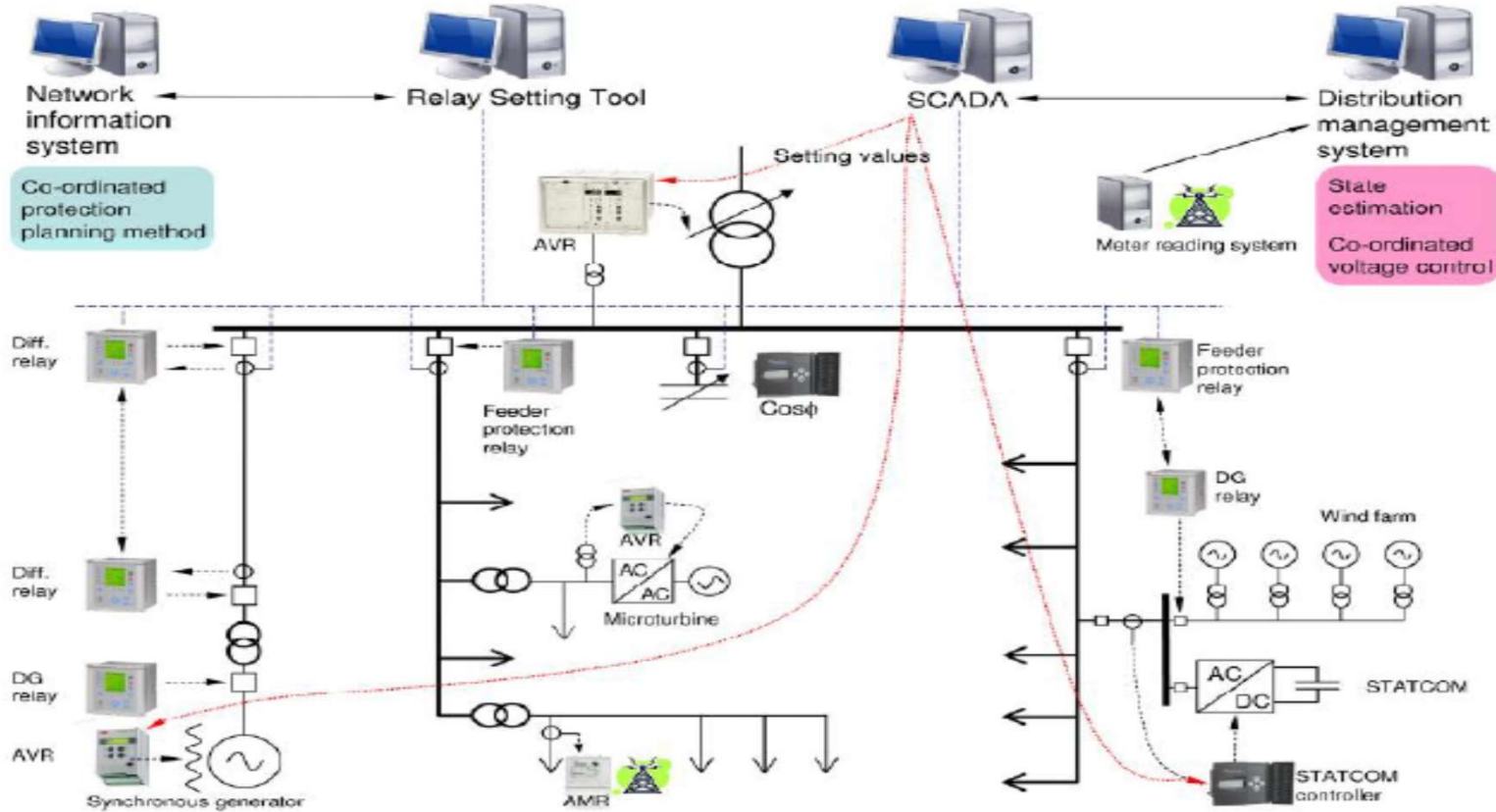
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## Monitoring and Control in Active Distribution Network

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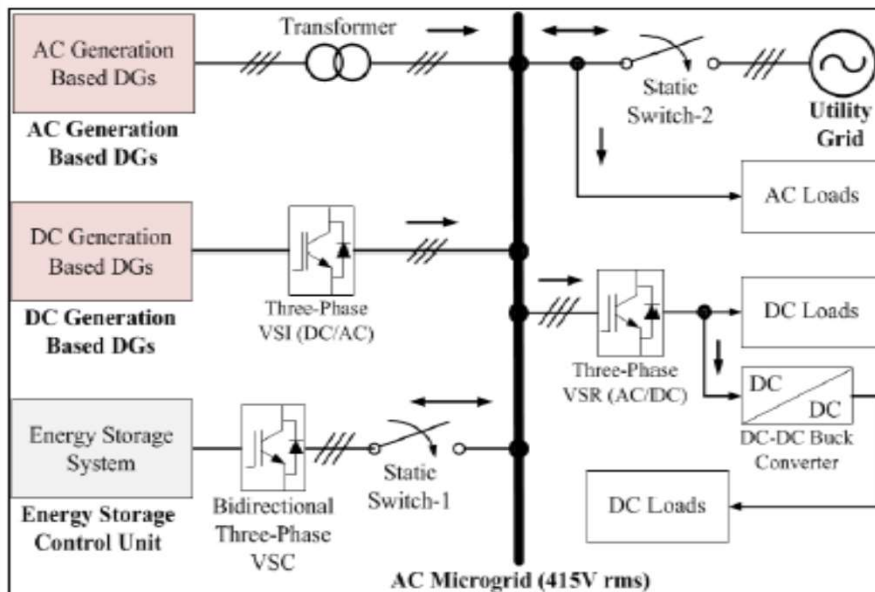


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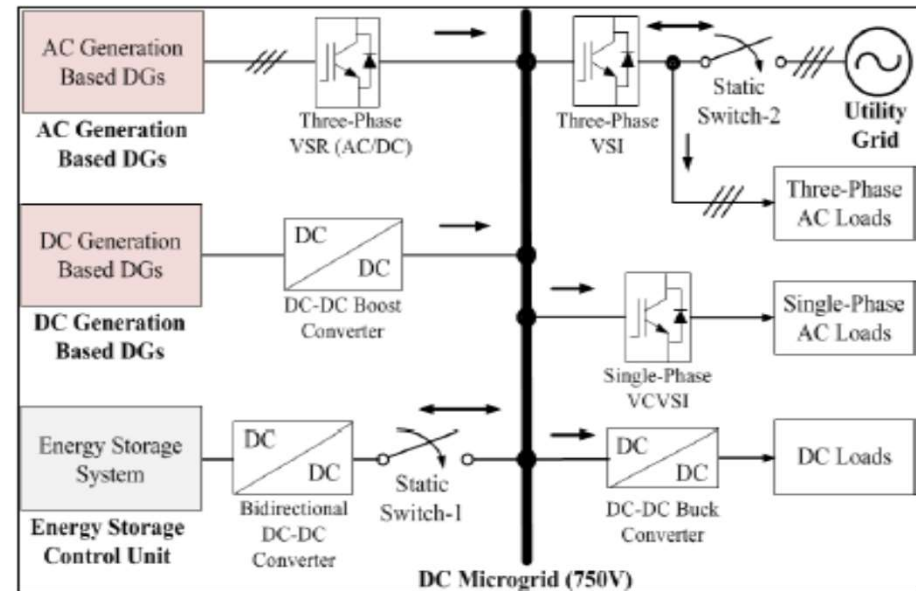
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## Microgrid for Integration of Several Sources and Storage



(a) AC Micro-grid



(b) DC Micro-grid

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## References

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