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Session Three "Distribution systems'

The Electric Distribution System In Oman: Current Context and Emerging Model With Deployment Of DERs

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Outline

- The Distribution System in Oman & Its current Context
- The Conventional Model vs Emerging Model of Power System
- Contribution of Distribution Systems To Power Sector Transformation
- Key Factors for a Smooth Energy Transition
- Conclusion

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The Distribution System in Oman

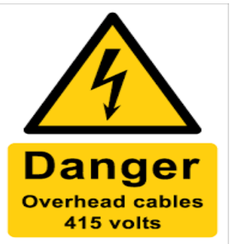
Overview

The distribution system is the latter phase in the electricity system after the generation and transmission. In this stage the voltage is being reduced by step down transformers and then electricity is distributed through distribution substations, overhead lines, poles, and underground cables. In addition, the distribution system contains wiring, service connection, measurement tools, and other control systems. According to the license granted by the authority of public services regulation (APSR), Nama Electricity Distribution Company and Dhofar Integrated Services Company are the two companies in Oman to handle the business of distribution sector.

Responsibilities

Responsible for distributing electricity in all Oman except some concession areas

This involves the operation and maintenance of the electricity distribution network assets, meter reading, and services for the supply of electricity



Responsible for operation the power distribution from the voltage level 33kV to 0.415 kV

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The Current Context of The Distribution System

According to the granted license by APSR to the distribution companies, the Licensee to undertake the following Regulated Activities:

- Distribute electricity and to finance, develop, own and/or operate and maintain its Distribution System in order to do so.
- To the extent permitted by the Sector Law and this License, to design, own, operate and maintain International Interconnections;
- To acquire certain assets and businesses of the Rural Areas Electricity Company
- To carry out any other functions assigned to it by the Sector Law, in each case, within the Authorised Area.

The Distribution Use of System (DUoS) Reform

- Assess the extent to which DUoS charges accurately reflect the costs incurred by utilities for providing distribution services
- Assess the alignment of the current DUoS charging methodology with energy policy goals, such as promoting renewable energy integration, enhancing grid resilience, and ensuring affordability for consumers;
- Develop charging structures that incentivize the adoption of distributed energy resources (DERs) such as rooftop solar panels, battery storage, and electric vehicles, while ensuring grid stability and reliability.
- Benchmark the current DUoS charging methodology against best practices and international standards in the energy sector
- Ensure the long-term viability and sustainability of DUoS charging methodologies by considering future trends, developments, and uncertainties in the energy sector.

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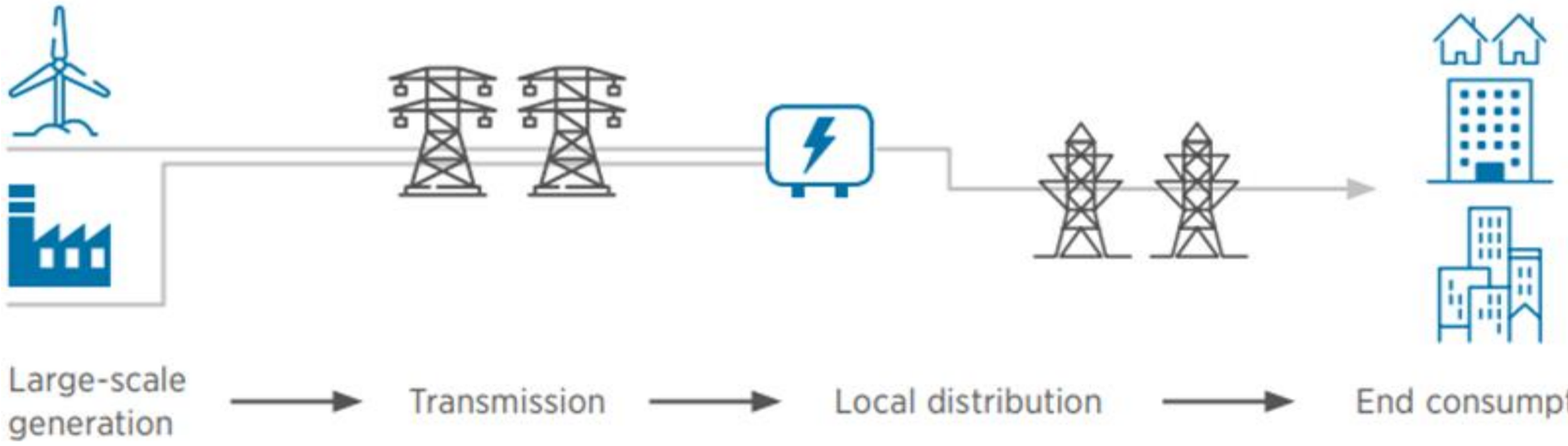
The Conventional Model vs Emerging Model of Power System

The Conventional Model of Power System



Conventional scenario

- ➜ Unidirectional flow of electricity
- ➜ No smart grid/homes
- ➜ Limited share of renewables

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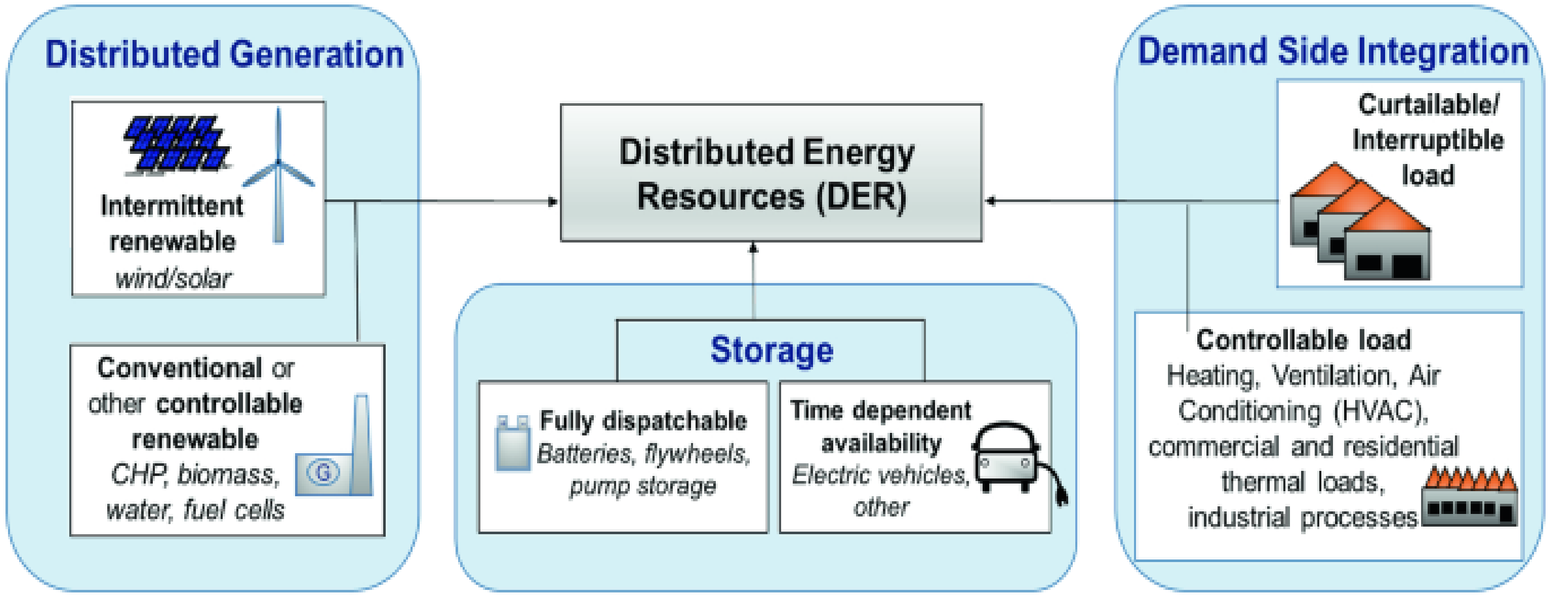
The Conventional Model vs Emerging Model of Power System

Adaptation Necessity to Distribution Energy Resources (DERs)



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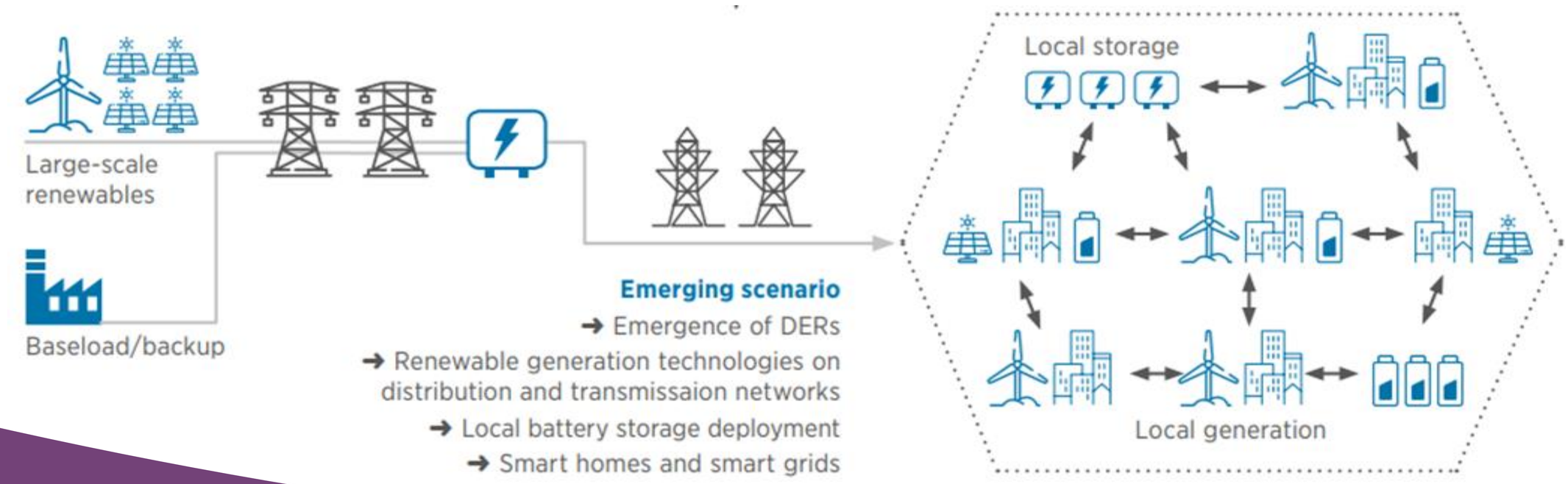
The Conventional Model vs Emerging Model of Power System

The Emerging Model of Power System



Emerging scenario

- ➜ Emergence of DERs
- ➜ Renewable generation technologies on distribution and transmissaion networks
- ➜ Local battery storage deployment
- ➜ Smart homes and smart grids

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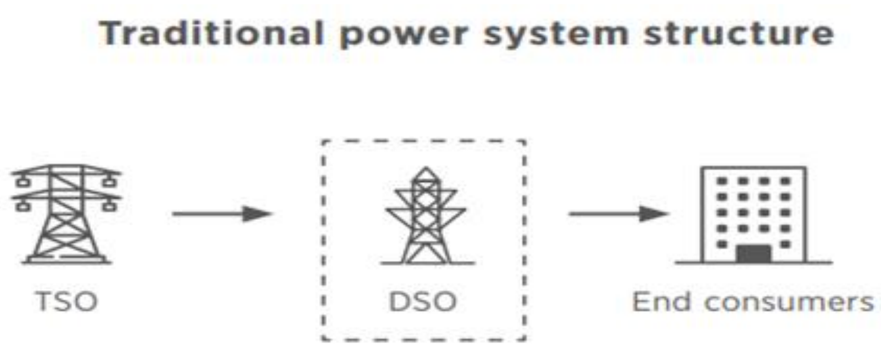
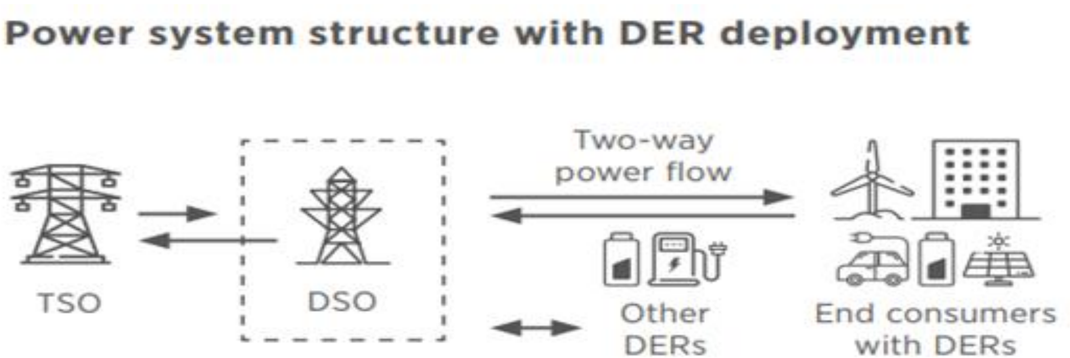
Contribution of Distribution Systems To Power Sector Transformation

The Additional Responsibilities of DSOs In the New Model of power System





Traditional Roles of DSOs

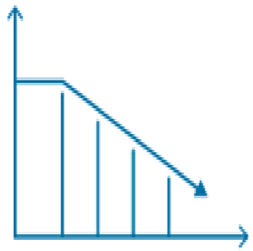
- Plan, design, operate and maintain the Dist. network.
- Management of Supply Outages.
- Connect Users to the grid.
- Load Shedding.
- Managing Network losses
- Connect & Disconnect DERs.

Emerging Roles of DSOs

- Peak load management through DERs.
- Managing metering data for small end customers.
- Network congestion management.
- Infrastructure of EVs.
- Provide reactive power support to TSOs.
- Procure voltage support.

Contribution of Distribution Systems To Power Sector Transformation

Key Benefits of the new role of Distribution System Operators (DSOs)



REDUCE NETWORK INVESTMENTS USING DERS

INCREASED FLEXIBILITY IN DISTRIBUTION NETWORKS

LEVERAGE DATA TO INCREASE RE PENETRATION

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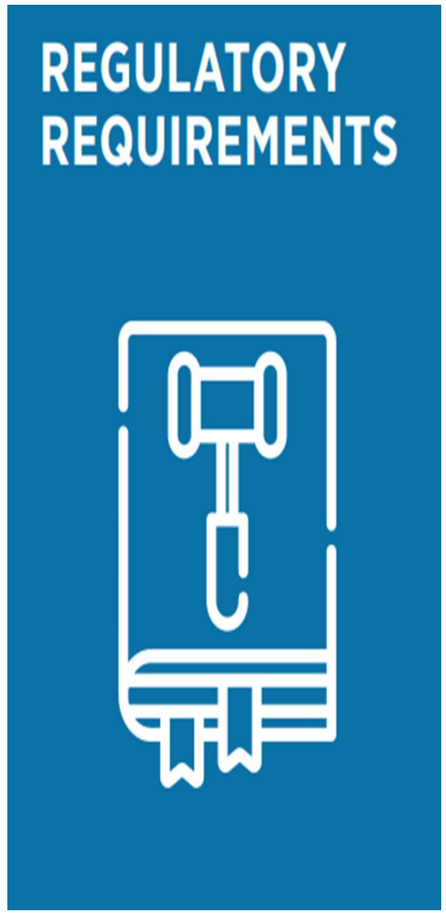
Key Factors for a Smooth Energy Transition



- Regulation to mandate implementation of Advanced Mater Infrastructure (AMI).
- Clearly defining the roles and responsibilities of DSOs, TSOs, as well as of the owners of DERs.
- Addressing cybersecurity requirements for all parties involved in the deployment of DERs.
- Regulations Incentivising DSOs for actively managing the grid.
- Clear price signal in place to guide prosumer's behaviour.
- Data Collection, management, and sharing rules for DSOs to ensure customer privacy.

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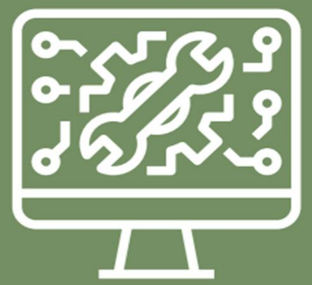
Key Factors for a Smooth Energy Transition

TECHNICAL REQUIREMENTS



- Upgrade assets to handle erratic and large reverse flow of power.
- Active network devices such as on load tap changer for transformers, ICT infrastructure including fibre cables, wireless communications, etc.
- Deployment of smart inverters along with the DERs.
- The addition of adaptive protection to distribution grid planning and design activities

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Key Factors for a Smooth Energy Transition

STAKEHOLDER ROLES AND RESPONSIBILITIES

- Ensure a level playing-field for all flexibility providers.
- Securely share customer and grid-related data with third parties.
- Better forecast for DER services based on past data or historical performance and weather forecasts.
- DER owners to clearly share with DSOs information related to capacity, location and type of DER technology.

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Conclusion

- The future of power distribution systems is a shift towards a sustainable, more resilient, and interconnected grid that can adapt to the changing energy landscape and integrate with DERs.

- The additional roles of DSOs shall have positive impacts on the way the power system is operated today.

- Several aspects required to be modified to enable distribution systems taking more active role towards a smooth energy transition.

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