Energy Transition -
A customer-led and technology-enabled transformation

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A customer-led and technology-enabled transformation

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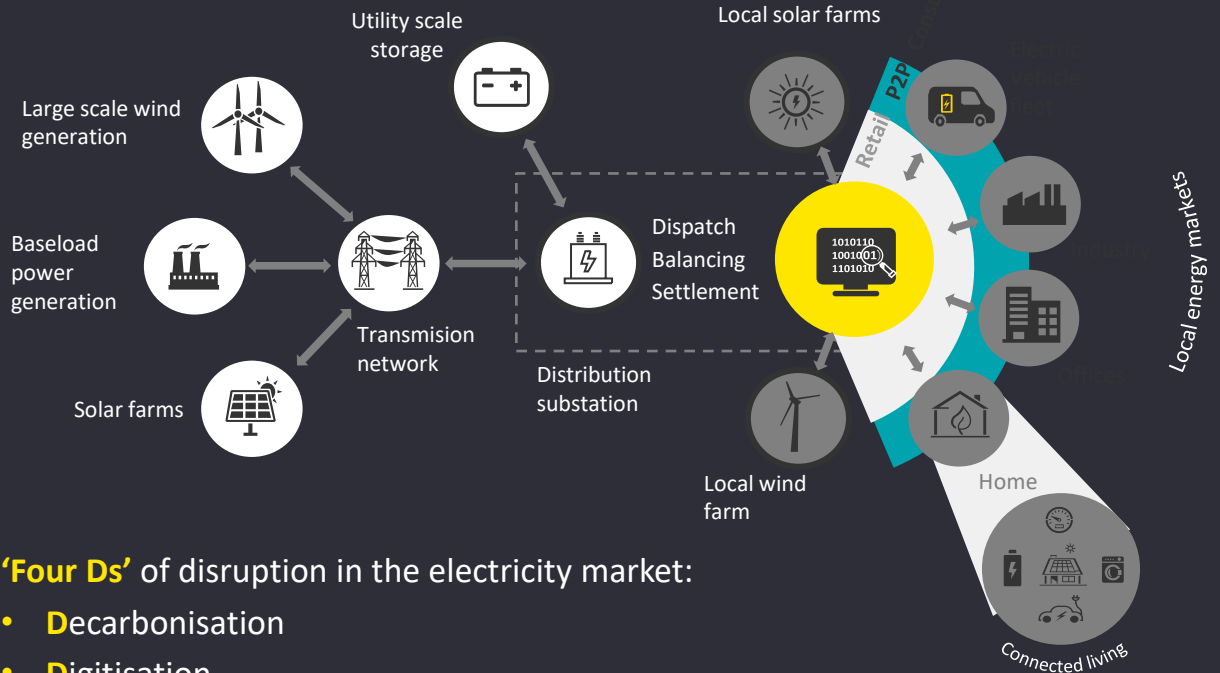
The better the question. The better the answer.
The better the world works.

Building a better working world

We are seeing the birth of a new energy system and Utilities are facing a consumer-led and technology-enabled energy transition

Sector in Transformation

- Empowered Customers
- Market Reform
- Competition
- Changing Generation Mix
- New Technology & Threats



'Four Ds' of disruption in the electricity market:

- **D**ecarbonisation
- **D**igitisation
- **D**ecentralisation
- **D**eregulated

UNDERSTANDING THE EMERGING TECHNOLOGY IS CRUCIAL TO REMAIN RELEVANT AS A UTILITY

The journey towards a distributed grid will see distribution companies evolve from network operator (DNO) to system operator (DSO)

Active management of complex systems in a self-healing, intelligent and distributed grid will necessitate advanced capabilities in addition to the core capabilities of today

Network Operator (DNO)

Network maintenance through reinforcement and load management

1. Connect

Connect load and energy resources to the network

2. Fortify

Ensure the network can support load and energy resources

3. Control

Flexible connections

Control of individual DER (Generation & Load) based on business (non-market) rules

4. Steer

Discrete flexibility platforms

DSO operated platform manages DER based on market rules and constraints

5. Integrate

Integrated flexibility platforms

DSO & TSO integrated platform to manage DER allows optimization across DSO

Advanced capabilities required:

- ✓ Capturing data from DERs
- ✓ Forecast optimization
- ✓ Distribution of near-real-time forecast and dispatch requests
- ✓ Sharing of dispatch objectives across the area level
- ✓ Transaction logging into a blockchain for settlement

System Operator (DSO)

Network development by procuring flexible services; operational & planning decisions in coordination with TSO

Journey to the distributed grid

Analytics will be a key enabler for network utilities on their transformation journey

Analytics attributes that will help network utilities…

Revealing insights
Deriving deeper insights from the data collected through smart meters, SCADA and other devices

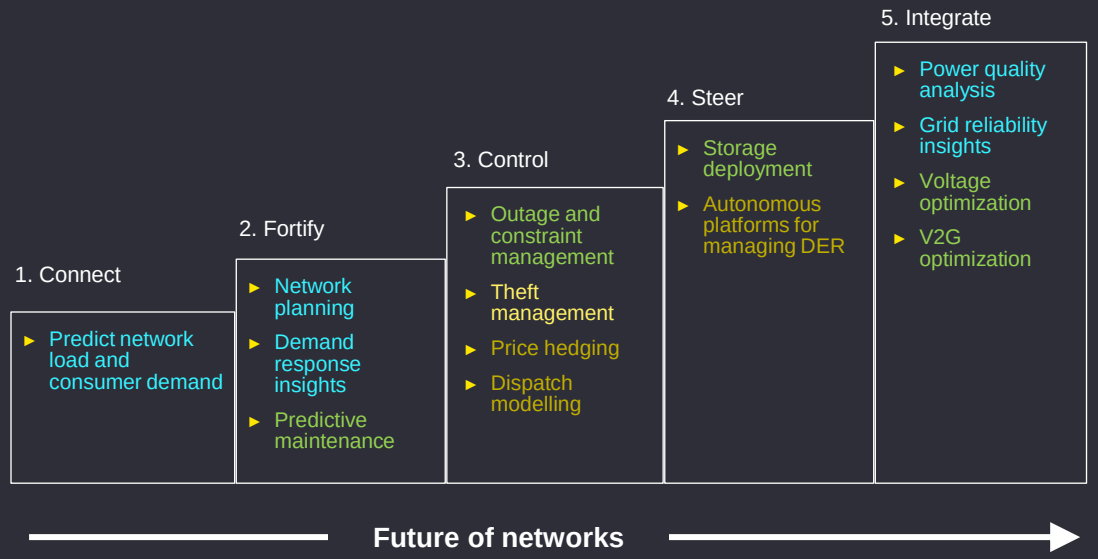
Optimizing performance
Learning newer ways to improve operational efficiencies of generation and network assets

Enhancing experience
Instant and quality experiences to the customers through digital interface and autonomous bots

Sustaining trust
Highly accurate execution of complex instructions

Intelligent automation
Integration with robotics resulting in intelligent autonomous systems

…on their journey to the future state



Would having a crystal ball to see the future help you make better business decisions?

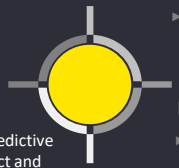
EY's definition of a Digital Twin

Digital Twin refers to a data informed, digital replica of products, processes and systems. It is analogous to the diagnostic capabilities that an X-ray or an MRI scan offers doctors prior to surgery.

Types of digital twins

Component level
- Highlight most crucial and essential component in manufacturing process
- Examples: rotor, blade

System level
- Improvising entire production line with the whole fleet of products in the system
- Examples: combined-cycle plant, crude unit



Asset/product level
- Design, monitoring, predictive maintenance of product and analysis of product life cycle
- Examples: turbine, motors

Process level
- Connecting multiple organizations across the supply chain, across the production environment
- Examples: manufacturing process

Application of digital twins

- Predictive Asset Maintenance
- Managing Distributed Energy Resources
- 3D simulation design platform
- Engineering planning
- Workflow optimization
- Network collaboration

EY's views on the use of digital twins

Our approach to building a digital twin begins with business knowledge and opportunities, the insights that can be generated and the business value of those insights

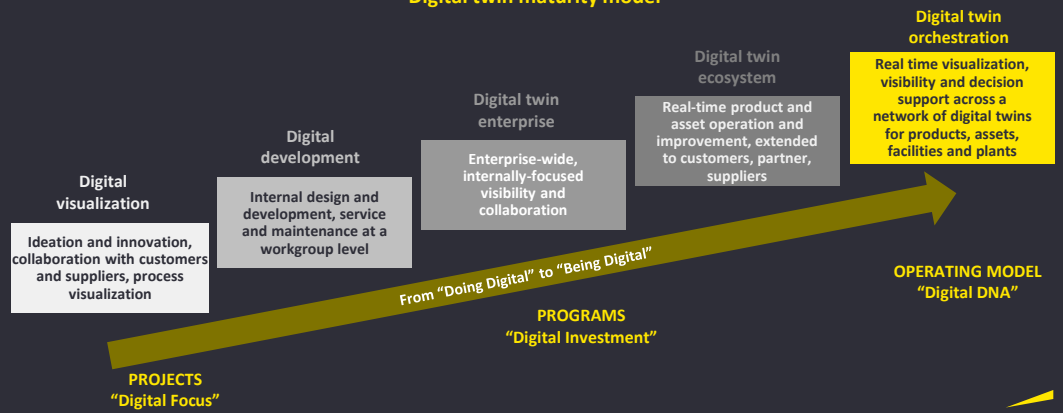
We focus on creating a canonical data model that enables different systems and applications to connect and exchange enterprise information

Use of open, interoperable and hardware-agnostic IoT systems makes it easier to introduce digital twins at different stages of asset lifecycle

The potential from digital twins is greatly enhanced when combined with use of technologies like machine learning, edge computing, etc.

Building a virtual connected network of distributed digital twins will enable efficient integration of growing DERs

Digital twin maturity model



enel

Launched a new initiative, URBAN FUTURABILITY, to transform the city of São Paulo, by deploying a Digital Twin of the electricity networks, to facilitate grid inspections and enable preventive asset maintenance

Enel-X's digital twin of the network helps facilitate grid inspections and enable preventive asset maintenance

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https://www.youtube.com/watch?v=9AW_lt3FAd8

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Network Digital Twin in Brazil

BENEFITS

Digital twin solution

Creating a digital twin of the electric network of Vila Olímpia, South Zone of São Paulo, in an all-in-one comprehensive platform

Real time laboratory

Use this platform as a laboratory of more than 40 digitalization and artificial intelligence initiatives

Technology-powered

Use of AI, RPA, data analytics, image collection, digital 3D modelling, augmented reality, etc. for remote identification of outages, anomaly detection, etc. to create a sustainable megacity

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Working across assurance, consulting, law, strategy, tax and transactions, EY teams ask better questions to find new answers for the complex issues facing our world today.

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