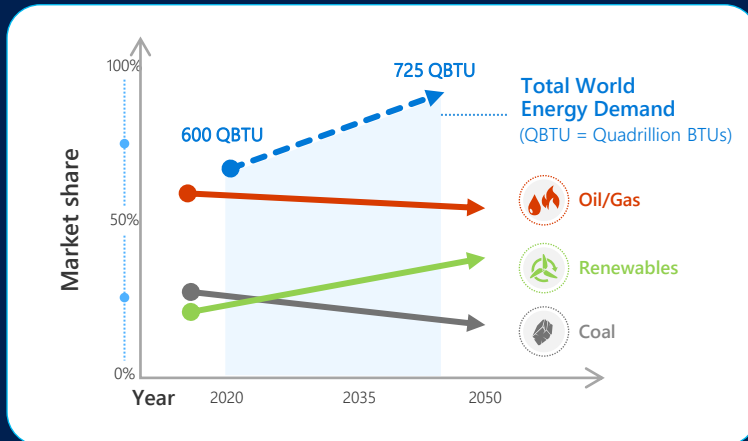# Microsoft in Energy
IoT and Digital Twins

Luis Morencos
Microsoft, WE Energy Industry Executive

The energy industry is undergoing a pivotal transformation...

ENERGY MIX

Overall Energy Demand

Total World Energy Demand
(QBTU = Quadrillion BTUs)

725 QBTU

600 QBTU

- Oil/Gas
- Renewables
- Coal

Power Generation
By 2035, **>50**% of electricity will be generated by renewable energy

DECENTRALIZATION

Today   Future

- Producer
- Grid
- Distribution Trade
- Customer
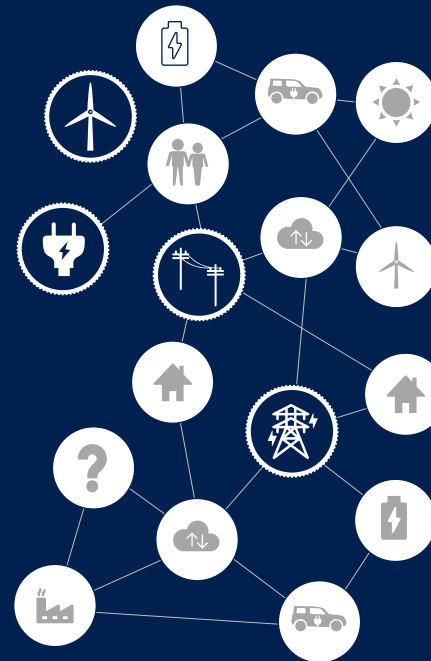
ELECTRIFICATION

Power Consumption Growth

- Residential
- Industrial
- Commercial
- Transportation
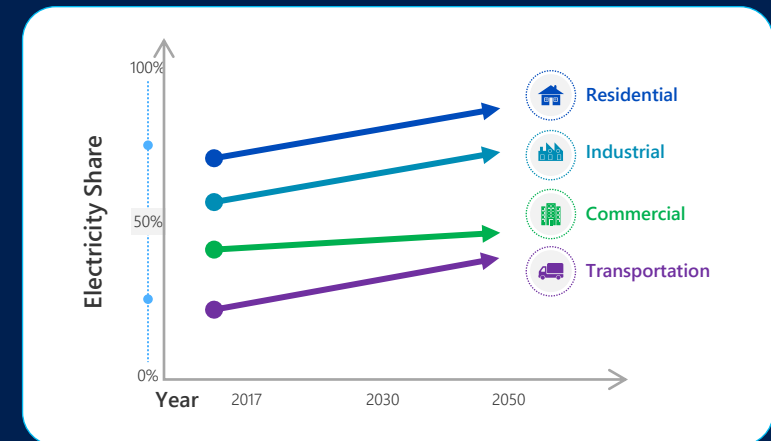
Overall Growth
By 2050, overall electricity use is expected to grow by **>50**%

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*We've got to move in that direction **[from oil & gas quickly to renewables],** but our shareholders also want the dividend. . . So we've got to figure it out.*

Distributed energy resources – small-scale local resources, often installed at a customer's home or business – can help meet California's greenhouse gas reduction goals, help customers reduce electricity use and support grid reliability.

Electricity is vital to our daily lives and can help meet rising energy demand with fewer emissions. Electricity is the fastest-growing part of the energy system.
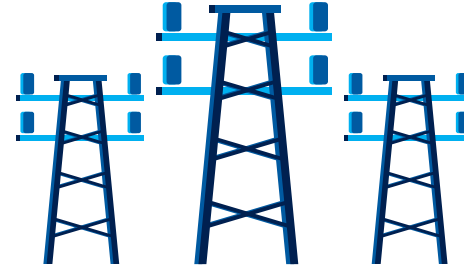
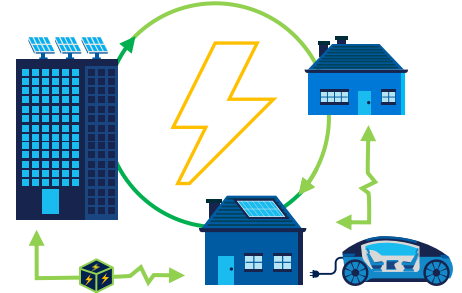# This is also driving Microsoft's Agenda
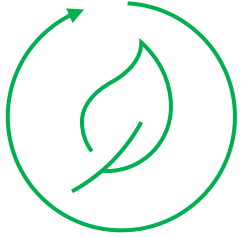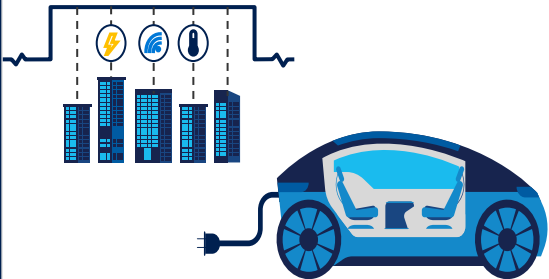

Report scope 1, 2 and 3 Emissions

Operations powered with 100% Renewable Energy by 2025

Benefit and Enable Smart Grid deployment

Benefit And Enable Grid Flexibility And Prosumer Participation

Smart Facilities & E-Mobility

BESS & Diesel-free Backup For Data-centers

Alternative Fuels: Hydrogen, Biofuels, SAF

Carbon-removal Solutions CCUS, BECCS, DAC, NBS

Microsoft for Energy: *Powering a sustainable future*

Operate for the future	Transform your workforce	Transition to clean	Reimagine energy

Azure • Microsoft 365 • Microsoft Dynamics 365 • Microsoft Power Platform • LinkedIn • Partners

Capabilities: AI • IoT • Cyber Security • Cognitive services • Digital Twin • Edge • HPC • Hybrid cloud • Blockchain • Mixed reality • Devices

Trust   Scale   Security

Digital twin is a technology paradigm for the future that's rooted in the past

In 1970, mirrored systems saved the crew of Apollo 13.

An oxygen tank explosion disrupted the NASA lunar mission.

On-ground NASA engineers used mirrored systems (a precursor to digital twins) to simulate the space craft's systems.

This life-saving solution was delivered to the Apollo 13 astronauts in record time.

Temperature: 1,000 degrees

Oxygen: 15%

Fans: Off

Last Update: **6 minutes**

Next Update: **14 minutes**

4 days to re-entry
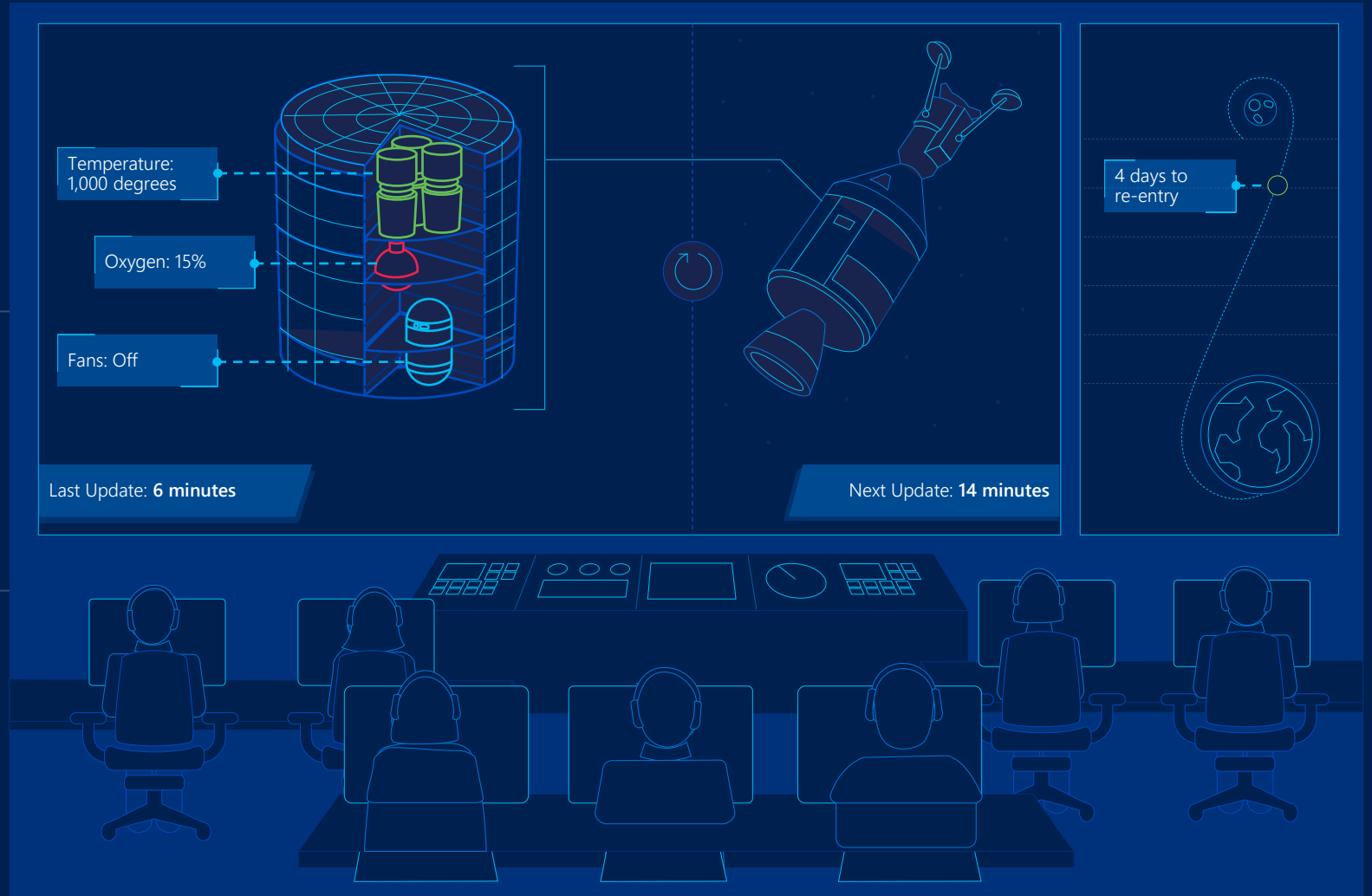
More than a simulation or dashboard, digital twins enable informed action and control

- **Remote Operations**
- **Rewind and replay**
- **Serialized asset tracking**
- **Digital verification and validation**

Microsoft – Adaptive Control

Today

- Command and control
- Data Enriched at control center
- Separate systems
- Cybersecurity
- Basic Analytics
- Monitor Assets
- Deep Domain Expertise
- High value operations

Tomorrow
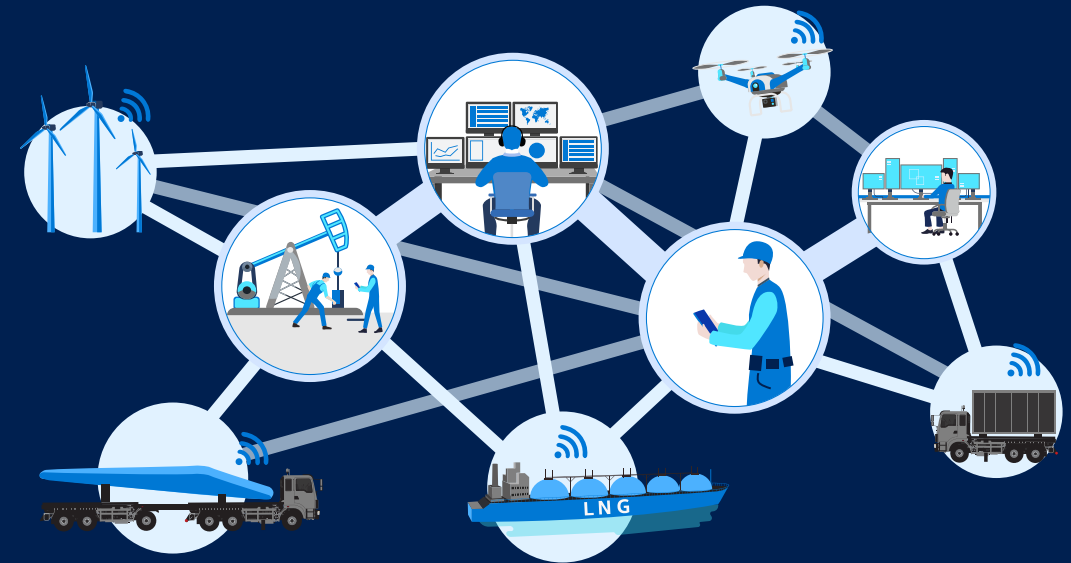
- Ubiquitous
- Data enriched at the edge
- Artificial Intelligence driven decision making
- Advanced Cybersecurity and encryption
- Distributed experts and contributors
- Monitor more assets, people, supply chain, overall operations
- Small to high value operations

Industrial Data Architecture for Energy

Industrial Data Architecture for Energy

Enterprise applications

L4: Business Planning

CRM | PLM | ERP | SCM

Engineered and SaaS Solutions

Remote monitoring | Predictive maintenance | Connected Industry | Software Defined Ops

Operations Technology

L3: Grid Ops; EMS, DMS, DERMS, AMI

Historian 2. | **Business integration**

SQL Server | Azure S... | API integration | BizTalk Services

Analytics and artificial intelligence

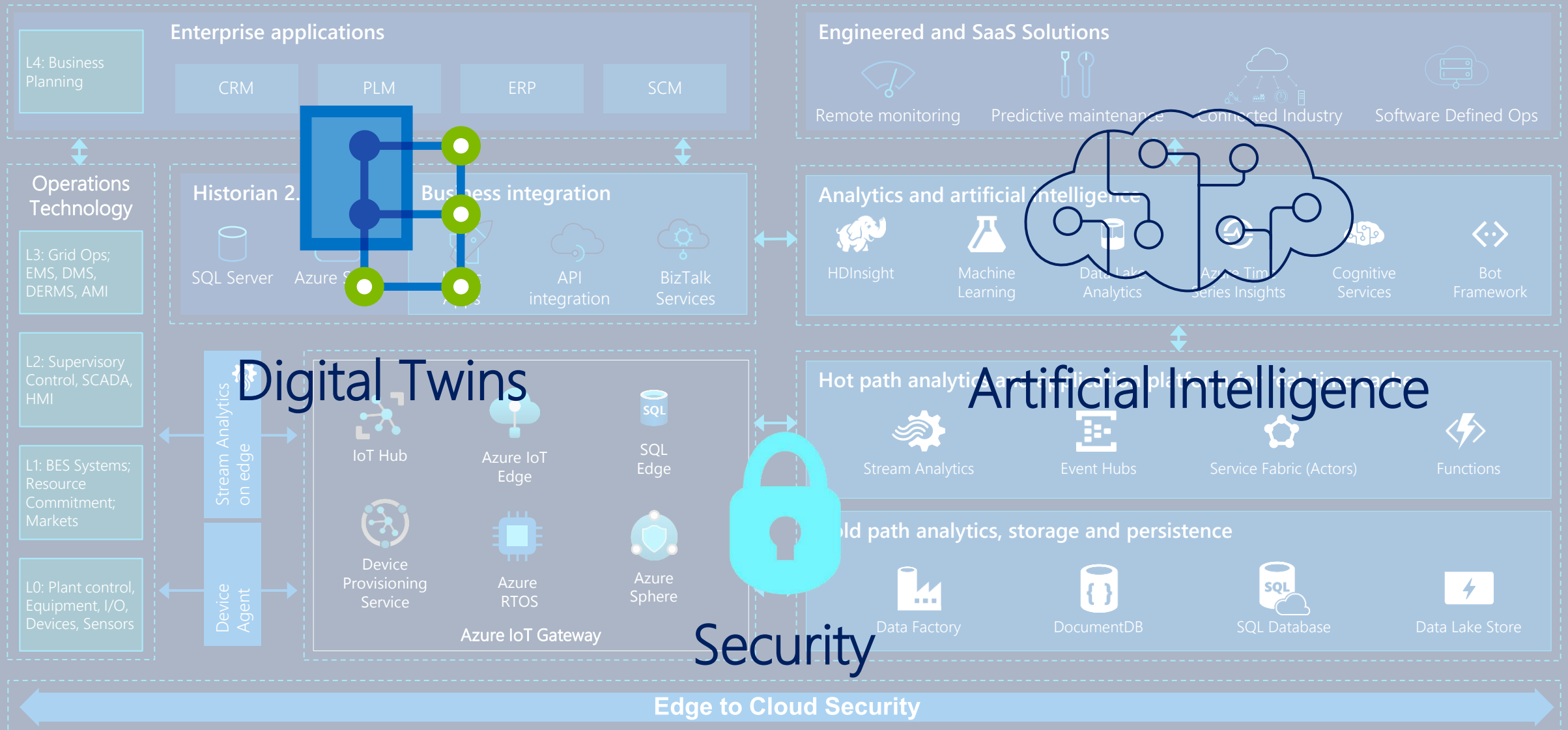HDInsight | Machine Learning | Data Lake Analytics | Azure Time Series Insights | Cognitive Services | Bot Framework

L2: Supervisory Control, SCADA, HMI

Digital Twins

Hot path analytic... ## Artificial Intelligence

Stream Analytics on edge

IoT Hub | Azure IoT Edge | SQL Edge

L1: BES Systems; Resource Commitment; Markets

Stream Analytics | Event Hubs | Service Fabric (Actors) | Functions

Device Provisioning Service | Azure RTOS | Azure Sphere

...old path analytics, storage and persistence

L0: Plant control, Equipment, I/O, Devices, Sensors

Device Agent

Data Factory | DocumentDB | SQL Database | Data Lake Store

Azure IoT Gateway

Security

Edge to Cloud Security

agder energi

Intelligent grid management for Norway

"

At Agder Energi we want to use new technology to make the power grid more efficient, more predictable and more flexible. We will go from being energy generators to energy partners, with a more active role for our customers."

Tom Nysted
CEO, Adger Energi

SOLAR ENERGY

Microsoft and ENGIE announce renewable initiatives

By ENGIE - 22 January 2020 - 17:05

Microsoft and ENGIE today announced both a long-term solar and wind energy power purchase agreement (PPA) in the United States and implementation of Darwin, an energy software developed by ENGIE using Microsoft Azure's intelligent cloud services to optimize performance of ENGIE's wind, solar, and hybrid (wind + solar) renewable assets worldwide.
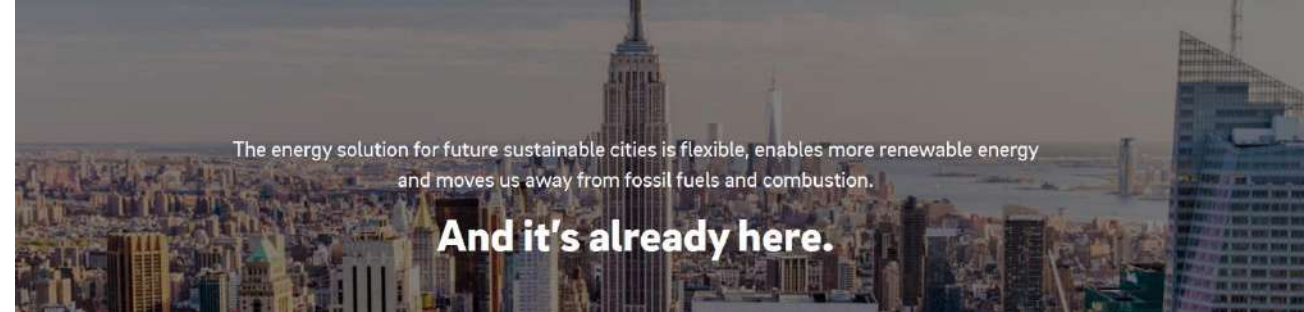
E.ON ectogrid™ a highly efficient 5th generation thermal network

The energy solution for future sustainable cities is flexible, enables more renewable energy and moves us away from fossil fuels and combustion. **And it's already here.**

"By making a loop of thermal energy streams, ectogrid™ helps provide all the heating and cooling necessary for an entire city."

"
What we liked about ectogrid™ is the ability to circulate, reuse and share the energy within our buildings. ectogrid™ is an innovation that fits well into what we want to be – a sustainable and innovative science park for research and innovation."

— **Senior advisor (former CEO)**
Medicon Village

Australian Energy Simulation Center (AESC)

- Simulation of the entire energy supply

- Integrates data from multiple suppliers and systems of record

- Enhanced forecasting and grid reliability

- Detailed models of wind, solar and battery storage systems

- Simulated grid behaviors to better enhance decision support

- Objective is a one-minute simulation with 3 minutes of processing time

- Enhanced support for environmental mitigation
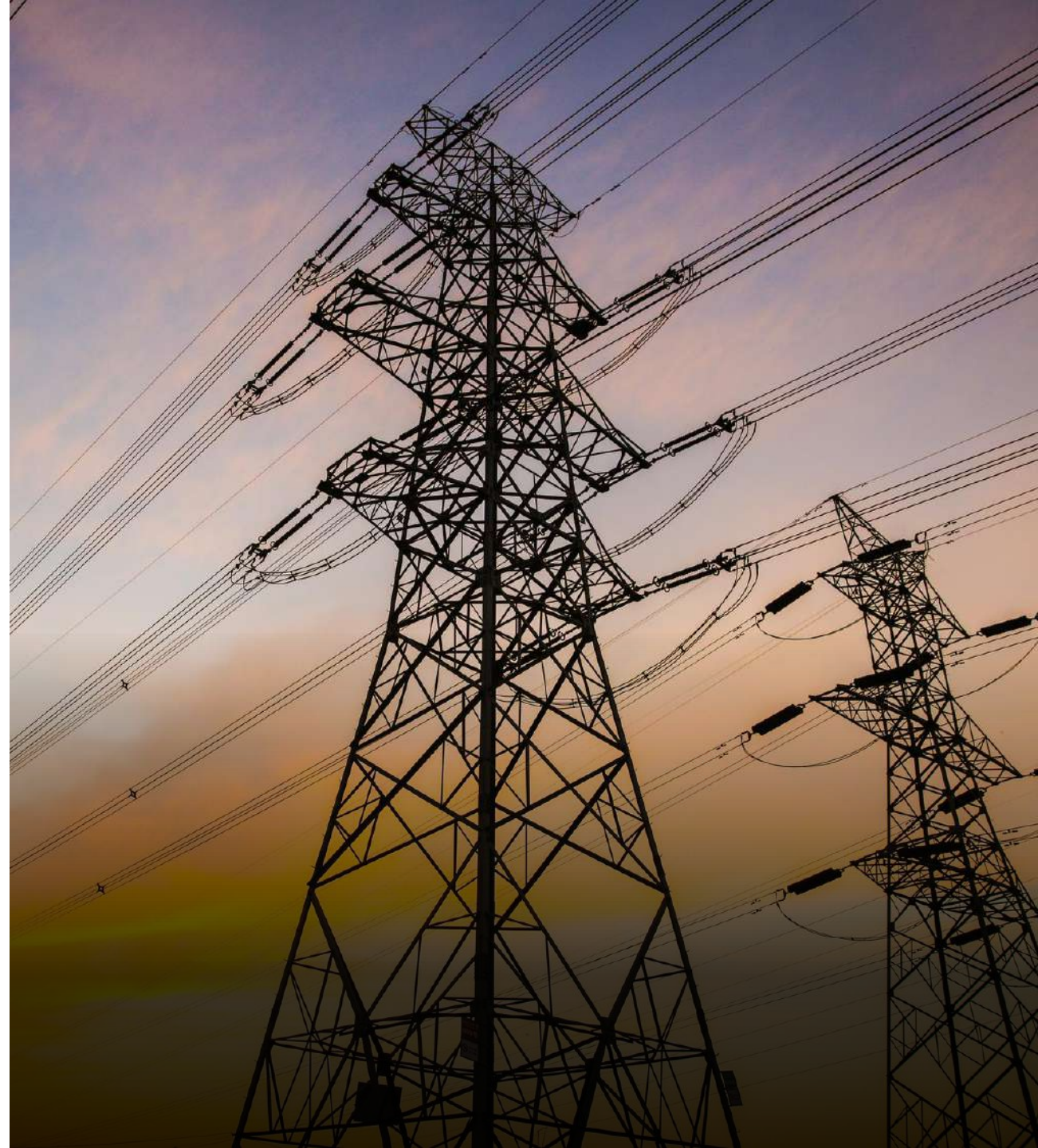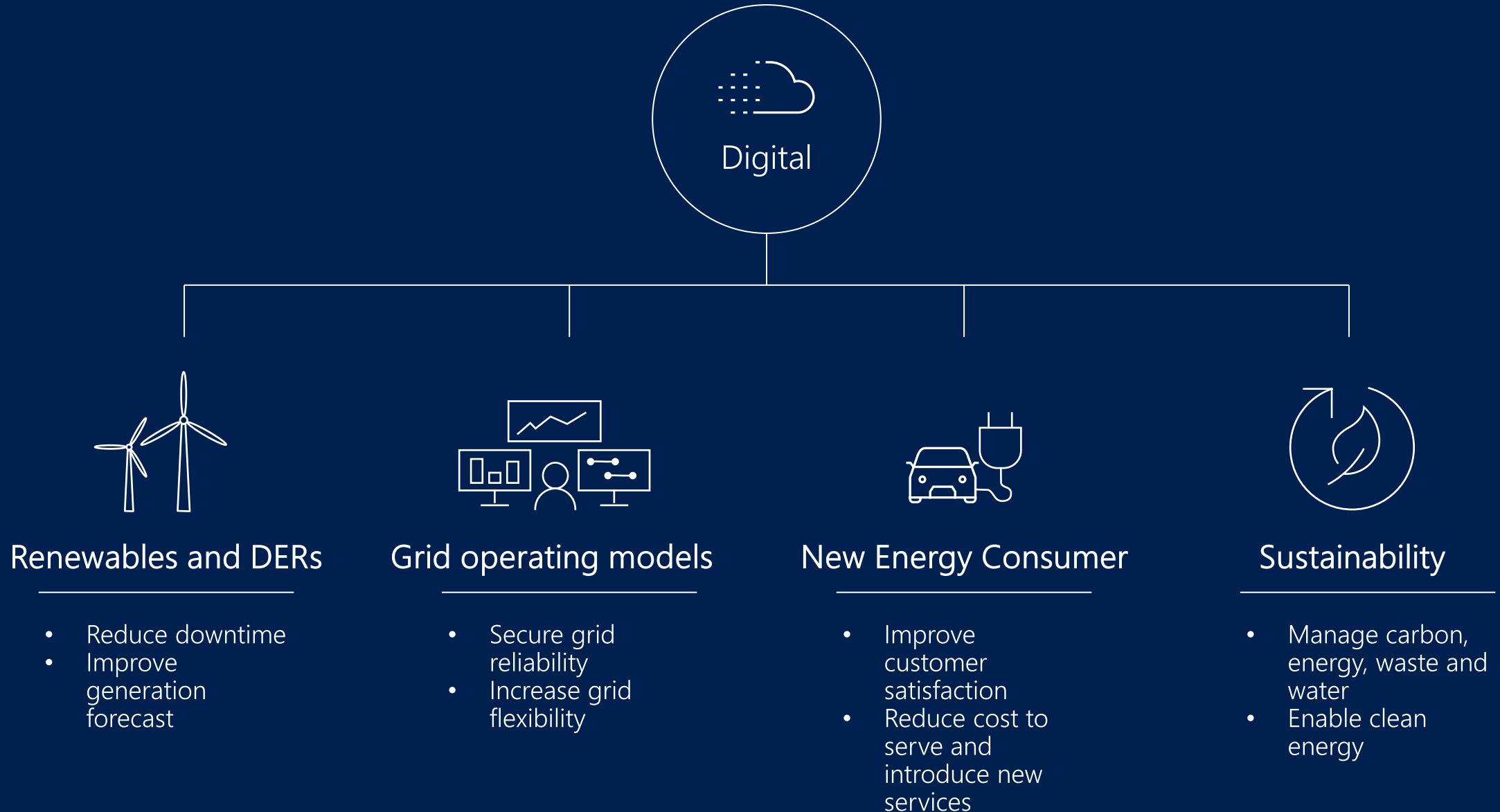
Jointly working to unlock Distributed Solar PPA

"

This project can have a tremendous positive impact for Microsoft, as it delivers solutions to reduce carbon emissions in Ireland and builds on a strong partnership with local stake-holders. It is not the MWh that matters, but the positive and innovative story."

— **Vanessa Miler**
CO&I Renewable Energy

Digital as an enabler for Decarbonization

Digital

Renewables and DERs

- Reduce downtime
- Improve generation forecast

Grid operating models

- Secure grid reliability
- Increase grid flexibility

New Energy Consumer

- Improve customer satisfaction
- Reduce cost to serve and introduce new services

Sustainability

- Manage carbon, energy, waste and water
- Enable clean energy

Thank you

Luis Morencos | WE Energy – Industry Executive

in Luis Morencos