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Wired for tomorrow

Unleashing the power of digitalisation in grids

in collaboration with

accenture

Executive Summary

Ambitious EU targets requiring grids to digitalise

- The European electricity grid is undergoing a massive transformation driven by the ambitious EU decarbonisation objectives and a moving industry context
- The power system is shifting from a central and one-way to a more decentral and two-way model for energy and data with evolving roles for DSOs, backbone of the energy transition
- To timely and successfully deliver the power system of the future, DSOs need to expand, modernise and digitalise to increase the grids' capacity and efficiency

Digitalisation as a means for enhanced grid efficiency: what is the state of play?

- In our study, Eurelectric, in collaboration with Accenture, assessed DSOs' digital maturity along with technological readiness to support their digital journey
- The EU DSOs self-assessed their digital maturity across their 4 core capabilities reflecting the end-to-end DSO value chain :

Build	Operate	Maintain
Expand the grid	Use the existing network at its full potential	Generate predictable asset insights and increase worker safety and productivity

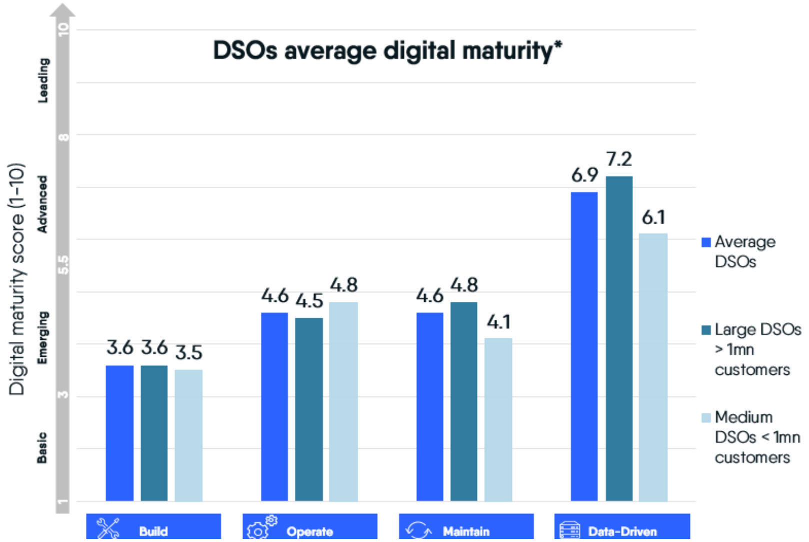
Data Driven

Integrated, scalable and secured technologies across the Build, Operate & Maintain focus areas

A successful digital transformation is business and data driven

1. Starts with a business case
2. Translate into use cases & data models creation
3. Implement the relevant technology

DSO's digital maturity



DSO digital maturity is not dependent on DSO size

Yet, spread in DSO digital maturity is substantial, strongly DSO dependent

Data-Driven capability and specifically the cybersecurity domain is on track, whereas Build capability underutilises digital

DSOs with a higher renewables penetration rate demonstrate higher degree of digital maturity across all capabilities

Key report insights on digitalisation

A must-have tool with proven ecosystem-wide benefits	The power of regulation	Limited availability of OT data in IT systems
Balancing build-out & flexibility	Providing skills and mitigating talent scarcity: a top priority	A goal-oriented transformation with ready-to-use technologies

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Content

The EU's ambitious decarbonisation objectives require unprecedented electrification, calling for more distributed energy resources and digitalisation

EU objectives*

- 55% CO2 by 2030
0 by 2050

+ 42,5% RES by 2030

Ban of non-electric cars and -45 % emissions for trucks by 2030

Active customers (e.g. energy communities, prosumers)

New business models (e.g. national flexibility targets)

*Sources: European Green Deal (Package of policy initiatives to realise net zero emissions by 2050) and Fit for 55 (Bring EU in line with goal to reach 55% net emissions reduction by 2030)

Industry context

Geopolitical crisis: Physical and cyber threats

Supply chain disruption

Regulatory pressure

Ageing network

Extreme weather events

Massive and unprecedented increase in demand for connections

Implications for DSOs

Electrification entails a need to increase grid capacity by investing 67 bn euros yearly until 2050*

Increase in decentralised generation requires more control, visibility, better grid planning and forecasting

Customer call out for more empowerment through relevant information and digital support

*Source: Eurelectric Grids for Speed (2024)

Mega trends: "the 3 Ds"

- Decarbonisation through electrification
- Decentralised generation
- Digitalisation

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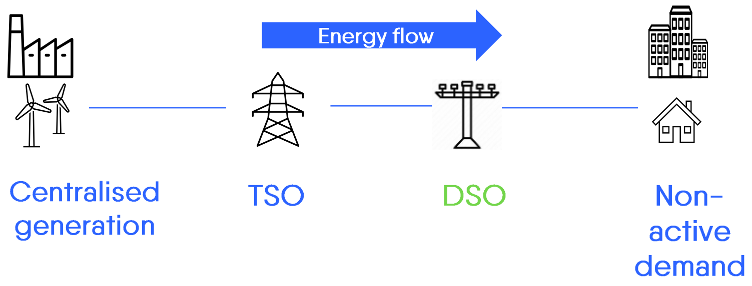
Due to these trends, the power system is shifting from a transmission-heavy model to more focus on transmission & distribution with evolving roles for DSOs

The energy transition implies a major change in the operations of the distribution network:

Traditional power system

- Unidirectional electricity flow
- Passive distribution network
- Limited share of renewables
- No smart grid or smart home/appliances

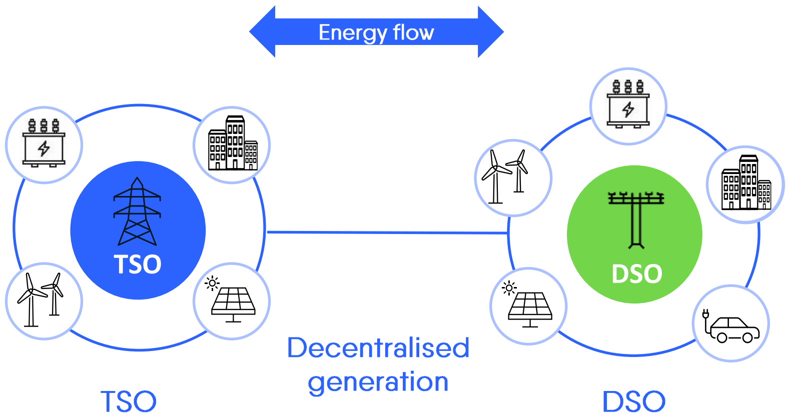
From a uni-directional model...



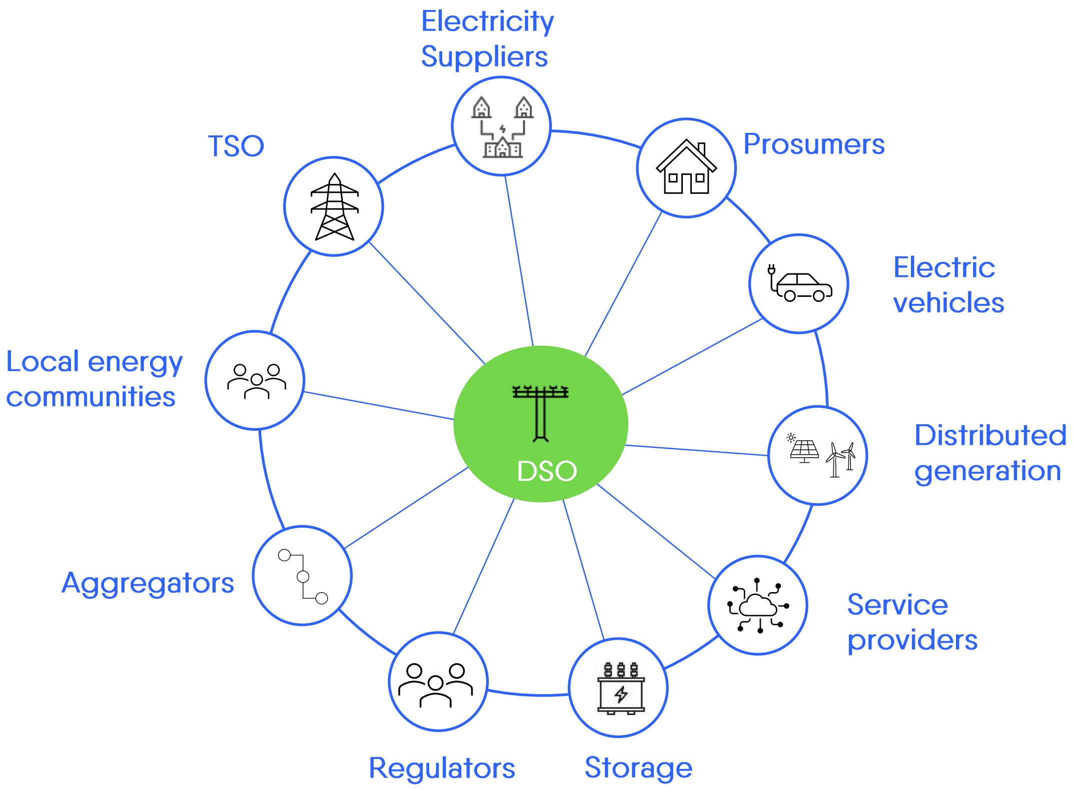
Modern power system

- Strong increase of RES installation and smart appliances
- Bi-directional electricity and data flow
- Active distribution network
- Active demand and new demand response capabilities
- Innovative services
- One system approach

To a bi-directional model...



DSOs are a core partner to the key involved stakeholders of the energy transition, specifically with customers:



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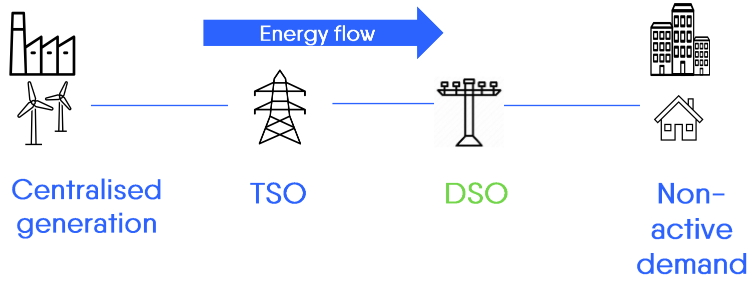

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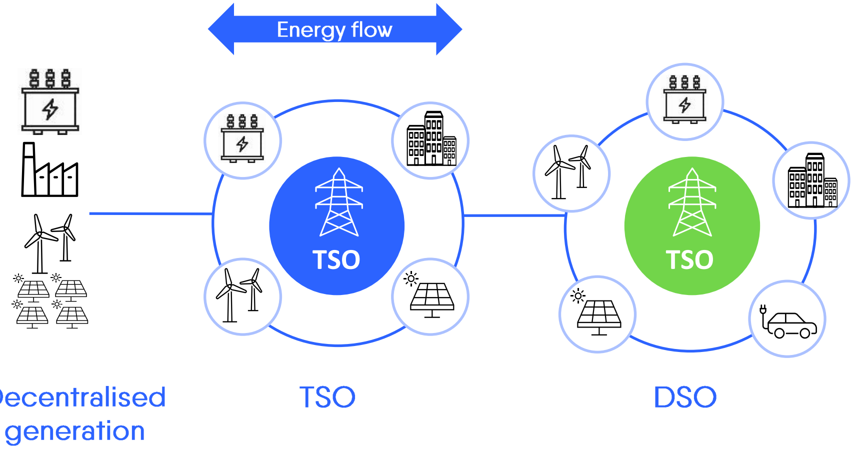

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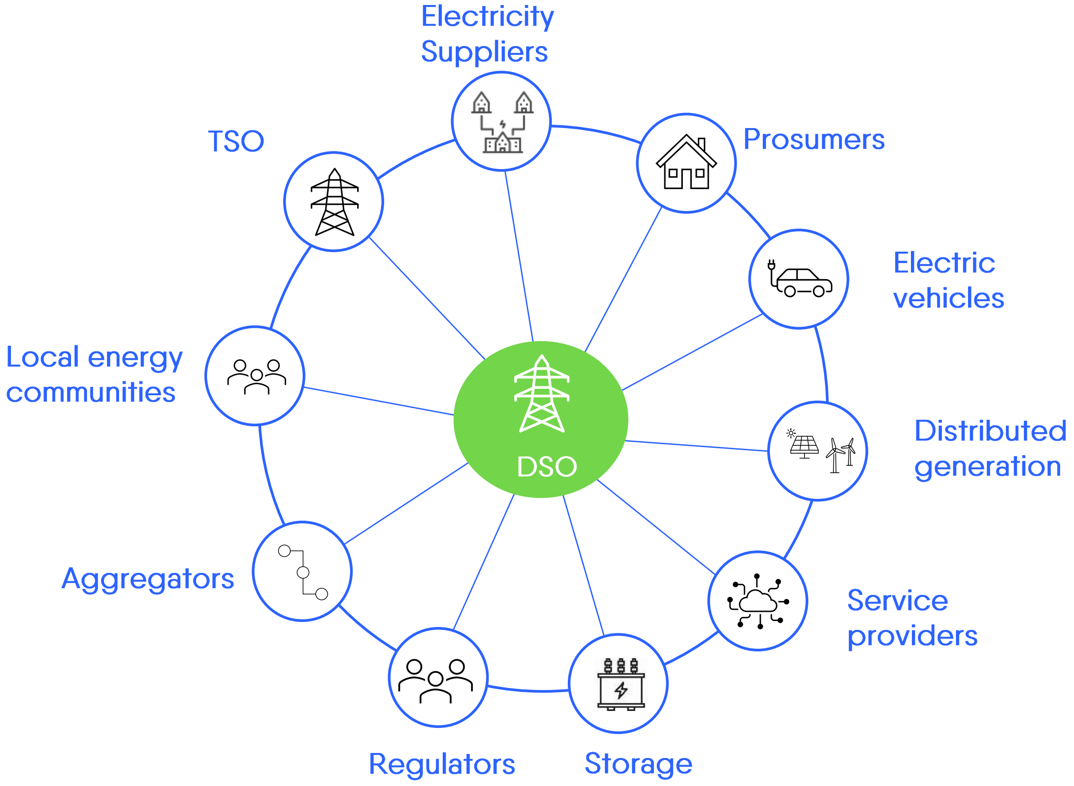

As the grid transforms towards decentralised generation and active consumers, distribution grids form the backbone of the energy transition

To deliver the power system of the future, we need to expand, modernise and digitalise to increase our grids' capacity and efficiency

Expand

- The rate of grid expansion is falling behind the new customer connections +19% in 2020-2021*
- To enable the rapid expansion of the grid need to improve the permitting process
- Develop mechanisms to incentivise the needed flexibility for the power system of the future

Modernise

- Establish enabling mechanism for flexible connection agreements with customers
- Improve customer service and reliability with large scale DERs
- Increase grid observability specifically on LV network
- Enhance skills of field force to handle the change in nature of the grid

Digitalise

- The legacy grid infrastructure (40% of the grid over 40 years) and technology systems are decades old and not suited to use the many data points being added to the grid system
- As new and a greater number of players enter the grid ecosystem, DSOs need to ensure all the data flow is highly secure for customer privacy and cybersecurity
- Need solutions to use data from DERs, smart meters, smart heating, smart chargers

Digitalisation is key to meet the challenges and opportunities of a changing energy landscape

If we don't fully digitalise our infrastructure, we will not be able to run our energy systems in a stable way going forward. We won't be able to manage a complex, decentralised system, with more variable generation and flexibility needs.

Leonhard Birnbaum, President, Eurelectric

*Source: Eurelectric Powerbarometer (2023)

Content

Key questions initiating the report

Is the grid digitalised enough to cope with the energy transition?

What are the challenges in grid digitalisation?

How can DSOs increase the pace of digitalisation?

How can technology support DSOs?

What is the technology vision for DSOs?

Eurelectric, in collaboration with Accenture, explored the state of play of DSOs' digital maturity and assessed the technological readiness for their digital journey

Goals of the study

1*

Assess the state of play, benefits and ways forward in digitalising the distribution grid

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2

Provide regulatory **recommendations** for **policy makers** in the digitalisation space

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**Only part 1 is covered in this report*

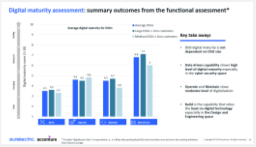
Methodology

- **Conduct a survey and perform in-depth interviews** to assess the maturity levels of DSOs
- **Design a roadmap** with different maturity levels and a North Star vision
- **Identify digitalisation benefits** with and for grid operators, customers, and market players
- **Bridge the gap** between DSOs and technology players

- Map digital energy policy for DSOs. Leverage findings from the **survey, in-depth interviews and policy workshops**

Outcomes

Digital maturity assessment



Digitalisation challenges and key insights

Technology roadmap and

Policy recommendations

Our report focuses on the four core DSO capabilities : Build, Operate, Maintain and Data driven from a digitalisation perspective

To deliver the power system of the future, increase our grids' capacity and efficiency, we need to expand, modernise and digitalise.
As a scope to our report, Accenture and Eurelectric identified "Build, Operate, Maintain and Data-Driven" as four core capabilities to cover the end-to-end DSO value chain.

Digitalisation maturity for core DSO capabilities :

Build

Expand the grid

To quickly ramp up the grid capacity for renewables integration and increasing energy demand

Operate

Use the existing network at its full potential

Maintain

Generate predictable asset insights and increase worker safety and productivity

Transversal digitalisation perspective, going across the 3 core capabilities :

Data-Driven

Integrated, scalable and secured technologies across the Build, Operate & Maintain focus areas

To aggregate data from all the sources on the distribution system and use them for better grid management

Study: a two-tiered survey to gauge digital maturity of DSOs followed by detailed discussions

Our survey is composed of 2 main parts: open strategic questions along with functional questions. Each capability is broken down in a set of sub capabilities used for the functional self assessment where DSOs graded themselves based on their capabilities and used technologies.

Open-questions (15)

Strategic
System OEMs
Digital/ Technological initiatives
Required business areas to digitalise
Major internal challenges
Major external challenges
Key strategic objectives

Functional questions (69)

Build	Operate	Maintain
Licensing & permitting	Operation planning, outage management, reliability	Asset data management
Network design & grid modernisation creation	Grid operational efficiency	Asset portfolio & risk management
Construction & commissioning	Customer operations & engagement	Maintenance strategy, planning & engineering
Contracts & procurement	Digital metering	Work order management, execution & field ops monitoring
Portfolio management	Flexibility management	Vegetation management

Data-Driven			
	Technology & platforms	Data & insights	Cybersecurity

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A representative sample of DSOs surveyed

31 DSOs

serving

80M+

customers in

21 countries,

covering

30%

of EU customer base

Countries Responded

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Size of DSOs

- 70% of DSOs have **more than 1Mn connected customers**
- Equal number of DSOs with less than 100k customers and between 100k-1Mn customers

Volume of renewable energy connected

- About **half of the DSO** participants have a **renewable penetration rate higher than 60% of their peak load**
- 39% of DSOs have a renewable penetration rate of 20% to 60% of their peak load

Voltage level

- **81% of DSOs** are working in **low, medium and high-voltage** levels
- **19% of DSOs** are working on solely **low and medium voltage**

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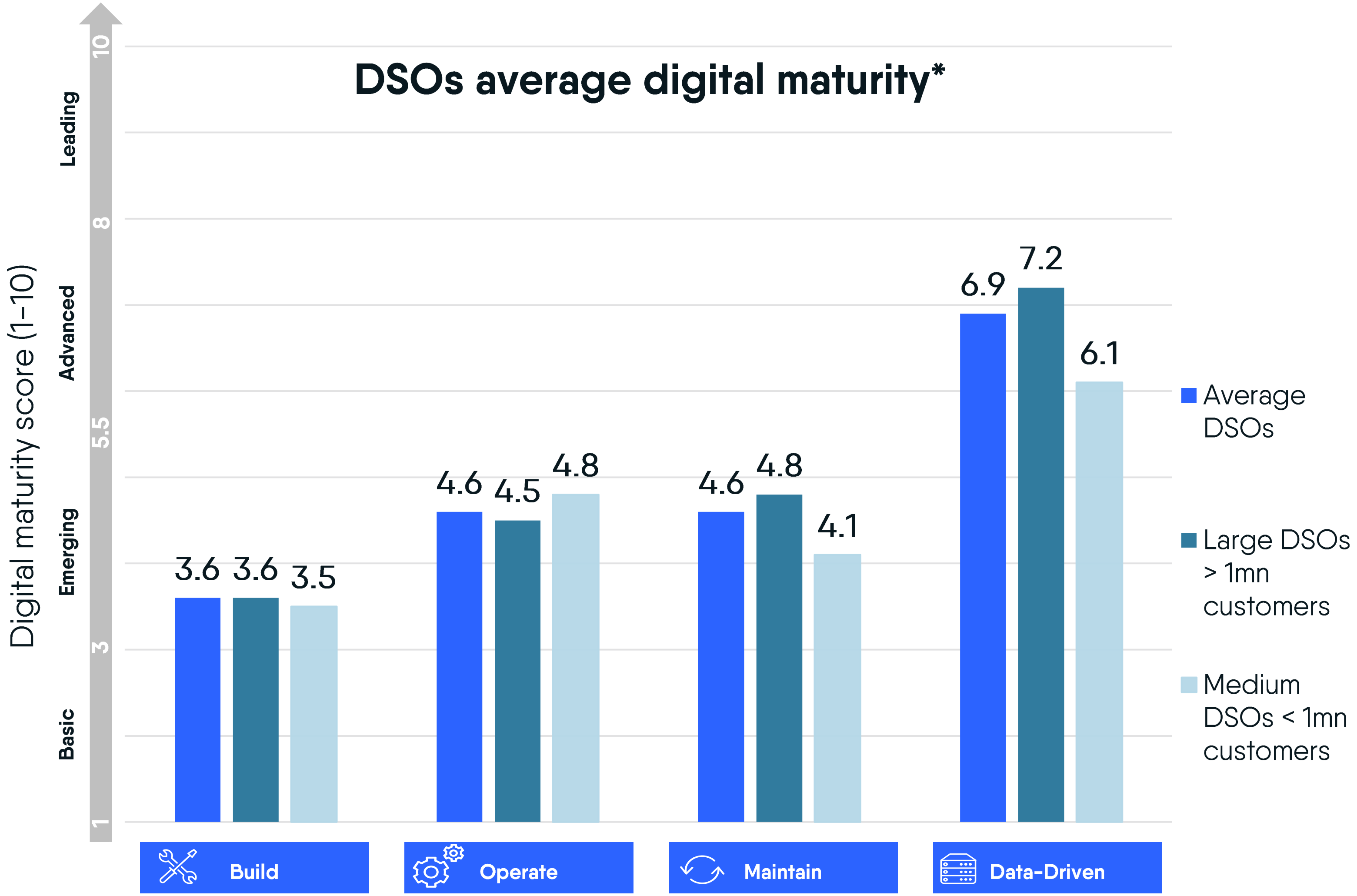
Digital maturity assessment: summary outcomes from the functional assessment

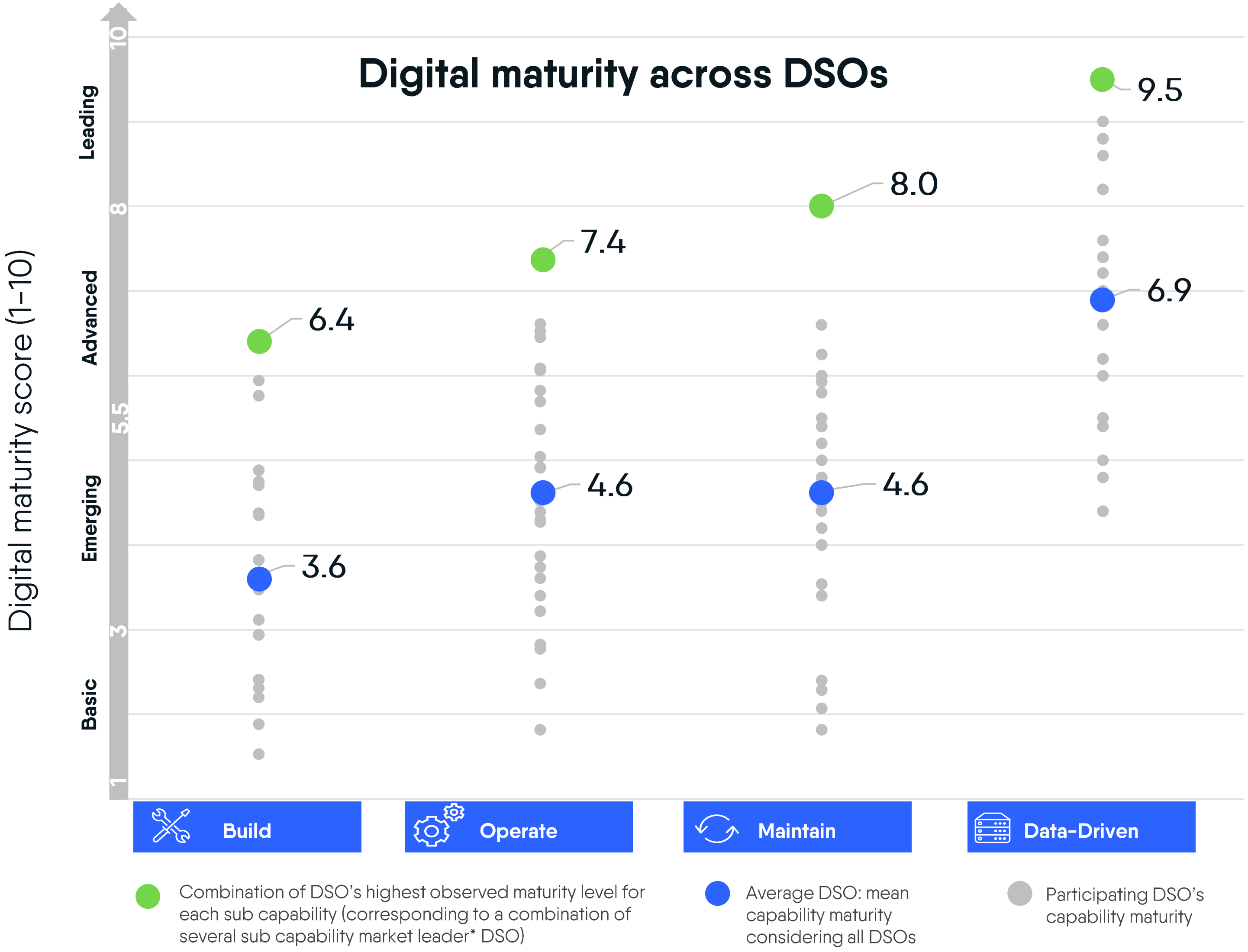


Key take aways

- DSO digital maturity is **not dependent on DSO size**
- **Data driven capability** shows **high level of digital maturity** especially in the **cyber security space**
- **Operate** and **Maintain** show **moderate level** of digitalisation
- **Build** is the capability that relies the **least on digital technology** especially in **the Design and Engineering space**

*Possible "digitalisation bias" in respondents i.e., it is likely that participating DSOs have launched more and more far-reaching initiatives than the industry average

Diverse maturity levels: from leading DSOs to lagging performers in the industry landscape



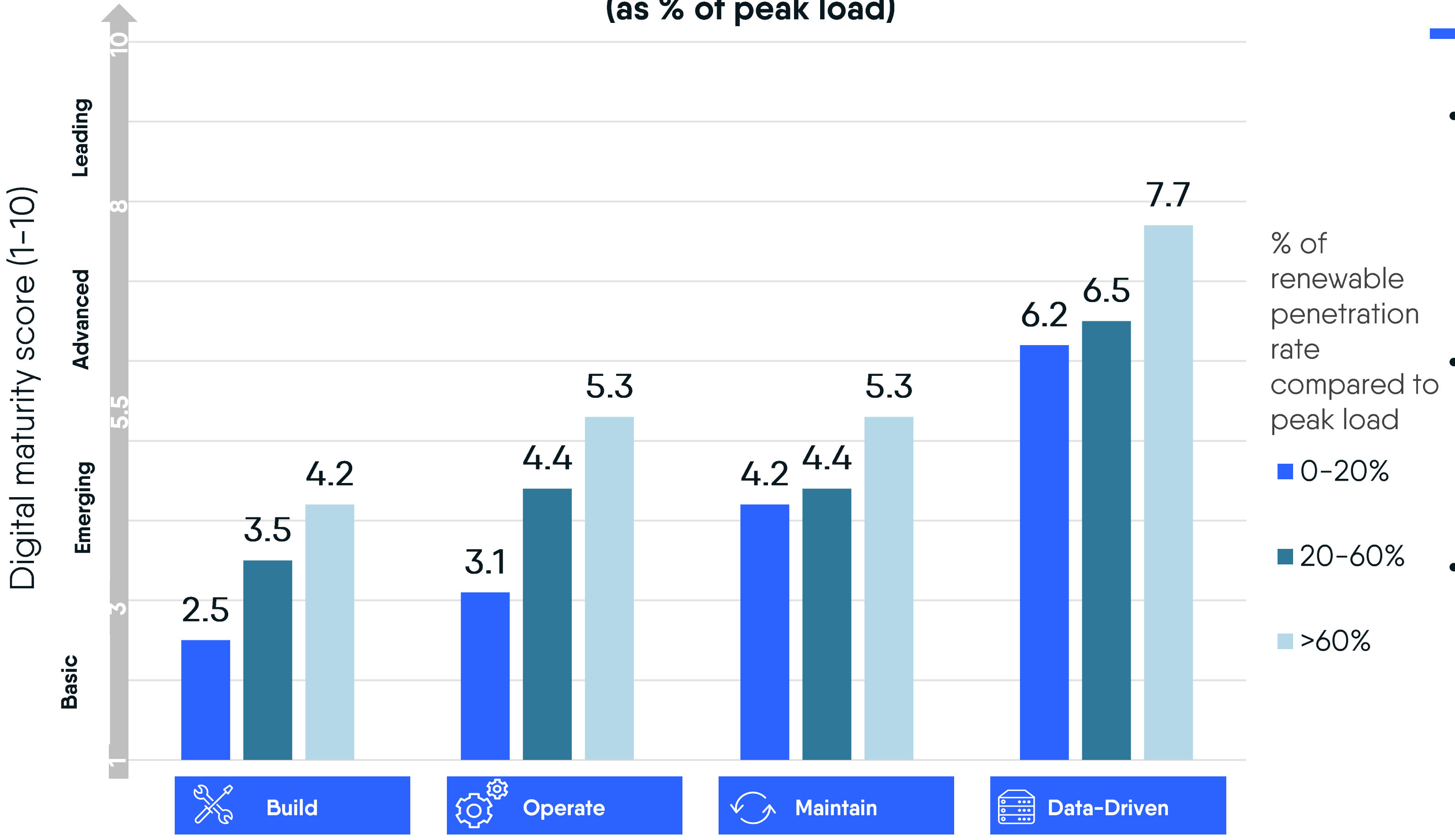
Key take aways

- The **spread in DSO digital maturity** is **substantial, strongly DSO dependent**
- For each capability, several sub capabilities are defined : **1/3rd of DSOs are market leader* in one sub-capability at least**
- **Build as a capability stands lower than other capabilities.** This is also applicable to the spread of Build
- **There is a higher concentration of DSOs in Operate and Maintain within the emerging to advanced stage** – very few DSOs in basic maturity
- All DSOs have a relatively **high Data-Driven maturity**

*Market leader: defined per *sub capability*, as the DSO with the highest observed maturity level for this given *sub capability* [ie. for a given capability there are potentially as many market leaders as defined *sub capabilities* within this capability]

Business demands shape the digitalisation of DSOs. A higher penetration of renewables is one of the push factors towards more digitalisation

Digital maturity of DSO depending on their renewable penetration rate (as % of peak load)

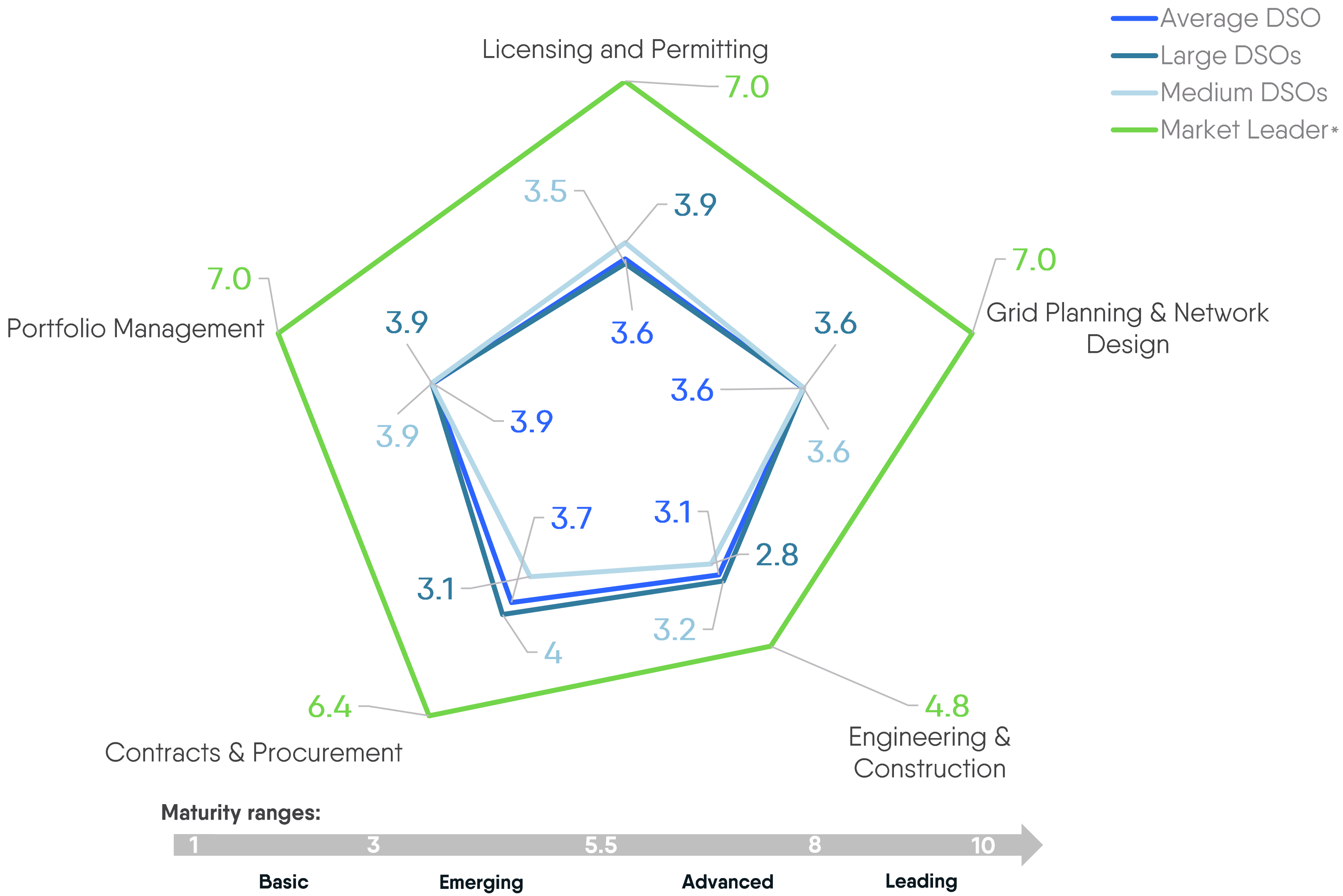


Key take aways

- DSOs with a higher proportion of renewables in the energy mix demonstrate **higher maturity across all capabilities**
- A higher proportion of renewables means **more complexity in the grid** operations and asset visibility
- To manage the complexity, DSOs have potentially **leveraged digital solutions** (e.g. link ADMS with Smart Meter data)

Build capability : DSO digital maturity assessment

Expand the grid



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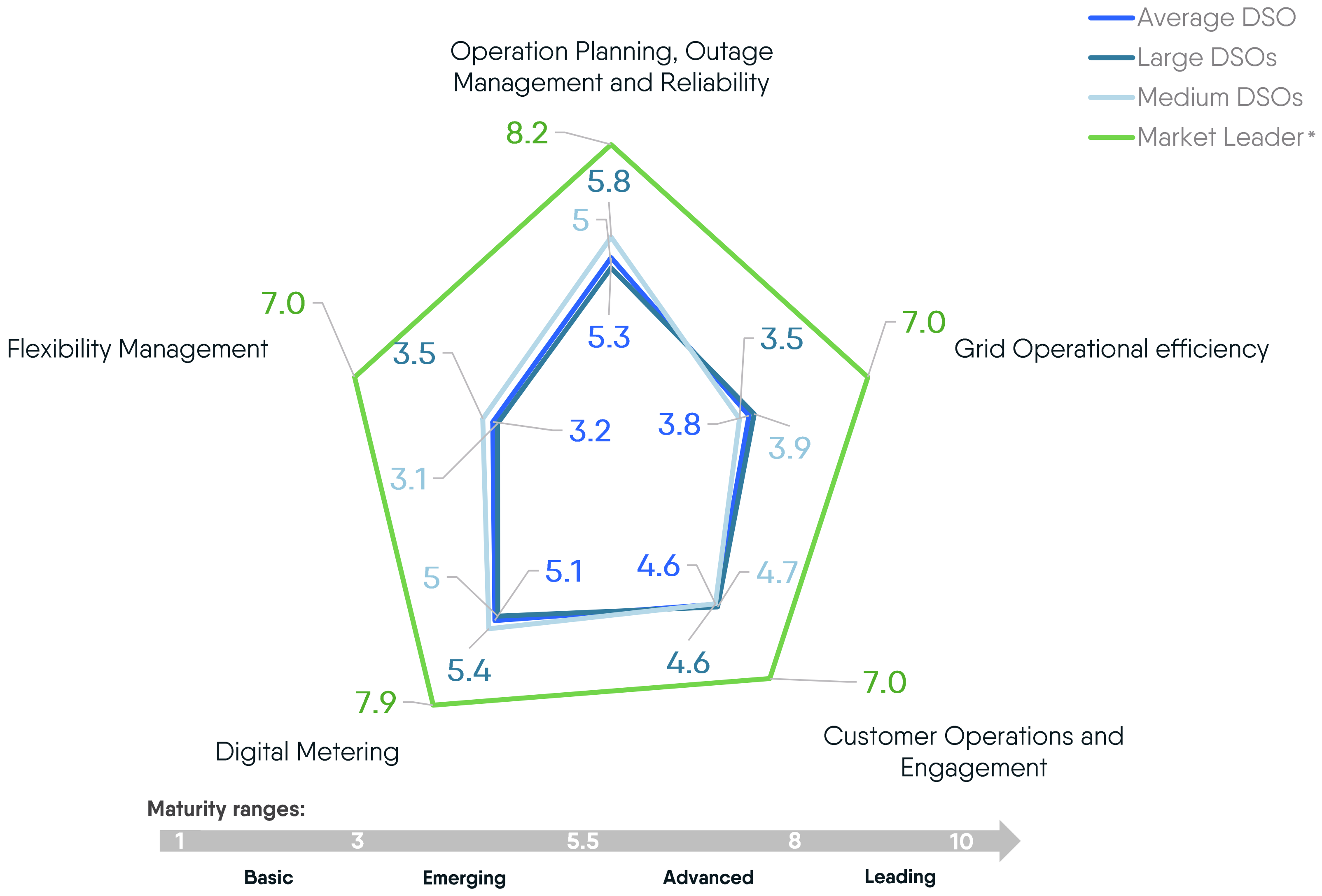
Highlights

- The DSOs overall demonstrate low (emerging level) to **moderate (advanced) use of digital tools** in the build capability
- The Build capability maturity is **strongly dependent on the industry environment's digital readiness** (permitting with municipalities, grid infrastructure contractors etc)
- DSOs generally **underutilise** digital tools to **expand the grid**, specifically in **engineering and construction**, leaders in this field show moderate digitalisation levels as well
- **Larger DSOs** are leveraging digital technology more than **medium-sized** DSOs, this applies to all build sub-capabilities
- **Market leaders** (6 different DSOs for the 5 capabilities) **show a high level of maturity** compared to aggregate confirming the room for growth across sub-capabilities

Operate capability : DSO digital maturity assessment

Use the existing network at its full potential



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Highlights

- The DSOs overall demonstrate **average use of digital technology** for the operate capability with a trend towards advanced maturity level
- The Operate capability that starts with being able to observe the grid in operation is highly **influenced by regulation policies** (e.g., smart meter roll-out, data usage, and readiness of the flexibility market)
- **Market leader maturity** in Flexibility Management and Grid Operational efficiency compared with average DSOs reflects a large gap
- **Flexibility management is not mature enough** to cope with future needs and is mostly in the **pilot phase**
- **Operate capability is not at all linked to the DSO size** (very DSO specific)

Maintain capability : DSO digital maturity assessment

Enhance predictable asset insights, worker safety and productivity

*Market leader: defined per *sub capability*, as the DSO with the highest observed maturity level for this given *sub capability* [ie. for a given capability there are potentially as many market leaders as defined *sub capabilities* within this capability]

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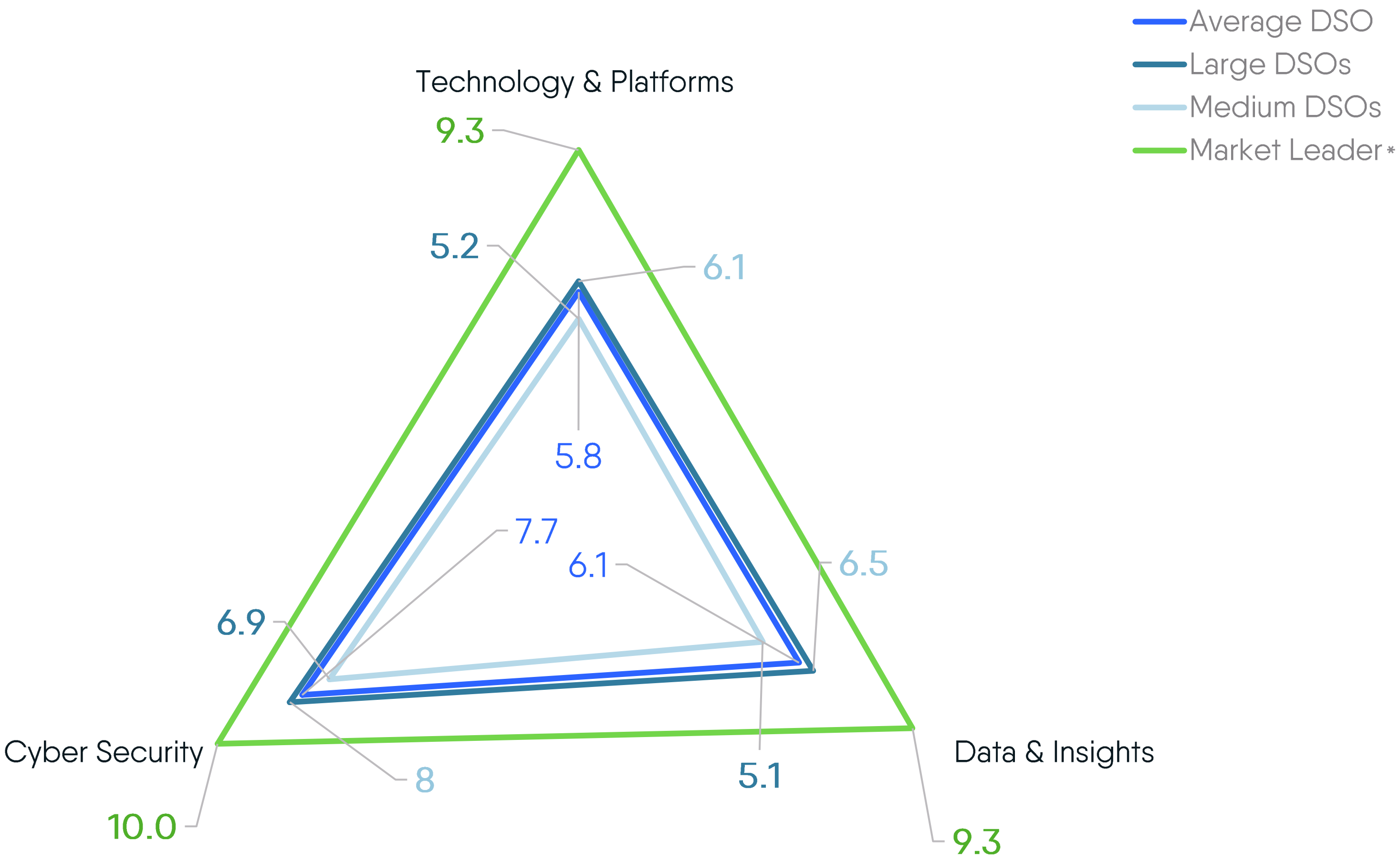
Highlights

- The DSOs overall demonstrate **average use of digital technology** for the maintain capability
- **Larger DSOs are leveraging digital technology more** than medium-sized DSOs, this applies to all sub-capabilities
- **DSOs are working on their Asset database as a foundation** to move towards predictive maintenance
- DSOs are also working on the **automated decision-making** solutions between **maintenance and new build,** and to have a **holistic asset management strategy**
- Market leader **in vegetation management** is doing **exceptionally well** while average DSOs are far way behind, which reflects a lot of **opportunity** lies for DSOs

Data-Driven : DSO digital maturity assessment

Integrated, scalable and secured technologies



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Highlights

- In Data-Driven, the DSOs in most aspects fall into the **advanced stage**
- The industry as a whole **emphasises cybersecurity**, with market leaders and large DSOs showcasing **exemplary practices, focusing on** a **secure** digital environment for their operations
- DSOs show a **positive trend**, with technology-related aspects falling into the **emerging to advanced stages for most of the DSOs**, indicating **ongoing efforts** to enhance their **technological capabilities**
- The maturity of **Market leaders** reflects they are using the best technology available in the market

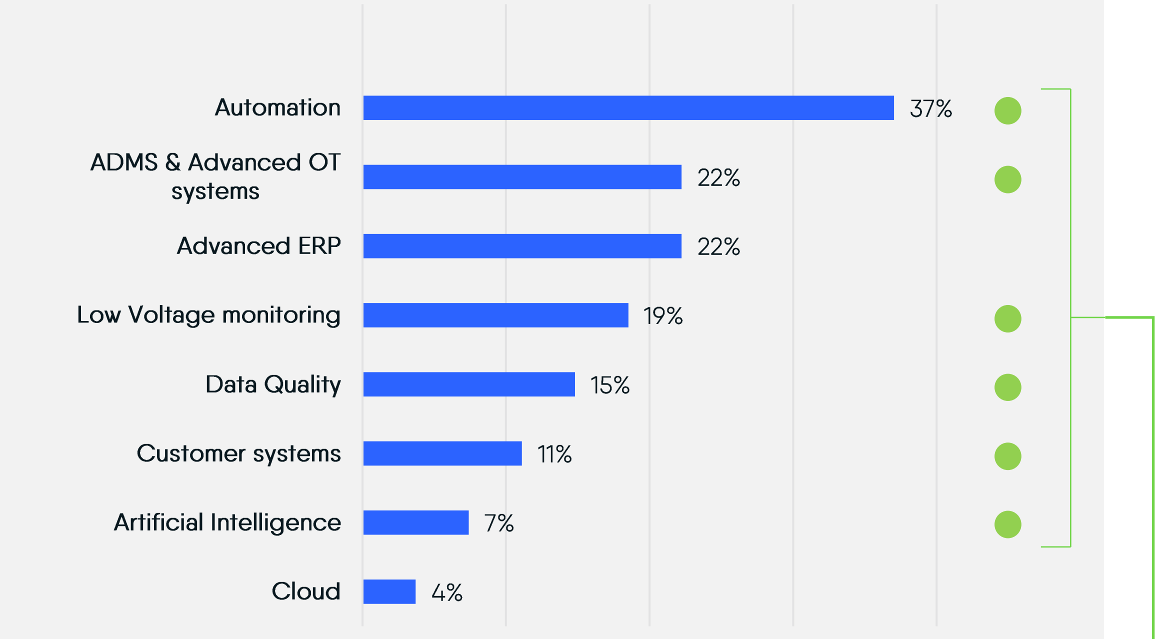
DSO have put the customer at the center of their current digital priorities which translates into digitalisation of operations initiatives

DSO digitalisation priority areas ...

Ascending priority

1. Reliability of services
2. Customer services
3. Renewables integration & flexibility
4. EV charging
5. Grid maintenance

... translate into digital initiatives



Key take aways

Priorities of DSOs are on **reliability** (availability and quality) **and customer services** e.g.: Meter To Cash, Customer Connection

DSO current digitalisation initiatives relate more to the "Operate" capability

Operate

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DSO shared their most pressing challenges on their digital journey

Internal challenges

Challenge number #...		For ... % of DSOs
#1	Talent acquisition and adapting to change	56%
#2	Availability of OT data in IT systems – concerns about cybersecurity	54%
#3	Prioritising digital initiatives	44%
#4	Data quality and availability	19%
#5	Keeping pace with rapid change in technology and innovation	15%

External challenges

#1	Evolution of monopoly/economic regulation not in pace with evolving business needs of DSOs	56%
#2	Supply chain and vendor reliability to ensure availability of components on time with agreed specifications	22%
#3	Ambiguity surrounding the future roles of DSOs, consumers & new entrants, creating strategic uncertainty	22%
#4	Availability of investment funds	19%
#5	Cybersecurity threats	19%

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Content

Key insights on digitalisation

Our six key findings from DSO survey responses and DSO interview content

A must-have tool with proven ecosystem-wide benefits

Digitalisation is a **no regret decision** for DSOs since it unlocks benefits for all stakeholders

The power of regulation

Appropriate **regulations advance digitalisation when ambiguity muddles it**, digital maturity reflects regulatory incentivisation

Limited availability of OT data in IT systems

All DSOs acknowledge the **business potential** of integrating Operational Technology (OT) data in IT systems but **face implementation issues**

Balancing build-out & flexibility

A **balanced approach** between build-out and flexibility is required to meet challenges, yet both capabilities **underutilise digital**

Providing skills and mitigating talent scarcity: a top priority

Digital transformation requires **specific skills** and **organisational change**

A goal-oriented transformation with ready-to-use technologies

Our technology scan demonstrates the **readiness of the tools** to support DSOs in their digital journey

A must-have tool with proven ecosystem-wide benefits

Digitalisation: a must-have iterative tool and a continuous reinvention

DSOs recognise the benefits of digital investments and are looking to launch more digitalisation initiatives irrespective of their current digital maturity …

Looking forward: digital initiatives in the pipelines to be launched

Degree of digitalisation: High → Low

Self-healing grid to deliver better **reliability** of power to customers Capacity maps and connection checks	
Digital twin for low-voltage levels to enable the Build activities	
Artificial intelligence organisation-wide and leverage as a tool for cost visibility & reduction	**Collaboration robots** for the field workers
Smart meters as sensors for grid assets	**Grid analytics** for failure detection and low voltage visibility
Robotic process automation to increase operational efficiency	

… while Accenture defined a comprehensive set of future benefits of a fully digitalised DSO for each of the four defined capabilities

Capability		
Build	Effective **capital allocation** and consistent **investment strategy** Excellence in complex and numerous **infrastructure projects execution** via digitally enabled processes and technology	Compliance with **technical, financial and regulatory requirements and deadlines** Visibility into **sourcing of materials** for carbon accounting & tracking for capital execution
Operate	Enhanced **grid reliability and reduced losses, improve continuity of service** for rapid changes in load profile and integration of renewables Enhanced **grid visibility** for real time **monitoring of flows and asset health**	Integration of DER systems to **manage, predict and control flexibility** in real time **Cyber resilience** by leveraging insights to proactively identify and mitigate threats
Maintain	Asset **Investment Planning** weighting asset health and future investments Leverage historical data to build analytical models to **reduce Total Cost of Ownership**	Enhanced worker productivity and safety using **AR-VR** based simulator **Predictive maintenance** planning using AI/ML and Big Data
Data-Driven	**Interoperability** by enabling seamless integration of diverse systems and technologies **Single source of truth** over whole asset lifecycle to provide accurate, reliable information and operational transparency	**Scalability** by ensuring a flexible and adaptable infrastructure that meets the needs for the secure migration to cloud

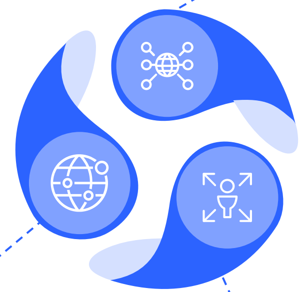
A must-have tool with proven ecosystem-wide benefits

Digitalisation strengthens DSOs' capabilities and efficiency resulting in benefits for the DSOs as well as for customers and market players

Our study derives multiple digitalisation benefits based on iterations with the Eurelectric members.

Distribution System Operators

- **Increased grid observability** and **remote grid control** leading to **optimised network operations, reduced losses,** and **higher continuity of supply** (e.g. voltage quality, self-healing grids)
- **Enhanced planning** for better assessment ahead on the **most cost-efficient** tools
- **Improved & accurate forecast of injection and load** due to significant **grid/weather events**
- Increased **grid's connection capability** via more flexibility control and accelerated build-out
- **Predictive maintenance and proactive field force deployment** by employing technology and analytics
- **Improved TSO-DSO and DSO-DSO data sharing** and grid development process
- Enabled **distributed grid intelligence** (e.g. prosumer-grid interaction, smart distributed grids)
- Better engagement **with market players** and multiple counterparties thus allowing benefits for the market parties and customers



Market players

- Improved **access to grid data** to better **optimise their business**
- Fostered **innovation** and **new services by market actors**
- Integrated more decentralised energy resources with **flexible access** (e.g. load shedding or infeed curtailment, flexible connection agreements)
- **Optimised diverse set of energy sources** such as EV, BESS, and solar (via electricity suppliers, and aggregators and energy communities)
- **Achieved awareness of grid capacity** and **green energy potential** areas via mapping
- Smoothened the **Meter to Cash process** (quality and end-to-end process duration) (benefit applies to DSOs and customers as well)

Customers

- Increased **grid reliability, quality of power supply** and **more accurate information** in case of a power outage to customers
- **Shortened customer grid connection period**
- **Empowered customers** to **adapt/control their (near real-time injection and withdrawal (e.g. leveraging EV, heat pumps, solar panels)** to save energy and consume cost-efficiently
- **Customers had better insights into energy consumption and understanding of their bills**
- **Customers chose from more and enhanced options in the market (including energy services)**
- Maximised value from **smart meters** – opportunity for customers' participation in **innovative offers and further engage in the ecosystem**

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The impact of regulation on grid digitalisation: driving progress or stifling innovation?

Appropriate regulatory incentives with clarity to DSOs accelerate grid digitalisation

10/10 **Cybersecurity score for the market leader**

Cybersecurity is ahead of all other sub capabilities. This progress can be attributed to the regulatory mandates that pushed DSOs to prioritise cybersecurity investments and implement strict measures to safeguard infrastructure against cyber threats.

99% **Smart meter roll out in some countries**

Austria, Italy, and Spain, for example, boast a near-full smart meter rollout, achieved largely due to the supportive regulatory framework in place. On average European Union has 56% smart meter adoption.

However regulatory ambiguity and the pace at which regulations are being adapted to DSOs' needs, impede their advancements

54% **Encounter hurdles in harnessing the potential of smart meter data**

Regulatory frameworks may lack specific guidelines to support optimal utilisation of smart meter data by many DSOs in their respective country, such as data sharing, and technical data like voltage, tariff structure, etc. which can hinder DSOs' ability to leverage smart meter data effectively.

32% **DSOs stated limit on CAPEX investment is a challenge, resulting in a low Build vs Operate maturity**

Regulatory limits on DSOs' CAPEX investments, in some EU countries were established years ago to safeguard customers from high electricity bills. However, these limits now clash with government directives for integrated renewable energy plans, hindering necessary grid investments. DSOs seek amendments to accommodate required investments for energy transition, as current limits restrain their ability to support renewable integration effectively.

Regulatory restrictions categorise most digitalisation investments as OPEX rather than CAPEX. Despite the evolving nature of infrastructure, current regulations only recognise "physical assets" as CAPEX (eg: IoT devices), leaving out crucial "digital assets" such as software licenses, cloud technologies, and other digital innovations. Despite their intangible nature, these digital investments should also be considered as CAPEX. There's a pressing need for regulatory frameworks that recognise the broader scope of digital investments as CAPEX, aligning with the strategic imperative of modernising grid infrastructure. Such regulation would facilitate the transition to smart grids, reduce operational costs over time, and ultimately benefit both DSOs and customers.

24% **Face challenges in defining and executing strategic initiatives due to a lack of clarity on future roles**

The lack of regulatory guidelines on DSOs' future roles impacts the investment in areas such as (1) Technology adoption for grid modernisation, (2) Infrastructure build activities like grid expansion, (3) Compliance concerns with future regulations and incentives, (4) Challenges in enhancing operational efficiency through more investments.

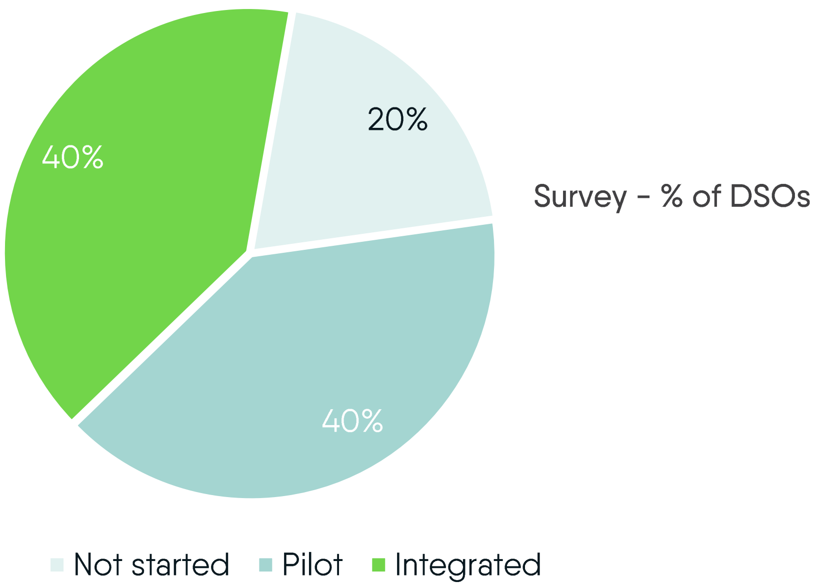
Even though regulations consistently support DSOs, they often lag behind the rapidly changing needs of DSO businesses. Regulations evolve slowly iteratively and involve multiple parties, which can delay the process and thus leave room for more support for DSOs

Availability of Operational data in IT systems can unleash the full potential of data

Limited availability of OT data in IT systems

IT-OT convergence is limited by multiple factors, yet DSOs acknowledge the benefits of this integration, irrespective of size and operating model. The market leaders have a higher level of integration and thus lead the maintain capability.

Status of IT-OT convergence among DSOs



Challenges faced by DSOs in IT/OT convergence

- **Cybersecurity** (as a top priority) complicates the interfacing of OT with IT
- **Technical challenges** in integration – data complexity, availability
- DSO historical **organisational structure** with a split in IT and OT teams
- OT and IT system require a **specific and different expertise**

Maximise integration between IT and OT for advanced functionalities

Concrete use cases identified by the DSOs are (among others) :

Fraud detection for energy consumption and billing by using IT data like customer & billing information; and OT data like smart meter data

Predictive maintenance of grids thus helping technicians to reduce time for routine maintenance, reduce rework and truck rolls – **thus enhancing overall asset health index**

Field solutions for advanced automation, metering, and protection functionalities enabled by virtual platforms (minimises risk of cybersecurity and data concerns)

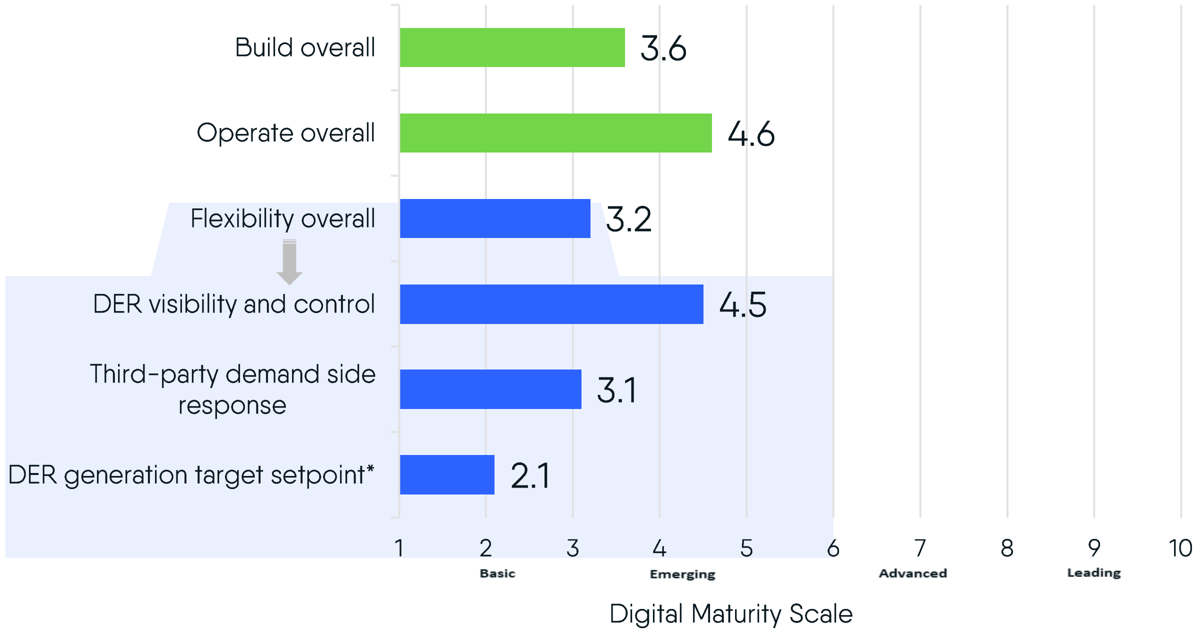
Simplified reporting and cross domain analytics (e.g. root - cause analysis for failure events)

Striking the right balance: massive build-out and flexibility as main levers to increase capacity

To cope with the ever-increasing need for 'more grid' DSOs acknowledge that both flexibility and build out need a push

- Considering the decarbonisation of society, DSOs are under pressure to increase capacity via grid build-out along with more flexibility.
- The survey demonstrates the DSOs underutilise digitalisation when expanding the grid and when working with flexibility. It can be shown in the digital maturity of **the capability Build and the subcapability Flexibility under Operate.** However, DSOs have a **good maturity** in **Distributed Energy Resources (DER) visibility and control** which lays the foundation **for managing current and future flexibility and allowing for maximised DER production.**

Average Digital Maturity in Build, Operate and Flexibility Management



The right mix is needed between massive build-out and grid friendly flexibility for long-term success

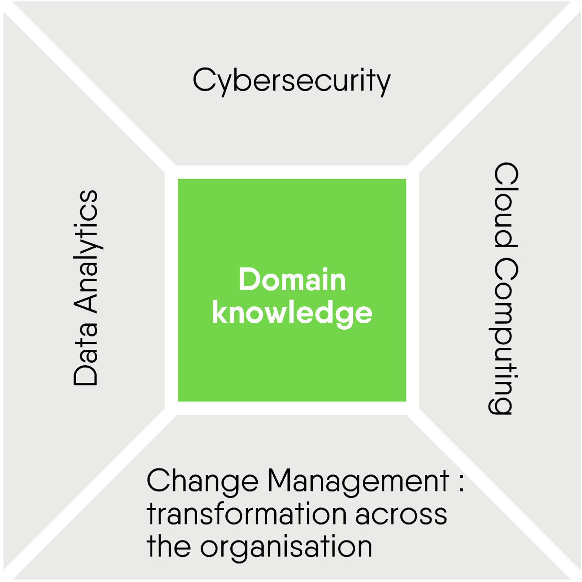
To maintain a symbiotic relationship between renewable energy with demand/storage, delivering enhanced and the most economically efficient flexible connections DSOs need to:

- **Leverage the digitalisation use cases to balance flexibility and build out with advancing maturity like:**
  - Dynamic Grid Management
  - Digital twin simulation
  - Collaborative planning platforms
  - Near real-time DER visibility, control & management
- **Invest strategically to leverage short term gains from the OPEX Investment focusing mostly on:**
  - Smart meter rollout
  - IT-OT integration
  - Investment ahead of the curve
  - Deferral of investments
  - Economic consideration between flexibility and expansion costs

Providing skills and mitigating talent scarcity: a top priority

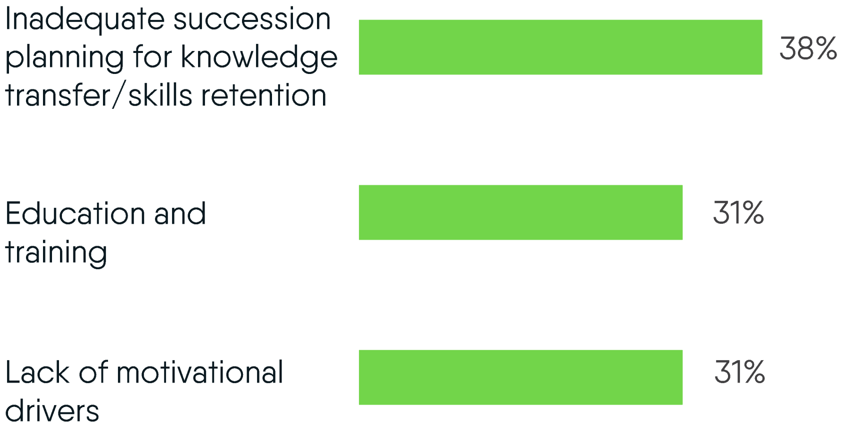
Almost 56% of the survey respondents have indicated lack of skilled talent as a key constraint in their digitalisation journey

What? — **Core skills required for digitalisation**



Why? — **The current talent availability in EU is limited due to multiple factors**

Main causes of skills shortage identified by utility leaders and recruiters



Source: Energy Outlook Report 2023 - Brunel

How? — **Hence, DSOs need to foster digital talent holistically**

- Show the “art of the possible” with a digital vision
- Establish a governance structure and operating model for driving digital initiatives across all functions
- Demonstrate the benefits of digitalisation in corporate functions – easier to achieve
- Create a digital mindset through training, collaborations, and rewards to employees who contribute to digital transformation efforts

DSOs believe digitalisation is a means and not an objective in itself, requiring a transformation across the ecosystem

Transformative

Digitalisation is a three-step transformation

1. Starts with a business case
2. Translate into use cases & create data models
3. Implement the relevant technology

Comprehensive

Digitalisation is twofold

Go Digital — Inject digital capabilities in the core functions of the business

Be Digital — Foster talent and create a digital mindset throughout the organisation

Collaborative

To be fully scalable and get the most benefits of digitalisation, it must be a joint mission with all other stakeholders of the value chain (e.g. contractors, municipalities, customers, TSOs)

… with ready-to-use technologies

Several technologies are available to support DSOs in their transformative digital journey

DSOs can learn from each other (e.g. Digitopia, Technopedia) and collaborate with technology companies using their use case expertise. This partnership not only gives access to advanced technologies but also helps in gearing up for the energy transition while boosting digital maturity.

Innovative

Accelerated by an ecosystem

Existing strong ecosystem of Technology providers & DSOs to inspire and guide

Demonstrated by technology

Ready availability of technology to be adopted by DSOs improve maturity across capabilities

Proven by use cases

In our study, **15+ Technology use cases were gathered** from industry partner companies and DSOs to demonstrate the **readiness of the technology** on following topics :

	Maturity Before	Maturity After
LV observability, congestion management, and grid stability	Emerging	Advance
Asset & operational performance streamlined with data and AI	Emerging	Leading
Digital twin and CAPEX & OPEX investment model	Basic	Advance
Renewable generation on distribution networks	Emerging	Advance
Field worker's empowerment suite	Emerging	Advance
Digital metering and LV grid visibility	Basic	Advance
Data privacy and cybersecurity	Advance	Leading

All use cases from our report are in appendix

Content

While designing their digital roadmap DSOs acknowledge facing several open questions

01. Cost benefit analysis, when required

Regulatory lead times, evolving objectives, and the dynamic energy landscape pose challenges for DSOs in meeting targets and assessing the impact and cost of digitalisation on traditional investments

02. Off-the-shelf vs customised solution

Accelerate by investing in an off-the-shelf solution or invest in building a customised fit-for-business solution with additional considerations of licensing, and support (e.g. metering & billing solutions). The procurement process happens to be long and depends on multiple factors not in the control of DSOs

03. Internal skills

Allocate internal skills and bandwidth to run ongoing business operations or direct towards new technology deployment

04. Identify areas of most benefit, and prioritise

Prioritisation of areas to invest – prepare for future by investing in Build activities and thus risking short-term issues in Operations & Maintenance or vice versa

05. Fitment of new technology

Challenge and complexity in compatibility of the new technology with the existing systems, data and security standards (e.g Robotic Process Automation)

A prioritisation exercise was conducted with DSOs to understand their digitalisation priorities given their current maturity

Priority matrix of capabilities by selected DSOs

High / Medium / Low

Build
- Infrastructure project control tower
- Modular and standardised design
- Building information model technology
- Streamline permitting process
- Connected Construction

Operate
- Speed up smart meter roll out
- Optimised and advanced KPI framework
- Leverage full potential of ADMS suite
- Smart meter data analytics
- Prepare for the future integration of ADMS /DERMS

Maintain
- Predictive Maintenance
- IT-OT convergence
- Connected worker attributes (with AR/VR/Robotics
- Asset investment planning, optimising investment and maintenance costs

Data-Driven
- Cybersecurity
- Data governance strategy & policy-
- Journey to Cloud and enterprise architecture

Key takeaways

Build
- Strong desire **to leverage digital technologies** given the growth in connections in the grid and the **new type of energy sources**
- **Leverage digital control tower** concept to manage the growing infrastructure project portfolio programs across the organisation
- DSOs yet do **not identify permitting** as a **digital priority area** despite low scores reported during the survey

Operate
- Opportunity to develop and position **more use cases for smart meter data analytics** – the investment has already been done. So, better use cases can **enhance the ROI of investments**
- Moderate **interest in controlling DERs, integrating ADMS with DERMS as either already present or less urgently required.** This is influenced by **regulatory limitations** which have shaped DSO priorities

Maintain
- Despite the challenges in IT-OT convergence, **willingness to integrate IT-OT** for predictive maintenance thus enhancing the overall asset health index
- Get a **future-ready workforce** and increase worker safety using **Augmented Reality/ Virtual Reality**

Data-Driven
- Despite achieving high maturity level and pressure of regulatory guidelines, **continued focus on cybersecurity**

Accenture's digitalisation pathway: leverage technology by building on solid foundations and taking progressive steps

DSOs should approach digitalisation as a holistic transformation which transcends beyond technology implementation, is progressive and set on foundations

Technology roadmap

- Assess current digital maturity
- Identify areas with business challenges and potential opportunities
- Develop roadmap to choose the right technologies
- Implement the initiatives

Progressive journey

- Establish an organisational vision
- Create business case for measuring impact
- Build on selection of the right technology, data, and enablers
- Measure the impact, reassess and continue iteratively

Digital DSO

Foundation

- Finance
- Governance
- Partnerships
- Operating model
- Infrastructure
- Regulations

Accenture's digitalisation pathway: an increased maturity from strategy to implementation

Strategic / Vision level

Vision to enhance business value across all functions through digital platforms and digitally enabled processes

→

A business case which is based on cost & time to impact, and rigorously measured for business impact through financial metrics

Implementation level

Strong data foundation → Digitally enabled solutions

Implementation at process level following the standardise / digitalise / automate path

Digital maturity

Short term

- Establish **the right team mix** – vendor, inhouse experts and OEM
- **Design data & technology architecture** as building block
- Identify **core processes** for digitalisation
- Establish **data as foundation** (data quality and availability)

Medium term

- Implement **successful use cases** at scale across the organisation
- Implement **technology as pilot** and then measure the impact before scaling across the organisation
- Develop **partner ecosystem** and upskill internal team competency
- Shortlist **opportunities from the business case** repository

Long term

- Develop **platform** available through APIs to an Ecosystem of Partners that can develop new Services
- Develop **digital mindset** across the organisation – adoption of newer ideas and automation as a tool

To help DSOs shape their digitalisation journey, Accenture proposed a technology roadmap

	Basic	Emerging	Advanced	Leading	North Star
	Basic technologies and manual processes	Current mainstream technologies	Systems are integrated together, data for business decisions	Taking full benefit of digitalisation, considering cutting edge technologies	
Build	Manual contracting, licensing & permitting processes without integration across systems, 2D models engineering, lack of control on supply chain	Integrated systems for capacity planning, 3D engineering models, usage of supply chain solutions & central project tracking	4D engineering models, control tower for project and supply chain monitoring	Analytics driven permitting, 7D engineering models (BIM), dynamic procurement contracting	• Data-led decision making • Integrated operations • Agile & AI-driven workforce • Customer centric business models
Build / Operate	SCADA systems, reactive outage management, no fraud detection, grid observability < 50%, no DER control	Customised OMS, low accuracy of fault location, grid observability < 60%, standalone DERMS - not integrated with CIS, AMR & MDMS	ADMS installed, FLISR and self-healing grid, fraud detection using analytics, grid observability < 80%, strong low voltage remote control	ADMS integrated with DERMS, fraud detection using AI, flexibility platform integrated with the market	
Operate		Corrective maintenance strategy, manual work order tracking & manual vegetation inspection	FMEA-based preventive maintenance strategy, mobile app for work order tracking, sensors used for vegetation inspection	Asset health monitoring through sensors, automatic work order scheduling, external data included for vegetation management	Digital twin for simulation and asset monitoring, work order management, real-time fieldwork tracking and digital workforce
Operate (data)			Lack of data architecture standards and cybersecurity policy, unclear segregation of critical & non-critical data	Established data architecture standards, pilots for AI & Cloud underway, cybersecurity not yet part of system testing	API-driven data architecture for interfacing external applications, cybersecurity part of system testing; Cloud-based scalable platforms, seamless integration of new technologies and mass data, system-driven security threat control

Maintain | **Data-Driven**

*This roadmap is illustrative as there is no "one size fits all" pathway (geography, customers, regulation being country specifics). Each DSO needs to envision a tailored roadmap based on its own actual maturity and business needs. The north star should hence be adapted for each DSO

Content

Use cases provided via Eurelectric Digitopia Business Members and DSO members

#	Focus Area	Sub-capability	Use case	DSO/technology company
1	Build	Licensing & Permitting	Accelerating permitting and digitalising the process	EASYPERMITS
2		Grid Planning & Network Design	Grid impact of large-scale decarbonisation projects	RAYSON/URBIO
3	Operate	Grid Operational Efficiency & Flexibility Management	LV observability & congestion management and grid stability	WESTNETZ & AVACON NETZ
4		Operation Planning, Outage Management & Reliability	Proactive outage and DER visibility & management	SIEMENS
5		Flexibility Management	Accelerating electric mobility with intelligent substations	SIEMENS
6		Grid Operational Efficiency	Maintaining grid stability with NXpower Monitor	SIEMENS
7		Grid Operational Efficiency	Management of high levels of renewable generation on distribution networks	ORACLE
8		Operation Planning, Outage Management & Reliability	Grid forming technology for distribution renewable energy	HUAWEI
9		Grid Operational Efficiency	Automated congestion management	GE VERNOVA

Use cases provided via Eurelectric Digitopia Business Members and DSO members

#	Focus Area	Sub-capability	Use case	DSO/technology company
10	Operate	Customer Operations & Engagement	Virtual inspections at customer sites	ENEL
11		Grid Operational Efficiency	Open-source active congestion management	ALLIANDER
12	Operate, Data-Driven	Digital Metering	Smart meter innovation and test network (SMITN) project	NATIONAL GRID/CGI
13	Maintain	Strategy, Planning & Engineering	DLR	RED ELECTRICA DE ESPANA (REE)
14		Work Order Management, Execution & Field Operation Monitoring	Field workers empowerment suite	ENEL
15		Asset Data Management	Asset & operational performance streamlined with data and AI	SAS
16		Vegetation Management	Digitalisation of clearance monitoring to maintain regulatory compliance	FUGRO
17		Maintenance Strategy, Planning & Engineering	Digitalisation of the maintenance process	PORI ENERGIA

1. Accelerating permitting and digitalising the process

EasyPermits Demo

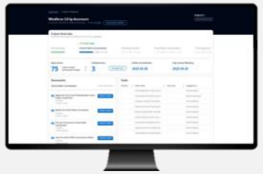
EasyPermits®

Business problem

- As part of its effort to reduce emissions by 55%, the EU has committed to reaching at least 42.5% of renewable energy in final energy consumption by 2030. This means doubling today's existing renewable energy capacity in 7 years. The main bottleneck to capacity additions in the EU is permitting.
- Under the revised Renewable Energy Directive (adopted in March 2023), the EU commits to accelerating permitting by setting clear timelines, introducing a one-stop-shop for applications and digitalising the entire process. However, today, most permitting authorities are not equipped with the adequate digital solutions. And, on top of that, many are understaffed to process applications fast.

Solution

- EasyPermits is a secure stand-alone web-based cloud solution that digitalises the administrative permitting process end-to-end and tackles key challenges for permitting agents and project developers by automating workflows, improving and standardising the collection and management of information, as well as improving collaboration and process transparency.
- It is targeting permitting agents, project developers and energy communities.



Benefits

- Increased transparency and efficiency allowing shorter lead times and higher number of projects to run simultaneously.
- Estimated 30-50% of cost reduction.
- Ability to reach first time-to-power quicker and therefore generate revenues at a lower capital cost (and avoid potential penalties).
- Increased transparency and efficiency allowing shorter lead times and higher number of project to run simultaneously.
- Optimised required time (and related costs) from local consultants supporting the application for permits.
- Improved transparency around planned and upcoming projects.
- Enhance community engagement to gain a social license to operate.

2. Grid impact of large scale decarbonisation projects

RAYSUN urbio

Business problem

- Large scale decarbonisation projects lead to the massive deployment of decentralised energy systems (DES), such as PV, heat pumps combined with retrofit measures. This significantly impact the grid's ability to absorb or deliver additional power at during peak production and consumption periods.
- Be able to anticipate and rationalise the investment needed over time is critical to avoid over-spending and coordinate DEC deployment with the grid capacity constraints with all players .

Solution

- Technology : Urbio is an AI-powered SaaS platform allowing to manage large-scale building decarbonisation projects end-to-end, including data governance augmented by machine learning, a digital twin with advanced navigation and filtering capabilities and a patented AI-powered generative design to simulate various decarbonisation scenarios.
- Urbio's platform combined with RaYSun's know-how and financial models help identify the most profitable DES projects such as Energy Communities and their impact on the grid.
- Change management: RaYSun provides a turnkey service including feasibility and financial analyses, CAPEX funding, deployment, and operational and invoicing services.
- Urbio's AI-powered SaaS platform, enhanced by RaYSun's expertise, minimises CAPEX and OPEX for DSOs/TSOs by streamlining decarbonisation projects, offering scalable infrastructure improvements and operational efficiency across Europe.

Benefits

Impact on below areas

- Customer : Cities, portfolio owners, energy providers.
- DSO : TSO.
- Market : currently deployed in Belgium, Germany, France , Switzerland and expanding in the course of 2024 to 2026 to cover all European countries.
- Timelines : the platform and data are available of the shelf. Business plan and impact analyses can be provided within 36 hours assuming cabins connection data are made available.

3. LV-observability and congestion management

westnetz

Business problem

- Significant increase in renewable resources, in particular PV-installations (4x compared to 2021), electric vehicles (12x), heat pumps (8x) etc. expected in upcoming years only at the case of the operating area of Westnetz GmbH in Germany – distribution grids in Germany are not prepared yet to integrate all new generation and loads. At the same time there is no or very little transparency at low voltage level currently available – only a few smart meters and other sensors installed.
- However, according to current legislation, there is a need for DSOs across Germany to control flexible loads (e.g. EVs, heat pumps etc.) to avoid grid congestions (§14a EnWG-Germany). Also DSOs need to use §14a EnWG as they are no longer supposed to deny connections in LV.
- Therefore, there is an urgent need for grid observability at low/medium voltage level.

Solution

- Realisation of a smart grid-Project at scale in two regions in Germany – For this purpose, we are installing a large number of "smart assets" such as digital secondary substations which can observe the LV and MV grid, be controlled remotely, retrofit old stations and install smart meters.
- Rollout of digital solutions (software) to enable grid observability through state estimation and identify grid congestions and resolve those automatically based on available flexibilities and automated decisions in the near future. Envelio technology is used at the core of E.ON DSO solution to enable grid observability and congestion management.
- All components and solutions are based on common standards across all E.ON-DSOs to facilitate and speed up scalability across E.ON.
- Introduction of a central data platform to gather all grid related data and adapting existing processes to incorporate new data, such as live measurement for purposes of grid operation or to support grid planning – new information are fed into existing processes (such as outages).

Benefits

- Benefits for the DSO: validation of the smart grid concept "at scale" and prove transferability to other regions, integration of more DRES, more efficient grid operation (remote resupply actions in case of outages etc).
- Benefits for the end-customer: enabler of Flex-Products, EV,PV, Battery, Heat pump-Integration in LV grid for every household.
- Benefits for the market: enabler of flexibility-products for customers and most effective usage of existing grid assets.
- Timeline: introduction of digital solutions and smart meter rollout has been started across all EON DSOs (with "high speed" in two regions in Germany).

4. Proactive outage and DER management (Gridscale® X)

SIEMENS

Business problem

- So far outage identification and management is reactive, without (topological) grid information (no LV visibility).
- Equipment overloading at bottlenecks.
- Lack of LV automation and sensorisation.
- Difficult to plan LV capacity and flexibility.
- Difficult to understand load at LV level.

Solution

- No process change needed, the solution can be a change agent for LV management - OPEX investment – technologically mature and available – 12 weeks deployment.
- Enable visibility of LV to gain insights. Use insights to assess impact and better prioritise. Enable flexibility to reduce outages.
- Additional measurements are integrated from SCADA to increase transparency on secondary substation transformers, aggregation of connection point loads to load at feeder level.
- Limit violations are automatically detected based on historic measurements and shown in the map. Easy UX for capacity assessment by easy visualisation of nominal VS actual load/capacity.
- Automatic detection of outages based on meter events, energising state, planned outages and holistic grid topology with directly processed meter data.
- Faulty LV feeders and/or connection points are detected and visually shown, with automatic case-creation including location, affected customers, priority ranking.

Benefits

- Check of outage impact and verify restoration through ping function to smart meter / whole feeder, allowing a clear view outage and enablement of intervention of field crew with additional info and indication of outage zones visualised in map for quick identification
  → up to 30% reduction of LV outage times by automatic identification.
- Improved SAIDI/SAIFI and reduced reporting efforts for regulators and increased customer satisfaction by better and consistent in-company and customer communication.
- Detection of limit violations indicating critical grid segments before something happens and aggregation of violations for voltage and power on service delivery point, connection, feeder and secondary substation.
- Visibility of grid impact and margin to support DERs connection request approval, suited for non-expert users. Grid investment decision support based on capacity and limit violations combined in one view → building foundation for future DER management / LV-grid active management and flexibility capabilities.

5. Accelerating electric mobility with intelligent substations

SIEMENS

Business problem

- Client: Gas station operator
- The expansion of the public charging infrastructure was an essential requirement for the acceleration of electric mobility for the customer.
- Energy infrastructure which can manage bi-directional power flows and handle unpredictable generation is the basis for a sustainable energy system.

Solution

- The grid connection is upgraded to a medium-voltage connection with much higher power through the substations which connect the gas stations' charging infrastructure to the public power grid.
- Installation of intelligent substations with ultra-fast charging technology for electrical vehicles which ensures highest reliability and better grid utilisation within the existing infrastructure.
- Cloud connection to SICAM Navigator with real time data monitoring provides transparency across all locations and enables optimal usage of the assets. For this reason, digitalisation is an important prerequisite for efficient load management and to optimise the use of power resources.

Benefits

Benefits for the end-customer: ultra-fast charging technology - reduced downtime for charging, more cost-effective solution.

Benefits for the DSO:

- Transparency of EV-charging network status and load.
- EV-charging station remote control and dynamic load management following instant power limitations by the DSO.
- Increased efficiency and grid reliability.

Benefits for the Market:

- Accelerating the shift to sustainable mobility to reduce CO_2 emissions.
- Strengthening the e-mobility expansion.

6. Maintaining grid stability with NXpower Monitor

SIEMENS

Business problem

- Client: Renewable energy operator.
- Overheating within the grid connection´s cable compartment was not detected early on.
- Due to an accident, an arc led to the complete destruction in fire of the medium-voltage system and thus to the standstill of the four connected windfarms until revamp.
- The standstill of the four connected wind farms resulted in a loss of turnover of around 500,000 euros per month. Long lead time for new components of 6-7 months lead to the total loss of ca. 5 Mio. € in revenues.

Solution

- IoT-enabled switchgear with NXpower Monitor software eliminated the chances of similar failures in future.
- NXpower Monitor is a Siemens Xcelerator X Offering which is scalable by design. It provides continuous visualisation and condition monitoring of electrical systems; helps to detected faults, such as a defective cable connector, at an early stage and avoid long downtimes, repair costs and emergency calls.
- Prevention of switchgear breakdown thanks to predictive maintenance.
- Managed services including on-call duty.

Benefits

Benefits for the end-customer: grid stability and reliable energy supply to the end-customers.

Benefits for the DSO:

- Maximised availability of the substation by reducing unplanned shutdowns.
- Enhanced grid transparency with continuous visualisation and monitoring of the health status of the system.
- Improved grid stability and asset utilisation.

Benefits for the market: accelerating the shift to renewable energy use to reduce CO_2 emissions.

7. Management of high levels of renewable generation on distribution networks

ORACLE

Business problem

- Managing the distribution network within the limitations of the regulatory framework whilst encouraging the connection of low carbon technologies to facilitate the low carbon transition to net-zero.
- The fastest uptake of the low carbon technologies have been in generation connected to the MV network. One of the operational challenges has been generation connecting remotely from the demand centers and the inherent technical constraints on the network.
- Often there is more renewable generation output than customer demand, so the DSO must balance the economic and technical operations to ensure value for money and equity of access to the network/market.

Solution

- The technology is the Distributed Energy Resource Module System (DERMS) within the Advanced Distribution Management System (ADMS). This has permitted the use of the advanced applications of the ADMS to support the forecasting, control and analytics of the network, despatch of DER, better utilisation of the network whilst maintaining operational standards and customer service.
- Introduction of the solution has necessitude process changes for provision of information from DER connecters for both technical and commercial parameters so these can be modelled in the DERMS module. In addition, a reporting process has been initiated to explain why a particular asset may have been constrained or not able to operate in the way originally planned.
- Incremental training was needed for control operators in the use of the new DERMS functionality.
- The introduction of the DERMS module was incremental to the ADMS so incurred a small OPEX implementation cost.
- The Solution is mature and fully operational and scalable to the whole network. Learnings from this implementation and increased functionality will be included in future product releases.

Benefits

- The DSO has been able to meet their regulatory requirement of facilitating the connection of low carbon technologies with the minimal delay (and CAPEX expenditure) by the use of DERMS and advanced network management techniques and adopting new, and more flexible, operating practices.
- A market for DER (generation, demand and storage) management has started (is at the early stage) with ongoing discussions on roles, responsibilities, incentives and how risk and reward will be assigned.
- From inception to this level of maturity has taken just over 5 years. It is an ongoing process as additional DER assets are connecting to the network, particularly at the low voltage. Customers have already realised benefits with the connection of high levels of DER but without a significant direct CAPEX expenditure which would have been seen in their bills (or via taxation).

8. Grid forming technology for distribution renewable energy

HUAWEI

Business problem

- Due to the high penetration of distributed PV systems, the DSOs and customers face severe voltage stability and power quality issues; the reverse power flow from low voltage to high voltage is also a big challenge to the DSOs.
- Voltage level: 10 kV.

Solution

- Technology : grid forming technology uses the control algorithms to transform the power-electronics-based installations from current sources to a voltage sources, the grid forming converters can support voltage by providing reactive power flexibility, they can act as a sink harmonics and correct voltage unbalance to improve the power quality, can provide inertia response to stabilise the frequency, and, thanks to the hybridisation with energy storage systems, PV installations can reduce the reverse power flow into the grid. Besides, when a black out happens, the grid forming system could be operated as an island and keep the critical loads online and will give the information to DSO to keep the workers safe.
- Process : no.
- Change management (if any) : training the workers to deal with the island system.
- CAPEX/OPEX investment : grid forming technology need converter suppliers invest the new technology, and also there will be new investment to battery.
- Technology maturity : pilot.

Benefits

- Benefits for the customers : when a black out occurs, the grid forming system could be operated as an island and keep the critical loads online; accelerate the integration process for distribution PV systems.
- Benefits for the DSO : enhance the voltage, frequency stability and power quality, lower the reverse power flow.
- Benefits for the market : increase the market space for PV and BESS, increase the C&I BESS revenue in the ancillary service market.
- Timelines to deploy and start realising benefits: in 2024, there will a C&I pilot project, and test all the functions; in 2025, there will be commercial operation projects.

9. Automated congestion management

GE VERNOVA

Business problem

- A rapid growth in the number and severity of congestion areas on distribution grids.
- The traditional tool to manage grid congestion (infrastructure) can not cope (cost, time, feasibility) with the challenge.
- Distribution grid operators need automation to manage their grids in face of expanding challenges and new responsibilities.
- Regulators, governments, prosumers and society demand new approaches to managing congestion.

Solution

- New sources of flexibility from distributed energy resources (DER) can be leveraged to manage congestion.
- Automation of: need analysis > solution identification > flexibility instruction.
- Combining: forecasting (to provide look-ahead anticipation of congestion), optimisation (using powerflow to quantify and pinpoint congestion) and market platform integration (to link with BSPs and flexibility sources).
- Grid aware DERMS solution manages congestion and identifies solution based on as-operated network & adapts automatically to events & changes.

Benefits

- Benefits for the customer : cost impact of congestion management is reduced; new grid connections can proceed faster (because congestion can be managed).
- Benefits for the DSO : congestion management by flexibility frees CAPEX for grid investment elsewhere, meet regulatory demands to use flexibility.
- Benefits for the market : flexibility resources and BSPs can monetise their ability to support grid operations.
- The solution is being deployed today at major distribution operators in US.
- The solution leverages digitalisation: digitalisation of the network model and DER model data, Load and generation forecast data across voltage levels, Powerful optimisation engine on 3-phase full impedance network model.

10. Virtual inspections at customer sites

enel

Business problem

- On-site inspections were not possible during the pandemic period therefore the need arised to continue a first necessity service to clients by reducing travel and avoiding contagion.
- Numerous field inspections reduce efficiency and increase the time to perform the activity and costs. In addition, field inspections must be carried out by a certain time within daylight hours. So, it was necessary to figure out how to maximise the number of inspections especially in winter with few hours of daylight.
- Medium and low voltage grid.

Solution

- Technology : desktop and smartphone application to perform pre-intervention inspections such as new connection works, with or without activation, small producer plants or modification of connections and contract. Up till 2023 we had carried out about 70k virtual visits in the various countries where it is present. It is necessary that the client knows how to use a smartphone and has a fast internet connection.
- Process : was changed because it allows our operators to do more work remotely without necessarily going on the client's site.
- Change management (if any) : first and second level training session for at least one operator from each blue team.
- CAPEX/OPEX investment : ~€2M
- Technology maturity : scalable.

Benefits

- Benefits for the customer : because they feel more involved in the process, the work is done in less time and offers a lower price if they prefer the virtual visit to the field visit.
- Benefits for the DSO : it has made work more efficient by providing convenience and safety, simplicity, efficiency, speed and flexibility, further ensuring the increasingly important sustainability aspects.
- Timelines to deploy and start realising benefits : agile work 1 year, 4 MVPs to delivery full solution. Return on investment after 1,5 years.

11. Open-source active congestion management

Business problem

- More and more network sections are congested. Active congestion management enables dynamic adjustments to mitigate the congestion. This method maximises transport capacity using measurements and prediction and reduces cost of mitigation through the market.
- Key capabilities are real-time measurements, energy forecasting, state estimation and market interfacing.
- Any voltage level, focus on high voltage and medium voltage.

Solution

- Technology : real-time measurements, energy forecasting, market interoperability. Strategic decision for open source to speed up innovation and ease integration.
- Process : primary congestion measures are left to a automated but supervised system.
- Change management (if any) : technical integration, market procedures and contracts.
- CAPEX/OPEX investment : ongoing effort of DevOps team refining the solution and realising integration.
- Technology maturity : pilot stage, rapidly growing in maturity.

Benefits

- Benefits for the customer : increased network capacity, now.
- Benefits for the DSO : increased network capacity, now. Building blocks for other digitalisation use-cases.
- Benefits for the market : opportunity for controllable loads and generation.
- Timelines to deploy and start realising benefits : minimal viable product in months using available open-source projects. Further automation and integration will come over time.

12. Smart meter innovation and test network (SMITN) project

nationalgrid CGI

Business problem

- The aim of the SMITN project is to extract additional value from smart meter data by providing more visibility of the LV grid connections to customers.
- Challenges to be addressed by this project focused primarily on connection uncertainties and data quality, for example unknown customer phase and feeder connections, asset data differences between GIS and Asset Management systems.
- Size: 8 million customers | Voltage Level: <132kV (LV & MV) | Geography: UK – Midlands, South-West England & Wales.

Solution

- The project established a validated LV test network against which algorithms using smart meter data can be tested

The following use cases were targeted:

- Phase identification.
- Planning profiles.
- Feeder allocation.
- Detection of low carbon technologies (LCT) such as electric vehicles, solar panels etc.

Benefits

- Benefits for the customer: ability to maximise customer's use of LCT's, less risk of blackout or restrictions on EV charging etc.
- Benefits for the DSO: more accurate modelling to assess the impact of increasing numbers of LCT's on the future load on LV feeders
- Benefits for the market: better quality of data provided to the market
- Project duration: 12 months.

13. Dynamic Line Ratings

RED ELÉCTRICA DE ESPAÑA | enline

Business problem

- Transmission and distribution system operators struggle with maintaining reliable energy transmission while integrating renewables due to inefficient data utilisation. REE had heavily loaded 66kV transmission lines in Ibiza due to the high number of tourists in the summer. Hybrid terrain type (partly dense vegetation, partly dense urban) heavily influenced the installation parameters and ampacity. Low wind and high air temperature areas due to urban constructions and mountainous areas also contributed to low system efficiency. Critical infrastructure near the lines were not allowing the necessary sagging.
- Voltage level: medium to high voltages.

Solution

- Technology : digital twin technology involves creating virtual replicas of physical assets, such as distribution/transmission lines, in a digital environment. These replicas are not static models but dynamic simulations that mirror the behavior and characteristics of their real-world counterparts in real-time.
- Process : Enline developed a disruptive technology that is 100% software-based with no need for additional hardware or sensors, no need for fieldwork, and no need for maintenance. Proven accuracy of min 95%.
- Change management : the solution deliverable is the Enline Cloud Based Digital Platform (SaaS service), which is considering all customer requests and to be used by the user after a short training session.
- CAPEX/OPEX investment : this software differentiates, as it allows precise monitoring of the location of risks and fault conditions with no need of human interaction, strongly reducing the CAPEX and O&M costs and being able to be implemented in a few days.
- Technology maturity : Enline's technology has been implemented in over 20 projects globally.

Benefits

- Increased revenues of up to € 16.8 million on the 66 kV lines.
- An average increase in transmission capacity of 21.1% along an entire year.
- Decrease of 10 to 15% of OPEX operations due to better data visualisation and reduction of outages and faults, improved efficiency of power assets.
- For asset management: real-time and predictive operating information of the power line, all information to be stored, O&M cost reduction, improved availability and increased reliability. Evaluation of asset health and expected lifetime.

14. Field workers empowerment suite

enel

Business problem

- The operational and maintenance activities we handle daily is complex, involving diverse professionals (both internal and external personnel), numerous projects, and a variety of digital tools and applications (not integrated) which imply inefficient and not synergic field activities management.
- High level of back office closing effort to certificate the field activities.
- Worker ergonomics in the management of activities is crucial to boost efficiency and safety.
- Medium and low voltage grid.

Solution

- Technology : smart execution offers a comprehensive suite of cell phone applications tailored for field workers involved in all phases of operational activities. With Smart Execution, essential tools for day-to-day work are seamlessly accessible through the Wall Worker List module: when an operator initiates a specific task, the relevant modules are automatically invoked, transparently and without the need for prior knowledge of which applications are required.
- Process : change in terms of users' empowerment: many task can now be executed directly from the field.
- Change management : first level and second level training session to all blue collars.
- CAPEX/OPEX investment : ~60M€.
- Technology maturity : scalable.

Benefits

- Benefits for the DSO : unified ecosystem across all countries, streamlining operations that have historically relied on disparate systems. Furthermore, Smart Execution fosters alignment between internal and external operators by establishing common processes. Notably, this approach significantly mitigates risks and hazards during fieldwork.
- Benefits for the customer : increase in the perceived efficiency and better quality of service.
- Timelines to deploy and start realising benefits : first MVP after 1 year: 4Q2020; first Full solution (ITA) 3Q2021; last Full Solution (BRA) 2Q2025. Benefits: time-based scale up curve.

15. Asset & operational performance streamlined with data and AI

SAS

Business problem

- Ensuring optimal performance of numerous assets such as power plants, refineries, and distribution networks is crucial for energy companies. Any downtime or inefficiency can lead to significant financial losses and disruptions in service delivery.
- The installation and maintenance of energy assets involve substantial investments. Energy companies need to carefully manage these costs to ensure profitability while also maintaining competitive pricing for consumers.
- With expensive and complex assets, ensuring reliability and safety is paramount. Any failures or accidents can not only result in financial losses but also damage the company's reputation and lead to regulatory penalties.
- Managing a large portfolio of assets requires efficient allocation of resources such as manpower, materials, and equipment. Optimising resource utilisation while maintaining high performance standards is a constant challenge for energy companies. Asset performance – they work as long as possible – get the most out of physical assets.

Solution

- SAS utilises advanced analytics and machine learning algorithms to predict equipment failures before they occur. By analysing sensor data and historical maintenance records, SAS can identify patterns and anomalies indicative of potential issues to proactively schedule maintenance and prevent costly downtime. No retraining needed – providing right tools to leverage existing knowledge and experience – people already have the skills.
- SAS helps optimise (CAPEX/OPEX) investments by providing insights into the most effective allocation of resources. By prioritising CAPEX investments for permissions and asset installations, energy companies can maximise the return on investment and minimise the risk of expensive downtime.
- SAS incorporates drone technology and sensor data analysis to reduce the need for manual inspections, especially in hazardous environments such as high-voltage areas. By utilising drones to perform flypath inspections and continuously monitoring equipment health, SAS helps ensure worker safety and minimise the risk of accidents.
- SAS offers a scalable technology platform that can adapt to the evolving needs of energy companies. Whether managing a small set of assets or a vast infrastructure network, SAS provides scalable solutions that grow with the business, ensuring long-term effectiveness and cost savings.

Benefits

- Cost reduction: SAS's predictive maintenance solutions drive down network operation costs by minimising downtime and enhancing asset performance. Leveraging GEN AI large language models, SAS can surface relevant service history information for assets, enabling more efficient interventions. This reduces operational expenses and lowers capital requirements, ultimately making network operation more affordable.
- Enhanced operational performance: with SAS's preventative maintenance capabilities, energy companies experience improved asset reliability and extended lifespans. By prepopulating service notes and leveraging customer service data, SAS helps allocate resources effectively, ensuring problems are solved efficiently and network operations run smoothly.
- Quick deployment and accessibility: SAS Viya, as a well-established platform, enables rapid deployment, allowing energy companies to realise benefits promptly. Moreover, its user-friendly tools empower engineers familiar with processes to contribute to the AI ecosystem, facilitating broader participation in data-driven decision-making.

16. Digitalisation of clearance monitoring to maintain regulatory compliance

FUGRO

Business problem

- Climate change, reduced and aging work force is putting a huge amount of pressure on DSO's and their vegetation and asset maintenance programs. Increased growing seasons and/or hotter and drier climates increasing the threat of wildfires are already being seen across Europe. This rapidly changing environment will need DSOs to adopt new digital technologies such as remote sensing to provide a holistic view of their entire network and its current state to help drive new maintenance programs that will be able to keep up. Our goal is to help DSOs build and maintain a digital asset library by transforming remote sensing data into a spatial digital twin of the world. This solution is called ROAMES and follows the principle of Map, Model, Monitor/maintain. Having acquired the geodata (map) our solution models the assets in 3D while also modelling the environmental features (vegetation) just like assets, generating analytics about these modelled features. These analytics are converted into insights that will improve monitoring and maintenance programs across our clients' network.
- Distribution and transmission.

Solution

- Technology : ROAMES solution needs to provide the data analytics to our clients' rapidly. We have developed a full cloud mastered, AI driven processing suite that can process up to 20,000 line km per month of network. Coupled to this rapid processing engine is a front end online hosted 3D visualisation tool with a digital twin of the network and supported by an online analytics engine offering insights into vegetation and critical clearances across their entire network.
- Process : clients do need to adjust their policies and standards documentation around inspection, asset and vegetation management. Fugro assists with the business case development during the pilot project stage.
- Change management (if any) : N/A.
- CAPEX/OPEX investment : N/A.
- Technology maturity : full mature/scalable.

Benefits

- Benefits for the customer : reduced faults, improved service, lower bills.
- Benefits for the DSO : significant cost benefits through improved vegetation programs up to 40% cost savings, ability to audit, reduction in vehicle/personnel travel across the network, reduction in faults across the network, ability to improve capacity across the network, improved planning and design services. Ability to operate with existing work force.
- Benefits for the market : helping the network operators move towards net zero/reduced carbon by deploying less field crews.
- Timelines to deploy and start realising benefits : can be delivered after first acquisition program.

17. Digitalisation of the maintenance process

Finnish Energy PORI ENERGIA SÄHKÖVERKOT OY

Business problem

- Before the maintenance system was used, maintenance was carried out using various Excel spreadsheets and other files. The problem with this approach was that it was poorly maintainable and not very straightforward. In addition, the maintenance work carried out could not be used to create a maintenance history for the equipment serviced. Service providers also lacked the possibility to view the equipment being serviced and its technical data.
- The solution to this maintenance problem was found from Industrial and Financial Systems (IFS). Today, we use IFS Cloud, the cloud-based IFS. IFS is used as a maintenance system for 110kV transmission line network separators, switching stations and substations.
- 110kV transmission line network separators are 110kV | Switching stations are 20kV | Substations varies between 110kV/20kV/6,3kV.

Solution

- Technology: technical aspect relies heavily on IFS Cloud features and integrations with other systems like Head-Power's IWM for work order management; however, lacks IoT sensor utilisation for continuous maintenance and real-time decision-making; primarily used for automated work task generation, fault reporting, maintenance budget planning, and viewing device technical characteristics.
- Process: the DSO must define assets for maintenance system use, create objects, choose extent of equipment data import, and export maintenance plans in IFS Cloud for preventive maintenance implementation; despite system transition, maintenance operations remain unchanged, requiring configuration and initialisation before automation.
- Change management: we maintain constant use of two versions of IFS Cloud: a production environment and a test environment. The test environment serves for various training, update, and version upgrade tests. Training primarily focuses on advanced features such as lobbies and migration work, targeting "super" users, thus requiring minimal basic training. Problem situations or skill shortages are addressed through a ticket system with consultants, especially during version upgrades.
- CAPEX/ OPEX investment: IFS Cloud necessitates regular maintenance, incurring costs for training, problem resolution, updates, version upgrades, and individual error corrections by consultants, categorised as either CAPEX or OPEX, with assistance provided during upgrades and updates by consultants as needed.
- Technology maturity: the mobile and desktop version of IFS Cloud is in early development stages and is being tested.

Benefits

- Benefits for the DSO: greatly automates the implementation of the maintenance plan and adds desirable features that did not exist before, such as equipment work history and simplifies the process.
- Timelines: implementation timelines for DSOs' benefit introduction vary due to diverse past practices; factors such as previous systems and data availability significantly impact durations, ranging from one to two years if data transfer is straightforward, to four to five years if extensive data collection is required from multiple sources.

Maturity level description of capabilities 1/4 (Build)

Capability	Basic	Emerging	Advanced	Leading
Licensing & Permitting	• Manually or using basic MS Excel to keep repository of forms, permit documents and applications	• Basic CRM systems • Digital record keeping, tracking projects, and permit processes	• Advanced CRM systems • Fully integrated digital system like ERP/SAP for tracking of the permit process with real time status	• Centralise management with one online portal for all types of licenses and permit application requests • Advanced compliance management solutions for dynamic compliance tracking and predictive analytics
Grid Planning & Network Design	• Partially integrated systems and high reliance on manual data collection • Basic models of new assets (DER, storage, EV) – HV/MV voltage grid fully modeled	• Advanced model used for new asset – HV/MV/LV fully grid modeled • Integrated systems like GIS to carry out system capacity planning, network studies and infrastructure requirement planning	• Smart grid technologies are fully integrated into the network design, leveraging analytics for probabilistic scenario decisions • Fully detailed grid model (HV/MV/LV) • Digital substation proportion for low voltage : >40%	• AI and ML algorithms to support and optimise planning and sensors to optimise the utilisation of the grid • Digital substation proportion for low voltage : >65%
Engineering & Construction	• Project visualisation relies on 2D drawings and manual decision-making • Sensorisation from high and medium-voltage grid >80%	• 3D models created for design and visual representation • Collaboration platform within the organisation • Fully sensorised high and medium-voltage grid	• 4D digital models (time-based) are integral to construction management for project visualisation, scheduling, budgeting & resources allocation • Sensorisation in low-voltage grid (<50%)	• AI-driven 7D (cost-based) project model • Sensorisation in low-voltage grid (>80%)
Contracts & Procurement	• Paper-based and basic MS Excel for contract management and supply chain tracking	• Nascent stage of using data analytics for dynamic cost and vendor selection • Using entry-level Supply Chain Management (SCM) software for tracking	• Enhanced data analytics capabilities and advanced contract lifecycle management, integration with ERP systems • Analytics for supply chain management and systems for tracking	• AI-driven contract analytics, predictive contract modeling, dynamic contract negotiation • Inventory tracked on real time basis
Portfolio Management	• No data is integrated; each project is planned, executed and monitored individually	• Big projects designed and run centrally with visibility of progress and supply chain	• Consolidated project scheduling with synchronised data and managed by control tower to all relevant stakeholders	• Connected construction, and data collected via sensors from the field is fed into project management

Maturity level description of capabilities 2/4 (Operate)

Capability	Basic	Emerging	Advanced	Leading
Operation Planning, Outage Management & Reliability	• Standalone SCADA systems for grid operations • Reactive approach for outages	• SCADA combined with OMS or DMS • In-house and customised outage planning	• ADMS (composed of SCADA, DMS, and OMS) system installed but underutilised • Analytics and IoT sensors are leveraged for outage planning • Grid observability for medium voltage : >85%, for low voltage : >40%	• ADMS + DERMS +local flexibility marketplace and • Advanced Integrated control room and outage planning with AI/ML-based analytics • Grid observability for medium voltage : >90%, for low voltage : >65%
Grid Operational efficiency	• Handled manually from the OT application in the control room while working in tandem with the field team	• FLISR has been commissioned at the control center, but the accuracy of fault location is poor	• FLISR application is enabled on every feeder and Self-Healing Grid in some critical network	• In addition to the FLISR, an advanced analytics layer is implemented to predict the fault location
Customer Operations & Engagement	• Legacy systems with little back-office operational efficiency • Limited mechanism and technology for fraud connection • Poor customer engagement	• Custom and legacy platforms for back-office processes, limited integration capabilities • Utilisation of basic analytics for identifying anomalies in usage patterns, • Automated messaging systems, basic email automation tools	• CRM, Billing solutions are integrated • Advanced analytics to detect anomalies • Personalised automated messages using advanced Customer Notification Systems for multi-channel alerts	• Intelligent and integrated platforms (CRM, billing, customer care, etc.) • AI predicted defaults • Predictive alerts, and real-time personalised message
Digital Metering	• Smart meter deployment <50% • Meter sends a monthly read, aligned to meter-to-cash processes • Some alerts and events may be processed and actioned (p.e. Tamper alerts)	• Smart Meter deployment (<60%) • Daily read consumption • Events and alarms monitoring	• Smart Meter deployment (<80%) • Daily profile data received (consumption, voltage), with interval data • Advanced event and alarm monitoring, including last-gasp	• Smart meter deployment (>80%) • Cloud-based IoT architecture • Real-time or near-real time streaming and/or edge processing of events alerts and interval data
Flexibility Management	• Limited visibility of DER sources across the network (only schedules are provided) • DER either are not visible or controlled via a decentralised DER management system; not connected with centralised control and operation center	• Information register of DERs in the network is maintained • Network topology for DERs is maintained manually by control engineers • Challenges are faced in optimising and balancing various renewable sources effectively	• DER sources are well integrated into ADMS/DERMS providing visibility of supply in real time. • Dynamic setpoint determined via the DERMS application • Advanced forecasting and predictive analytics tools are used to optimise the energy mix	• Combination of ADMS, DERMS and Market System with an additional centralised system allows to generate of dynamic profiles for DER • Automatic calculations of demand-side response needs

Maturity level description of capabilities 3/4 (Maintain)

Capability	Basic	Emerging	Advanced	Leading
Asset Data Management	• Manual data entry and limited asset database • Asset Data is stored but not updated automatically; data used only for reporting	• Data are stored in EAM system but no integration; Restricted access • Limited data availability to asset management applications	• Asset management system integrated with other ERP systems for automated workflows. • EAM system integrated with OT systems, Data Historian, GIS, etc.	• Fully Integrated EAM system for end-to-end asset lifecycle management. • Asset Data is used along with sensor data to generate predictive maintenance plans. • Data is leveraged to identify critical assets
Asset Portfolio & Risk Management	• Basic use of MS Excel for data collection and OPEX and CAPEX planning • Asset health is assessed through manual inspections and historical data	• Entry-level Asset investment planning (AIP) tool is employed with preventive asset health monitoring	• AIP tool is employed, optimising predictive maintenance, and sensors/IoT devices to monitor asset health	• AI-driven solutions for asset management and risk assessment; IoT sensors and data collection devices across the entire asset portfolio
Maintenance Strategy, Planning & Engineering	• Entry-level CMMS (Computerised Maintenance Management System) for preventive and corrective maintenance planning and scheduling is used	• FMEA and RCA-based maintenance • CMMS and EAM are used	• Advanced analytics tools, machine learning, and AI are used for asset performance analysis. • Asset Performance Management (APM) Systems for predictive analytics and optimisation.	• Digital twin technology is used to create virtual models of assets, simulating performance and optimising maintenance and planning the predictive maintenance
Work Order Management, Execution & Field Operation Monitoring	• Manual Work Order scheduling and Tracking • Non-real-time status and tracking of workers is done. Radio and mobile-based communication. • Safety systems are defined	• WO is scheduled digitally based on availability, mobile app-based work tracking • Mobile apps are used for safety monitoring	• WO is scheduled automatically based on skills, location and time. GPS in mobile devices for tracking. • Safety systems are enhanced with real time risk monitoring	• AI-based WO is scheduled considering real-time data, skills, and historical performance; Real-time tracking of fieldwork via Light version Mobile apps of SCADA, ADMS, and EAM system available • Safety is data-driven, with AI-driven safety analytics
Vegetation Management	• Manually driven inspection and vegetation management activities with systems used to provide only basic data	• Usage of sensors for vegetation inspection and analytics for work planning and packaging	• Intelligent data models for inspection planning and execution using weather, tree species, topology and customer profile	• Usage of Drones, LiDAR and image analytics for inspection • Work packages generated via system based on data analytics including detailed information on trees, route and crew

eurelectric accenture

Maturity level description of capabilities 4/4 (Data-Driven)

Capability	Basic	Emerging	Advanced	Leading
Technology & Platforms	• Applications are highly customised and are on-premise. Not scalable from database as well as loading on systems • Applications are designed and deployed in-silo with their own data model and closed APIs	• Some degree of commonality in construction or underlying infrastructure • Application architecture is open to accommodate only key standard solutions with no plug-ins for custom applications	• Architecture suite is architected both on cloud and on-prem. Some of the cloud applications are more like pilots • Application architecture is open to accommodate all major enterprise applications through APIs • A reasonable degree of commonality in underlying architecture for security, databases, and application infrastructure	• Infrastructure is built to support mobile capabilities and is scalable, optimised, and future-proof in a fully integrated way across organisation capabilities • Usage of industry standard data and data exchange models (e.g. CIM)
Data & Insights	• No data architecture standards/policies • No standards or data quality policy in place	• Data architecture for every application exists but lacking standard adherence • Standards and policy exists but are not consistently applied	• Data architecture governance processes are clearly defined and documented • Clear process and framework is in place to capture, store, share, archive, and remove data • A mix of internal and external data is used. Data is pulled from external sources in batches on a delayed basis with integration issues	'• Standards and governance for data architecture are in place and followed • Rigorous controls in place for clear segregation of information and its use across the wider partner ecosystem • High data quality and comprehensive policies exist
Cybersecurity	• There is no dedicated Cybersecurity Plan in place and Cybersecurity initiatives are not monitored via KPIs. • The Organisation does not have a dedicated ICT Security Management Policy and Procedure in place nor a Third-Party Risk Management one	• The Cybersecurity Plan is available but Cybersecurity initiatives are not monitored via KPIs and C-level executives and/or the BoD are not involved in Cybersecurity • The Organisation has an ICT RM Policy and Procedure integrated and conducts periodic ICT RM campaigns	• There is a Cybersecurity Plan in place covering at least 1 year, KPIs to monitor the security initiatives and the BoD is involved at least once a year • The organisation has an ICT RM Policy and Procedure integrated with the Business Continuity activities (definition of processes, etc.) and conducts annual ICT RM campaigns	• All the Security Governance activities are centralised and dedicated figures are available at the operational level (Network Security Management, Infra. Sec., Information Sec., etc.) and the BoD is reviewing Quarterly • In addition to an ICT RM Policy and Procedure integrated with the Business Continuity, it has a dedicated TPRM Policy and Procedure, with all the ICT providers clustered and analysed, periodically assessed, and with dedicated security standards for all new contracts

List of Abbreviations

Abbreviation	Definition
OT	**Operational Technology (OT)** refers to the use of hardware and software systems to monitor, control, and manage physical processes and machinery in utility setup. It encompasses technologies such as industrial automation, sensors, SCADA (Supervisory Control and Data Acquisition), and process control systems
IT	**Information Technology** is the general use and management of computing technology in businesses and other organisations.
ADMS	**ADMS (Advanced Distribution Management System)** is a comprehensive software platform used by utilities to efficiently manage and optimise the distribution of electricity. It integrates real-time data from various sources, such as sensors, SCADA systems, and smart meters, to monitor and control distribution networks. ADMS assists in tasks like fault detection, outage management, load balancing, and grid optimisation
SCADA	**SCADA (Supervisory Control and Data Acquisition)** is a system used in utilities to monitor, control, and manage various equipment and processes. It collects real-time data from sensors and other devices, allowing operators to supervise and control operations remotely
ERP	**Enterprise Resource Planning (ERP)** is a platform companies use to manage and integrate the essential parts of their businesses. It helps streamline processes by integrating various functions into a single system
AMI	**Advanced Metering Infrastructure (AMI)** is an integrated, fixed-network system that enables two-way communication between utilities and customers. Smart meters are the key building block of AMI. They typically collect data at intervals of an hour or less.
DERMS	**Distributed Energy Resource Management System (DERMS)** is a software platform used by utilities, particularly distribution system operators (DSOs), to manage grids that heavily rely on distributed energy resources (DERs). These DERs include assets such as rooftop photovoltaic solar panels, behind-the-meter batteries, and electric vehicle fleets. The primary purpose of DERMS is to deliver vital grid services, balance demand with supply, and help utilities achieve mission-critical outcomes

Content

Accenture as knowledge partner :

Role of Accenture

In support of the study, *Wired for tomorrow. Unleashing the power of digitalisation in grids*, Accenture is the knowledge partner for digital grid transformation. The Accenture Utilities team devised 84 questions and elaborated the digital maturity survey to assess European DSOs digital maturity for core capabilities across the value chain. Accenture processed the DSOs responses and designed a roadmap illustrating the pathway towards a fully digitalised Distribution System Operator.

Any policy references or related recommendations included in this study are those of Eurelectric and do not reflect the opinions or views of Accenture.

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