ONLINE
WORKSHOP

CurrENT
Enabling Network Technology
throughout Europe

FROM INNOVATION TO MAINSTREAM

HOW TO DEPLOY INNOVATIVE GRID TECHNOLOGIES AT THE DISTRIBUTION LEVEL?

16 May | 10:00 - 12:00 CEST

CurrENT's 'handbook': *Recommendations for deployment of DSO Projects*

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Why the report?

1. **From Innovation to Mainstream**

- How to Deploy Innovative Grid Technologies at scale quickly on Distribution Level

2. **DSOs will bear the burden of the energy transition**

- €400Bn of investment predicted to be needed
- 10% efficiency from IGTs where it could help would lead €16 billion saving
- Implementing new technology is rewarding but challenging!

3. **DSOs deployment of innovation is different**

- Limited resources for onboarding new technologies
- Reliance on standards and specifications, less bespoke, but standards bodies are outpaced
- Justifying innovative is hard due to greater uncertainty
- Changing roles for DSOs and increasing responsibilities

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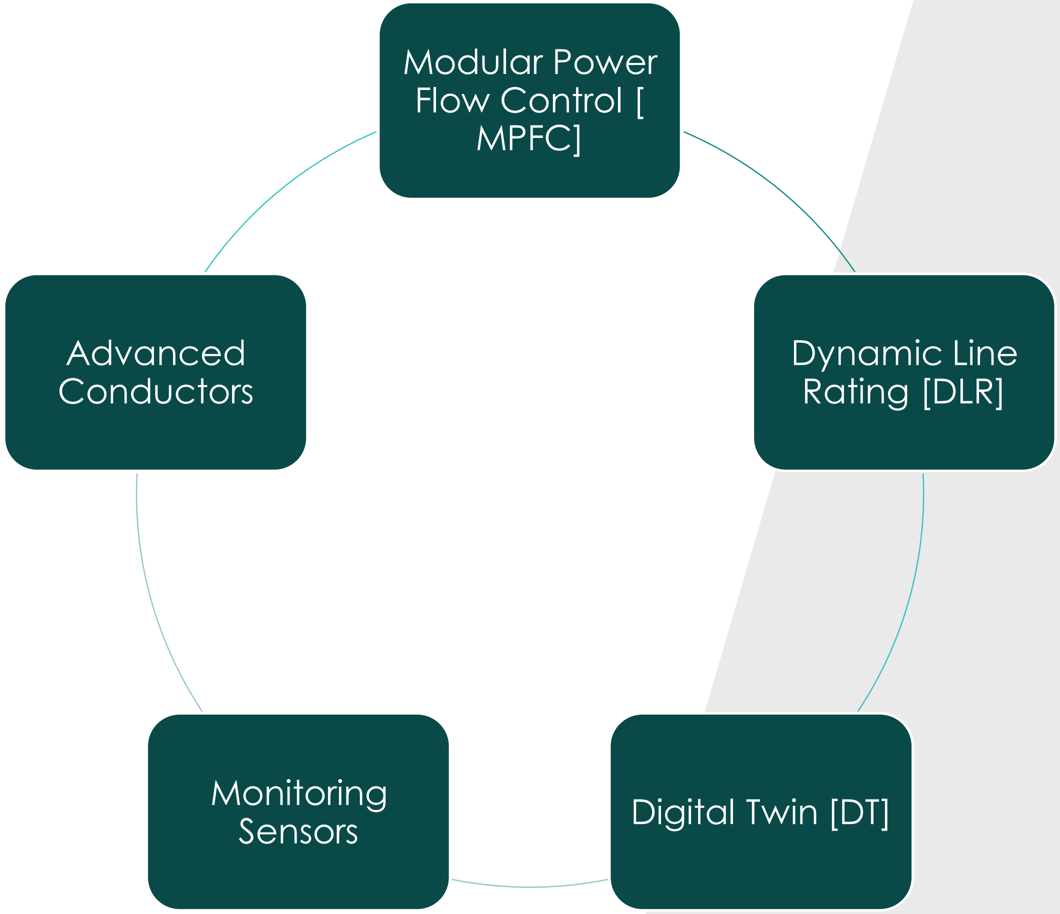
What is in the report?

- First edition (living) report

Contents

- Known Deployment Issues
- Innovative Grid: General recommendations
- Innovative Grid: Technology Specific recommendations
- Concluding Recommendations



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Technology Overview

Modular Power Flow Control	Devices that control the power flow in a circuit or network that is proven to provide GWs of additional network capacity saving €100m's, designed to be combined (modular) with rapid installation, resizing or relocation
Dynamic (Line) Rating	A system that assesses the environmental impact (from sensors and/or weather data) on the rating of a line or equipment in real time or forecasted, with average increases of up to 200% daily or 30% annually
Advanced Conductors	A range of conductors that deliver an increase of up to 200% of the transmission capacity over conventional types with lower line losses and greatly reduced sag
Monitoring Sensors	A range of advanced sensors that permit greater accuracy, reliability, using up to 80% less resources, c.70% less power and/or are 30% lower in cost.
Digital Twin	A digital model of the intended or the actual real-world physical power network, including to optimize use of Innovative Grid Technologies. Used for simulation, integration, operation, testing, monitoring, and maintenance.

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General deployment recommendations

Network Studies	▪1. Higher RES make uncommon studies common ▪2. Wider range - fault level analysis, dynamic, power quality and EMT ▪3. New modelling tools needed for assessing benefits of technologies ▪4. Use of technology toolbox ▪4. CurrENT provides access to models to support this
Procurement and Functional Tender Specification	1. Functional specifications in tenders, not technology specific = widest inclusion of grid innovation technologies. 2. Testing restricted to what is needed 3. Use of PQQ and RFI 4. Avoidance of unintentional bias
Cost Benefit Analysis	1. TOTEX NPV calculation but with a true reflection of the costs and benefits 2. Actual annual phased spending for building the project 3. IGT added benefit from early construction, or delayed spending 4. Recognizing phased project deployments
Installation and Testing	1. How to install quickly and easily 2. How to work without international standards 3. CurrENT can provide method statements for deployment

- ✓ Some issues are universal
- ✓ These issues span project development
- ✓ Guidance on managing key issues provided
- ✓ CurrENT OEMs support commitment

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Specific deployment recommendations

- ✓ Areas covered based on past DSO project tech assure and deployment
- ✓ Covers all stages of development e.g. concept - commission
- ✓ Includes concerns, suitability, performance, cost and selection
- ✓ Example cases provided for learning and outreach
- ✓ Gives current best practice for each technology

Areas Covered

- High level description of technology
- Benefits of the technology
- Communications
- Procurement / tendering specifications
- System and Equipment modeling
- Recommended technology risk management
- Deployment process stages / lead time
- Type tests
- Recommended CBA methodology
- Example cases

Concluding Recommendations

- **Efficiency first:** benefit from grid optimising technologies to ensure faster, cheaper, more flexible, solutions
- **Distribution Technopedia:** providing industry with a best practice range of technologies to be considered.
- **Technical assurance:** limited to functional needs of a technology and shared/accepted between peers.
- **Application of Symbiotic Technologies:** from this report be considered in combination.
- **Innovation incentives:** are recommended to regulatory bodies and policy makers to support the introduction of these technologies
- **Trialing what matters:** avoid '*death by pilot*', by recognising minimal risk of grid-optimizing technologies and impact of not using them, apply a streamlined process to trial, and then apply rapid wide-spread scaled deployment

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Applying Advanced Conductors To Distribution

Scottish & Southern Electricity Networks

Fort William to Fort Augustus 132 kV OHL

Line Info:

Location: Fort William to Fort Augustus

Voltage: 132kV

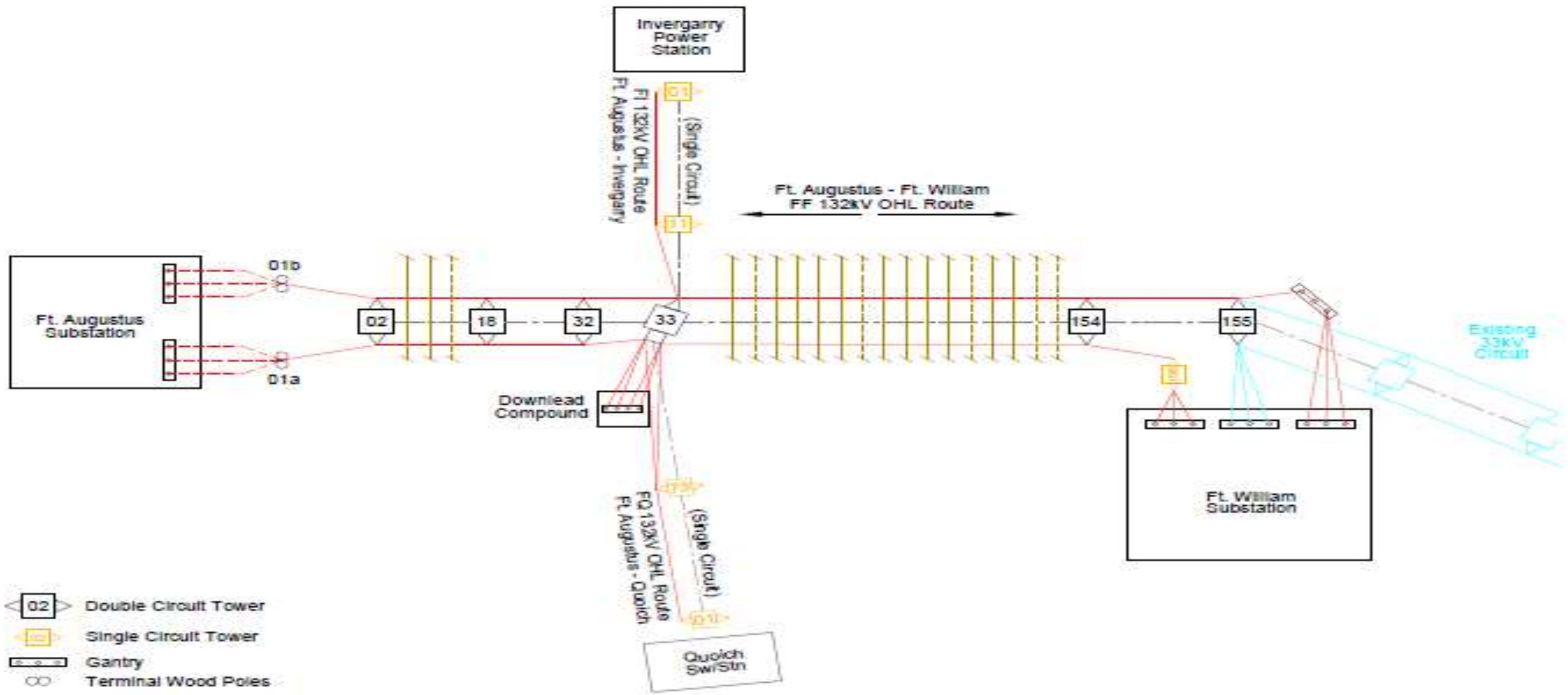
Route Length: 44km

Conductor: Lynx ACSR (50°C)

Earthwire: Horse ACSR

Tower: Double Circuit PL16

Date of Construction: 1955



Project Challenges

- **Increased Capacity needed Urgently –** Smelter expansion and jobs at risk
- **Conductor Assessment** - is there a conductor to meet these requirements ?
- **Existing Asset** - Keep tower changes and extensions to a minimum
- **Access** – Challenging terrain, vegetation and felling
- **Environment** – Risk of landslide when working above A82
- **Emergency Return to Service** – Must be returned in 10 hours in the event of a fault on live side

Conductor Selection

Lynx ACSR Conductor

Monte Carlo ACCC Conductor

Scottish & Southern Electricity Networks

Why Advanced Conductors?

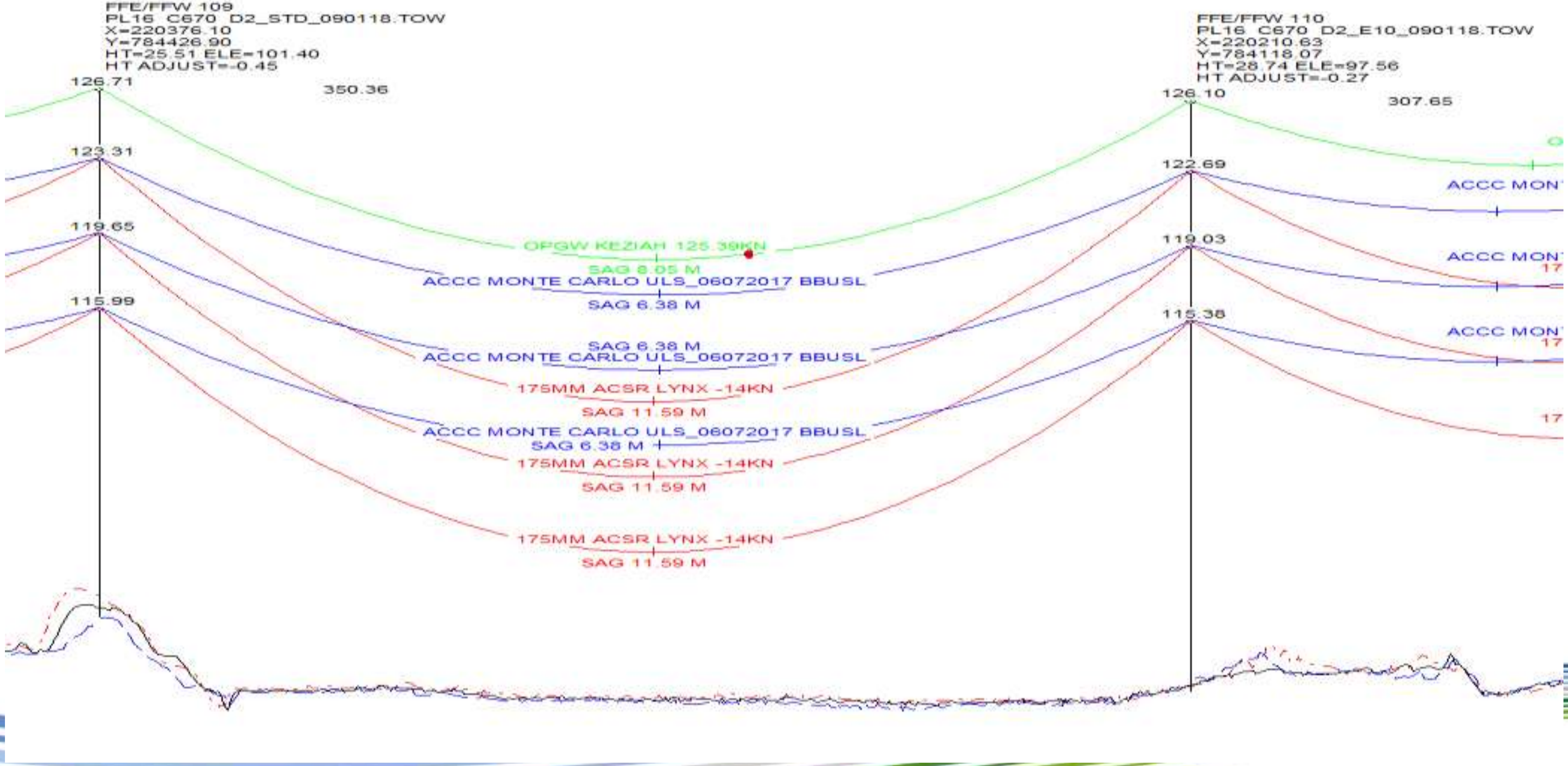
Criteria	AAAC - Upas	ACCC – Monte Carlo ULS	Other HTLS
Capacity Achieved	✘	✓	✓
Clearance Requirements met	✘	✓	✘
Unit Weight (equal or less than existing)	✘	✓	✓
Experience within SSEN	✓	✓	✘
Type Tested (to SSEN requirements)	✓	✓	✘
Load and Strength Acceptable	✘	✓	✘

Scottish & Southern Electricity Networks

Advanced Conductor Performance

Conductor System	100	200	300
Lynx Heavy Ice of 60mm	2.3	6.86	12.95
Monte Carlo Heavy Ice of 60mm	1.54	5.06	9.69

Conductor System	100	200	300
Lynx 75 degree	1.09	3.59	7.2
Monte Carlo 75 degree	0.23	0.93	2.08



Scottish & Southern Electricity Networks

Progress to Date

- Both circuits wired with Monte Carlo ACCC conduction in 2018 & 2019, No problems recorded to date.
- Only 3 % towers required changed to accommodate for high risk accessible road and railway network. (5 of 155)
- PL16 is a standard tower used throughout the UK, Monte Carlo ACCC conductor doubled capacity and reduced sag.
- ACCC Monte Carlo has been type tested by SSEN according to BS standards and UK conditions.
- ACCC Monte Carlo now been treated as approved product and used on other SSEN Projects.
- Re-using the existing assets and extending their life while doubling MVA ratings with minimum disruption.

Conclusion

- There are many types of advanced conductors available.
- These are available both in terms of size and type to suit your individual requirements
- Challenging targets 2030 & beyond
- The best route for a replacement overhead line is the one the existing one is already on !
- They offer an opportunity to fast track both your customer connections through increased capacity and rectify any historical ground clearance issues on existing structures.
- SUSTAINABILITY

Modular Power Flow Control

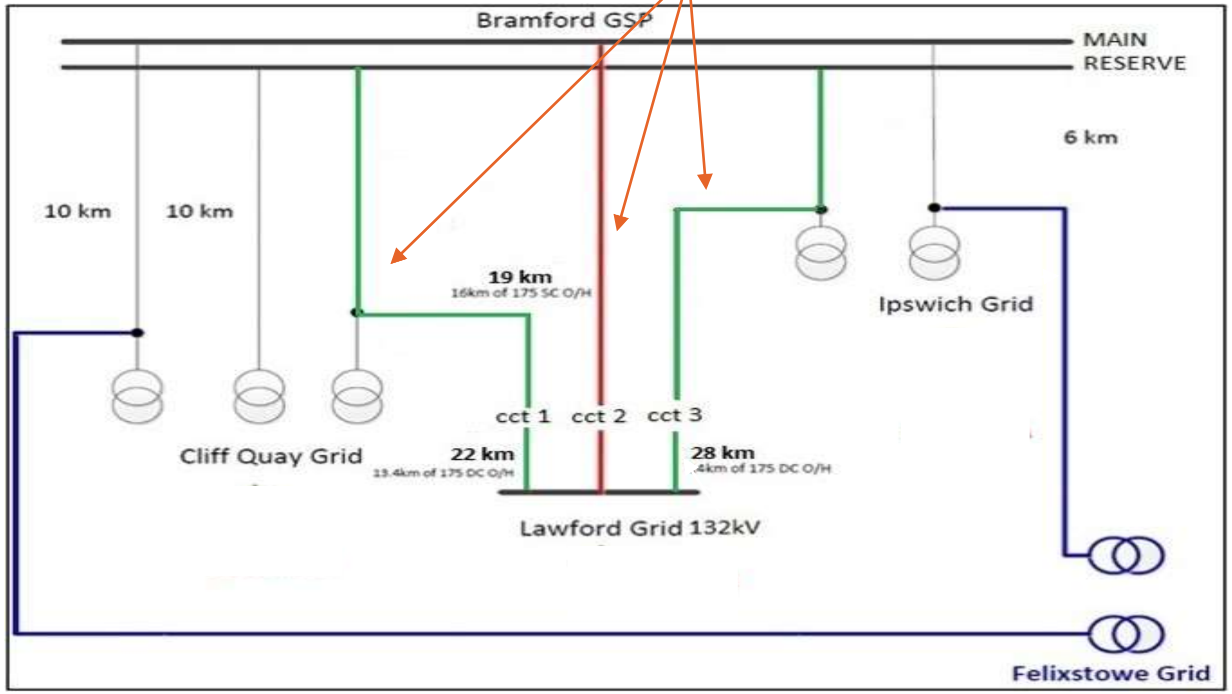
Case Study Project LoadShare

Andrew Burton Innovation Project Lead UK Power Networks

The Challenge

- ❑ Power flowing through three parallel 132kV circuits is not balanced due to different impedance
- ❑ Constantly changing load
- ❑ More power flows through circuit 2 - spare capacity on circuit 1 and circuit 3
- ❑ OHL route Site of Scientific Specific Interest (SSSI)
- ❑ A complex problem requiring an active solution

Three parallel circuits between 132kV sub-station

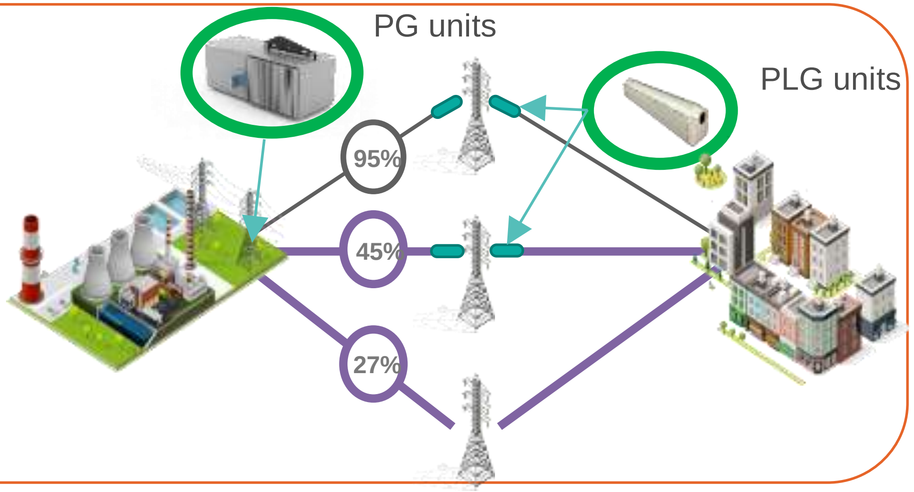


Single Line Diagram

The Solution - Power Flow Control Devices

- ❑ Combination of two devices from Smart Wires named Power Guardian (PG) and Power Line Guardian (PLG)
- ❑ Modules wrapped around an existing conductor enabling dynamic switching of small individual series block of impedance to control power flow.
- ❑ Inject reactance in series to increase overall reactance of the circuit.
- ❑ Dynamically controlled to change impedance on the circuit according to the requirement

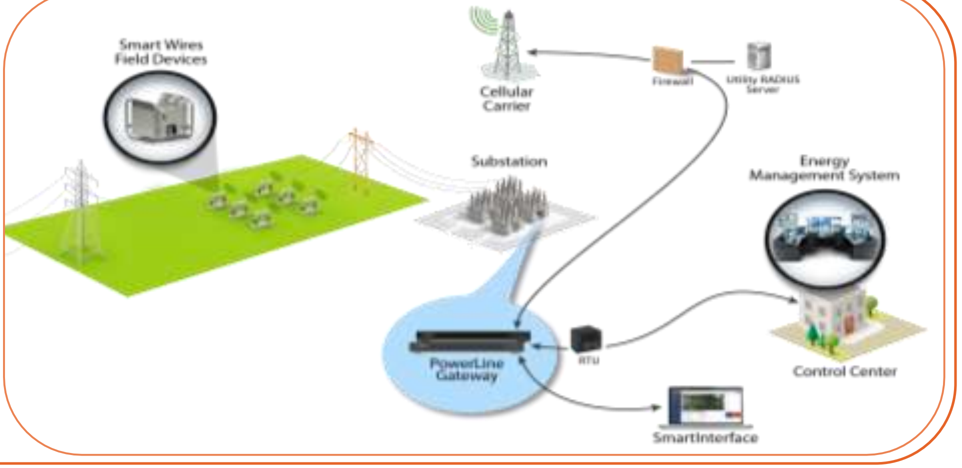
- ❑ Constantly change impedance of circuit 1 and 2 as power flow changes
- ❑ Power is pushed to alternative lines with spare capacity
- ❑ Constantly monitor all three circuits load and temperature
- ❑ Unlocking spare capacity for more generation



Deployment

- ❑ Technical Assurance
  - ❑ Initial Assessment
    - ❑ Compliance with UKPN technical Specs including type tests
  - ❑ Operational Assessment
    - ❑ Network operation impact and associated infrastructure

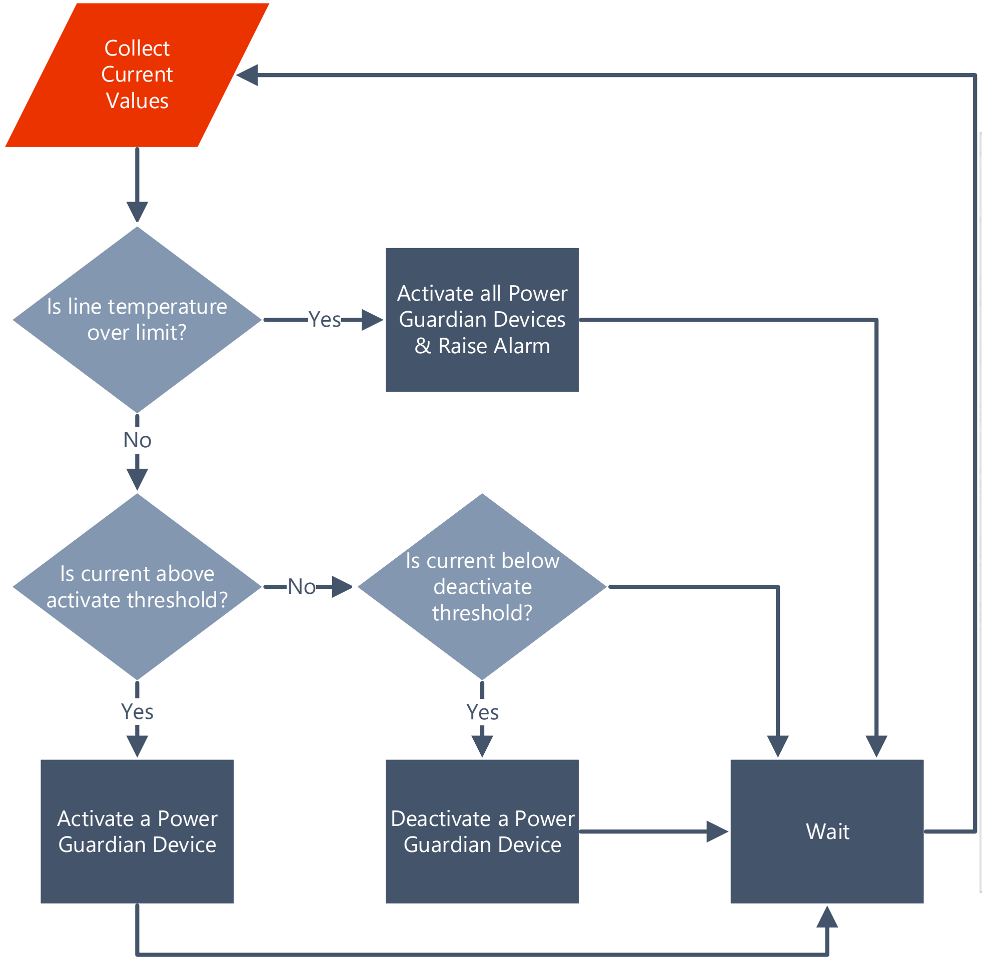
- ❑ Design and Planning
  - ❑ OHL LIDAR Assessment for 70° operation
  - ❑ Tower and Foundation Assessment
  - ❑ Communication with UKPN Control Centre (Cyber Security)
  - ❑ System Integration (Network Control)
  - ❑ Access to Towers (Wayleaves)
  - ❑ Line Outages for Installation

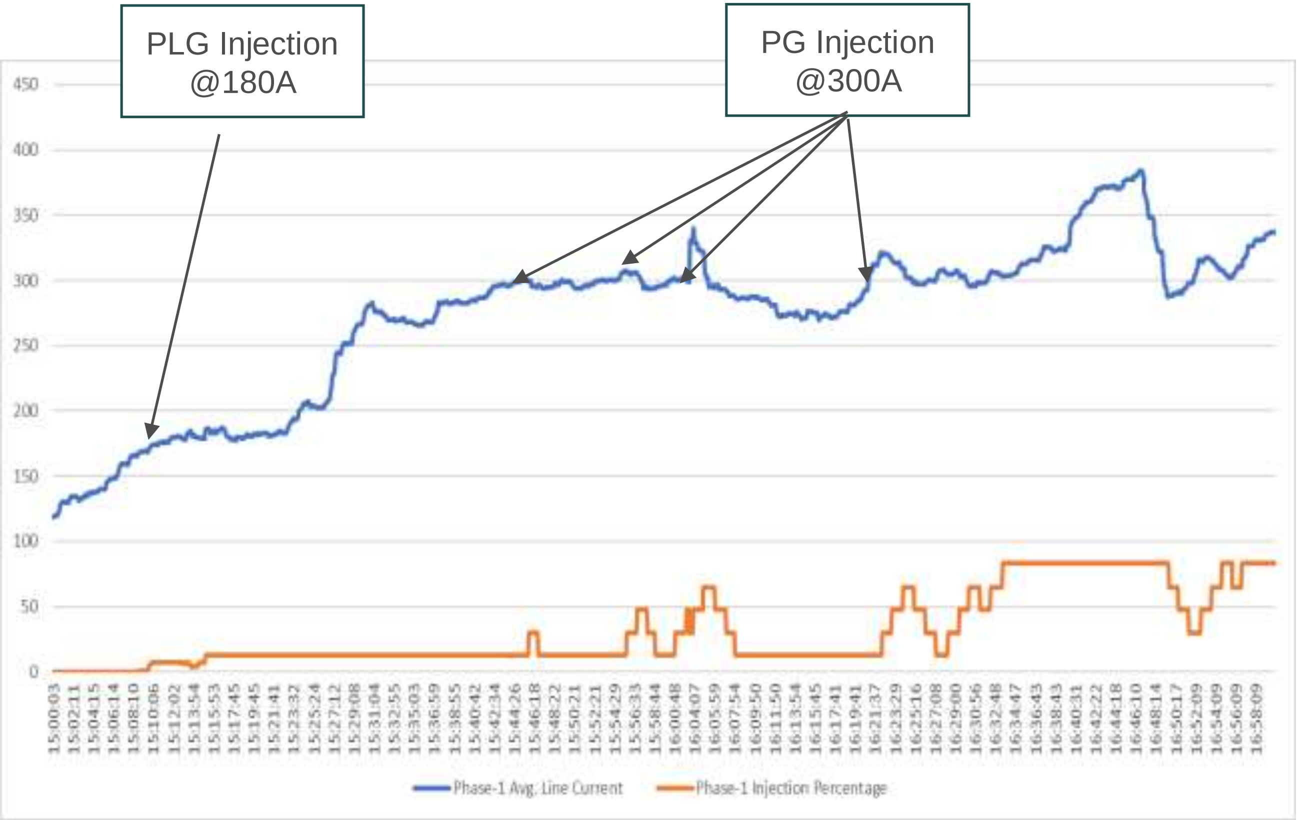


- ❑ Deployment
  - ❑ Installation
  - ❑ Commissioning
  - ❑ Trials

Operation

- ❑ Balancing Algorithm – Automatic operation
- ❑ Injection occurs at 180A PLGs and 300A PGs





Benefits

Innovative approach and most efficient and effective way of releasing network capacity

Accommodate new connections on constrained part of the network without costly network reinforcement

Fastest solution to deploy and dynamically controlled (Active Network Management)

Avoid the traditional reinforcement and disruption to landowners, road users or customers

Save up to £8 million to customers by avoiding significant reinforcement

+95MW =
power to 45,000 houses*

* Based on an industry standard usage of 2KW/household]

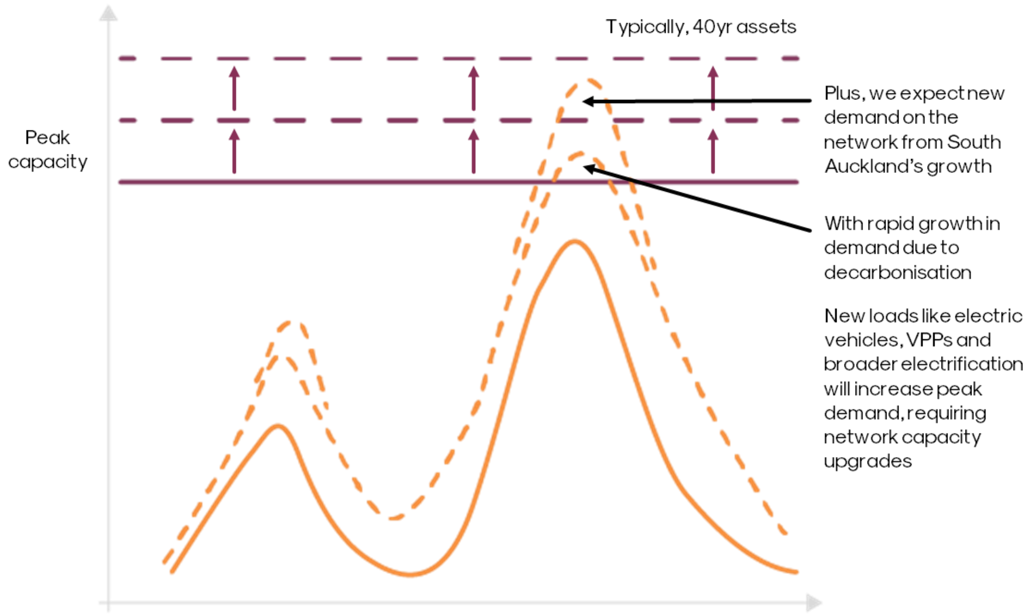
Questions?

Sharing Counties Energy's DSO Journey

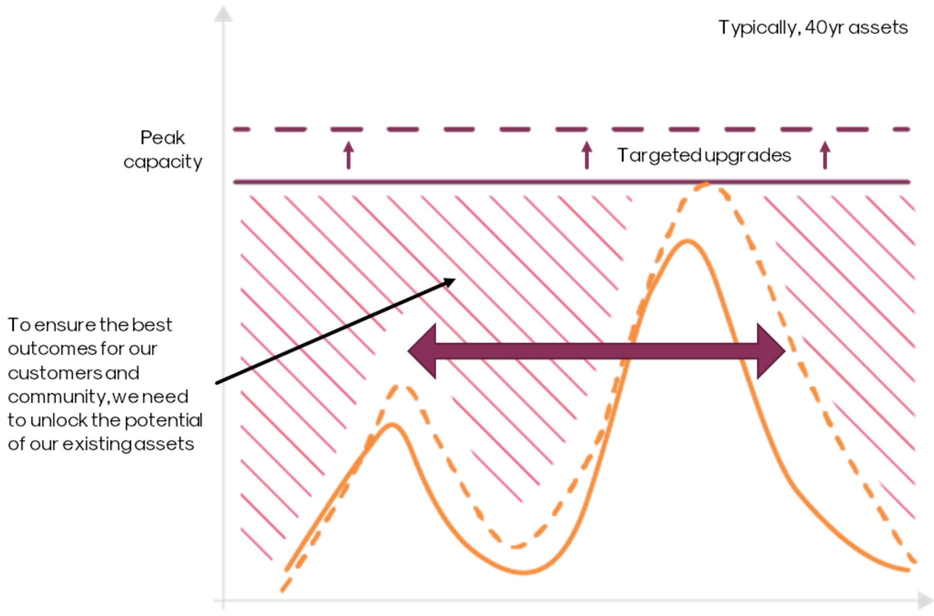
May 2024

Counties Energy

Why the strategic need to look beyond the status-quo?



Strategically, creating a 'stretch' in network capacity through smart network orchestration e.g. dynamic voltage control using LV visibility, etc.



Also utilising spare capacity with flexible DER and commercial arrangements e.g. dynamic operating envelopes, flexibility tariffs, etc.

Guiding principles that help embark our DSO transition

Our
DSO Transition
Guiding
Principles

1. ***Start small, scale fast, be right sized***
   The transition will be incremental and new capabilities will be developed at a realistic pace, along with the evolving market focusing on areas that are most likely to benefit first

2. Create an energy system that enables **equal opportunity for all customers**, striving for participation from customers from a range of segments

3. Our DSO services should deliver value to customers through the facilitation of **neutral local capacity service**, utilisation of flexibility services & dynamic capacity mgmt.

4. Our DNO/DSO services should **include flexibility services as a tool** to deliver quicker, more efficient and cheaper connections

5. Aim to **create and deliver shared value with customers** through offering network and 3rd party provided flexibility services

6. Deliver maximum value to customers through the **use of smart grid technologies** (e.g. LV visibility, microgrids, automated load transfer, etc.)

7. Ensure we keep **our internal environmental goals** at forefront and minimise system losses

8. Be the enabler that **creates new opportunities for** innovative energy services, **economic and social benefits** through the maximisation of energy system

Counties Energy

High-level view of the DSO Transition Programme

We are here

Phases

1. Define
2. Develop base understanding & capabilities
3. Offer base DSO service to market
4. Grow DSO iteratively

Example initiatives

1 — Define
- Develop initial strategy
- Stakeholder discussions
- Comms plan

2 — Develop base understanding & capabilities
- Network enablement – granular LV visibility, etc.
- Digital enablement – AMI headend and GIS/EAM upgrades, etc.
- Develop initial network operating envelopes
- Develop strategy for DER orchestration and network augmentation
- Test feasibility of local capacity service
- Understanding operating & commercial model req.

3 — Offer base DSO service to market
- Develop the DSO MVP with simple commercial propositions for selected areas
- Invite small no. of friendly DER aggregators and retailers to participate
- Go live with base DSO functions for EVC aggr.
- Amend distr. code & pricing methodology
- CPP discussions with reg.

4 — Grow DSO iteratively
- Develop asset mgmt., planning & operations iteratively
- Grow DSO for solar/batt. aggregators

2022-23	2023-24	2024-25	2025+
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Project Objectives

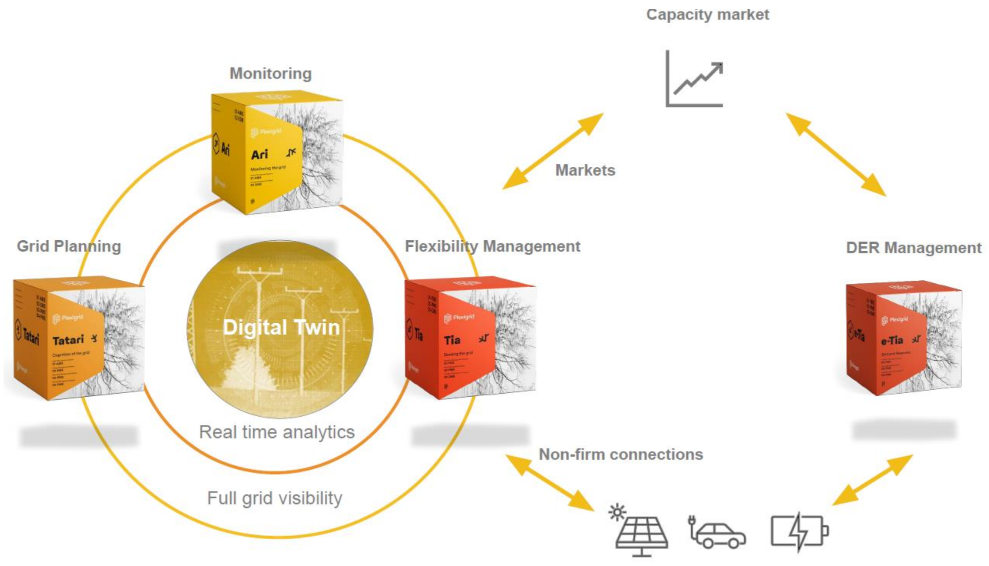
- Map an electrical model for the LV network for a given geographic area
- Use of historic smart meter data for running power flows, forecasting and constraints modelling
- Model different EV charger penetrations and usage profiles and model LV constraints
- Live monitoring of grid state to detect and forecast congestions
- Calculating of Dynamic Operating Envelopes (DOEs) required to address the LV constraints
- Using 2030.5 for communicating those DOEs to respective DER aggregators (initially OpenLoop)
- Post-event reporting to validate the response of DERs and constraint alleviation

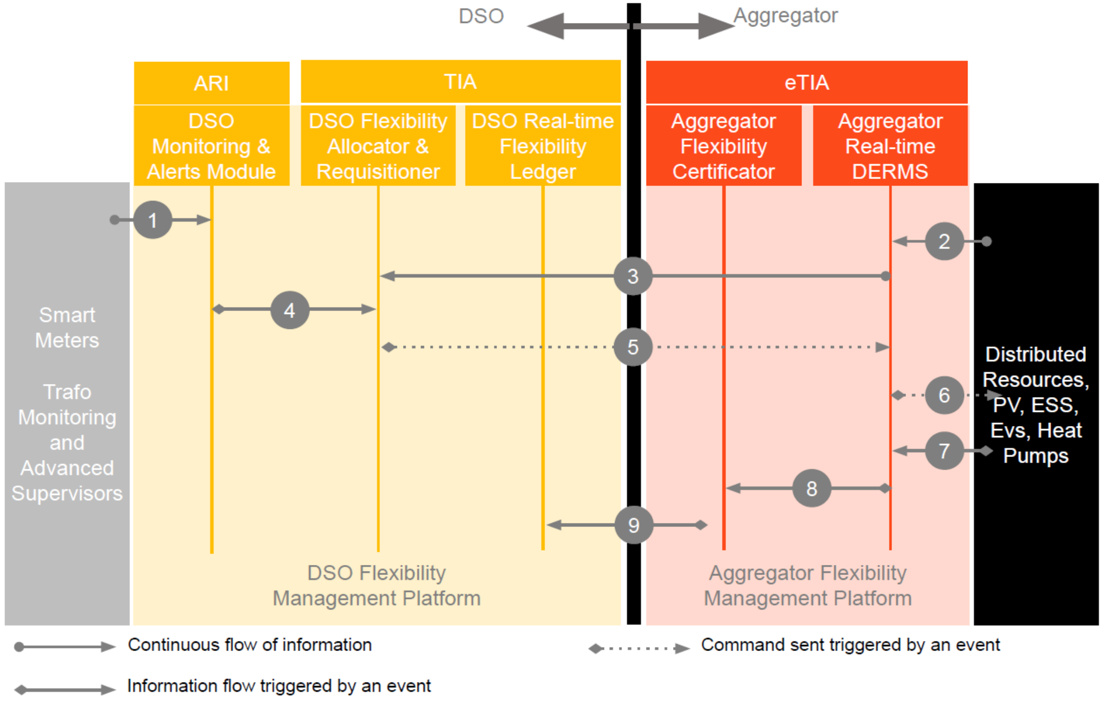
Digital Twin, DERMS and Aggregator interface capability

Counties Energy

Ara Ake
Future Energy Development

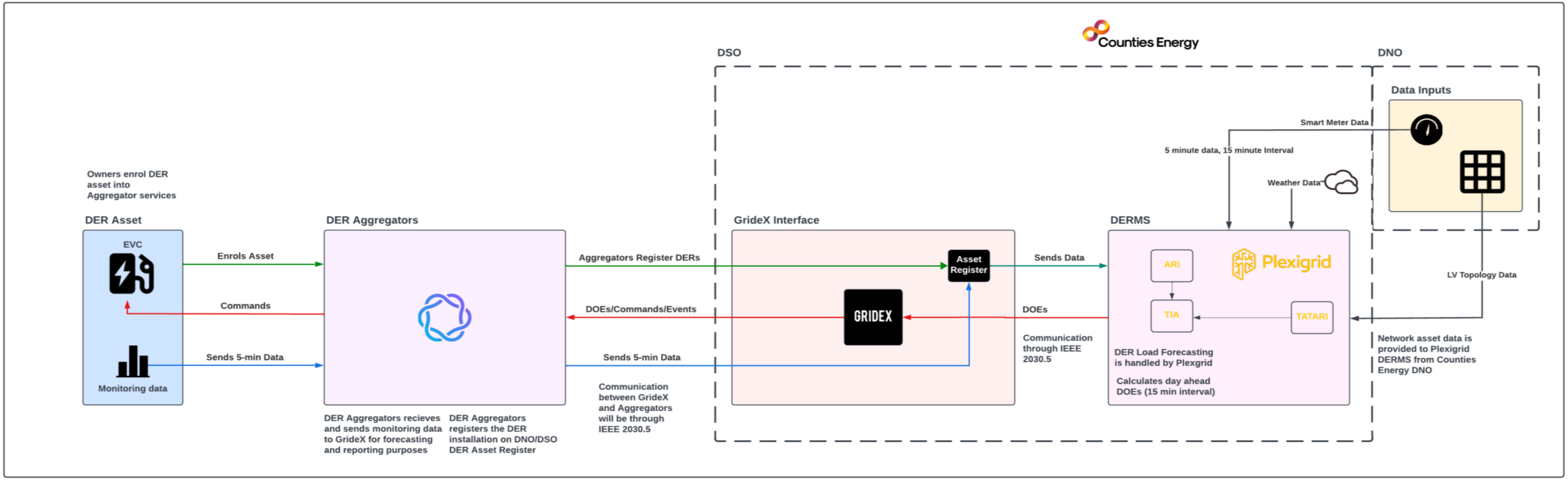
Plexigrid





1. Continuous flow of information from supervisors to the monitoring and alerts platform (ARI)
2. Continuous flow of information from EVs, PVs, ESSs, HPs to the aggregator DERMS
3. Continuous flow of info from EVs, PVs, ESSs, HPs from the aggregator's DERMS to the DSO
4. Generation and distribution of alerts and alarms to the flexibility module.
5. Flexibility activation command from the DSO to the aggregator.
6. Flexibility activation command from the aggregator to the final resource.
7. Response of the device on execution or not of the received command.
8. Confirmation of flexibility activation and certificate request
9. Send flexibility activation certificate from aggregator to DSO

What are we implementing – High-level Architecture



What are we implementing - Project Phasing

Phase 1 (completed)

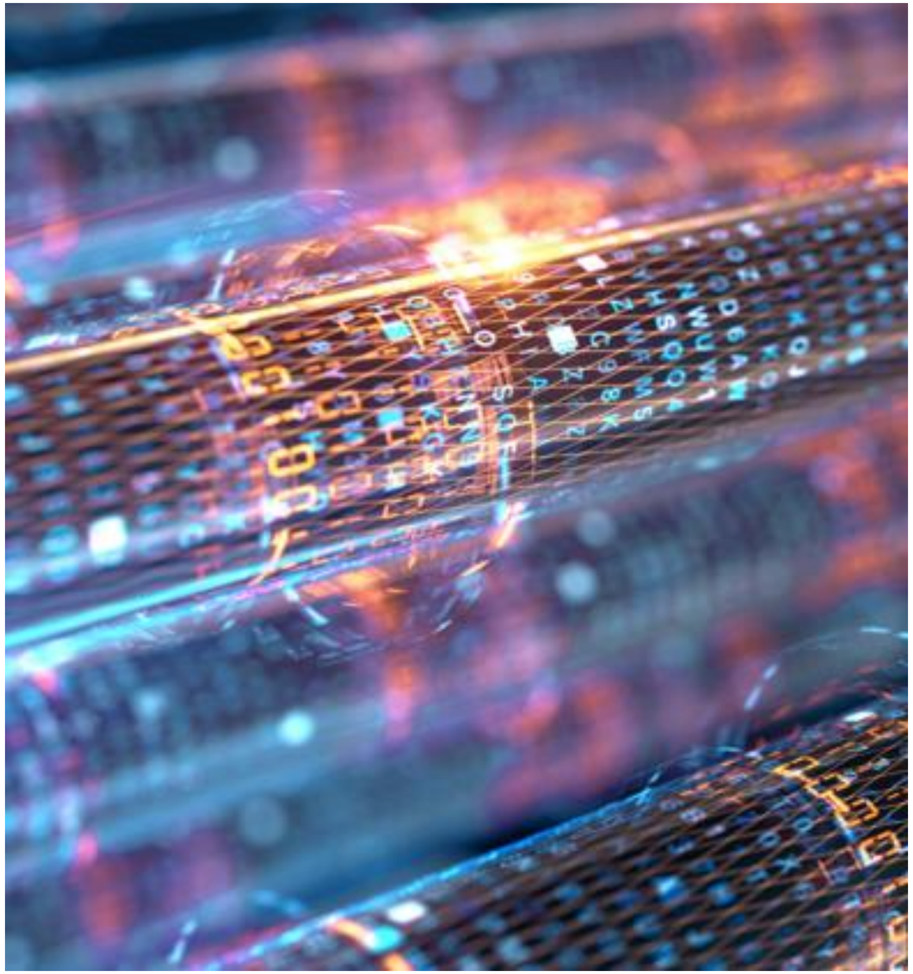
- This saw Counties Energy and Plexigrid collaborate in a desktop study based on simulated data sets and historical batch data. Plexigrid analysed the existing structures, data formats, and IT platforms to enable the integration of the required data into the Plexigrid platform. Counties Energy delivered the data required for stage 1, including LV voltage network model for the test area and smart meter data (consumption only).

Phase 2 (underway)

- This sees the integration of the platform with OpenLoop as the in-house aggregator service. It also includes end consumer participation, implementation of 2030.5 server on the network side and on aggregator side, near-real time data integration of meter data to the Plexigrid platform. The implementation of the 2030.5 application protocol for communication will be done jointly between Plexigrid, OpenLoop and Counties network operations to ensure interoperability.

Challenges and opportunities we faced so far

- Building a dedicated ‘DSO’ environment that is away from the ‘Core’ business – this is where we can learn and test safely
- Obtaining granular low voltage visibility through 5min smart meter data is not easy – working through mesh network issues, data accuracies, integrations, etc.
- Accuracy of the LV data impacted the constraint forecasting and DOE calculations – a high reporting rate from smart meters required, needed Transformer Monitoring
- Writing and validating the constraints engine spec – looking at international case studies on ‘capacity allocation’ approaches
- Build vs. buy discussions regarding IEEE 2030.5 server/client modules, impacting pace of delivery
- Performing good customer research to help build good DSO customer propositions



What aspects we shouldn't forget

- Customer experience and the need to drive tangible customer outcomes - Design, Test, Learn and Iterate
- The need for granular low voltage visibility – consider a multi-model approach, don't put all the eggs in the 'smart meter data' basket
    - 5min data, communications issues, cost, etc.
- Take a standards-based approach when looking to interface with DER aggregators – IEEE 2030.5, etc.
- Keep in mind the organisation's technology stack and cyber security framework
- Building flexibility/DSO services with a strong commercial framework – if it doesn't create value, it doesn't matter what technology stack you implement
- Learn through collaborations, especially internationally
- There is no one-size-fits all

Thank you

Ngā mihi nui

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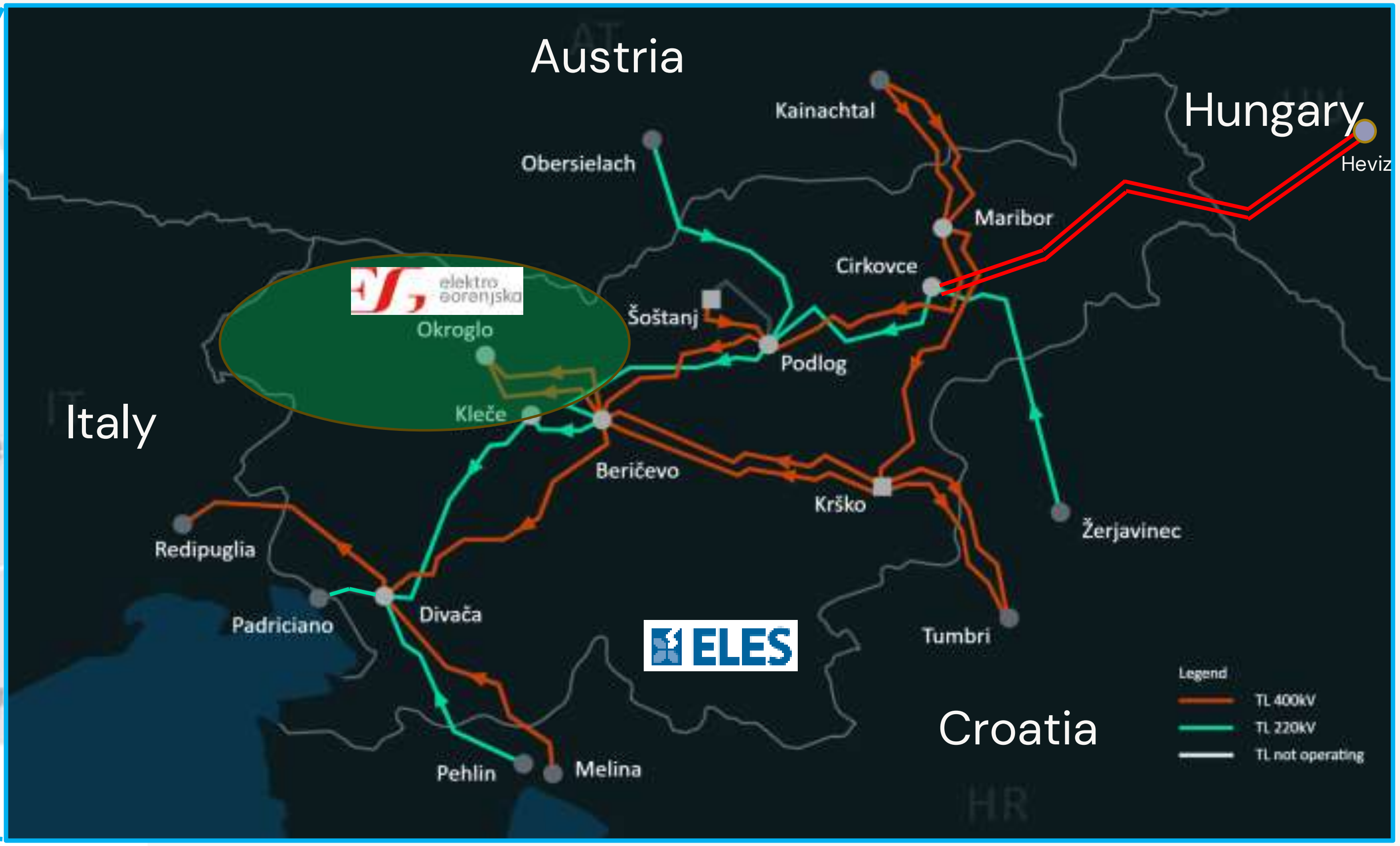
Advanced concept of efficient use of transformers leveraging the Dynamic Thermal Rating technology - project TrafoFlex

Lenart Ribnikar, Elektro Gorenjska d.d.
Andrej Souvent, Operato d.o.o.

From Innovation to Mainstream: How to Deploy Innovative Grid Technologies at the Distribution Level
CurrENT's Online Workshop, 16.5.2024

Elektro Gorenjska (EG)



- EG is a Slovenian DSO providing electricity to approximately 90 000 end users which stands for 10% of Slovenian territory
- EG grid consists of 13 HV/MV primary substations and nearly 1500 MV/LV secondary substations
- EG is strongly commited to R&D activities, being involved as a partner in numerous national and international projects
- One of our focuses is also Asset management which is strongly connected to DTR

Advanced concept of efficient use of transformers leveraging the DTR – Project TrafoFlex

The project's ultimate goal was to

- Develop, test, and validate a dynamic thermal model of transformers that considers different types of substations and to
- Develop the concepts of advanced use of transformers for power system operation, flexibility market, and asset management leveraging the Dynamic Thermal Rating technology.

Project partners: Elektro Gorenjska (DSO), Eles (TSO & DSO), Operato as the technology provider, and the Jožef Stefan Institute and EIMV as research institutions.

Executed in 2021–2023.

DTR (Dynamic Thermal Rating) is a power system operation concept aiming at maximizing utilization of the equipment (e.g. power lines, transformers), when weather conditions allow it, without compromising the safety of operation and without negative impact on the life expectancy of the equipment.

The motivation

- Peak load growth, mainly due to the massive transition to electric heating and the increasing integration of electric vehicle charging infrastructure.
- **The pace of emerging problems** – taking into account also the massive integration of renewables – **could be greater than the ability of the DSOs to reinforce the grid.**

That's why it's important to utilize the existing distribution power system infrastructure as much as possible.

The concept

Project TrafoFlex:

19 MV/LV substations of different types:

- pole-mounted,
- stand-alone concrete buildings,
- metal enclosures, and
- substations inside other buildings.

Different kinds of transformers in the range from 100 kVA to 1000 kVA.

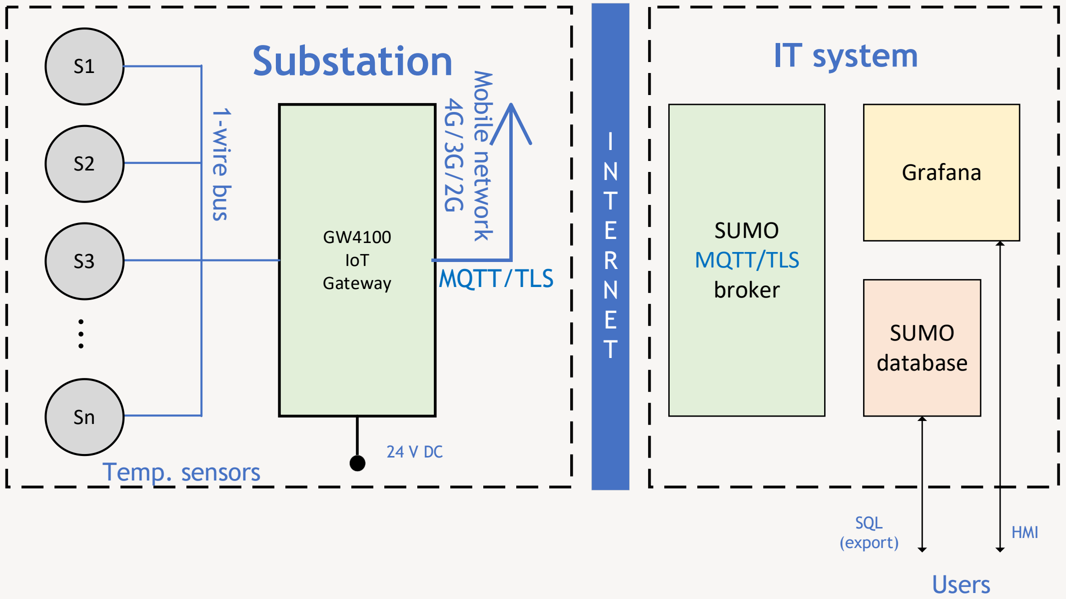
Weather data

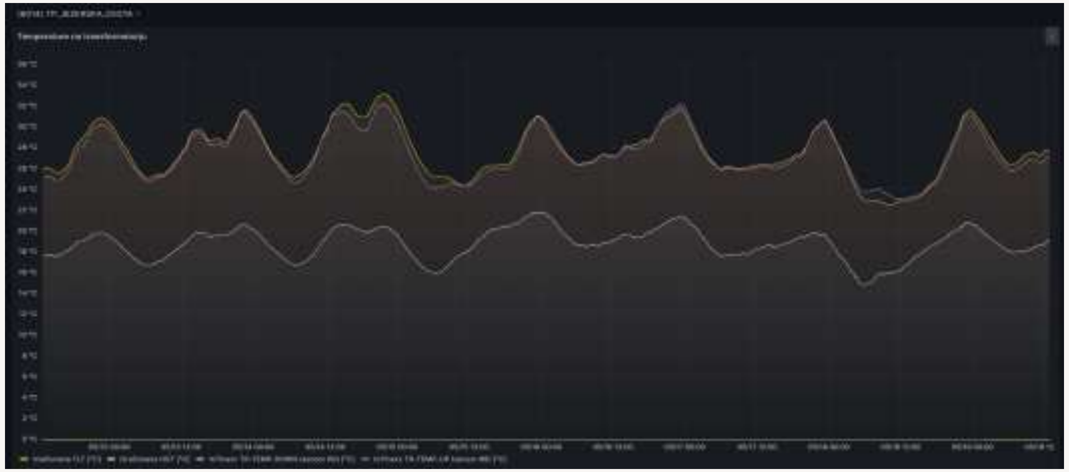
Operational or meter measurements (secondary currents)

Results:

- Transformer's loading limit – loadability
- Top liquid and hot spot temperatures

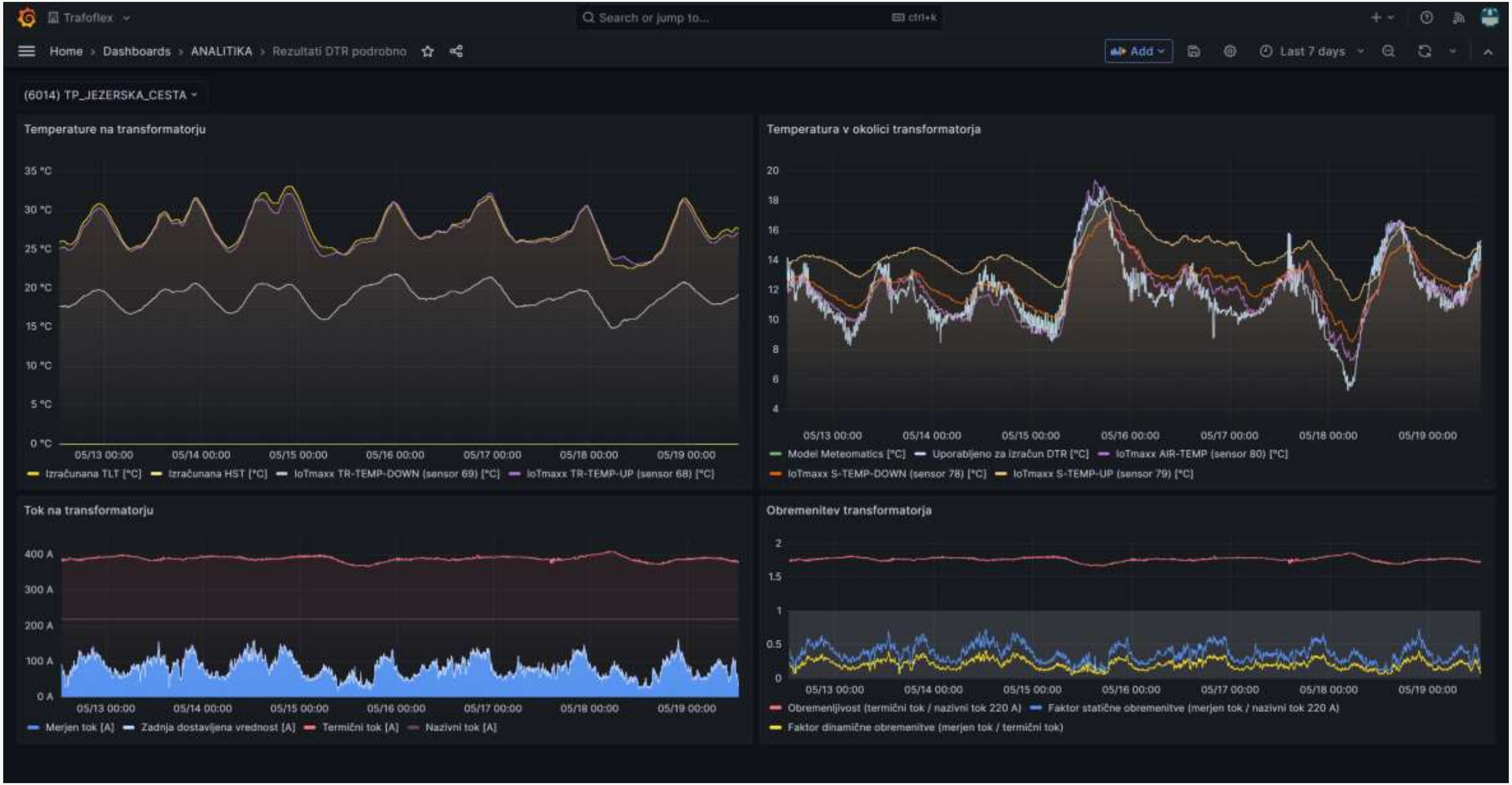
IoT measurement system



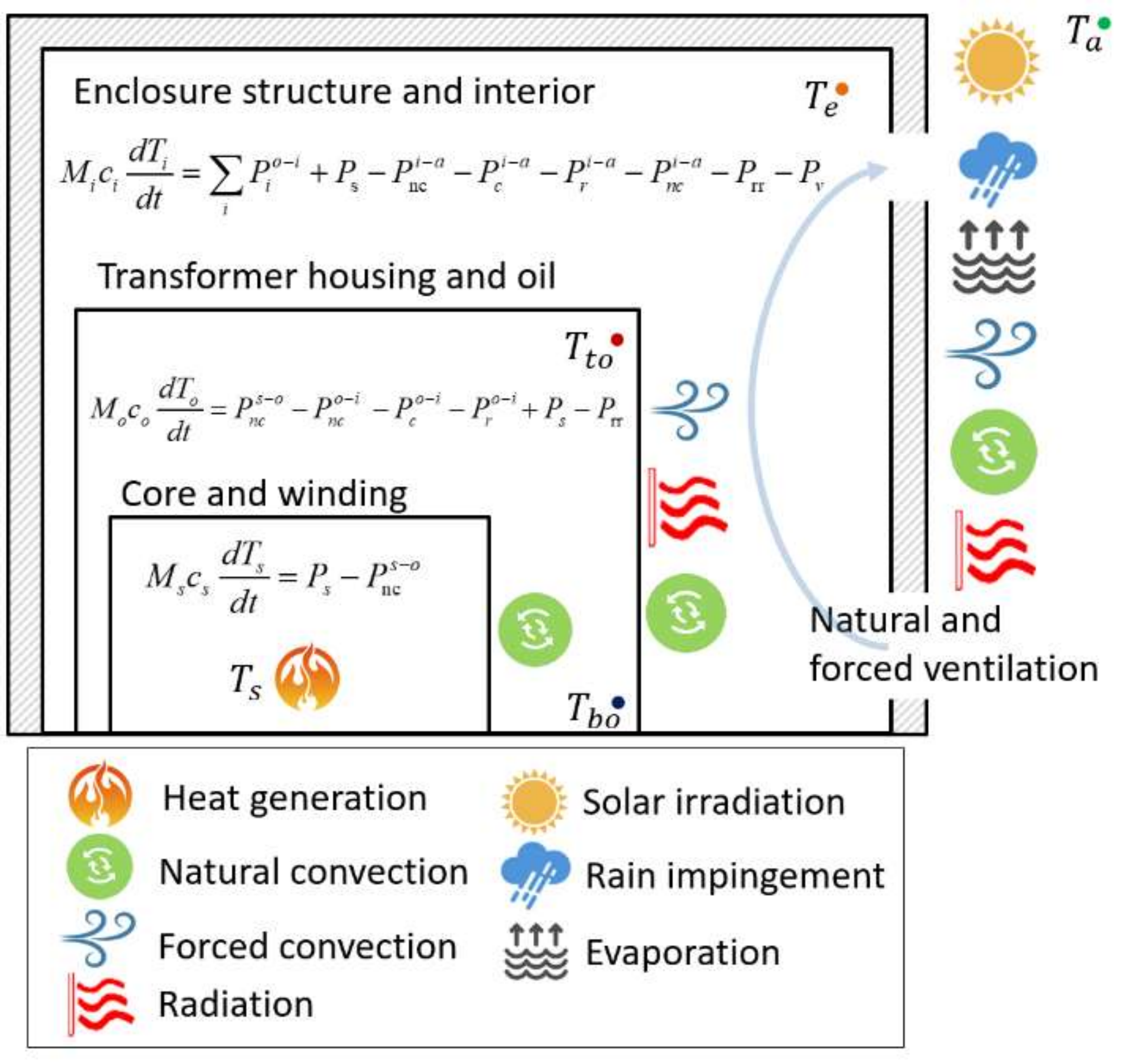


An IoT system was developed and implemented to obtain data needed for thermal model parametrization and to verify the results.

Data visualizations



Dynamic Thermal Model



Conventional models

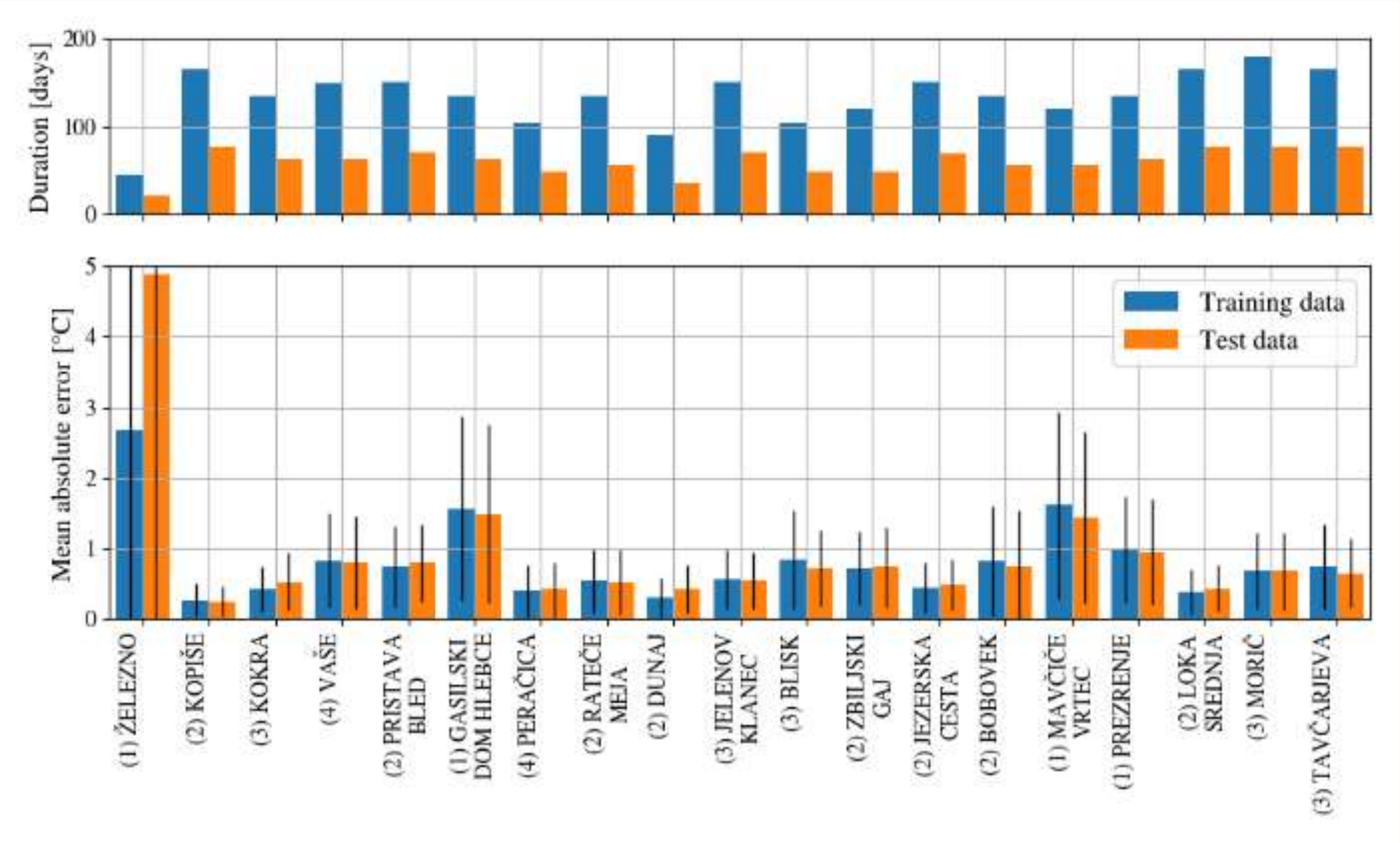
- IEEE/IEC
- Swift, Et al.
- Susa, Et al.
- Wang, Et al.

TrafoFlex Model

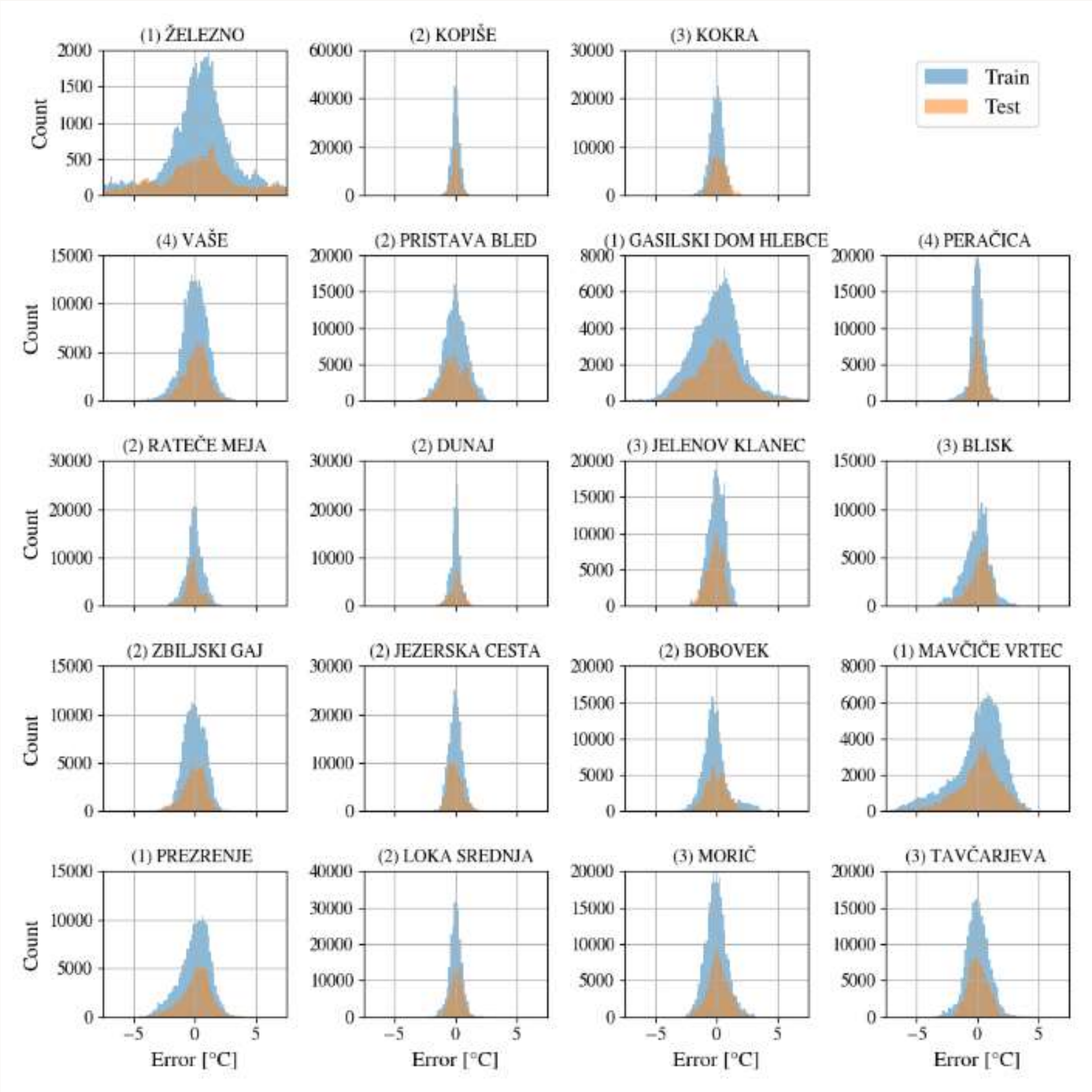
- Multi-mass model that allows us to simulate heat transfer between N sequential bodies using 7 different heat generation /transfer mechanisms.

More info: *Souvent Andrej, Et al.: Advanced concept of efficient use of transformers leveraging the Dynamic Thermal Rating technology*, CIRED Rome 2023, session 3 – paper number 10986

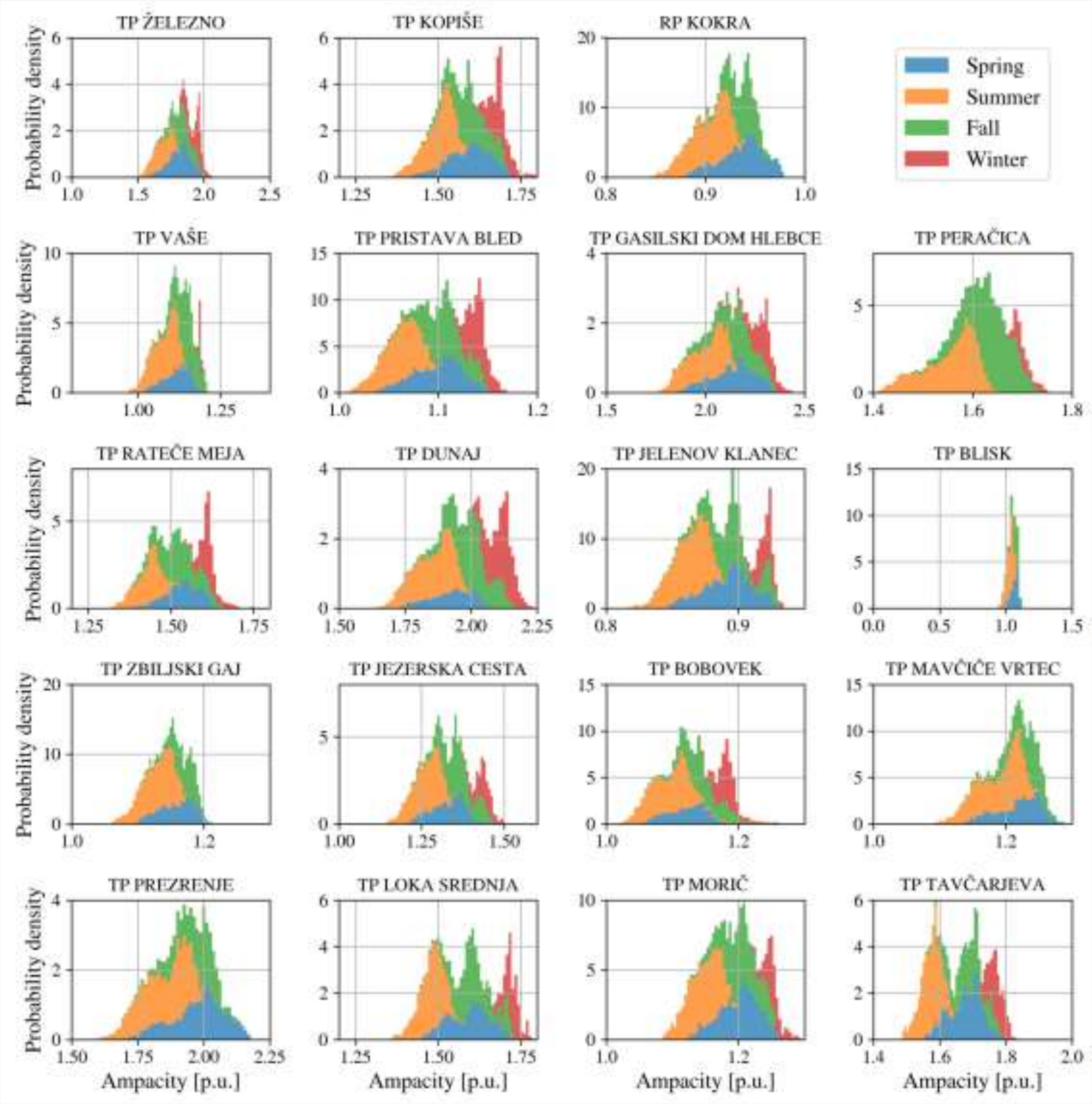
Length of training data and mean absolute error



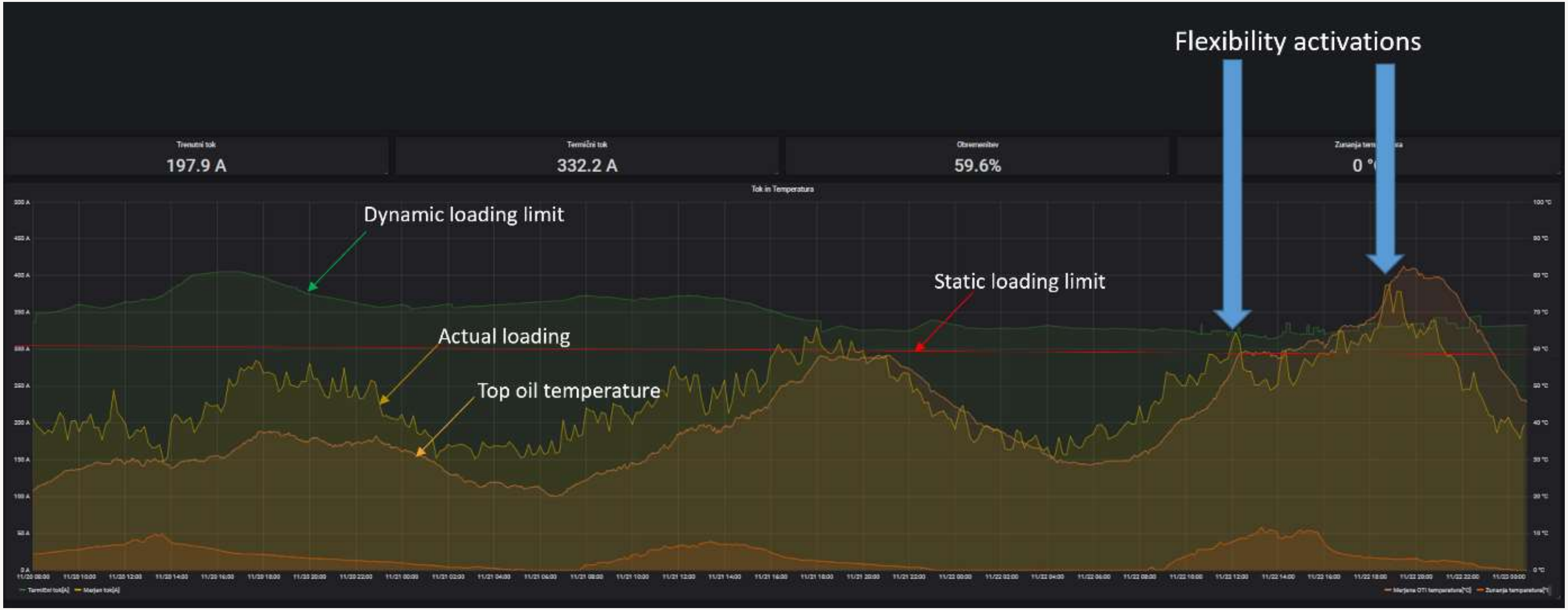
Histograms of model deviations for top liquid temperatures



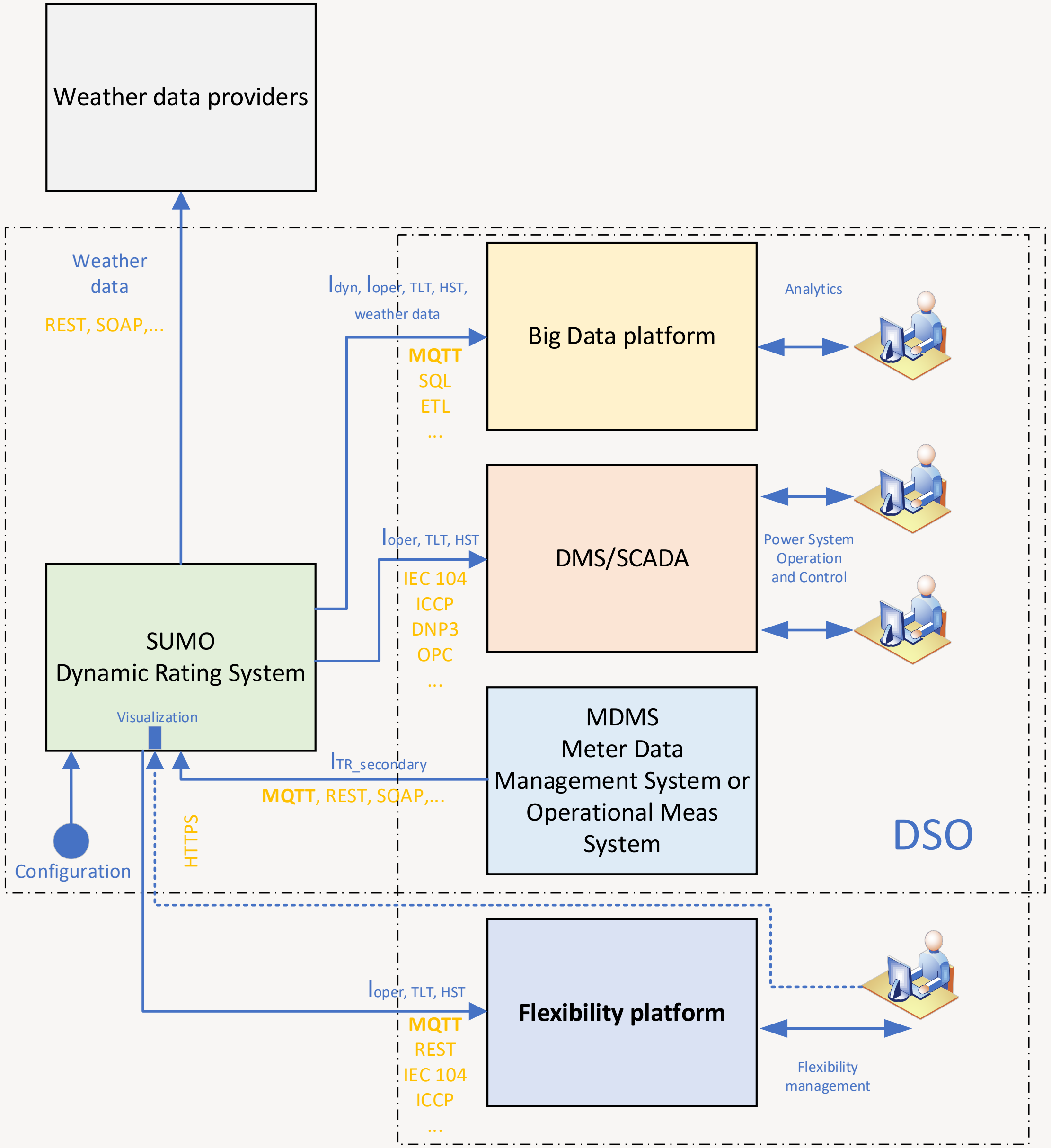
Loadability in different seasons



Operating a transformer on a dynamic limit



DTR system integration



Conclusions

- Multi-mass model of a generalized distribution transformer was developed, tested, and validated. The model takes into account different types of substations.
- Overall, the accuracy of the thermal model is good (below 2 °C), yet dependent on the substation type.
- Key uncertainties arise from the weather data!
- The results are useful both for operation (in conjunction with flexibility utilization) and asset management.
- It brings benefits in terms of deferring investments and reducing the need for flexibility activations.

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DSO ENTITY
DSOs FOR EUROPE

Innovative grid technologies: Knowledge sharing at DSO level

Dr. Arsim Bytyqi

Knowledge sharing at DSO level/Innovative Technologies

The current knowledge sharing is focused around 5 key DSO priorities and challenges:

There is more knowledge sharing on the topics covered by network code:

1. **Resilient and cybersecure smart grid**
2. **Flexibility and demand response**
3. **TSO–DSO interaction and data exchange**

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4. **Observability and controllability of the grid**
5. **Efficient smart infrastructure and collaborative network planning**

Collaborative approach, engagement with relevant stakeholders and innovations is essential to meet the DSO future needs.

Revised approach on Technologies/Innovations

1. Link to concrete use cases/challenges and implemented projects with quantifiable results.
2. It is not about listing an exhaustive list of vaguely understood technologies. Quality > quantity.
3. The information presented should be compact while comprehensive enough to understand the actual benefits of applying innovative technologies.
4. Linking and connecting innovative technologies with strategic topics is essential.

Reviesed approach on Technologies/Innovations

- Open data/information is useful to connect innovation with solutions.
- Existing Recommendations should be extended for strategic priorities.
- Recommendations should consider the connection between innovative technologies and strategic topics.
- TRL level should be carefully explained du to implementation challenges.

Current Workshop

From innovation to mainstream: how to deploy innovative grid technologies at the distribution level?

Dr. Oliver Franz
VP European Regulation @ E.ON SE
Chair of the Distribution and Market Facilitation Committee @ Eurelectric

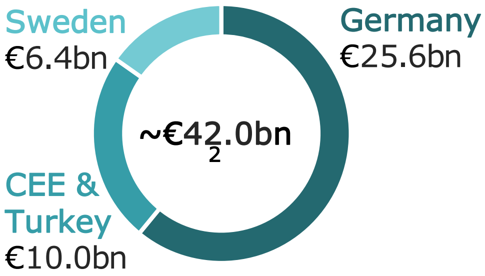
Outline

Information about E.ON

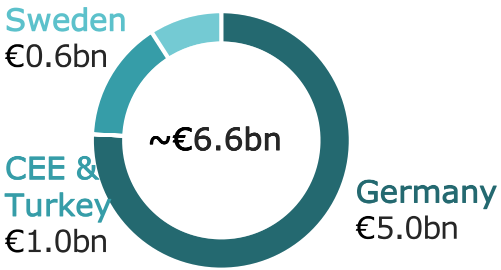
Feedback on the Current paper „Recommendations for the deployment of DSO projects”

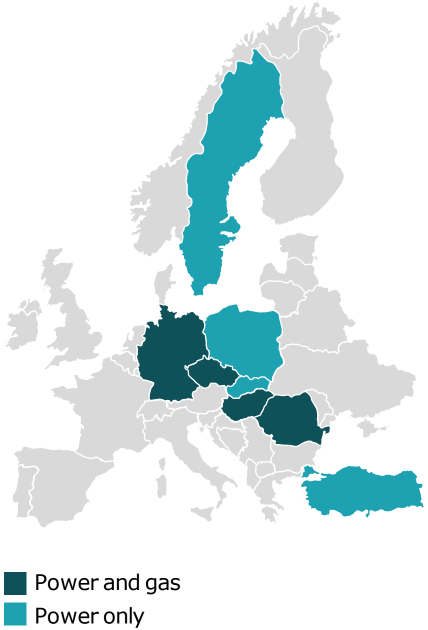
E.ON Energy Networks — Overview

Regulated Asset Base 2023[1,2]

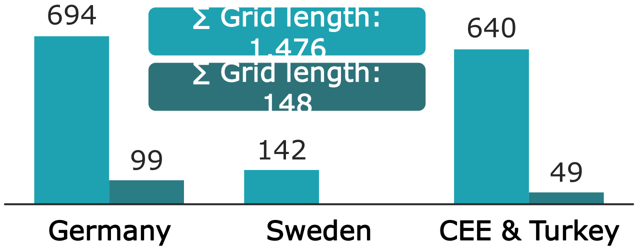


EBITDA[4] 2023

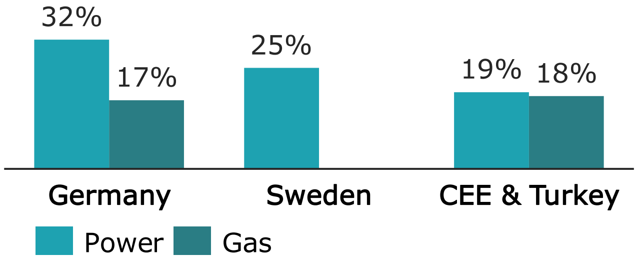




Grid length ('000 km)[3]



Market share (%)[5]



1. In general, RABs from different regulatory regimes are not directly comparable due to significant methodical differences. 2. Thereof ~€2.8bn from at equity participations Slovakia (ZSE) and Turkey (Enerjisa Enerji) included at 100%.
3. Differences may occur due to rounding. 4. Adjusted for non-operating effects, Turkey (Enerjisa Enerji) and Slovakia (ZSE) included as an at equity participation (i.e. with net income result).

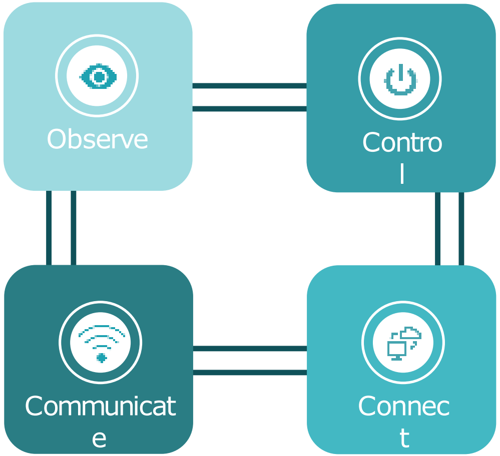
20% of our RAB effective CAPEX is embedded in digitalization

Asset smartification progress in Germany

Networks	Invest	2026		Benefit
Medium voltage	Smart substations with sensors	20% controllable		+ Automation + Network reliability + Efficiency + Increase transparency + Integration of green energy
		2x current replacement rate of substations		
		~25x ↗	100% observable	
Low voltage	Sensors & devices	~10x ↗	30% observable[1]	

Digitalization leads to smartification

Digital interconnection of assets via control centers



1. Based on mathematical models our low-voltage system operations obtain a good view by a share of 30% observability

Our intelligent solutions are based on E.ON standards to enable LV-observability & automatic grid congestion management at scale

Intelligent Solutions

Grid Monitoring
- Observability via state estimation
- 1 min data based on smart meters & feeder measurement

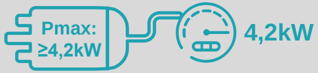
Detection of congestions
- parameter set to identify congestions

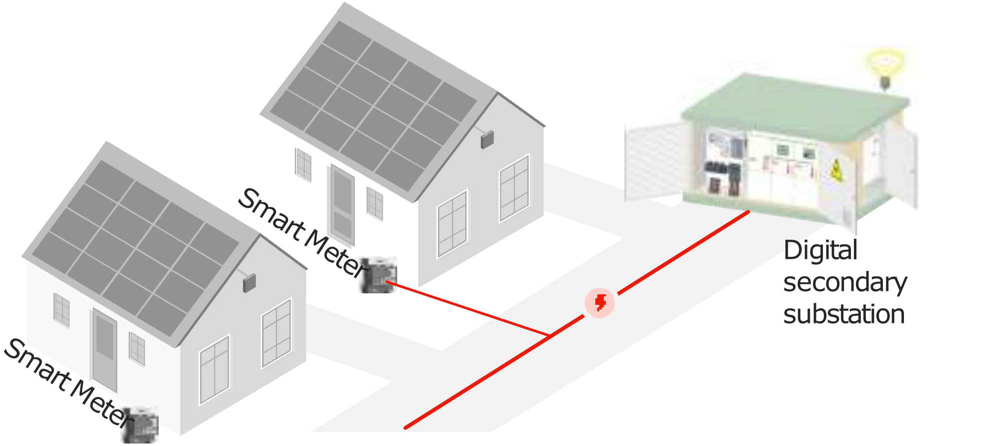
Automatic congestion management
- scalable solutions by automatic control of flexibilities
- Reduction of power (above 4,2 kW)

Flexibilities

Room cooling | Heat pumps | Battery storage

Control > 4,2 kW





State estimation minimizes no. of measurement

requirement by law: 7% up to 15% of all connection points to be equipped with smart meters for observability (currently under study @EON Lab)

Feedback on the Current paper „Recommendations for the deployment of DSO projects”

- Unsure whether E.ON agrees that “one of the **greatest challenges** to introducing these new technologies is the time of limited DSO expert resources to consider the specifics of the technology and its deployment” → others seem bigger.
- **CBA** results are not necessarily discussed between companies and regulators; **NRA do not steer technology** and they are regularly not supposed to; benchmarks and other efficiency considerations are doing that job.
- Remark on **anticipatory investments**: Eurelectric's Gridsforspeed study result show that they are clearly beneficial; NRA will still need convincing
- **National tender regulations** should not be underestimated; DSO might not be allowed to describe technical features alone as these might be “not specific” enough (additional issues include impossibility to run supranational tenders etc.).
- **Beyond (monopoly) regulation** there are issues in **accounting** that are creating an obstacle to **activation of ICT spending** in many EU countries

Feedback on the Current paper „Recommendations for the deployment of DSO projects"

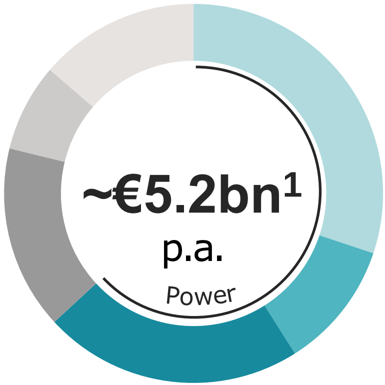
- **Natural monopoly regulation** is a much more complex problem than described in the paper. E.g., the (non-timely) recognition of OPEX often is a major obstacle for DSO to introduce more OPEX heavy technologies
- Many technological solutions will **increase losses** – an issue to be tackled in regulation or at least necessitating an adjustment of losses (regulatory) reduction targets the DSO might have
- Some technologies work best in **existing right of way corridors** i.e., they should be **appliable without major public permitting hopefully** (but experience from Germany shows that even using a different kind of overhead line might lead to the necessity of "changing" the current permit).
- **Technopedia for DSOs**, EU DSO Entity has tasked the Task force on Digitalization to do that work. A project concept is under development and will be shared within the Advisory Group once validated, which Current participates in.

#WeLoveTechnology

thank you

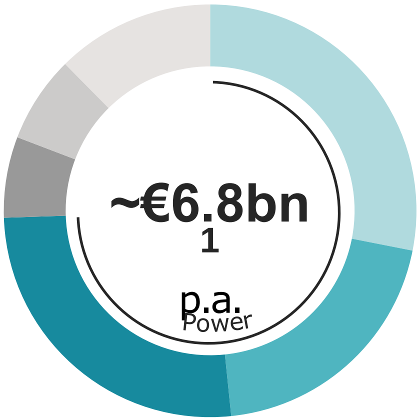
Accelerated capex deployment in line with strategic ambitions

Capex 2023



97% EU taxonomy aligned[2]

Capex 2024-2028



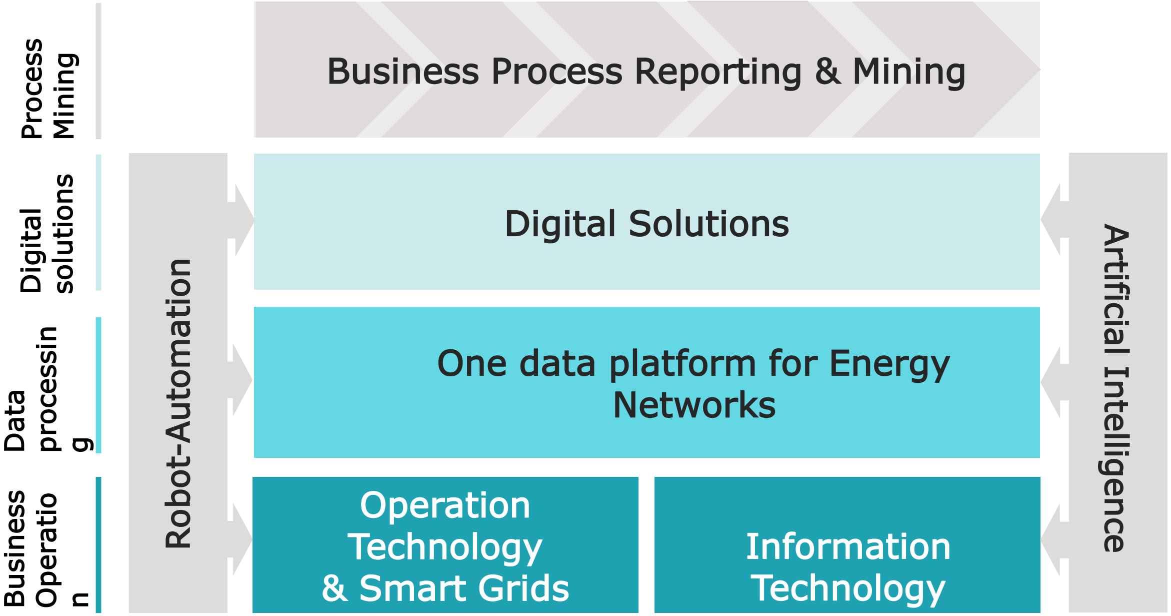
>€1bn
avg. annual increase

~€34bn
total capex Energy Networks 2024-2028

Asset reinforcement · Renewables build-out · Changing customer needs · Other (Power) · Gas · Other[3]

1. Cash-effective investments, annual average 2. Based on EU taxonomy eligible capex 3. Broadband, smart meter and additional network business investments

A global platform helps bundling regional data to enable the intelligence through process mining, AI and network solutions



Information Technology as well as **Operation Technology & Smart Grids** build the foundation

5 standard IT applications rolled out or being rolled out in DSOs

The **E.ON and Energy Networks Data Platforms** transform data into a **digital twin** of our grid.

Digital Solutions developed on this digital twin data model can be scaled in all DSOs

>10 standard solutions defined creating positive business impact

Business Process Reporting & Mining supports process optimization.

Robotic Automation and **Artificial Iintelligence** booster digitization and automation

WE will significantly increase our network smartification investments