
ONLINE
WEBINAR
CurrENT
Enabling Network Technology
throughout Europe
From Risk to Reward
Why Innovation at the Distribution Level
Can’t Wait
23 APRIL | 10:00 - 12:00 CEST

Agenda

Ewan Ramsay, Policy and Communications Officer at CurrENT Europe, outlook for DSOs

Mark Norton, Smart Wires and Chair of CurrENT's DSO Working Group Presenting the Second edition of the 'Recommendations for the deployment of DSO projects'.

Rena Kuwahata, Energy Analyst Power System Transformation at the International Energy Agency, Discussing the pace of grid development

Efthimia Chassioti and Konstantinos Krommydas from IPTO, case study deploying Smart Wires's Modular Power Flow Control

Alberto Mendez, CEO of Plexigrid, Discussing the importance of digitalisation at the distribution level

Riccardo Vailati, Chair of the Infrastructure Workstream at CEER and Team leader at ARERA, Discussing regulatory regimes that can support the deployment of innovative grid technologies.

Q&A Session with the audience

Outlook for DSOs

Ewan Ramsay, Policy and Communications Officer at CurrENT Europe

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Grids at the heart of European Competitiveness

- The '*Draghi report*' set the scene for how Europe **needs to evolve,** focusing on competitiveness
- **High and volatile energy prices** identified as one of the key barriers to European competitiveness
- To facilitate **both** decarbonisation and competitiveness goals, **stronger electricity grids with increased RES integration** identified as the key enabler
- The European Commission has laid out a clear pathway:
    - Competitiveness Compass
    - Clean Industrial Deal
    - Affordable Energy Action Plan

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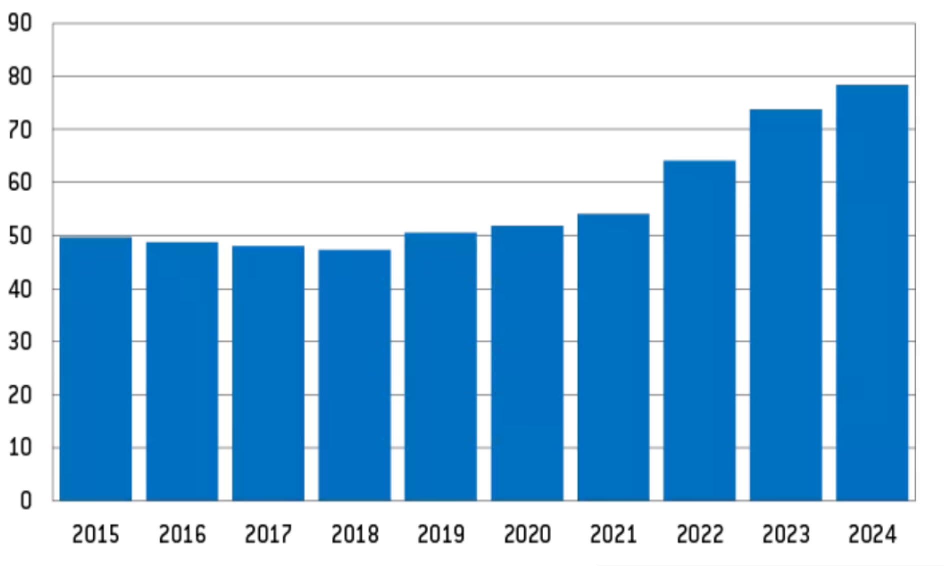
Investment needed in the distribution grid

- DSOs have an increasingly important role to play to ensure **RES are fully integrated** into European electricity grids
  - Around 80% of renewable capacity will be connected at the distribution level by 2030 [1]
- Of the nearly €100 billion of annual investment needed, **nearly 2 out of every 3 euros** in grid investment must go to the distribution grid[2].
- As share of RES grows, failing to investment in distribution grids will lead to increased levels of curtailment, potentially **costing consumers billions up to 2030**
  - In 2024, **roughly 50% of the 9TWh** of curtailment in Germany was connected at the distribution level[3]

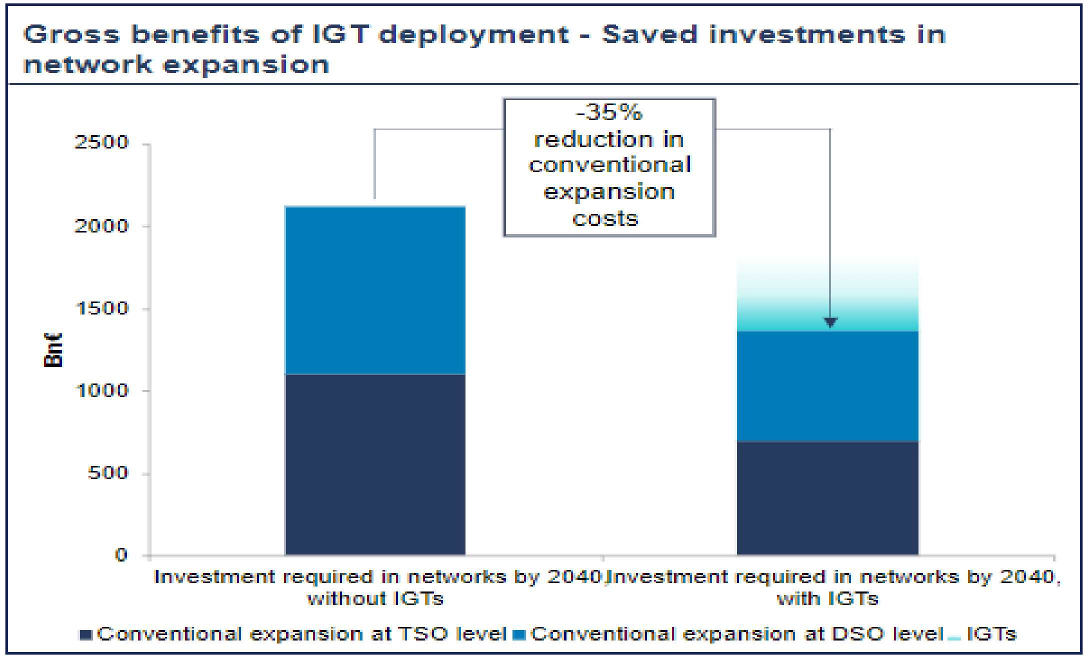


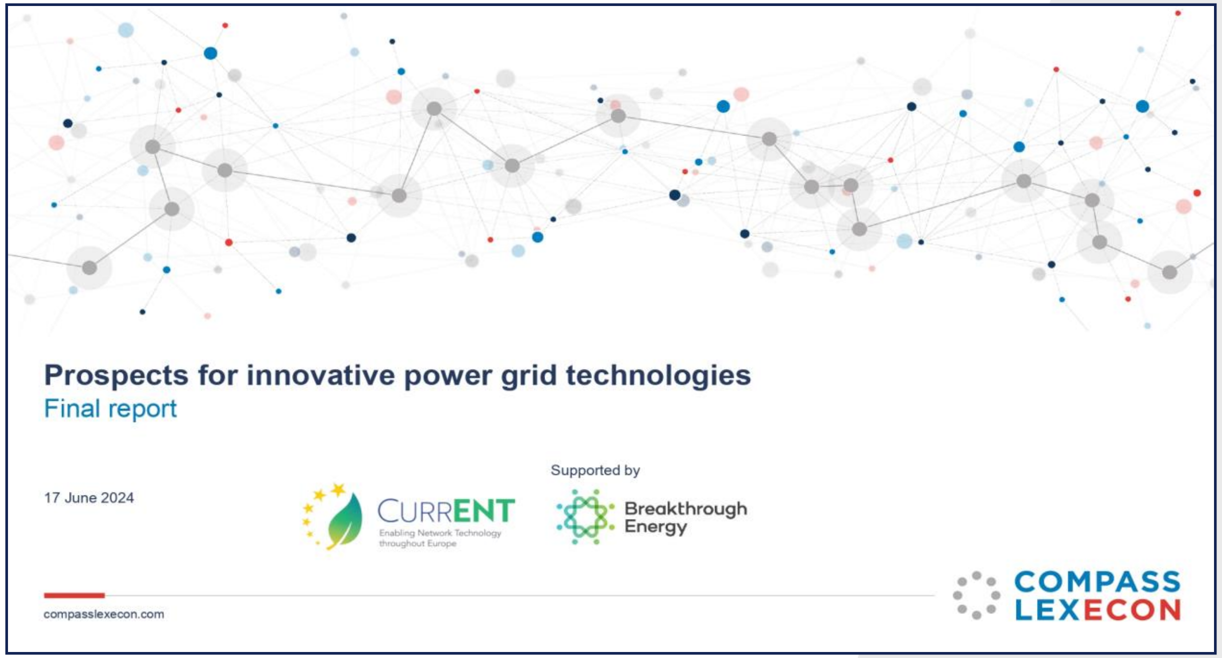
European transmission and distribution network investments, 2015 – 2024, €billions [2]

[1] Connecting the dots: Distribution grid investment to power the energy transition, 2021, Eurelectric
[2] Upgrading Europe's electricity grid is about more than just money, Brugel, 2025
[3] Federal Network Agency: In 2024, 96.5 percent of the renewable electricity generated reached the end consumer

Compass Lexecon: Innovative grid technologies can save €700bn by 2040

The widescale deployment of innovative grid technologies can lead to a 20 to 40% increase in grid capacity, and a 35% reduction in conventional expansion costs.





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Outlook for DSOs - summary

- Grids identified as a **key enabler of competitiveness**, with a specific focus on the distribution level to integrate RES
- The European Commission is clear with its targets and agenda for **legislative action**
- **Nearly 2 out of every 3 euros** of €100 billion in annual grid investment must go to the distribution grid
- **Failing to invest will result in curtailment**, costing consumers billions annually
- The **wide scale deployment of innovative grid technologies** must be a critical part of the solution

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Risk perception of deploying innovative grid technologies

Mark Norton, Vice President European Business Development at Smart Wires and Vice Chair of CurrENT Europe

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DSO Deployment Paper Launch

‘From Risk to Reward: Why Innovation at the Distribution Level Can’t Wait’

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Objectives

1. Brief Introduction to the DSO deployment Paper
2. Opening consideration of webinar:

   'From Risk to Reward: Why Innovation at the Distribution Level Can't Wait'

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Factors behind DSO Deployment Paper

1. **Reducing DSO resource commitment:** Limited bandwidth and internal resources to examine new technologies
2. **Managing technological justifications:** Innovation outpaces standards, but DSO traditionally have high reliance
3. **Managing uncertainty:** Innovation is key but justifying innovative projects is more difficult

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Updated CurrENT paper:
Deployment recommendations for new technologies

- Advanced Conductors
- Digital Twin Platform
- Dynamic Line Rating
- Modular Power Flow Control
- Monitoring sensors
- Superconducting (HTS) cable systems
- Innovative Software Solutions for Grid Optimization

Second edition: of live document updated, including new technologies

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Overarching Recommendations

- Efficiency first!
- Focused Distribution Technopedia
- Application of Symbiotic Technologies
- Innovation Incentives
- Minimizing Technical Assurance
- Trialing what matters

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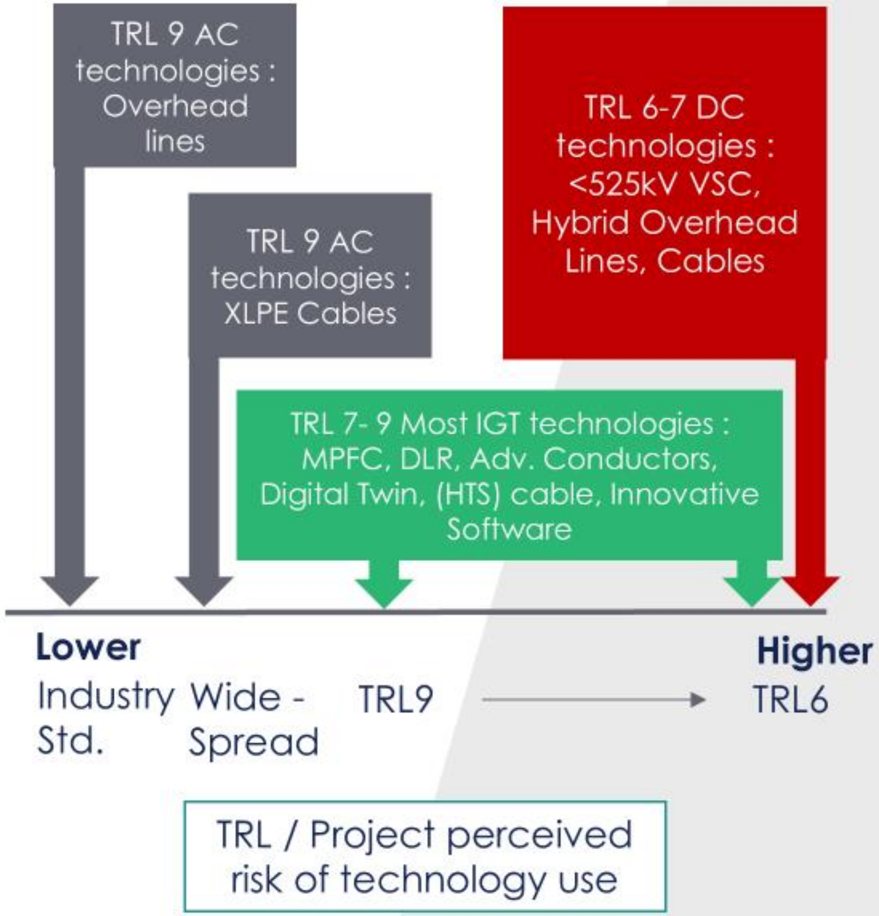
Present focus Use and Technological Readiness

- Focus at present on only project risks
- Technology Readiness Levels (TRL), a common measure of technological maturity, but TRL calculation is not universal
- Even TRL 9 'Commercially Ready' is not a guarantee of use
- TRL 7+ 'System prototype demonstration' useful for purposes of this webinar discussion



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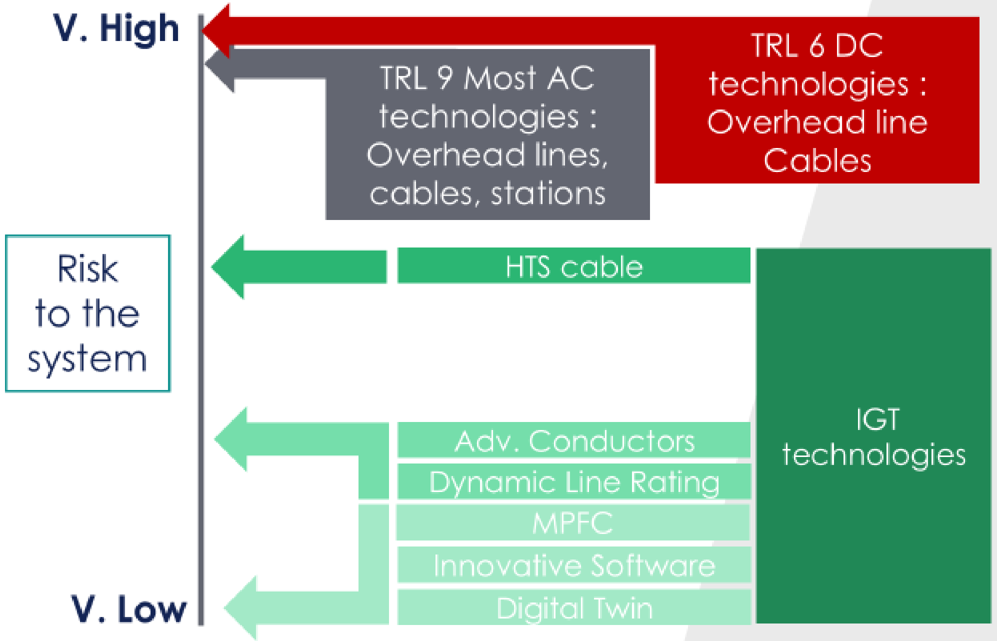
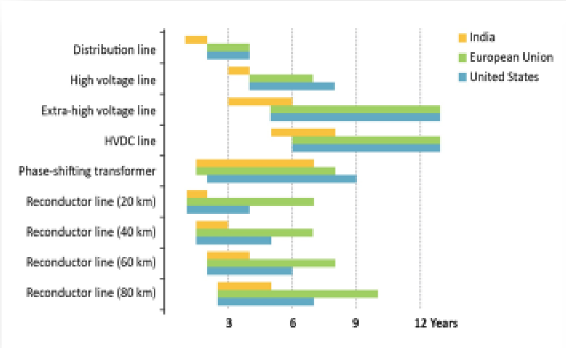
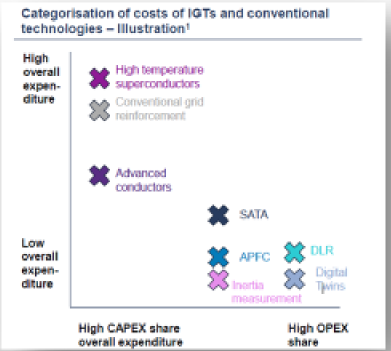
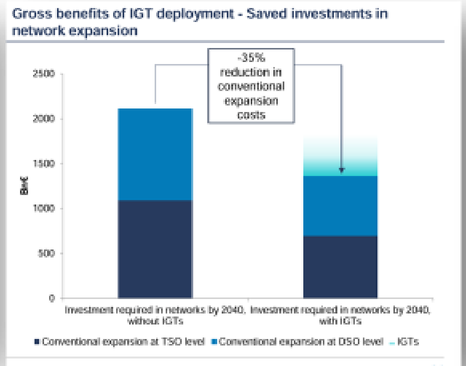
System risk (hidden larger risk)

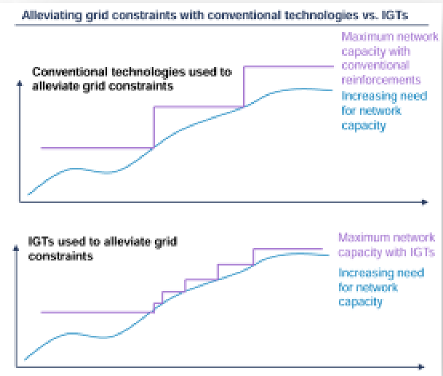
- System risks are growing
- Key contributors to this is:
  - Economic Cost
  - Timely solutions system needs
  - Enabling Flexibility services
- Entire system risk can be measured from the combination of these

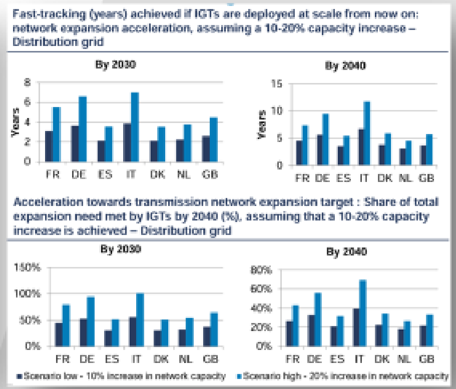












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Sources: IEA, BNEF and Smart Wires

Sources: Compass Lexecon Prospects for innovative power grid technologies

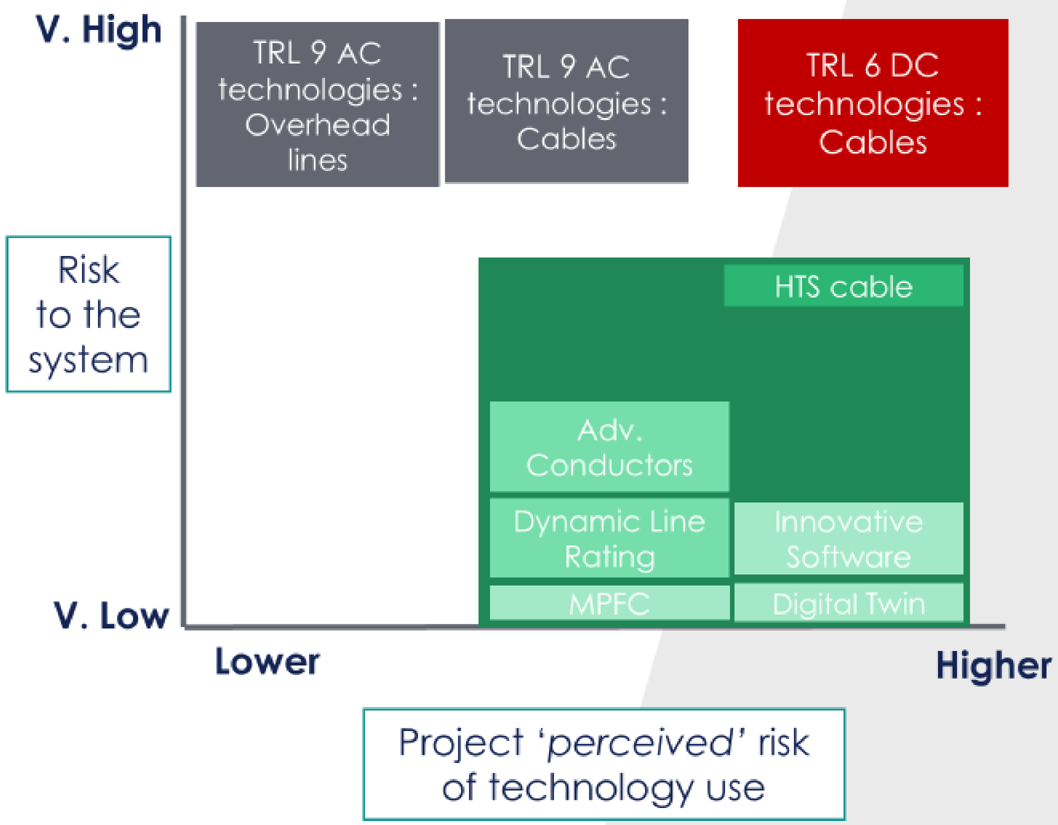
Impact of moving to considering total risk

Risk

1. **Typically, likelihood and <u>scale of impact</u>** are considered, for example:
   - UK Network Asset Risk Metric (NARM) Methodology
   - NERC Severity Risk Indicator (SRI)
   - ENTSO-E Winter Adequacy Outlook
2. **Security of Supply (system risk) required in project decision making**
3. **Innovative Grid Technologies are lower risk** e.g. DC cable technologies used in roughly 50% of the Ten-Year Network Development Plan

Reward

1. Innovative Grid technologies offer significantly greater mitigation for system risk
   - **Saving up to €350Bn spend** on distribution networks in Europe by 2040[1]
   - **Reducing 60% growth in grid costs for consumers by 2050** with ~75% of this from new build[2]
   - **Acceleration of 4 – 7 years of 2040 project portfolio**[1]
   - **500GW growth of capacity flexibility required in next 25 years**[3]



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[1]Source: Compass Lexecon Prospects for innovative power grid technologies
[2]Source: ACER Monitoring report 2024
[3]Source: Eurelectric 'What is flexibility in the power sector', in detail 2025

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Discussing the pace of grid development

Rena Kuwahata, Energy Analyst Power System Transformation at the International Energy Agency,

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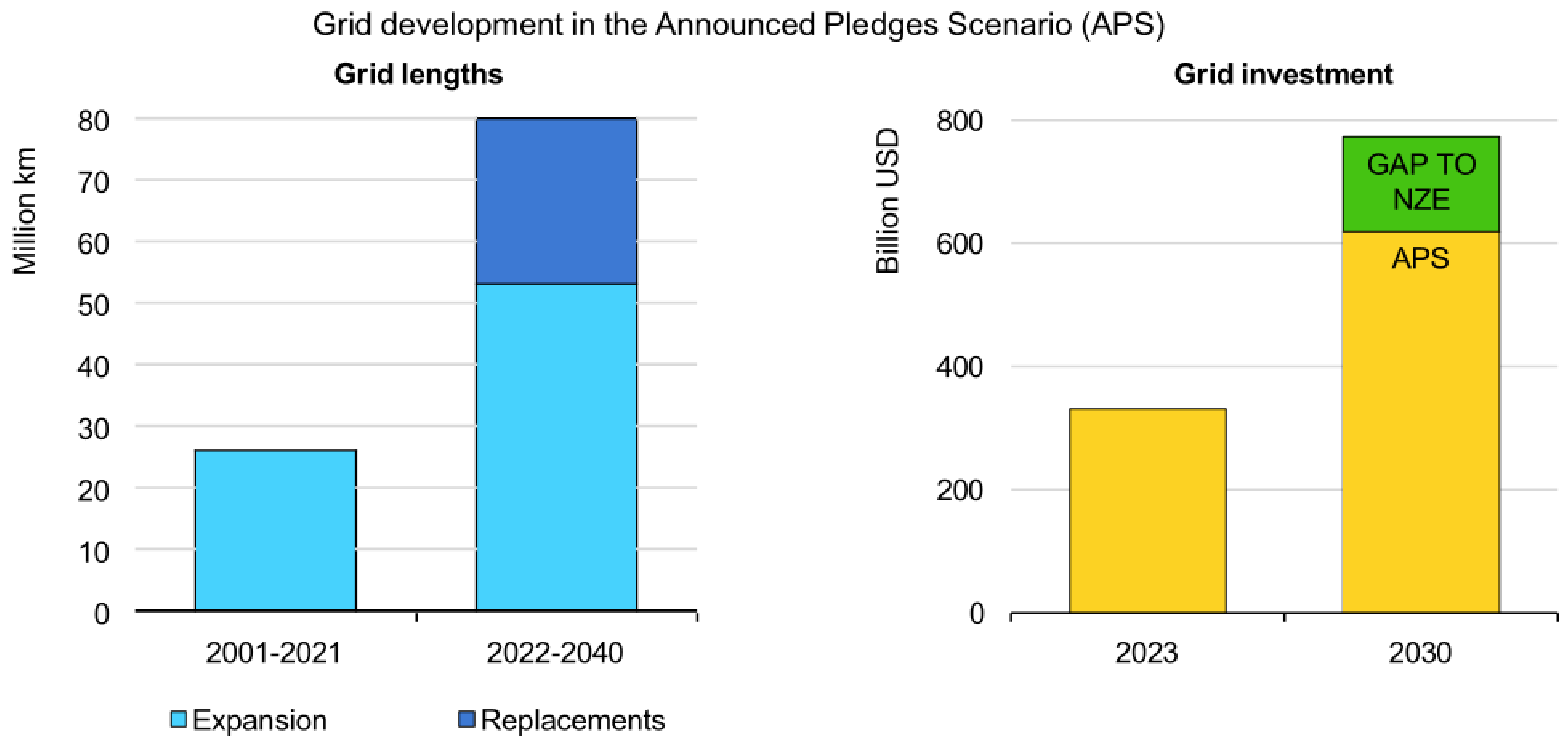
International Energy Agency

Accelerating deployment of technologies enabling secure and efficient grids

Rena Kuwahata, Energy Analyst Power System Transformation

23 April 2025

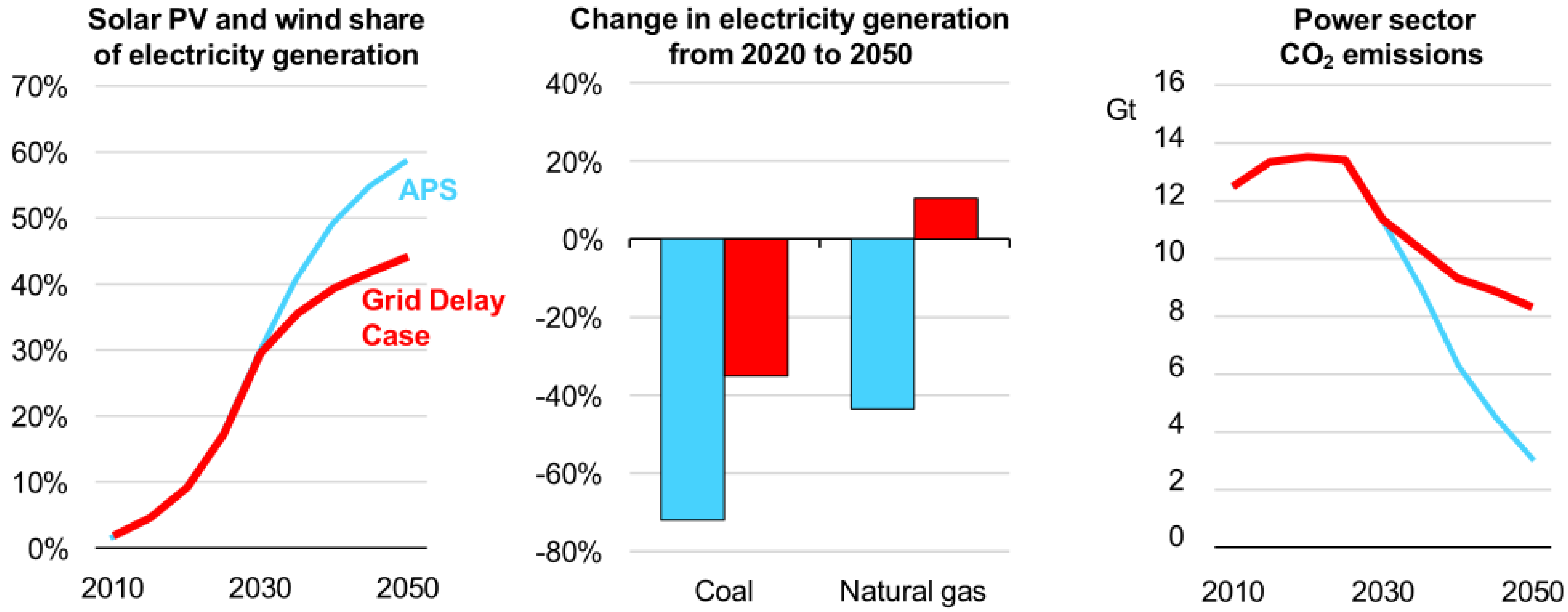
Grid development needs to accelerate to keep up with transitions



Over the next two decades, 80 million km need to be added or replaced, as much as the global grid length today, calling for grid investment to double by 2030, in step with renewables.

Clean energy transitions depend on robust electricity grids

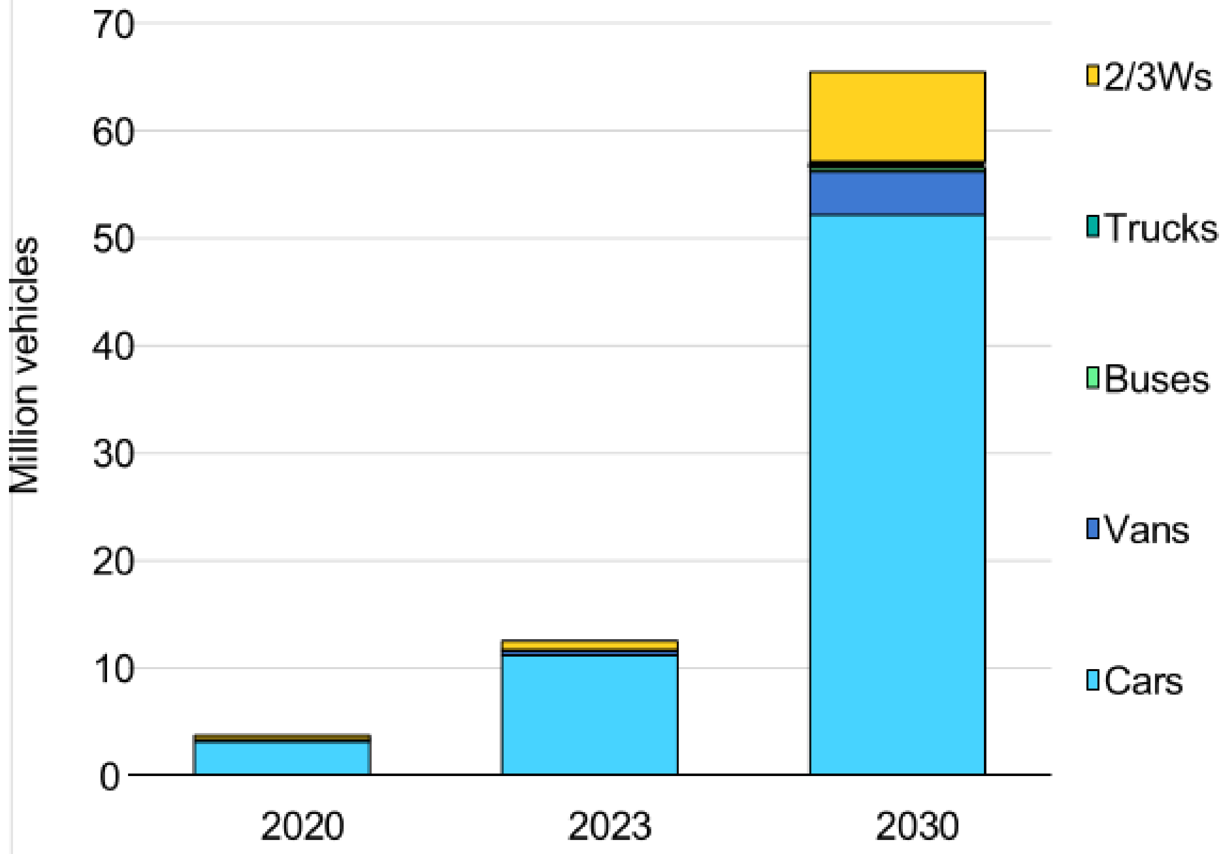
Impacts of failing to accelerate grid investment and modernisation

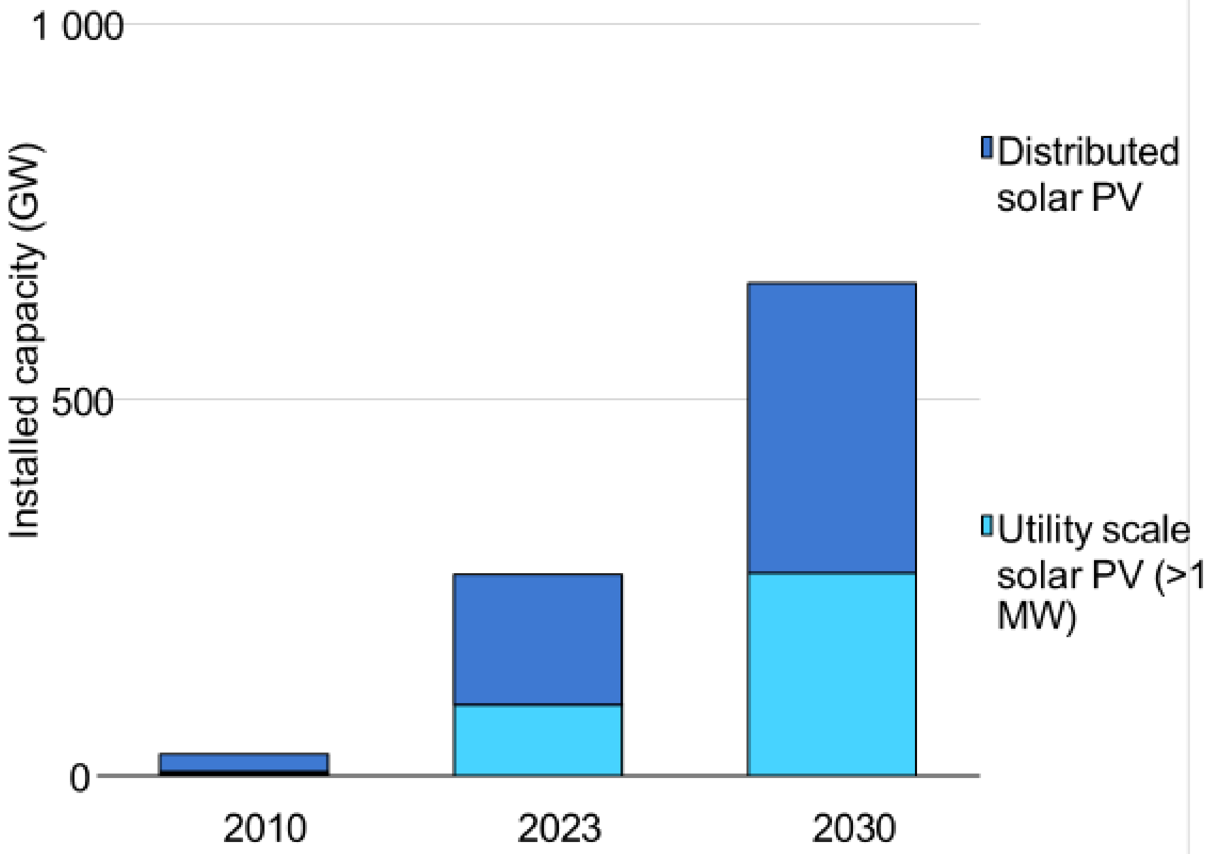


Failing to step up the pace of grid investment and modernisation would stifle the growth of renewables, and lead to greater use of coal and natural gas, raising fossil fuel import bills by USD 500 billion and CO_2 emissions

Electric vehicles and distributed solar PV put focus on distribution

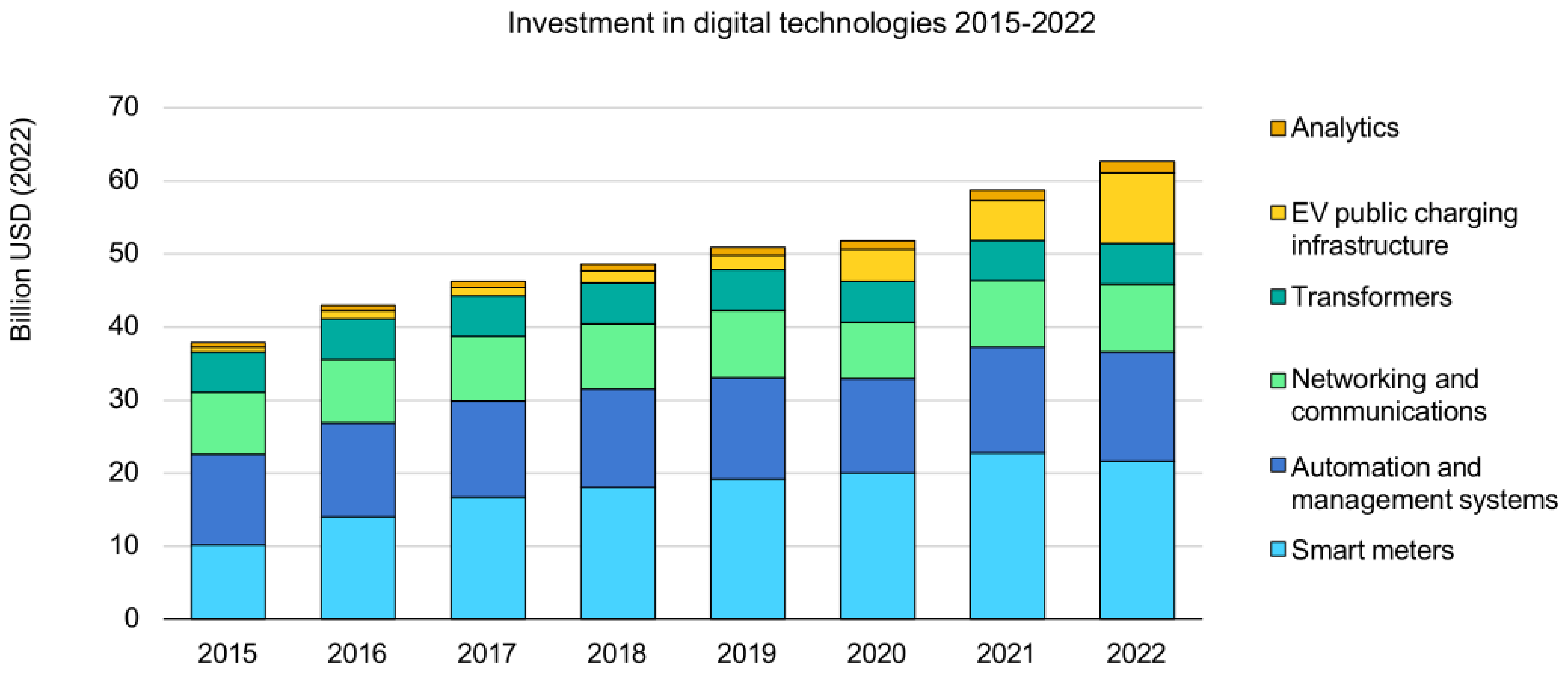
Growth of EVs in Europe, APS – Solar PV installed capacity forecast and historic





The significant growth of EV's and solar PV, will require expanding and reinforcing distribution grids, hand in hand with increased digitalisation.

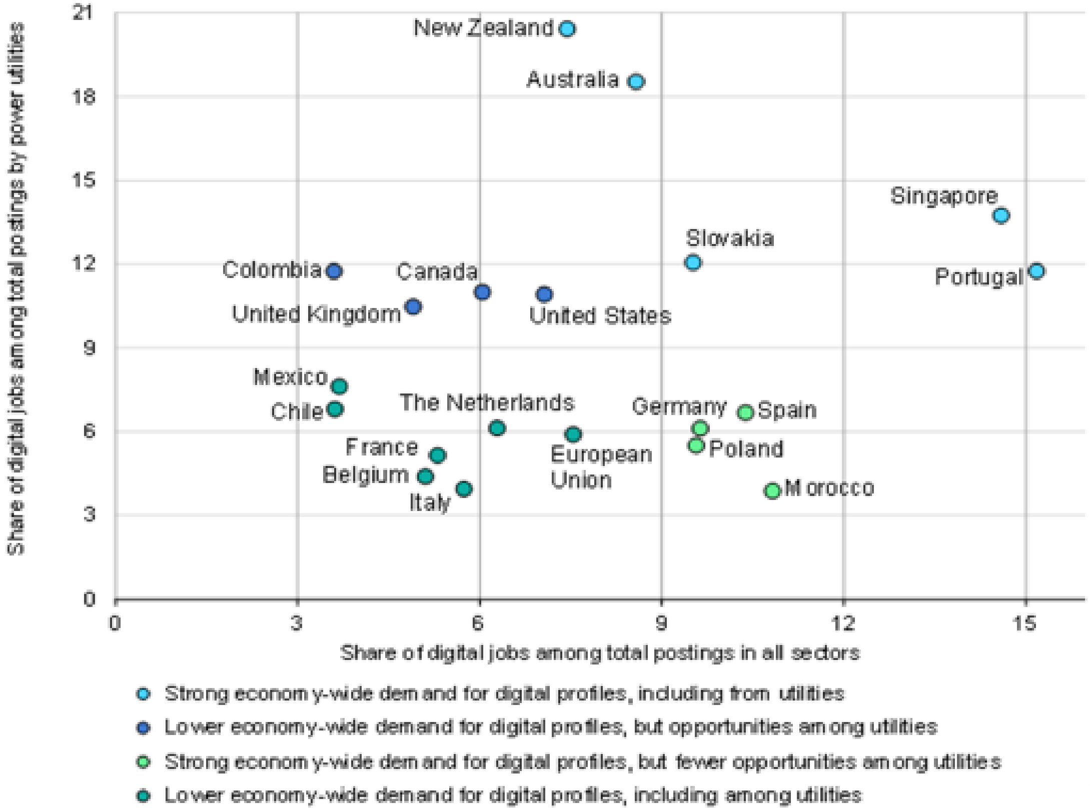
Digitalisation of grids is increasingly becoming paramount



Investments in new digital technologies have risen with the increased penetration of distributed generation from renewable sources, as the direction of power flows is becoming less predictable, but needs to accelerate.

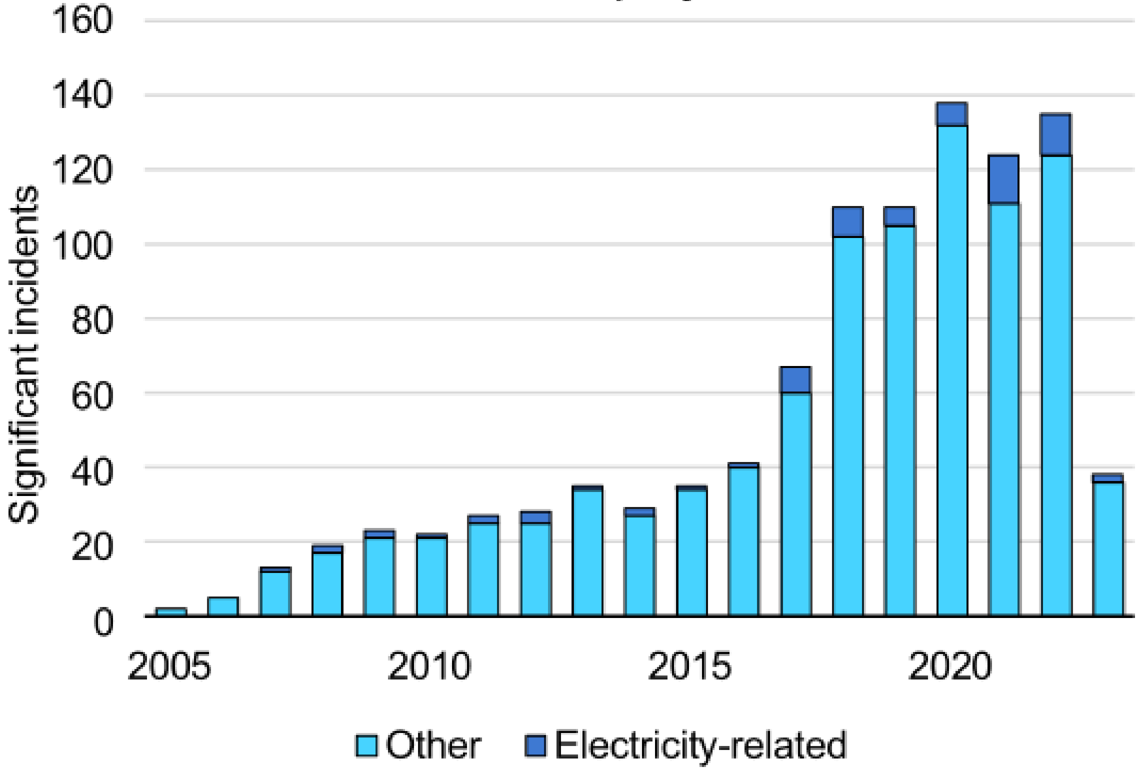
Deployment needs tackling delivery constraints and emerging risks

Share of digital job postings among total from power utilities, 2022-2023



IEA. CC BY 4.0.

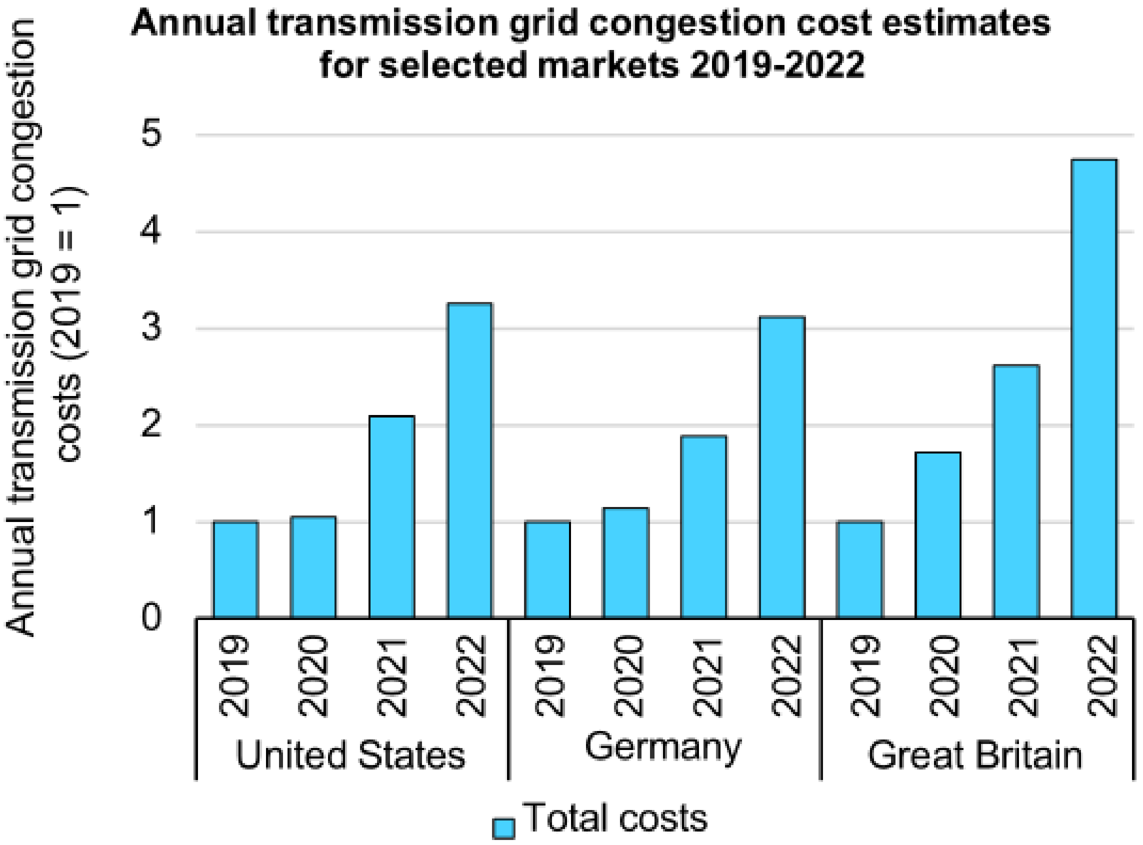
Total and electricity-related significant cybersecurity incidents per year

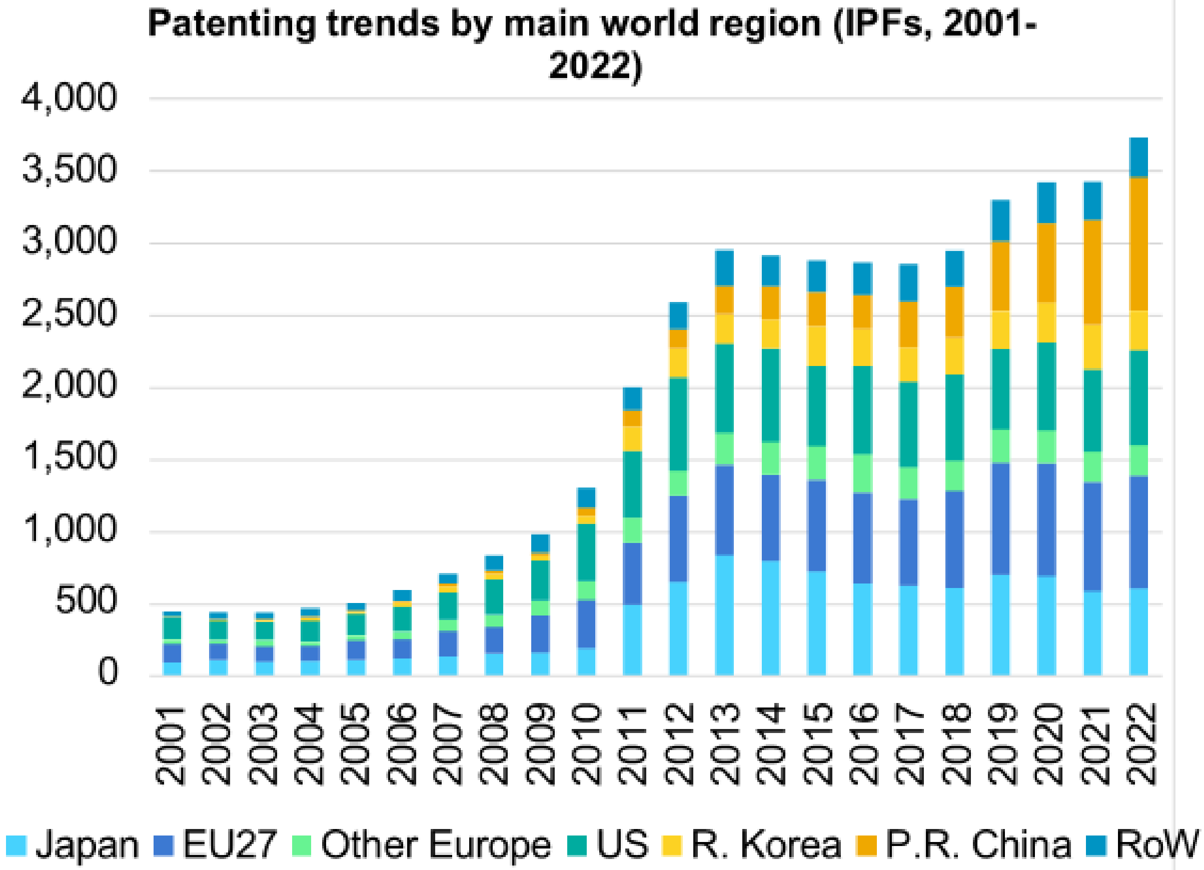


Source: IEA analysis (2024), based on data from Lightcast (accessed July 2024).

Developing digital expertise across regulators and utilities enables better risk management and deployment incentives for grid modernisation.

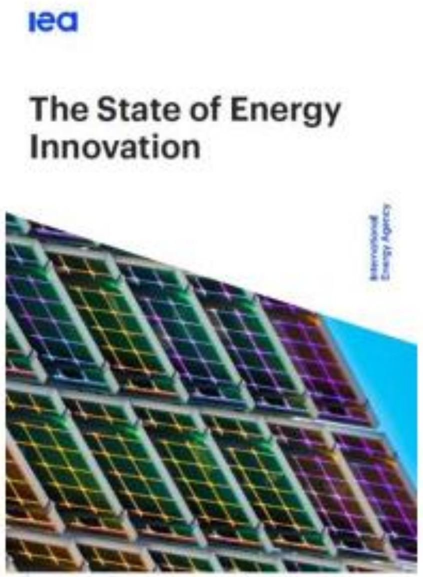
Delays risk competitiveness in innovation and cost increases





Strategic deployment of grid technologies supports emissions goals and energy security efficiently while maintaining European competitiveness in global innovation.

Some regulatory examples…



Growth in the number of regulatory sandboxes for energy technologies

"Regulatory sandboxes" are temporary frameworks that allow for certain regulatory exemptions or special freedoms to facilitate the testing of new products and services in a safe and conducive way that does not expose test projects to the full costs and risks of regulatory compliance, while providing the necessary safeguards to protect consumers and the energy market. They also facilitate structured co-operation between innovators and regulators, who provide legal guidance. They have emerged as a means of enabling regulated energy suppliers – such as electricity network operators – to undertake innovation projects that would normally be considered too risky under their mandate to minimise costs and risks. They first emerged in the energy sector in the United Kingdom and the Netherlands in 2015, and the concept spread to countries including Singapore shortly thereafter.

Recent developments include:

- In 2024, **Brazil's** electricity regulator approved a regulatory sandbox for demand response, targeting large consumers, building on its Tariff Sandbox to test new tariff models for low-voltage consumers, launched in 2023. It launched a public consultation on a voltage control sandbox in 2024.
- In 2024, **Denmark**'s first regulatory test zone (a structure foreseen in legislation from 2019) started operating with exemptions from electricity regulations to test solutions for integrating high shares of variable renewable energy at an industrial cluster.
- In 2024, **Moldova** enacted a law to grant 7-year exemptions for complex trials, extendable by 5 years.
- In 2024, the **United Kingdom**'s gas and electricity regulator updated its framework to a four-tiered approach and launched a project to develop guidance for applications of AI.
- In 2024, **Spain** launched a second regulatory sandbox on voltage control. Payments and exemptions from reactive power charges were offered to large consumers to absorb excess reactive power and prevent voltage surges.
- In 2023, **Australia's** energy regulator granted its first 30-month trial waiver to a project deploying smart meters to enhance load management services.
- In 2023 in **Canada,** Ontario Energy Board's Innovation Sandbox (from 2019) was updated with the power to provide temporary regulatory relief. It launched a call for pilot projects funded with USD 1 million from compliance penalties.

Beyond traditional funding, regulatory frameworks could evolve to include incentives rewarding improved grid capacity utilisation while maintaining reliability standards, as with the European Union Agency for the Cooperation of Energy Regulators (ACER, n.d.), Australian Energy Regulator (AER, n.d.) and the Federal Energy Regulatory Commission (United States, FERC, 2021). Well-designed regulatory testing environments, such as those in the United Kingdom (Ofgem, n.d.) and Singapore (EMA, 2024), present opportunities to bring new solutions to market more quickly. Training programmes combining power system fundamentals with AI literacy can help operators maintain appropriate control while benefiting from AI's analytical capabilities. These complementary approaches recognise that successful AI integration depends on both technical excellence and human expertise working in concert.

Key takeaways for moving forward

- **Bring planning up to date** - prioritise modernisation and efficient utilisation of existing grids
- **Unlock investment** – incentivise investment in grid modernisation and new technologies
- **Address barriers** – reform regulations to incentivise risk-managed deployment
- **Leverage digitalisation** – digitalise infrastructure and advance distributed resources
- **Build a skilled workforce** - create a pool of talent with digital and electricity skills

Case study deploying Smart Wires's advanced power flow control

Efthimia Chassioti and Konstantinos Krommydas from IPTO

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Risks and benefits of deploying MPFC technology - Experience gained from IPTO

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European Commission
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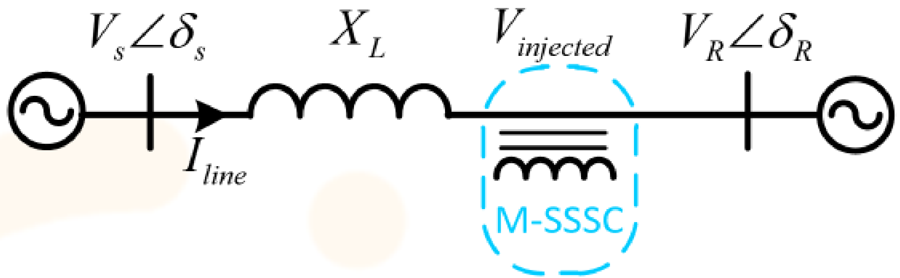
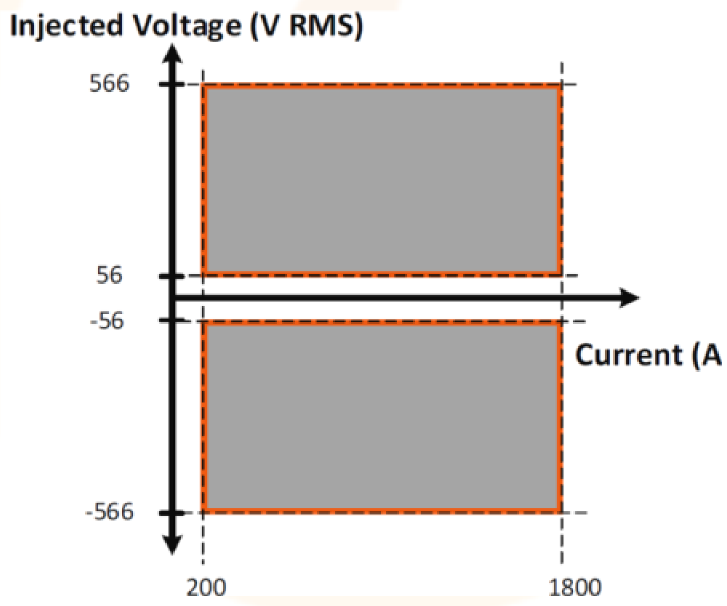
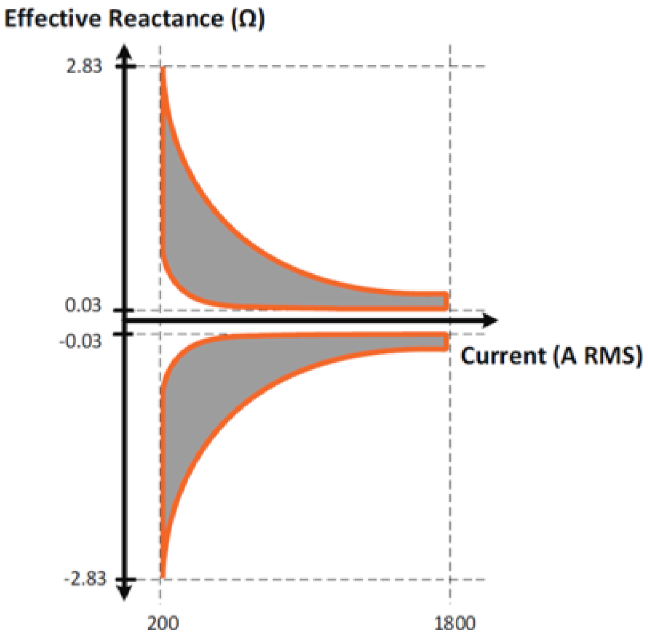
Operation principle



$$X_M = \frac{V_{injected}}{I_{line}} \qquad P = \frac{V_S V_R}{X_L + X_M} sin\delta.$$

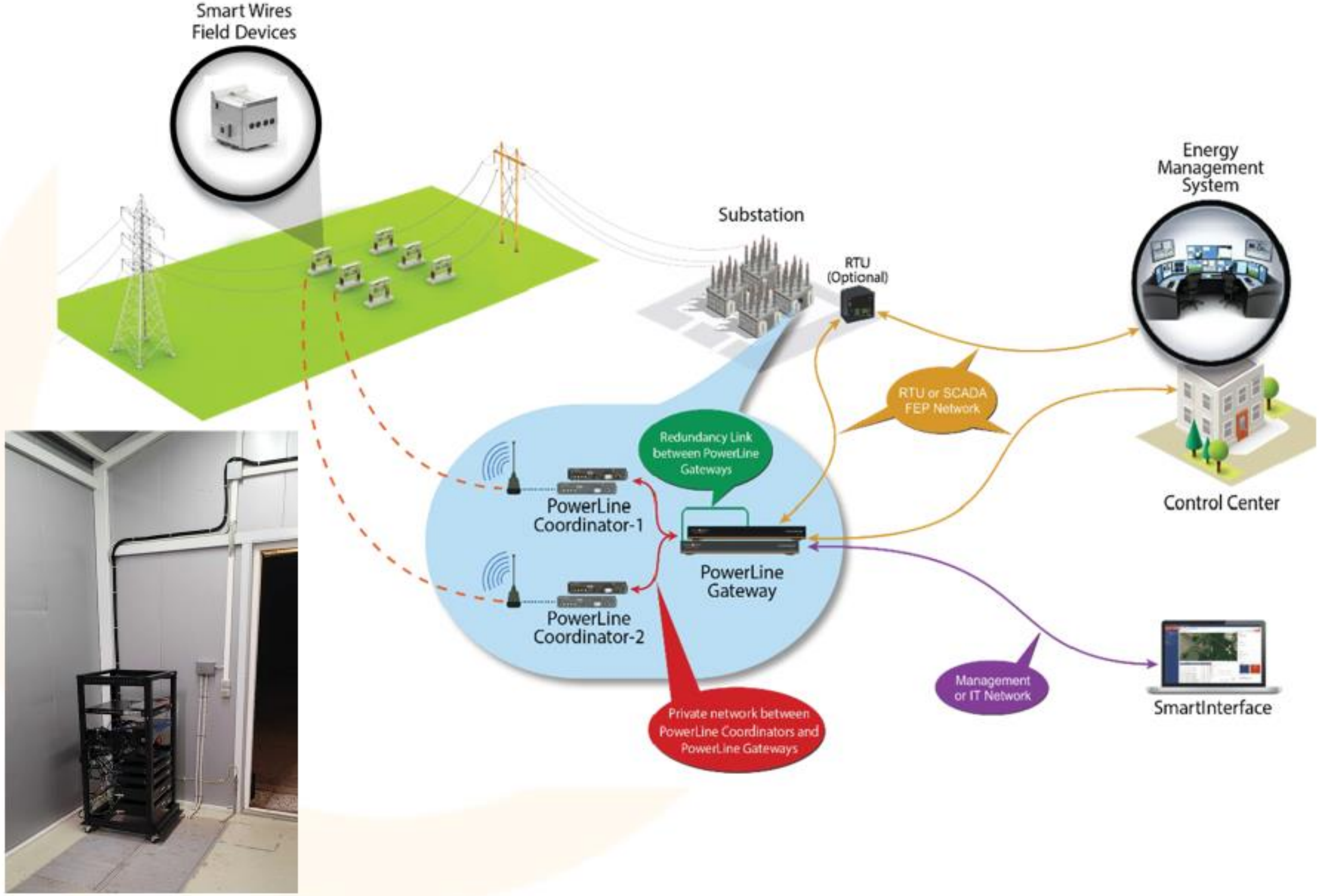




MPFC deployment

1. Base steel structure
2. Post insulators
3. SmartValve devices
4. SmartBypass device
5. Bypass Filter

Communications



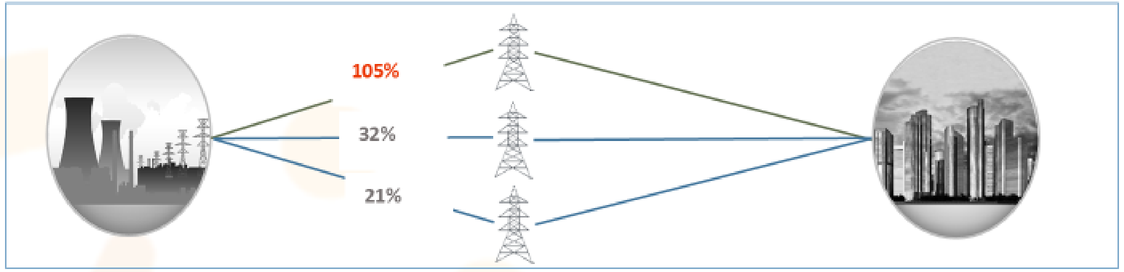
Control methods

M	**Monitoring**	SmartValves are bypassed and can report line current and other telemetry data.
Ω	**Fixed Reactance**	SmartValves are programmed to inject a fixed level of reactance on the line, automatically regulating the injected voltage to account for changes in line current.
V	**Fixed Voltage**	SmartValves are injecting and the operator can tell the system what percentage of nominal voltage to inject, up to the system's maximum capacity, on a percentage basis.
I	**Current Control**	SmartValves devices can automatically start or stop injecting based on the current flow.

Use Case

Before MPFC

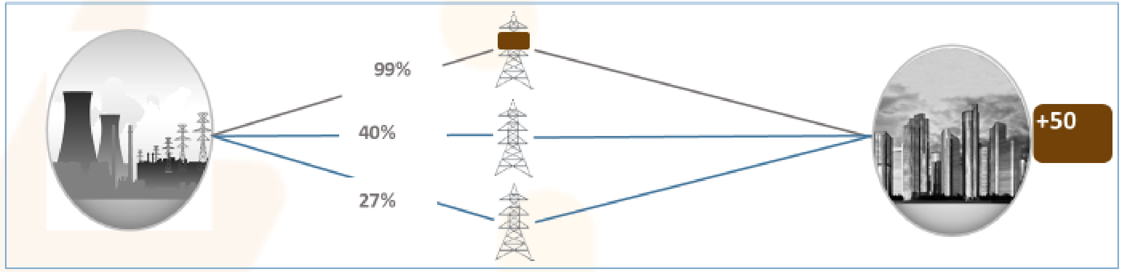
Simplified planning scenario predicts future overload



MPFC in "Push" Mode

Power is pushed to alternate lines with

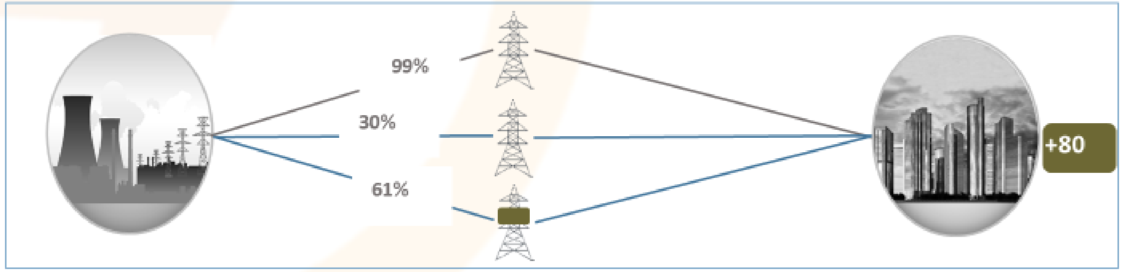
spare capacity, resolving overload



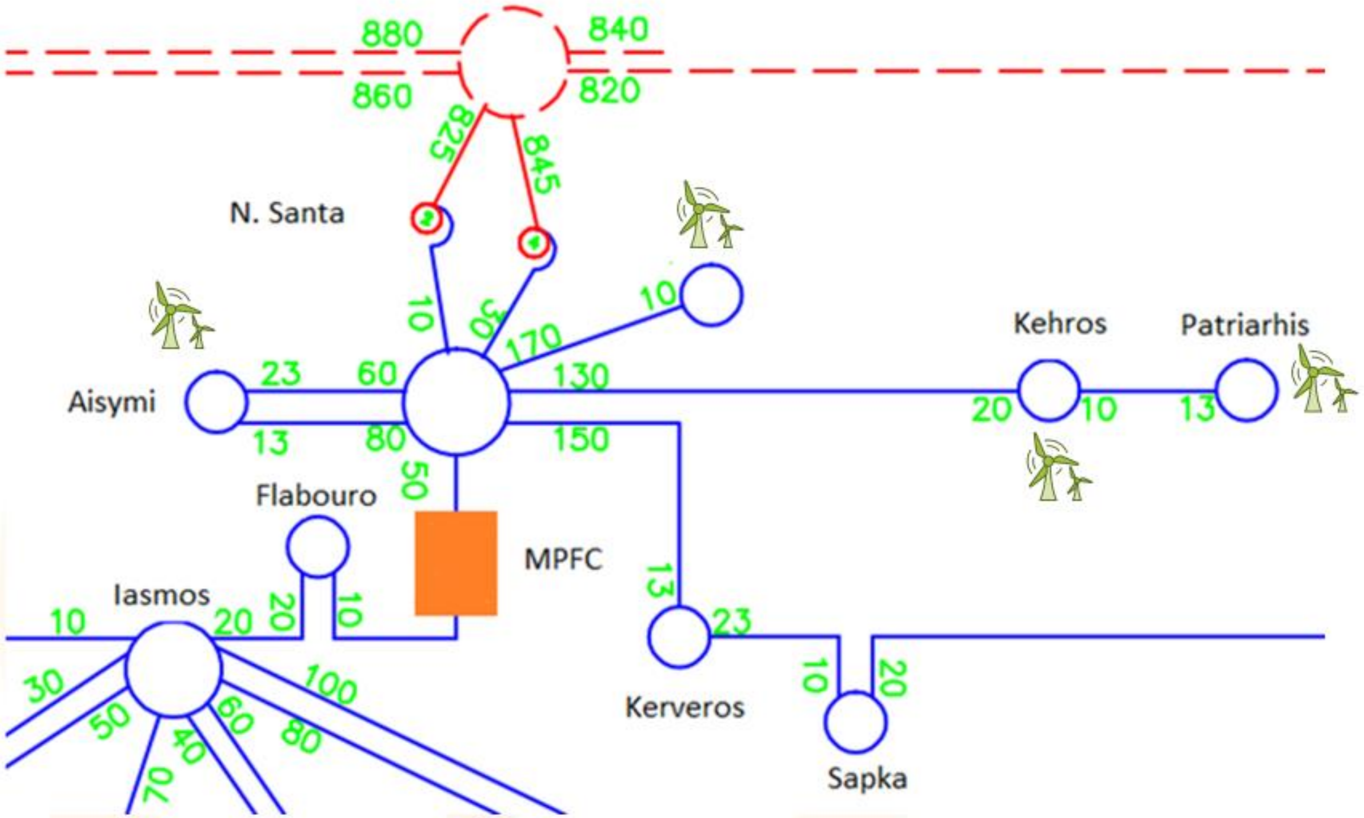
MPFC in "Pull" Mode

Power is pulled onto lines with

spare capacity, resolving overload



Motivation of the project



Requirements for "turn-key" projects

Construction & implementation of projects connecting to the Hellenic Electricity Transmission System (HETS) is done according to:

- Electrical characteristics of the Greek 400 kV , 150 kV and the Medium Voltage networks (where required) 30 kV , 20 kV , 15.75 kV
- The specified operating conditions, provided in technical issues of the Tender Invitation
- The static and seismic safety requirements for the buildings and equipment
- The respective national and international regulations

All the above are described in IPTO's internal document "*DESIGN PRINCIPLES AND GENERAL REQUIREMENTS FOR PROJECTS PRODUCED BY CONTRACTORS AS "TURN KEY" FOR CONNECTION WITH THE HELLENIC ELECTRICITY TRANSMISSION SYSTEM (HETS)"*

Installation

- **A previous support structure designed by Smart Wires for a 330kV** use case in Australia was used
- **IPTO approved the use of this design for the 150kV network,** taking into account the different climatic and seismic requirements
- **The differing standards notably steel quality and coatings** were also considered and approved
- The weights and loadings of the structure were used in **designing the ground foundations and in adjusting the overhead line configuration**
- The fact that the MPFC was **installed in the context of a pilot project expedite the approval process**

Installation

- Installation process which was taken in 2 phases
  - **1 phase – ground preparation** (concrete ground foundation and preparatory work on the overhead lines were prepared before commissioning)
  - **2 phase** - Outages were taken to **place the SmartValve's on the ground foundation and connect them to the lines**.
- The whole duration from assembly, process to **commissioning took 9 days and 3 days of outages**.
  - Start of installation: 28th August 2021
  - Finished of installation: 6th September 2021

Installation of Ground Foundation Structures

The construction of these concrete bases lasted around 25 days, including the time to allow concrete to cure.

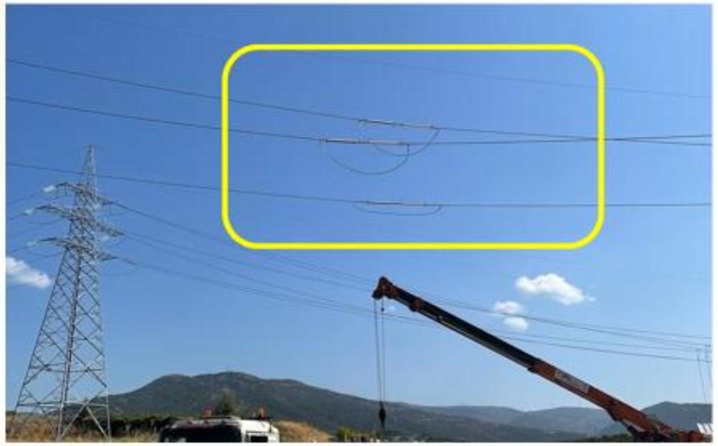
Adjustment of Overhead Lines

Before

2 DAYS
Installation process

1 DAYS
Outage required

After



European Commission | Horizon 2020 European Union funding for Research & Innovation

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Installation of the SmartValve 1-1800

Installation of the devices

Completed Commissioning

9 DAYS
Installation process

3 DAYS
Outage required

Simulation Scenarios

- Scenario with a sudden increase of the local demand of 40 MW

Initial Situation		After the increase in demand		With SmartValves activated	
Line current	Line loading	Line current	Line loading	Line current	Line loading
264.8 A	55 %	304.3 A	64 %	278.7 A	58 %

- Scenario with a sudden increase of RES production (from 106 MW to 236.5 MW)

Initial Situation		After the increase in RES		With SmartValves activated	
Line current	Line loading	Line current	Line loading	Line current	Line loading
493.7 A	63.5 %	586 A	75 %	565 A	73 %

- Scenario with new interconnecting line N. Santa – Maritsa (N-1 Fillipon-Nea Santa)

Initial Situation		After N-1 incident		With SmartValves activated	
Line current	Line loading	Line current	Line loading	Line current	Line loading
305 A	64 %	354 A	74 %	330 A	69 %

Simulation Scenarios

- Scenario with N-1 in Komotini Power Plant

Initial Situation		After N-1 incident		With SmartValves activated	
Line current	Line loading	Line current	Line loading	Line current	Line loading
273.6 A	57 %	349.6 A	73 %	324 A	68 %

- Scenario with line N.Santa – Iasmos reaching its thermal limit after an increase in local demand by 126.2 MW

Initial Situation		After N-1 incident		With SmartValves activated	
Line current	Line loading	Line current	Line loading	Line current	Line loading
434.1 A	91 %	481.4 A	101 %	456.9 A	96 %

- Scenario with line N.Santa – Iasmos reaching its thermal limit after N-1 in line Xanthi-Iasmos

Initial Situation		After N-1 incident		With SmartValves activated	
Line current	Line loading	Line current	Line loading	Line current	Line loading
395 A	83 %	494 A	103 %	468 A	98 %

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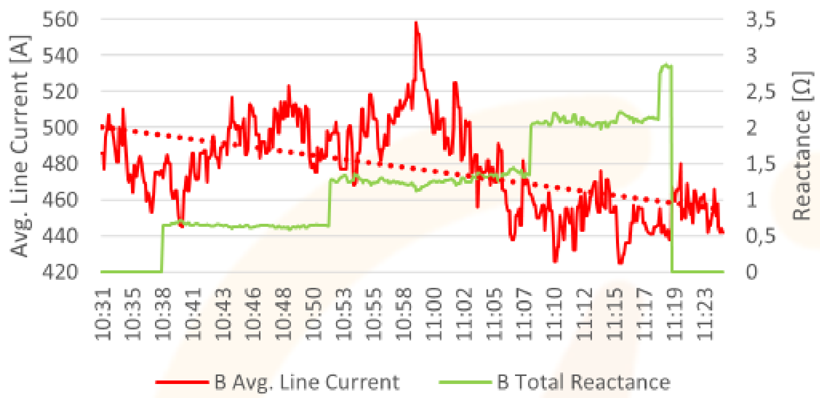
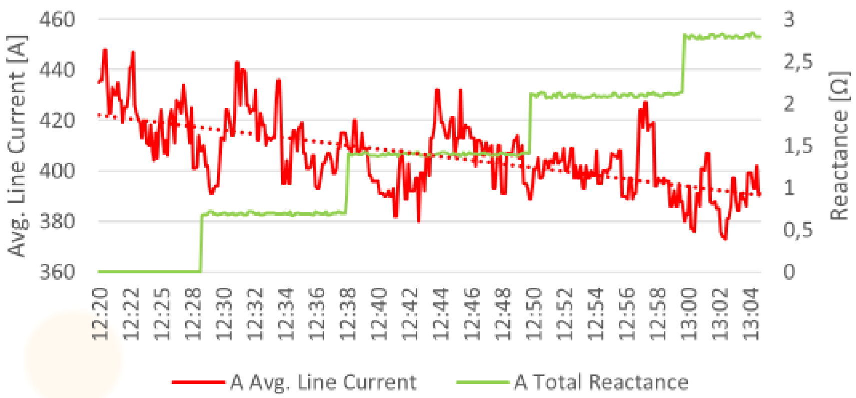
Fixed Voltage Injection - Fixed Reactance Injection

Inductive – Fixed Voltage Injection



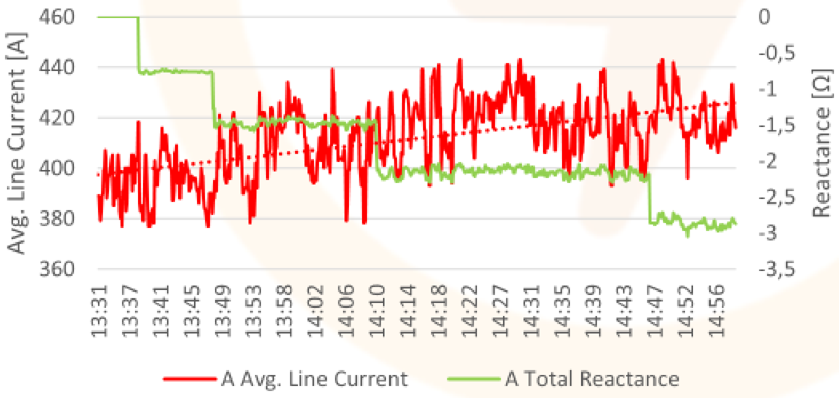
+2.8 Ohms change was approx.
-40 A RMS change (10 MW)

Inductive – Fixed Reactance Injection



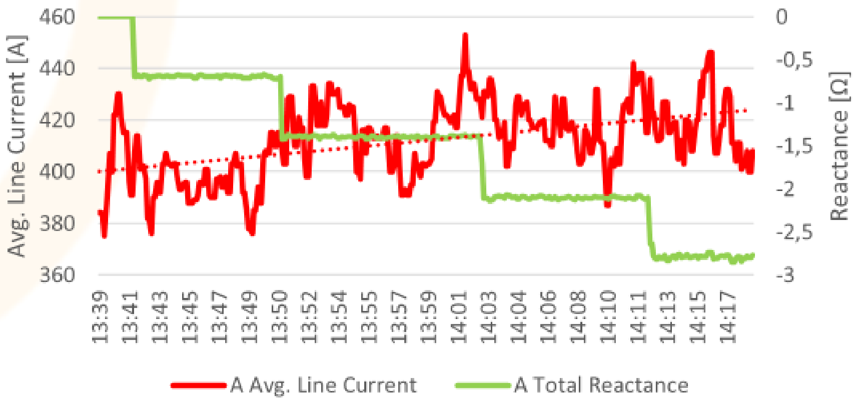
+2.8 Ohms change was approx.
-40 A RMS change (10 MW)

Capacitive – Fixed Voltage Injection



+2.7 Ohms change was approx.
+25 A RMS change (6 MW)

Capacitive – Fixed Reactance Injection



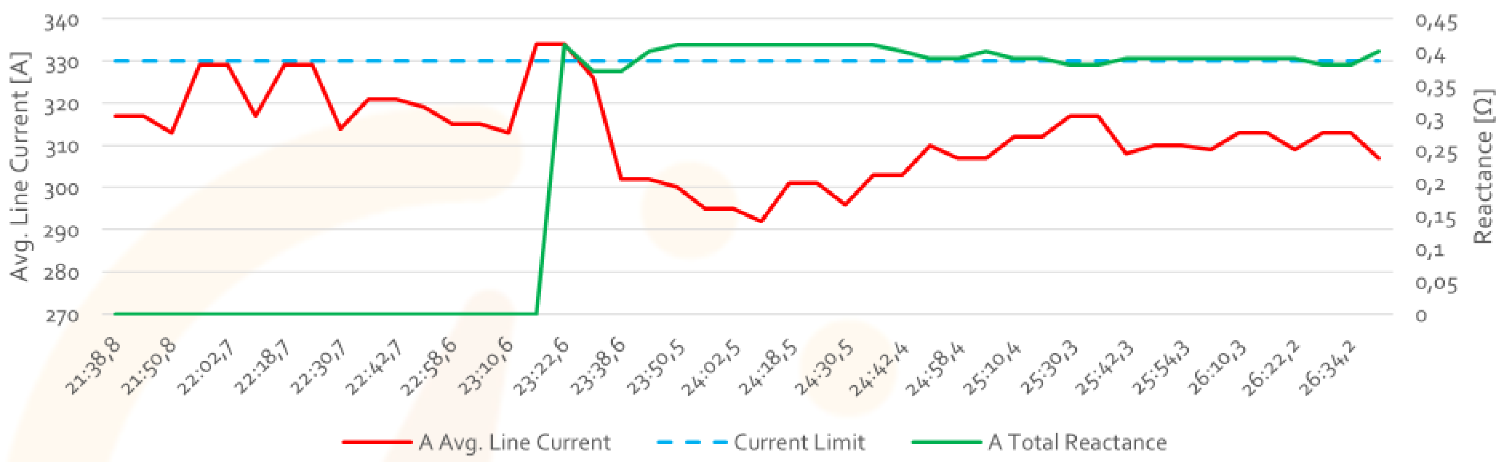
-2.7 Ohms change was approx.
+25 A RMS change (6 MW)

Current Control Mode

-

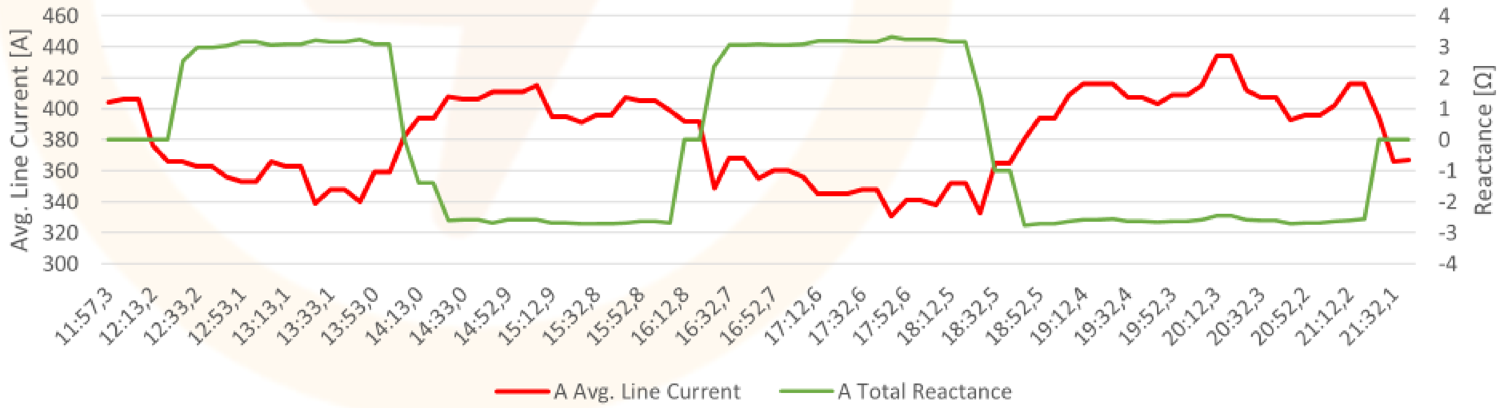
Transitioning Between Modes

Inductive – Current Control Mode



0.4 Ohms change resulted in approx. a 8 A RMS change (2 MW).

Inductive/Capacitive Transition



6 Ohms change resulted in approx. a 100 A RMS change (25 MW)

Manage the risk deployment

- Compliance with requirements for turn-key projects
- Minor deviations from IPTO's requirements were assessed with additional studies
- Installation in the context of a pilot project
- Previous experience with MPFC facilitated internal procedures
- Internal bypass functionality of MPFC
- Continuous support from vendor

Benefits of MPFC deployment

- Alternative to lengthy reinforcement projects
- Reduce network congestion and increase system reliability
- Enabling faster connection of renewable generation
- Reduce the environmental impact of transmission investments
- Facilitating outages for maintenance reasons
- Bridge solutions by resolving overloads

Conclusions

- The MPFC technology advantages were verified during the demonstration
  - Fast Delivery & Installation
  - Redeployability, Modularity, and Scalability
  - Reliability
  - Flexibility in Control
- Simulation and real-time results are in good agreement
- Promising technology for dealing with congestion issues in the future or in other areas of the network
- IPTO gained experience with innovative grid technologies

Thank you for your attention!

ipto

FARCROSS

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 864274

Plexigrid

Reinventing Electricity Grids for the Energy Transition

STRICTLY CONFIDENTIAL

Plexigrid

No Green-Deal

without a Grid-Deal

STRICTLY CONFIDENTIAL

EU Regulators and European Electric Utilities getting ready for the change

Dan Jørgensen. EU Energy Commissioner

"Basically, we need to double the utilization of the grids and connections we already have "

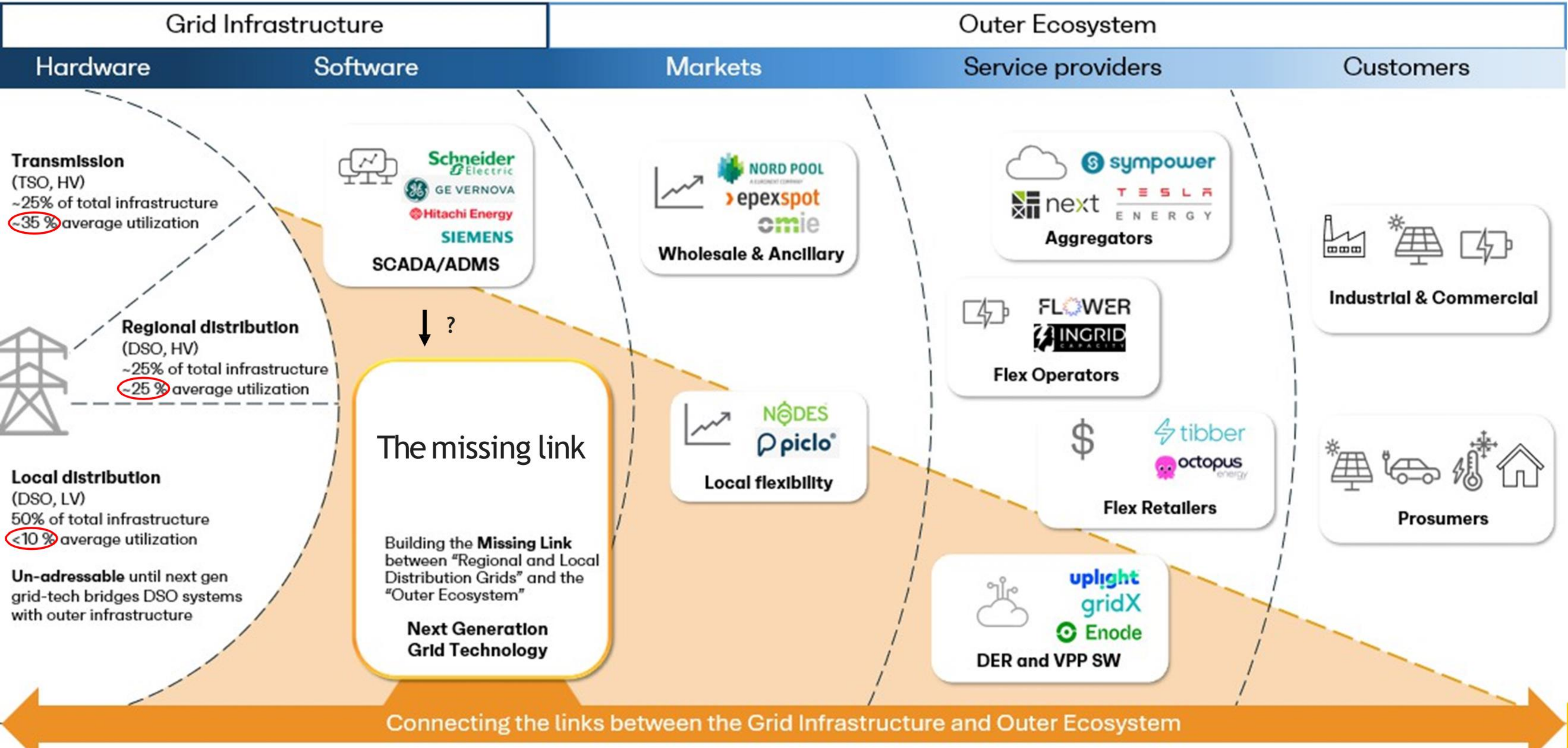
"It means rationalising, digitalising, using AI in the systems we already have."
Dan Jørgensen, 27th Feb 2026

Kristian Ruby. Secretary General Eurelectric

*" -Maximising current grid capacity. We can optimise existing infrastructure through **digitalisation**, **AI**-driven asset management, and **smart flexibility solutions**. Unlocking the full potential of digital grids will keep costs in check, prevent congestion, and enhance resiliency."*

"Local grids do not always make headlines, but they are the key to Europe's clean, safe energy future. It's time to give them the attention they deserve."
Kristian Ruby, 30th March 2025

The Grid Onion and The Missing Link. MV and LV operates at a much lower efficiency level because it lacks a real-time interplay between the inner layers of the onion and outer layers of the onion



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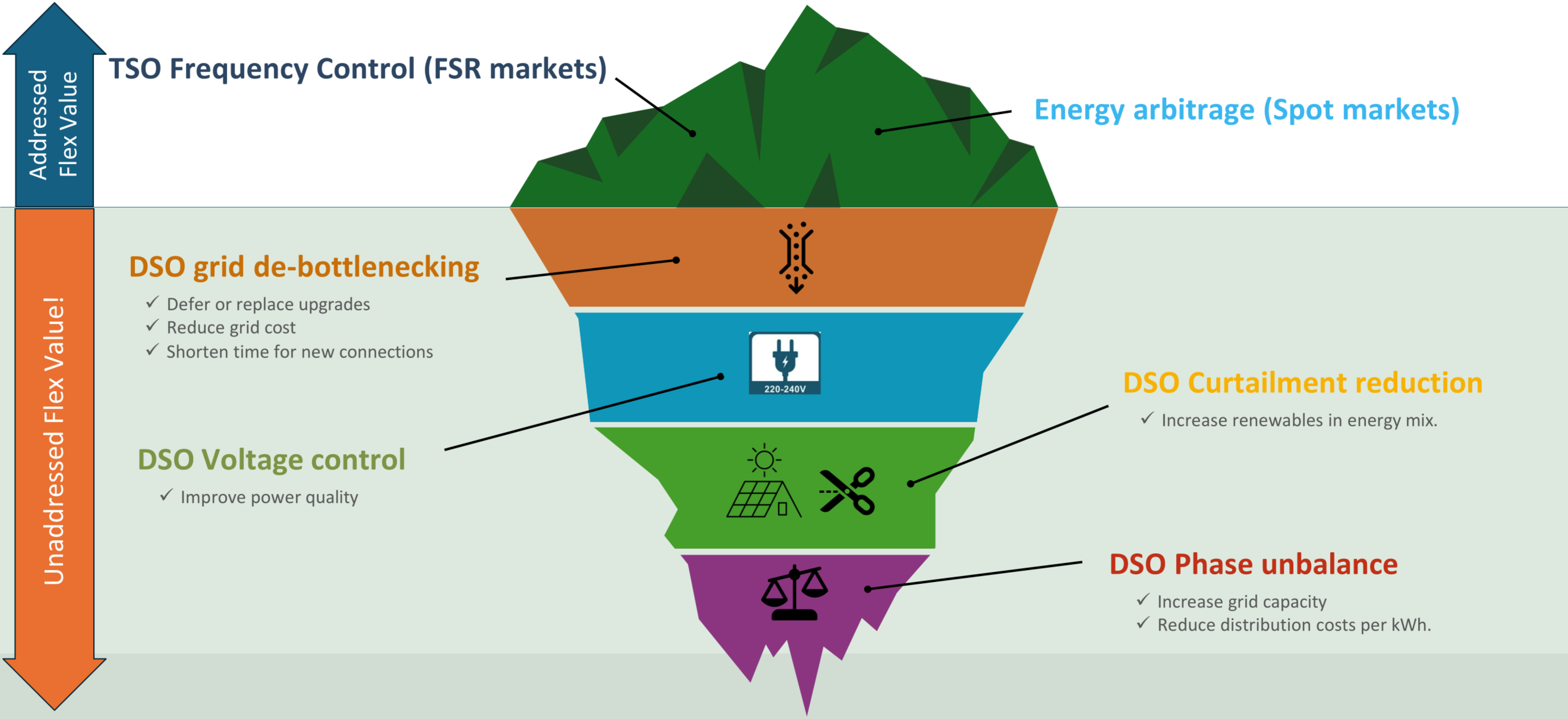
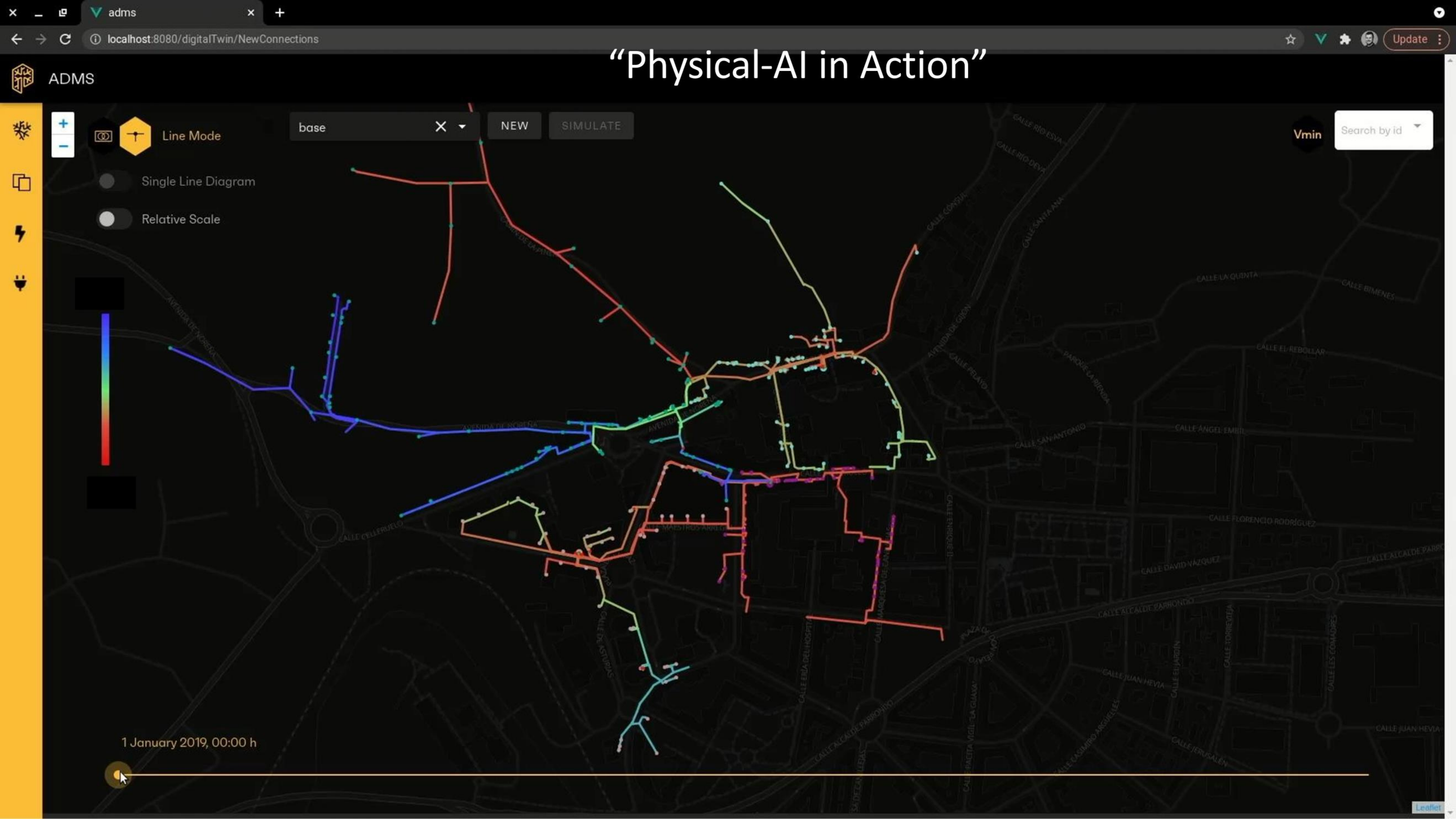
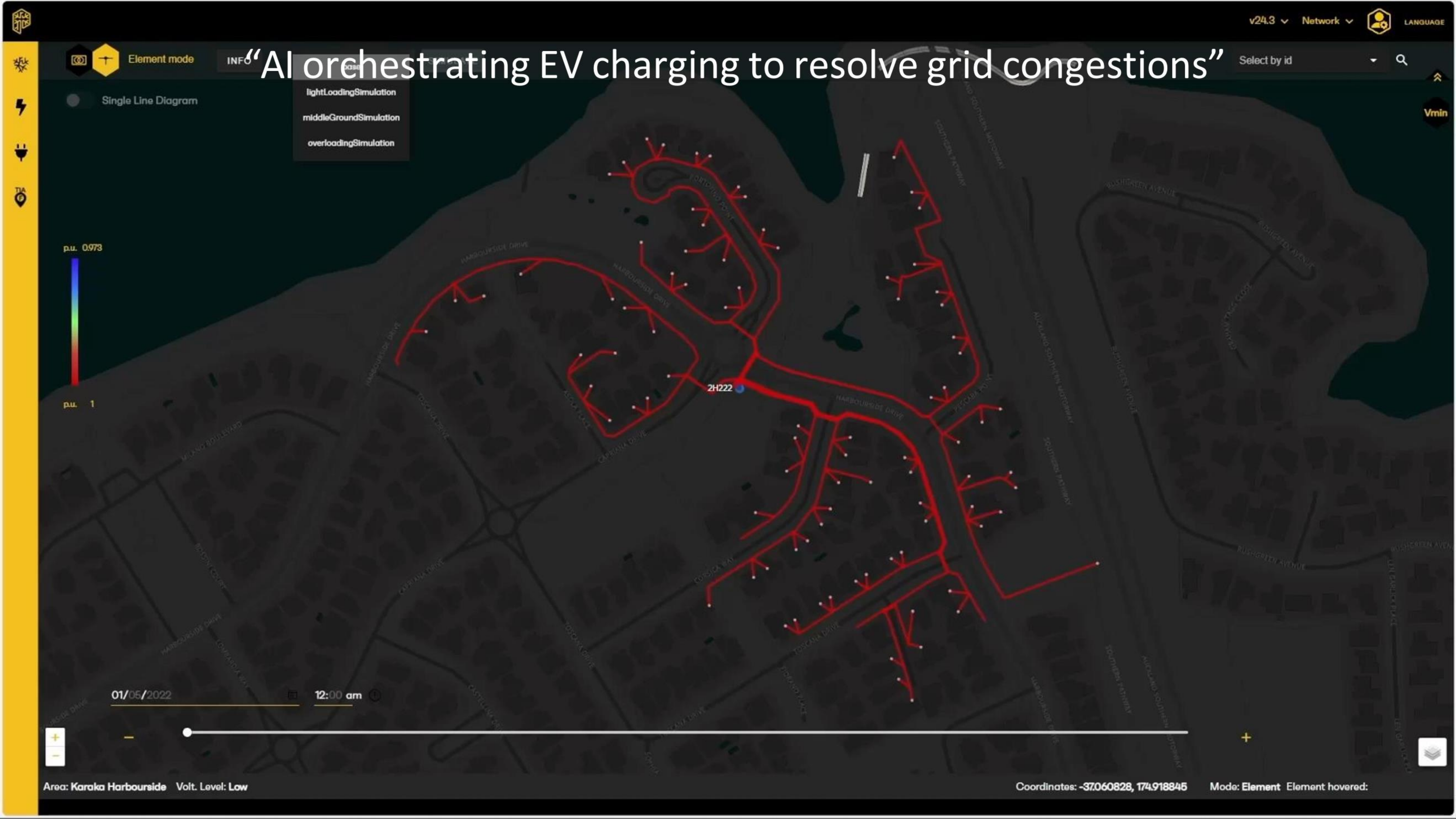
The **“Flexibility Iceberg”.** There’s a huge supply of flexibility ready to engage, but but most of the flexibility value is still unmonetized due to distribution grid limitations



"Physical-AI in Action"



“AI orchestrating EV charging to resolve grid congestions”



“AI generating automatic purchases and activations of flexibility in local flexibility markets”

The main barrier to the adoption of this next-gen DSO approach is not technology, but Regulation. No Green-Deal without a Grid-Deal

The Problem. The "Grid-Deal":

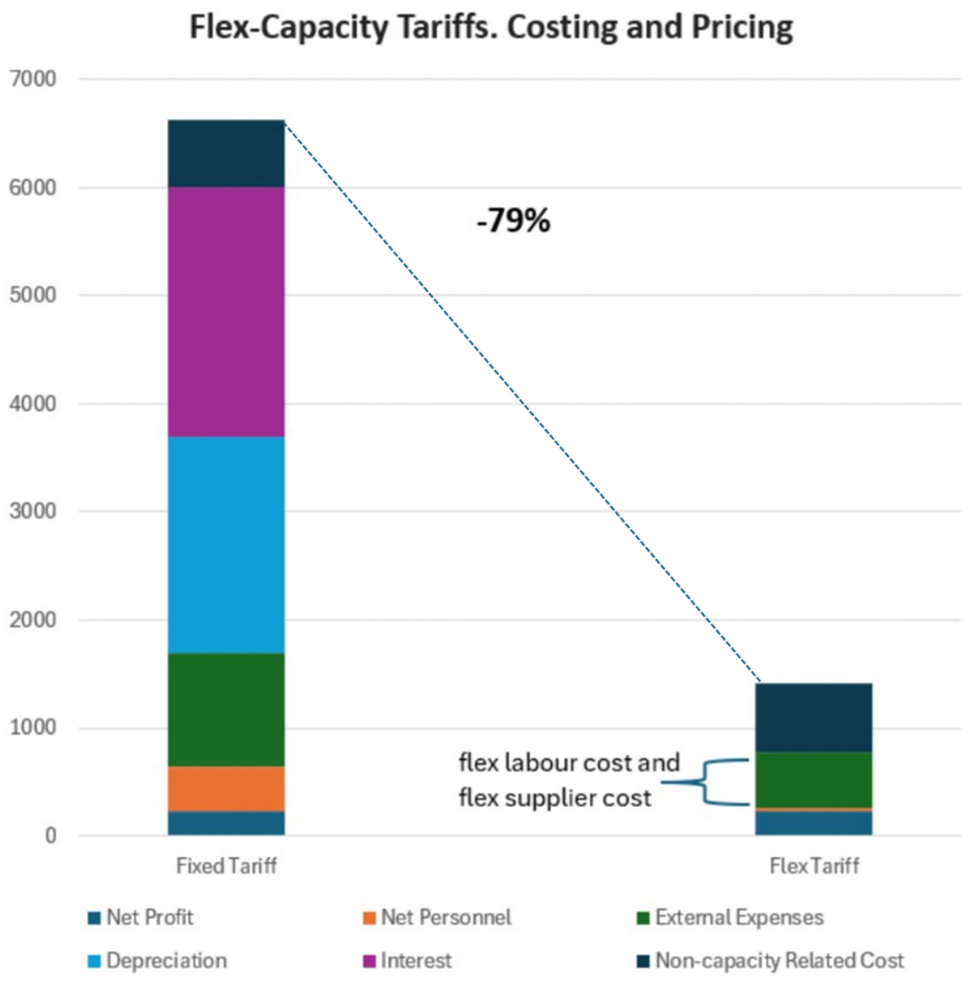
- DSOs remuneration schemes are set so that the DSO makes more profit as it deploys more capacity and invests more CAPEX, and less profit if the DSO makes a better utilization of existing capacity instead of deploying additional capacity and saves CAPEX. This provides clear disincentive for DSOs to go from a "fit and forget" based on a deployment of capacity at low utilization of capacity, to an "active grid management" that makes a more efficient use of grid capacity.

The Solution. The "Grid-Deal", aligning incentives so that the change becomes a win-win-win for consumers, grid operators and for the technologies enabling the change. E.g."flex-grid tariff":

- Every European electricity consumer should have the alternative to sign up for a "flex-grid tariff" for flexible devices (like EVs, HPs, Air conditioners, batteries, or any other flexible device), under which the consumer gets a rebate on its grid fees in exchange for connecting the devices to the DSO and accept that the DSO can reschedule these flexible loads, within pre-agreed limits, in case of local congestions.
- Thes "flex-grid tariffs" should be implemented and operated through local flexibility markets and through aggregators, in accordance to EU Directive 944/2019.
- The "flex-grid tariffs", should be priced so that are cost reflective (as the cost structure behind these "flex-grid schemes" is ~70% lower), but they should also be priced so that the DSO makes the "same profit per kW contracted" as a conventional grid tariff, creating a win-win situation for consumers and grid operators. Otherwise DSOs have a clear disincentive to offer these "flex-grid tariffs" to consumers, and to go through the heavy and complex transformation needed to accomplish that.

Flex-grid tariff.

Sweden. Example for an 11kW subscription for EV charging



Germany. EnWG 14a. Flex-grid tariff for flexible DERs

https://www.gesetze-im-internet.de/enwg_2005/14a.html

- **§14a EnWG** regulates the **controllable consumption devices** (steuerbare Verbrauchseinrichtungen) in electricity grids.
- Aims to support **grid stability** by enabling DSOs (distribution system operators) to manage flexible loads.
- Applies to devices like **heat pumps**, **electric vehicle chargers**, and **battery storage**.
- DSOs can temporarily reduce power to these devices during grid congestion.
- Consumers benefit from **reduced grid fees** in return for flexibility (between 55% to 60% discounts in grid fees for flex loads)
- Ensures **consumer protection** with minimum supply levels.
- Part of Germany's strategy for integrating **renewable energy** and electrification.

Regulatory regimes that can support the deployment of innovative grid technologies

Riccardo Vailati, Chair of the Infrastructure Workstream at CEER and Team leader at ARERA

ARERA
Autorità di Regolazione per Energia Reti e Ambiente

Regulation of electricity distribution in Italy: mitigating CAPEX bias and implementing output-based incentives

Riccardo Vailati
Team leader investment plans and quality of energy infrastructures, ARERA

Webinar 'From Risk to Reward: Why Innovation at the Distribution Level Can't Wait'

23 April 2025

Outline

- Mitigating the bias favouring capital expenditures over operational expenditures

- The example of output-based regulation of continuity of supply promoting network automation

- The recently introduced benefit-based regulatory scheme

Mitigating the CAPEX bias

- In 2004-2023, the Italian regulatory framework was based on a hybrid approach, with rate-of-return regulation for capital expenditures (CAPEX) and price-cap regulation for operational expenditures (OPEX)
- From 1/1/2024 a **fixed OPEX/CAPEX share (FOCS)** is applied for the remuneration of all DSOs above 25 000 customers (> 99% of customers), and the electricity and gas TSOs. A fixed share of the actual yearly expenditures is added to the regulatory asset base, while the remaining part is treated like an OPEX
- The FOCS is set for each DSO based on a combination of historical OPEX/CAPEX shares as well as forward-looking projections of CAPEX and OPEX: the FOCS for years 2024 and 2025 was set in late 2023 as an average of the actual capital expenditure shares of 2021 and 2022, of the preclosing CAPEX share of 2023 and of the forecast CAPEX shares of 2024 and 2025. The FOCS value for 2026 and 2027 will be updated again as a combination of historical and forward-looking projections of CAPEX shares

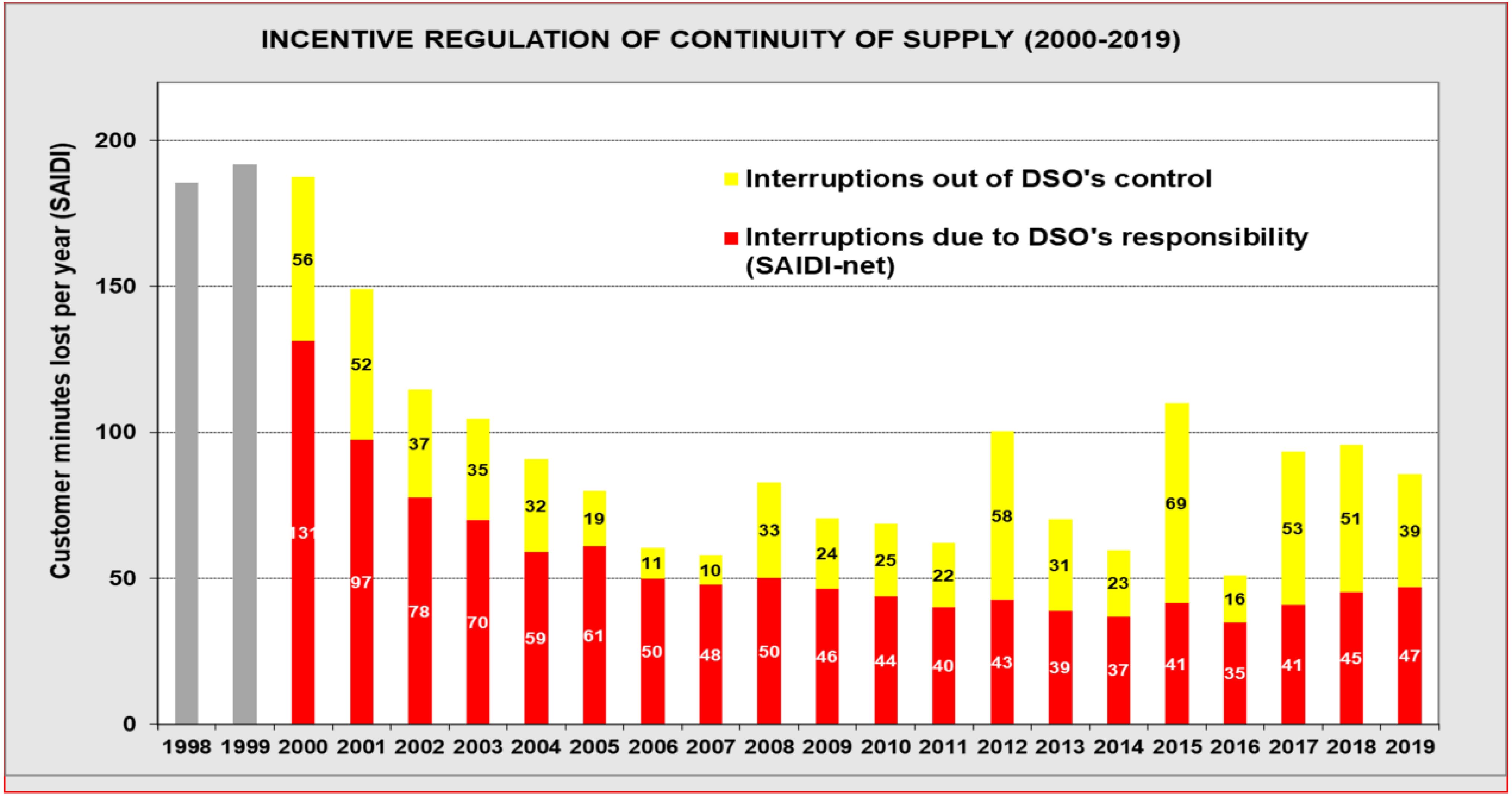
Output-based regulation: continuity of supply

	1st regulatory period 2000-2003	2nd regulatory period 2004-2007	3rd regulatory period 2008-2011	2012-2015 2016-2019	2020-2023 2024-2027
Quality of supply regulation (SAIDI and SAIFI)	Rewards/penalties SAIDI only	Rewards/penalties SAIDI only (long term targets)	Rewards/penalties SAIDI and MAIFI+SAIFI	Rewards/penalties SAIDI and MAIFI+SAIFI	Ordinary regulation + regulatory experiments
Multiple interruptions (number/year, MV)	*Monitoring numb. interr.* *(per single MT cust.)*	Guaranteed standard, MV only *(only long interr.)*	Stricter guar'd standard, MV only *(only long interr.)*	Individual standards, MV only *(long and short int.s)*	Individual standards, MV only *(long and short int.s)*
Very long interruptions (max duration, MV LV)		*Consultation and statistic research*	Guaranteed standards (incl.except.events)	Guaranteed standards (incl.except.events)	Review of guar.stds and new rules on except.events
Emergencies and network resilience to extreme events		*First investigations*	Emergency guidelines	Investig.96/2015 and sanctions	New incentives for network resilience

- Significant exploitation of network automation (medium voltage)

Output-based regulation: effects over two decades

SAIDI without notice



Benefit-based regulation

- For the period 2019-2024 ARERA introduced an incentive scheme rewarding investments to increase network resilience against extreme events and heat waves
- From 1/1/2024 the benefit-based regulation has been extended to (at least theoretically) all distribution investments delivering more benefits than costs. A pilot scheme was activated in 2024: 6 DSOs out of 10 submitted their applications
- New applications are scheduled by end of June 2025, which is the same deadline of post-consultation 2025 distribution network development plans. The scheme is reward-only, based on estimated project benefits and capped at 13% of project CAPEX
- Works progressed during 2024 and 2025, including the recent regulatory order 112/2025 which defined an **updated list of benefit categories, the approach to calculate each benefit and several parameters**

Benefit-based regulation: the benefit categories (1)

- BP1 - expected reduction of customer interruptions during heat waves
- BP2 - expected reduction of customer interruptions against extreme events
- BA3 - expected reduction of customer interruptions during ordinary conditions
- BP4 - expected avoided costs (economic costs and emission costs) for emergency actions following interruptions
  - Reduced use of emergency generators
  - Reduced post-faults interventions (vehicles)
- BP5 - expected reduction of RES-plants interruptions
- BP6 - expected reduction of severe voltage dips
- BP7 - expected avoided costs of post-failure extraordinary maintenance

Benefit-based regulation: the benefit categories (2)

- BP8 - expected avoided operation and maintenance costs (continuous): avoided tree cutting, water consumption of transformers
- BP9 - expected reduction in the cost of electricity production and CO_2 emissions for newly interconnected areas (electrification of rural areas or islands)
- BP10 & BA10 - reduction in network losses (emissions and direct economic costs)
- BP11 - reduction of RES disconnections due to voltage variations (CO_2 and direct costs)
- BP12 - reduction of congestion from the downstream distribution network to the upstream distribution network or the transmission network (aka RES hosting capacity)
- BP13 - expected reduction of congestion due to electricity withdrawals, aka loading capacity (three options: HV/MV transformers, MV lines or MV/LV transformers)

https://www.arera.it/fileadmin/allegati/docs/23/296-23ti.pdf

https://www.arera.it/fileadmin/allegati/docs/25/112-2025-R-eel-ALLEGATO_A.pdf

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Thank you!

Q&A with participants