Grid Connection Paper - DSO Entity's Public Webinar 1

Delivering the Fit for 55: How to face the grid capacity challenges?

12 April 2024 (9:30 – 11:00 CET)

DSO Entity, Regulatory Affairs & Strategy Team

Agenda

09:30-09:35	**Welcome address**	**Peter Vermaat** DSO Entity, Secretary General
09:35-09:50	**Keynote speech**	**Joachim Balke** European Commission, DG ENER, Head of Unit C4 Infrastructure and Regional Cooperation
09:50-10:00	**DSOs fit for 55 – Requirements, challenges and solutions for distribution grids in the energy transition**	**Claire Vandewalle** DSO Entity, Regulatory Affairs & Strategy, Advisor
10:10-10:40	**Facing grid capacity challenge: Sharing of best practices from distribution grids** • Denmark' s practice: Geo-dependent standard connection fee • Belgium's practice: Introduction of capacity tariffs • Netherland's practice: Flexible connection agreements	*DSO Entity, Country Expert Group's representatives* **Henrik Fiil-Nielsen**, Denmark, N1, Director, Head of Regulatory Affairs **Luc Decoster**, Belgium, Fluvius, Regulatory Manager **Michiel Roks**, Netherlands, Alliander, Senior Advisor Regulatory Affairs & **Samira Rotteveel**, Policy Advisor
10:40-10:55	**Q&A session**	
10:55-11:00	**Closing remarks**	**Claire Vandewalle** DSO Entity, Regulatory Affairs & Strategy, Advisor

DSO ENTITY
DSOs FOR EUROPE

1. Welcome address by Peter Vermaat

DSO Entity's Secretary General

DSOs FOR EUROPE

2. Keynote speech by Joachim Balke

European Commission, DG ENER

Head of Unit – C4 Infrastructure & Regional Cooperation

European Commission

EU Grid Action Plan

EU DSO Entity Webinar

12 April 2024

Joachim Balke
Head of Unit, DG ENER C.4

Importance of electricity grids

€584bn investment by 2030!

Capacity expansion (cables & substations), modernisation (40%) and smartening

Transmission grids

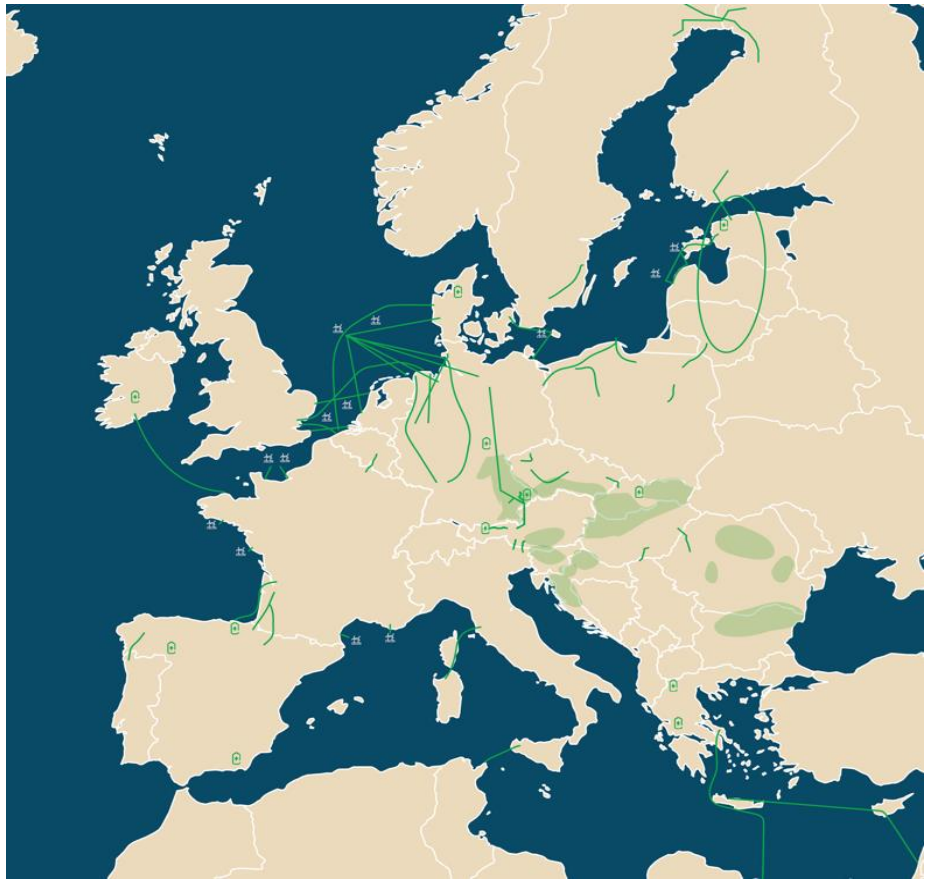
- Transport of renewables across Europe:
  - Cross-border capacity (PCIs)
    - ✓ x2 by 2030
    - ✓ ↓ Annual €9M generation costs by 2040
  - Offshore ~317 GW
  - Industry electrification
  - Between distribution areas

Distribution grids

- ~70% new renewables (1,000 GW by 2030)
- 40M electric vehicles by 2030
- Heat pumps deployment rate x2
- Smart grids
  - Digitalisation → Digitalising the Energy Sector Action Plan 2022
  - Flexibility
  - Prosumer

European Commission

First PCI/PMI list: Electricity



Features

- 85 electricity projects
- 5 new offshore corridors, 12 projects
- 7 Projects of mutual interest (PMIs)
- 5 smart electricity grid projects

European Commission

1

Network planning

HLGs reinforced monitoring, ministerials

COM to assess funding needs (CEF-Energy)

ENTSO-E to improve TYNDP

EU DSO Entity to support DSOs

2

Regulatory incentives

COM guidance on anticipatory investments

COM guidance on offshore cost sharing

European Commission

3 Smart & efficient grids

ENTSO-E and EU DSO Entity to enhance grid capacity transparency

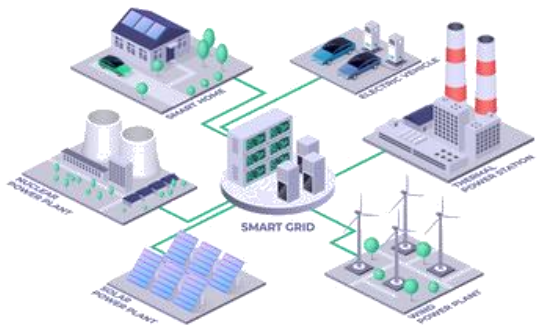
ENTSO-E and EU DSO to promote uptake of smart grids and innovative tech

ACER to recommend best practices on OPEX+CAPEX in tariff reports

4 Financing

COM –through Investors Dialogue– to address financing obstacles

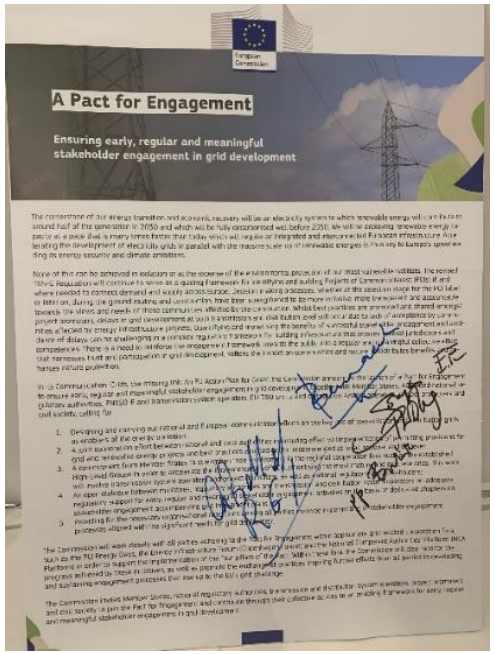
COM to increase visibility on funding for distribution (ERDF, CF, RRF)



European Commission

5 Permitting & public acceptance

- MSs to use Emergency Reg + RED for grids
- COM update ENV guidance for grids
- NCA platform
- Pact for Engagement



6 Supply chain

PLANS AND PERMITTING

- ENTSO-E, EU DSO and tech providers to develop standard specifications
- Grid procurement plans
- Common tech requirements for connection (NCs)

European Commission

Implementation

1. Adoption of GAP on 28 November + presentation 2023 PCI Days

2. Implementation ~18 months

3. Numerous dialogue formats: HLGs, Clean Transition Dialogue etc.

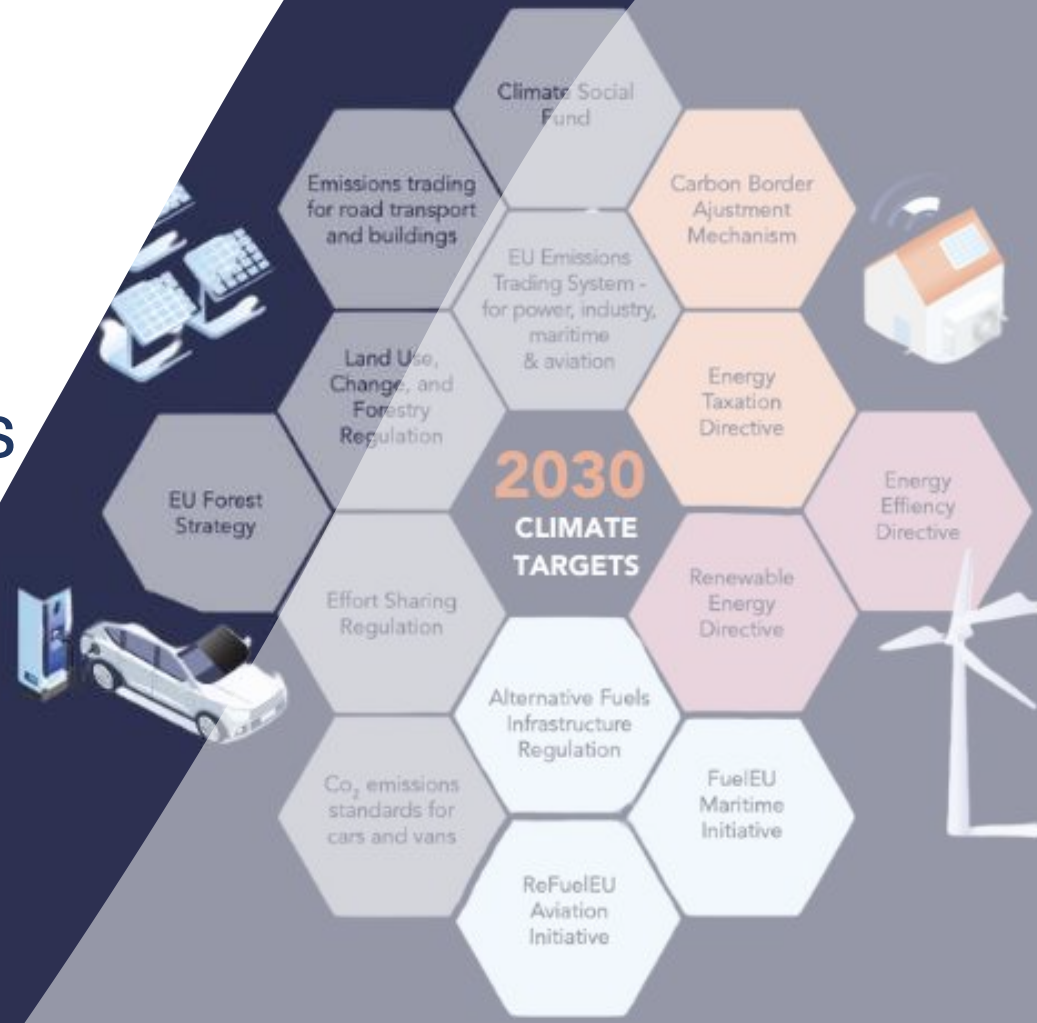
4. Copenhagen Energy Infrastructure Forum 27-28 June central platform

Thank you

DSOs FOR EUROPE

3. DSOs fit for 55:

Requirements, challenges and solutions for distribution grids in the energy transition



Grids in the spotlight: Recognition of the relevance of distribution grids (DSOs) in the energy transition

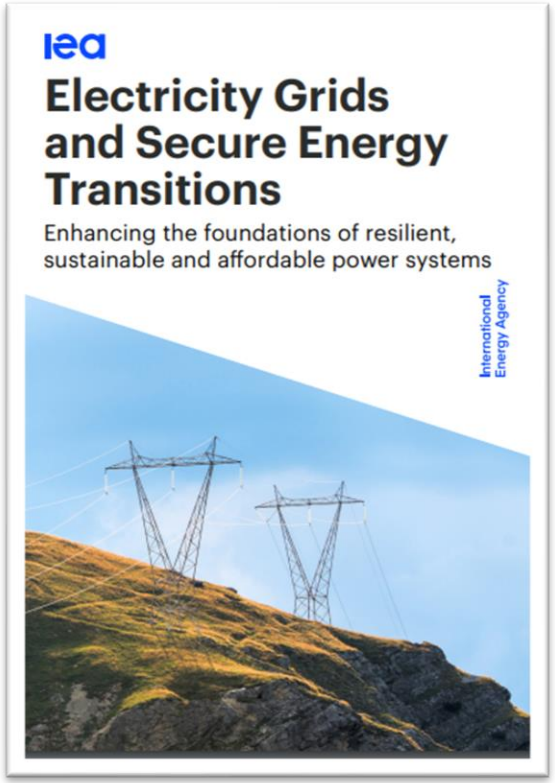
"With this special report, we aim to put an urgently needed spotlight on power grids."

IEA October 2023

"The EU is bringing grids to the centre of its agenda."

European Commission, Grid Action Plan

November 2023



- 26 February: European Commission's **Clean Transition Dialogue on energy infrastructure**
- 25 March: **High-level Roundtable on Grids**
- **15-16 April: Informal Energy Council** on grid

Role of DSOs as technical enablers of political objectives

EU Objectives

+42,5% RES by 2030 & 600 GW Solar installed by 2030

-55% CO2 by 2030

130M EVs expected on EU roads by 2035 accommodated by 65M chargers

Active customers energy sharing

Doubling deployment rate of individual heat pumps to add 10M units by 2027

70% of RES connected to the distribution grid

General enabler of RES integration and flexibility

85% of charging will happen at home and 6% in the workplace by 2035

Technical realisation

Most heat pumps will need to be connected to the DSO grid

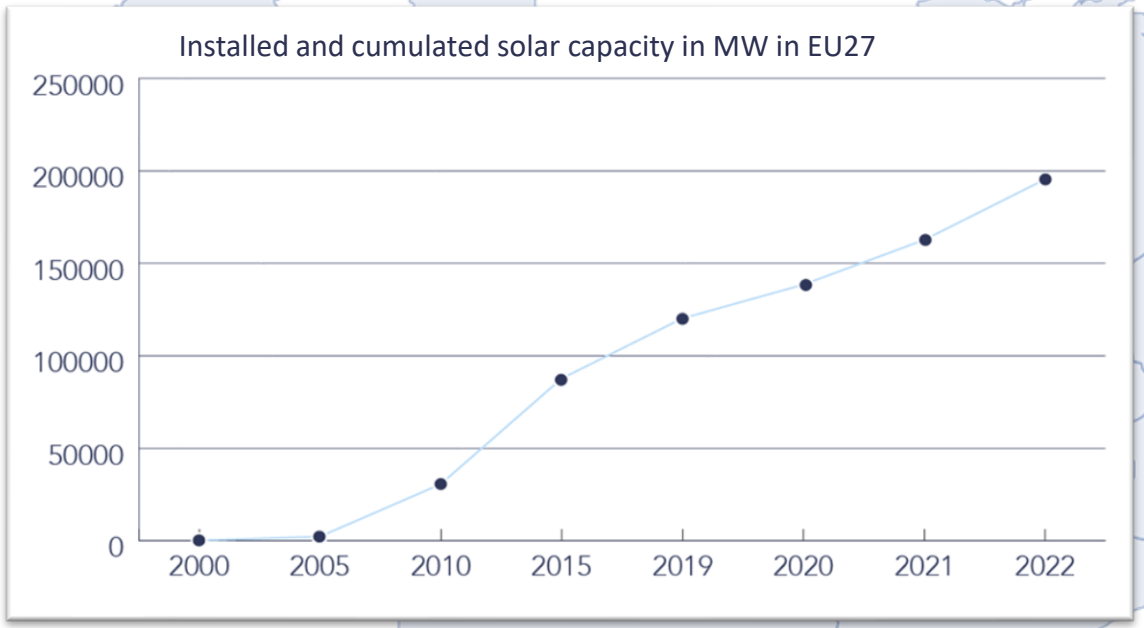
DSO Reality

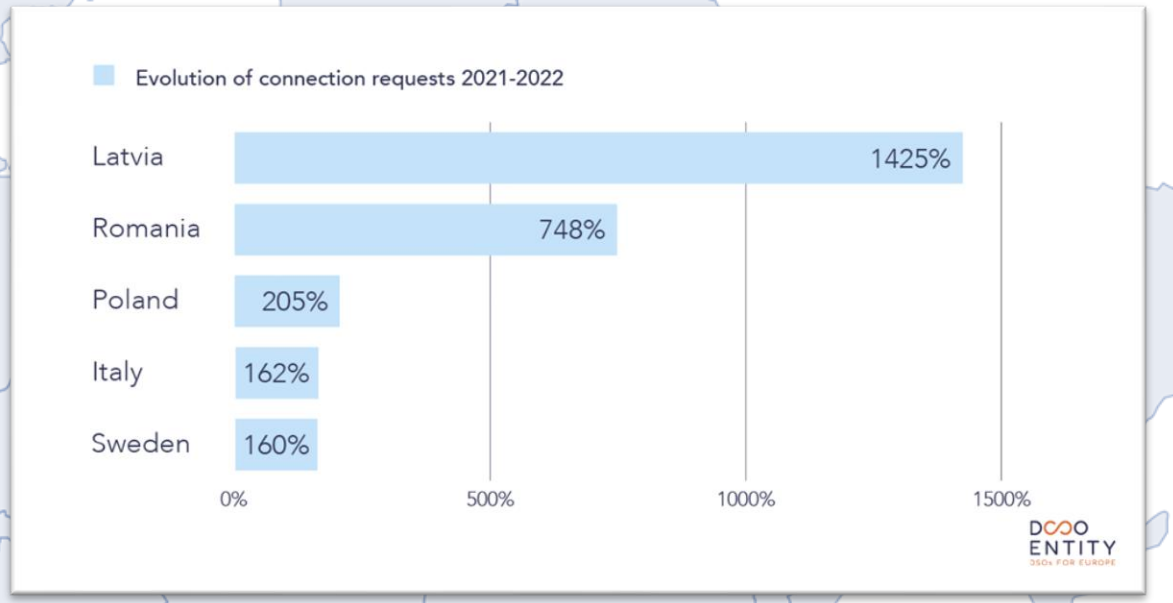
DSOs fit for 55

DSOs are under growing pressure as they face a significant increase in requests for connecting RES

Increased EU's energy targets require grids to adapt their capacity and increase flexibility

70% new RES installed capacity to be connected to DSO grid by 2030





X10 connection requests in some MS

DSO Entity, as part of its mandate, identified key challenges for DSOs & shared best practices

ADDRESSING THE CHALLENGES

High demand in short time

- Austria (Netz Oberösterreich)
- Italy (E-Distribuzione)

Capacity constrains

- Denmark (Netselskabet N1)
- Netherlands (Alliander)

Permitting

- Netherlands (Enexis)
- Portugal (E-Redes)

Investments and funding

- Czech Republic (CEZ Group)

Regulatory framework & technical rules for grid connection

- Lithuania (ESO)
- Italy (E-Distribuzione)
- Republic of Ireland (ESB Networks)

Staff and skills shortage

- France (Enedis)
- Czech Republic (CEZ Group)
- Spain (Iberdrola)

Network tariff regimes

- Belgium/Flanders (Fluvius)

Alignment with the challenges identified in the EU Grid Action Plan

Zoom-in on grid capacity challenge

Action Point 3a

Support DSO grid planning by mapping the existence and characteristics of **DSO development plans** and by improving best practices and recommendations

Long-term

Action Point 6b

(with ENTSO-E)
Agree on harmonized definitions for available **grid hosting capacity** for System Operators and set a pan-EU overview

Short-term

DSO Entity identified in 7 out of the 14 Action Points and key actor to support and deliver the tailored-made measures

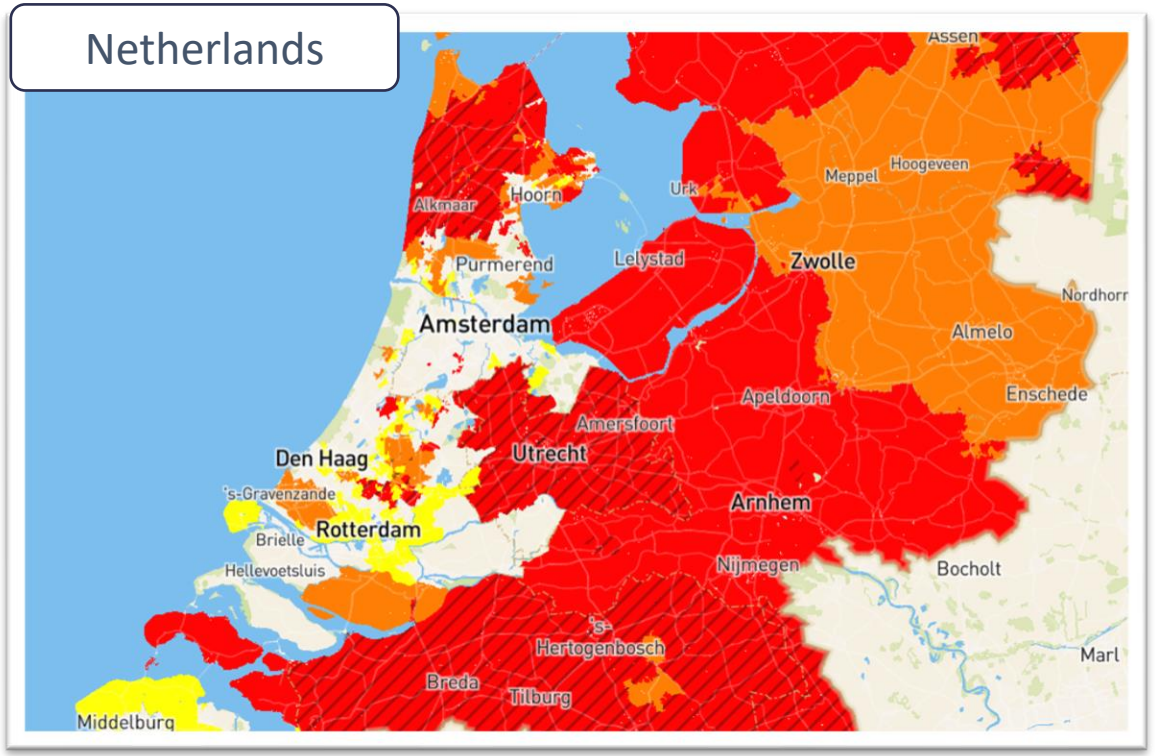
Grid investment & financing | Grid capacity & planning | Grid smartening

Zoom-in on grid capacity challenge for DSOs

Our challenges

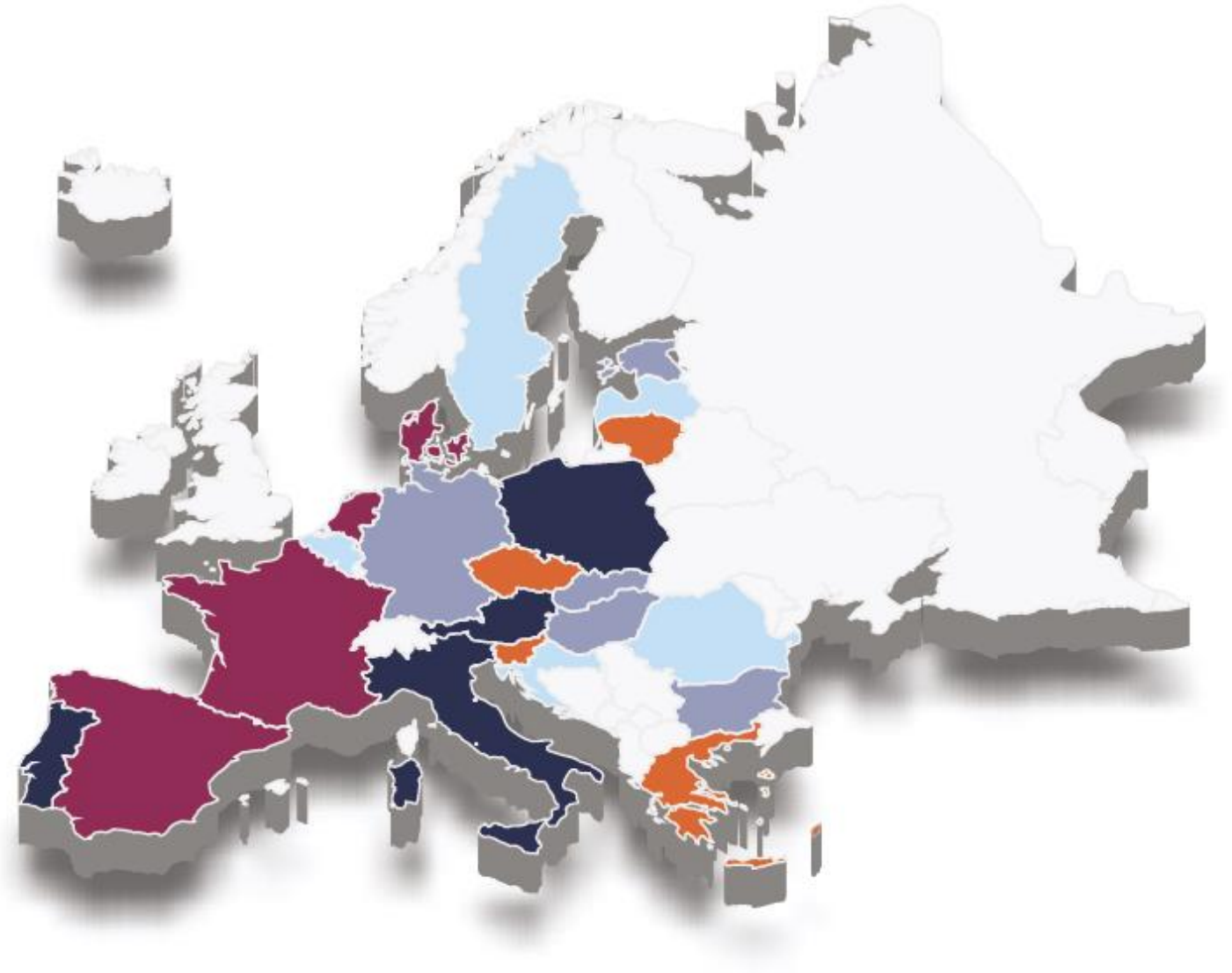
- **40%** of the European Distribution Grids older than **40 years**
- **+60%** electricity consumption by 2030
- **1000 GW** of wind and solar capacity installed by 2030, of which **70%** connected to DSOs
- **€400bn** investments to enable the **energy transition** for the **benefits of European citizens by 2030**

Facing the risk of grid congestion



Feed-in capacity map in Netherlands
Source: Netbeheer Nederland, 2024.

DSOs proactively adapt and innovate to connect renewables to the grids with capacity map tools



+20 Member States have capacity maps or similar tools informing about grid availability

- National capacity mapping
- Individual DSOs initiatives
- One DSO reporting
- Third Party Reporting (e.g. TSOs)
- Comparable information tool

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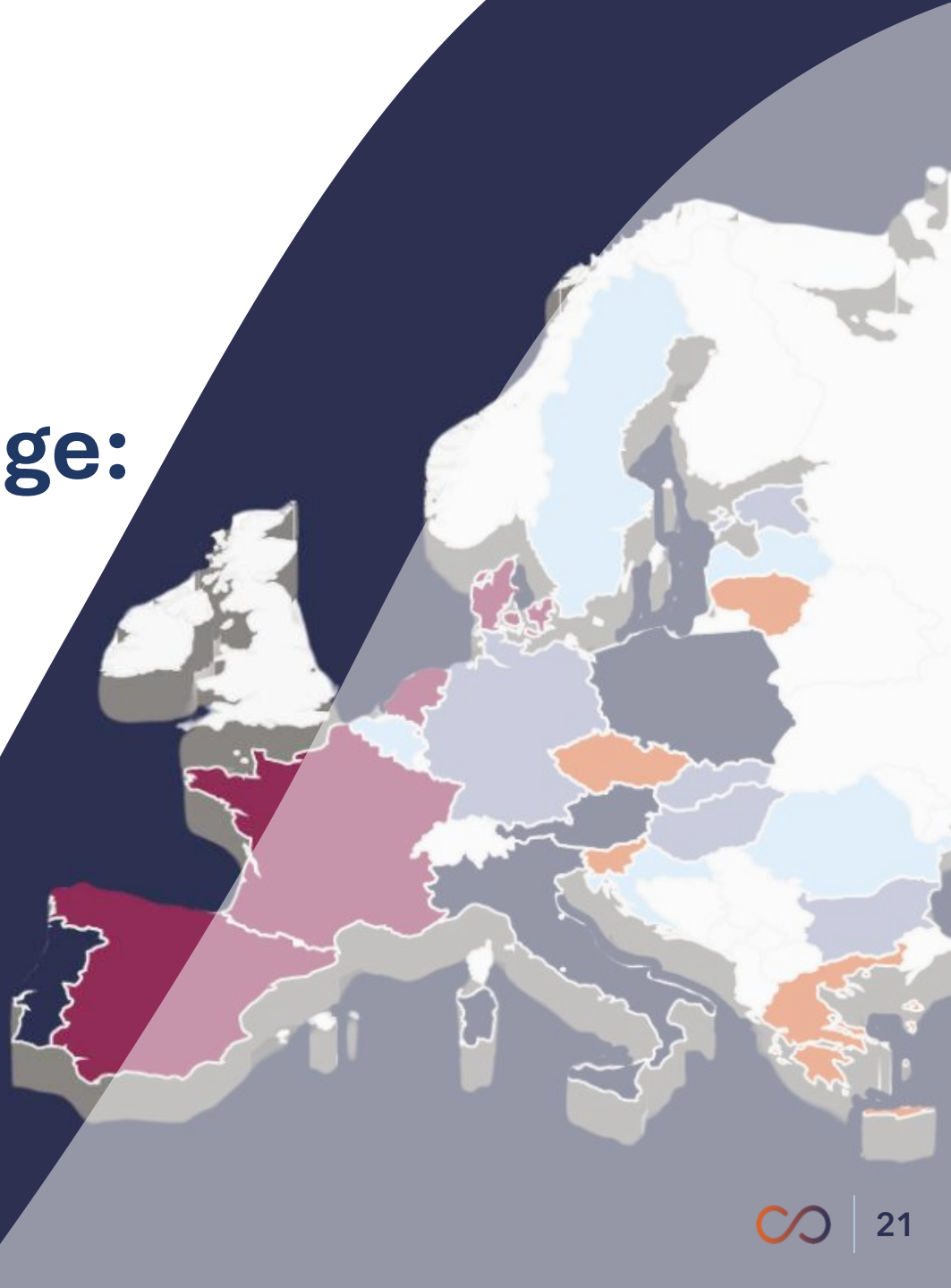
4. Facing grid capacity challenge:

Sharing of best practices from distribution grids



Facing grid capacity challenge: Sharing of best practices from distribution grids

Denmark' s practice: Geo-dependent standard connection fee

Henrik Fiil-Nielsen, Denmark, N1, Director, Head of Regulatory Affairs

Belgium' s practice: Introduction of capacity tariffs

Luc Decoster, Belgium, Fluvius, Regulatory Manager

Netherlands' s practice: Flexible connection agreements

Michiel Roks, Netherlands, Alliander, Senior Advisor Regulatory Affairs

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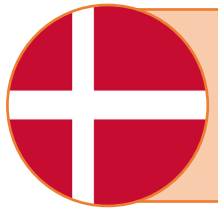

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Facing the grid capacity challenge

Geographically dependent standard connection fees in Denmark

By Henrik Fiil-Nielsen,
Director, Head of Regulatory Affairs

Elnetselskabet N1

What?

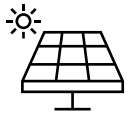
Elnetselskabet N1

A geographically dependent standard connection fee

- Purpose: A **cost-efficient and expedient integration of new energy** production and consumption.

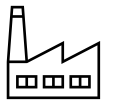
Applies today

✓ **For an electricity producing installation**:
Higher standard connection fee, if built in areas with production surplus. Lower, if consumption surplus.



Likely applies by 2025

✓ **For an electricity consuming installation**:
Higher standard connection fee, if built in areas consumption surplus. Lower, if production surplus.

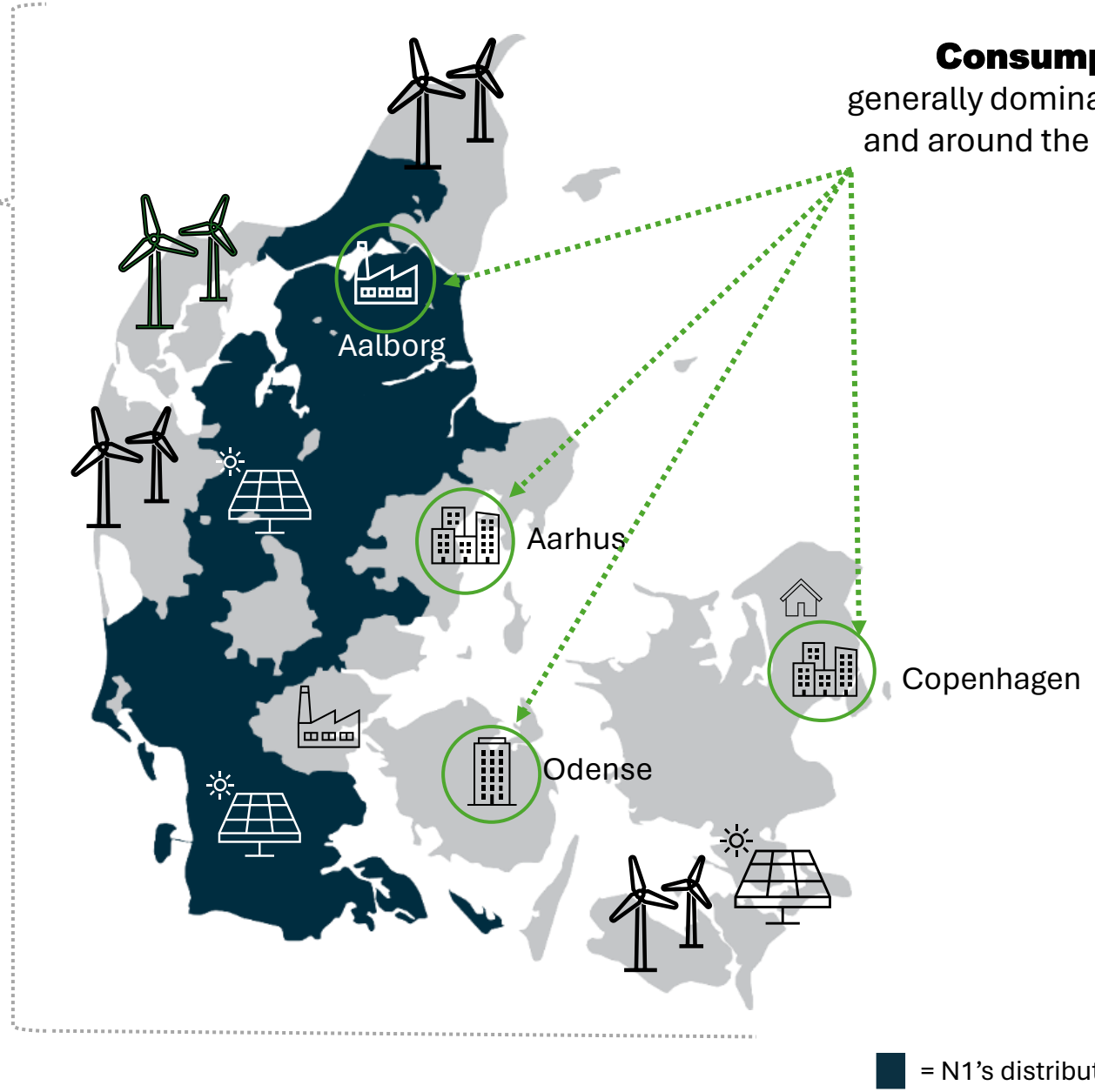


- The **standard connection fee** covers costs of connection **investments for** electricity production and consumption.
- In addition to the connection fee, grid customers pay for **running costs**. This is **not geographically differentiated**.

The basic argument for differentiating by geography in DK

Production
generally dominates away from the major cities

Consumption
generally dominates in and around the major cities



Elnetselskabet N1

Why?

Benefits of a geographically differentiated connection fee

- ✓ Contributes to **better utilization of the grid** by giving incentives for placing new installations in accordance with grid capacity. This:
  - ❖ Alleviates congestion issues and improves cost reflectivity
  - ❖ Reduces the need for reinforcement of the grid
- ✓ Ensures **cost-efficiency** by linking the fee more closely to the impact on the relevant section of the grid – it's not a penalty.
- ✓ Provides **clarity to the grid costumers** about the cost associated with selecting different locations for a project.
- ✓ Allows **faster grid connections.**
- ✓ **Reduces grid loss** by incentivizing production in areas dominated by consumption and vice-versa .

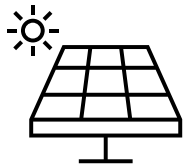
Elnetselskabet N1

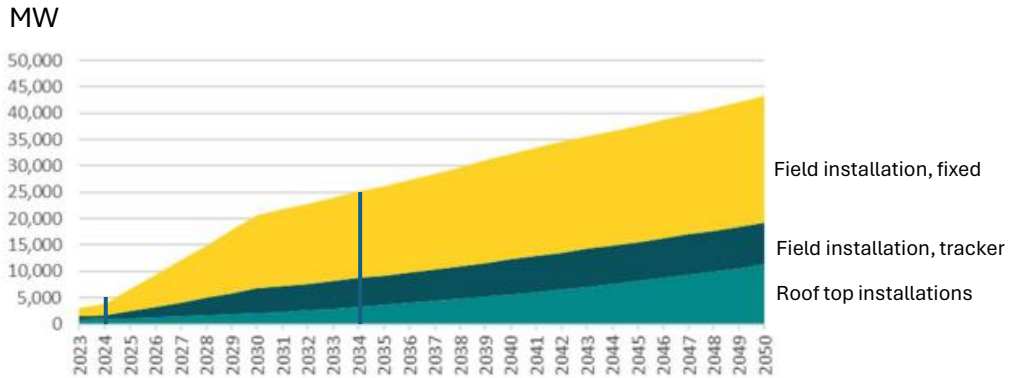
Why now?

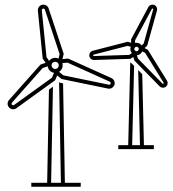
Elnetselskabet N1

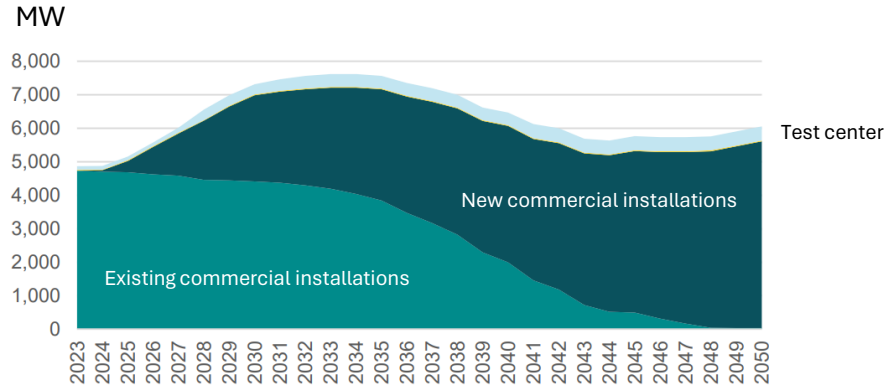
The influx of renewable electricity production projects is remarkable

The Danish Energy Agency projects more than a **fivefold increase** in production capacity from solar energy by 2034 and a (moderate) wave of onshore wind projects.







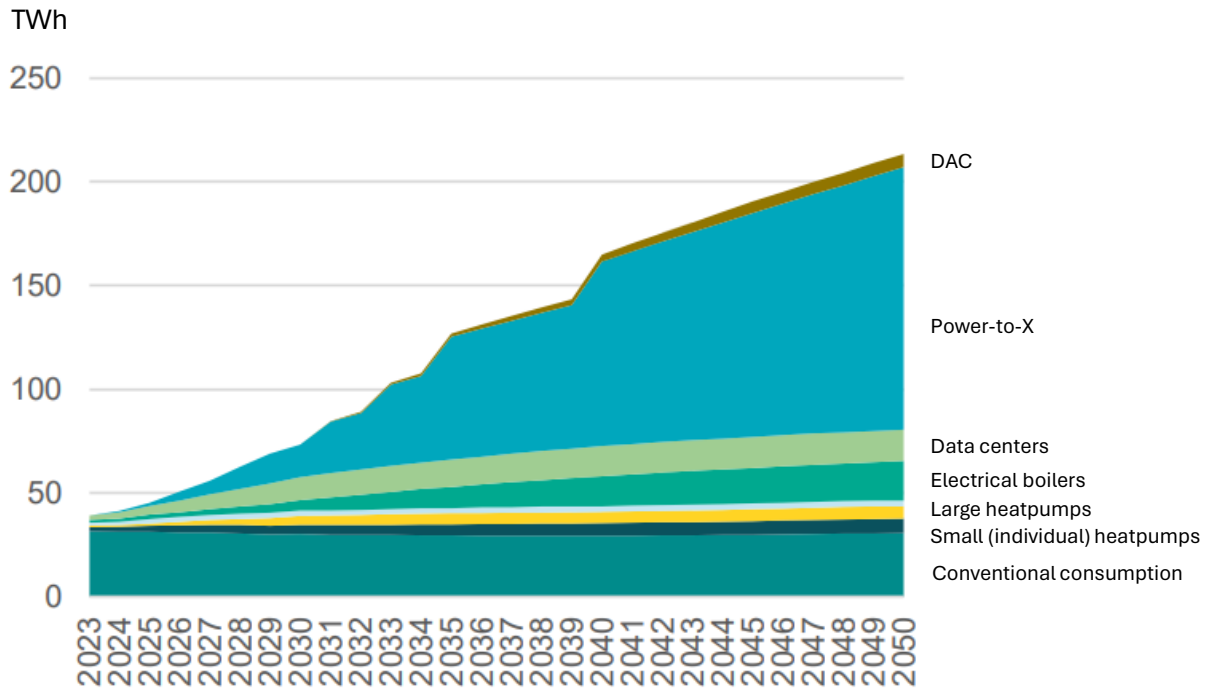


Why now?

Elnetselskabet N1

Denmark is being ‘electrified’ by electric vehicles and power intensive consumers

The Danish Energy Agency projects a massive increase in electricity consumption driven by Power-to-X, datacenters, electrical boilers and heat pumps.



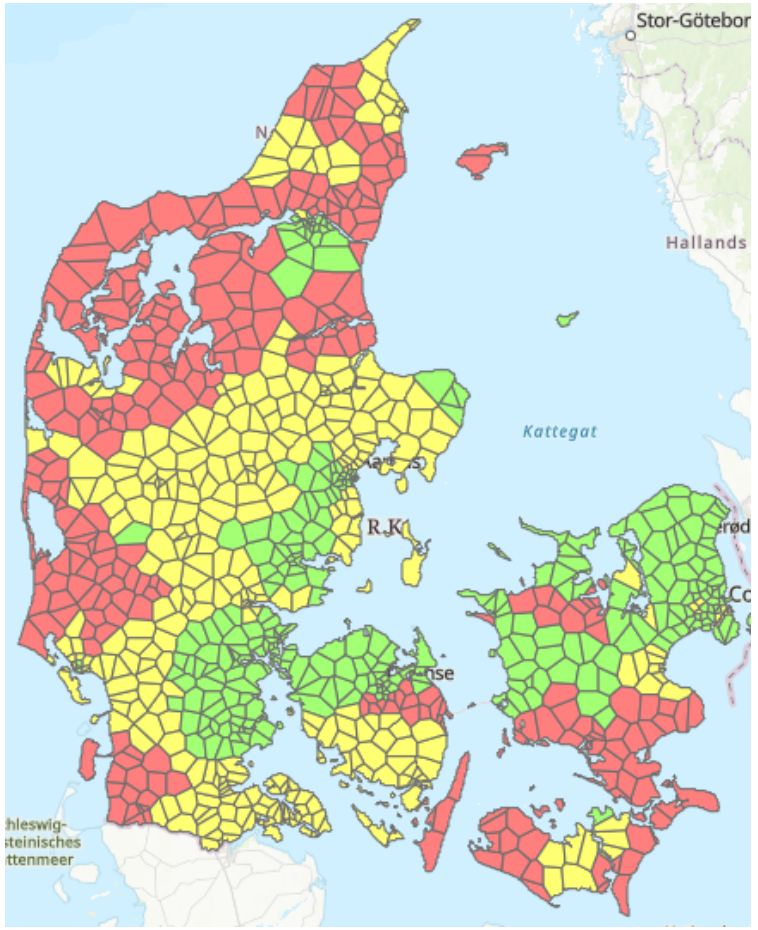
Solution

Elnetselskabet N1

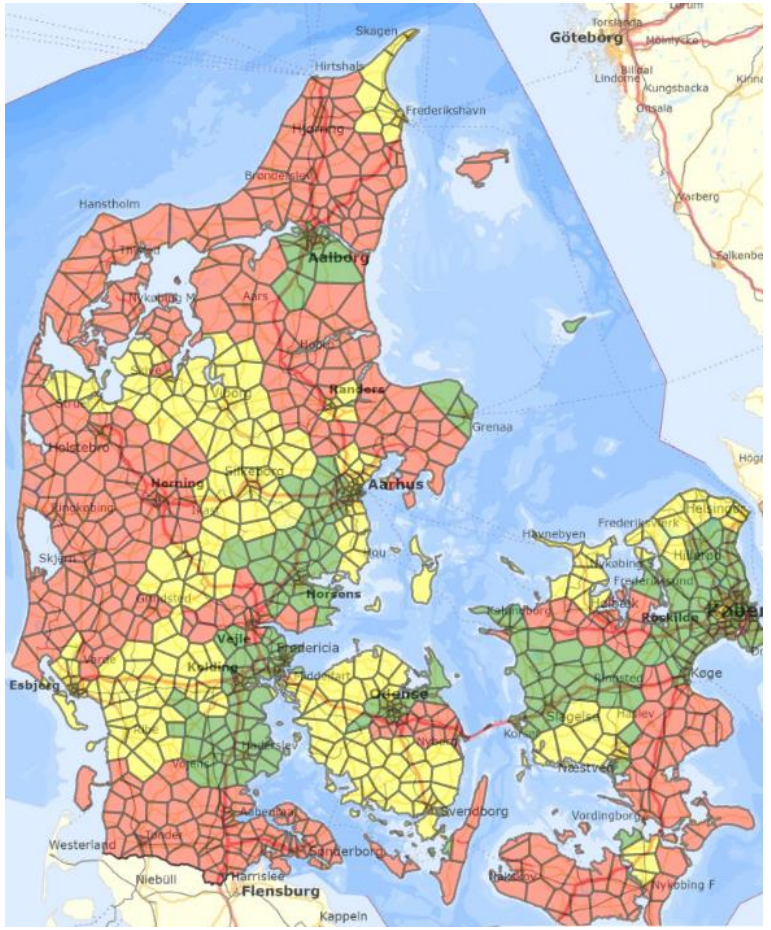
The Geozone map for production

- Updated annually to **reflect if the geozone is dominated by production (red) or consumption (green).** Or it is mixed (yellow)

2023



2024



Solution: Example

Elnetselskabet N1

Geographically differentiated connection fees for production in N1's area

Customer category	Red geozone	Yellow geozone	Green geozone
Unit	[DKK/MVA]	[DKK/MVA]	[DKK/MVA]
A-høj+	66000	55000	49000
A-høj	661000	393000	153000
A-lav	917000	508000	147000
B-høj	1693000	967000	317000
B-lav	2130000	1119000	224000
C	164000	164000	164000

Example

Significantly lower fee in consumption dominated areas (Green geozone)!

Improvements and considerations

Elnetselskabet N1

Improvements:

- ❑ **Geographically differentiated connection fees for consumption** (awaits approval by Danish regulatory authority)
- ❑ **Reflect the flow of electricity in lower levels of the grid.** Today, the categorization is based on the direction of the flow of electricity in the intersection between DSO-grid and TSO-grid.
- ❑ **Align with TSO tariffs** by introducing coherent TSO-DSO tariff design. Reflect the full picture of connection costs by geography.

Considerations:

- ❖ **More regular updates** of the map: Predictability vs. real-time cost reflectivity

Questions?

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Introduction of capacity tariffs in Flanders

Delivering the Fit for 55

How to face the grid capacity challenges

Luc Decoster

Transition manager Fluvius

Webinar : EU – DSO Entity

Friday 12th of April

fluvius.
Tot bij u

Fluvius in the energy landscape:

→ Multi-utility System operator

Electricity & gas distribution

206.000 km distribution grid

2,5 B Turnover
1,2 B Investmen

5500 Employees

6,6 M customers

Regulator

In Vlaanderen is de VREG de regulator (Vlaamse Regulator van de Elektriciteits- en Gasmarkt). De medewerkers adviseren de gewestelijke overheid en controleren de toepassing van decreten en besluiten.

VREG

Production

elektriciteit onder andere in kerncentrales of klassieke centrales met fossiele brandstoffen. Voor groene elektriciteit worden hernieuwbare energiebronnen zoals wind en zon gebruikt.

Import

In België zijn er geen aardgasbronnen. Het aardgas wordt voornamelijk ingevoerd uit Noorwegen, Nederland en Qatar (vloeibaar aardgas = LNG), en in mindere mate uit Rusland en Groot-Brittannië. LNG wordt aangevoerd per methaanschip, via Zeebrugge.

Transport

elia

fluxys

Transport

Fluxys

Fluxys vervoert aardgas vanuit de gasterminals via het hogedruknet, naar de Fluvius-netten e naar grote industriële verbruikers.

fluvius.

Fluvius

In Vlaanderen brengt Fluvius als distributienetbeheerder aardgas en elektriciteit naar de klanten (tot in woningen en kleinere bedrijven).

Klanten

Data Management

Metering company

3,5 M Smart Meters

Public lighting

Supply, services

Bron: www.creg.be

Content

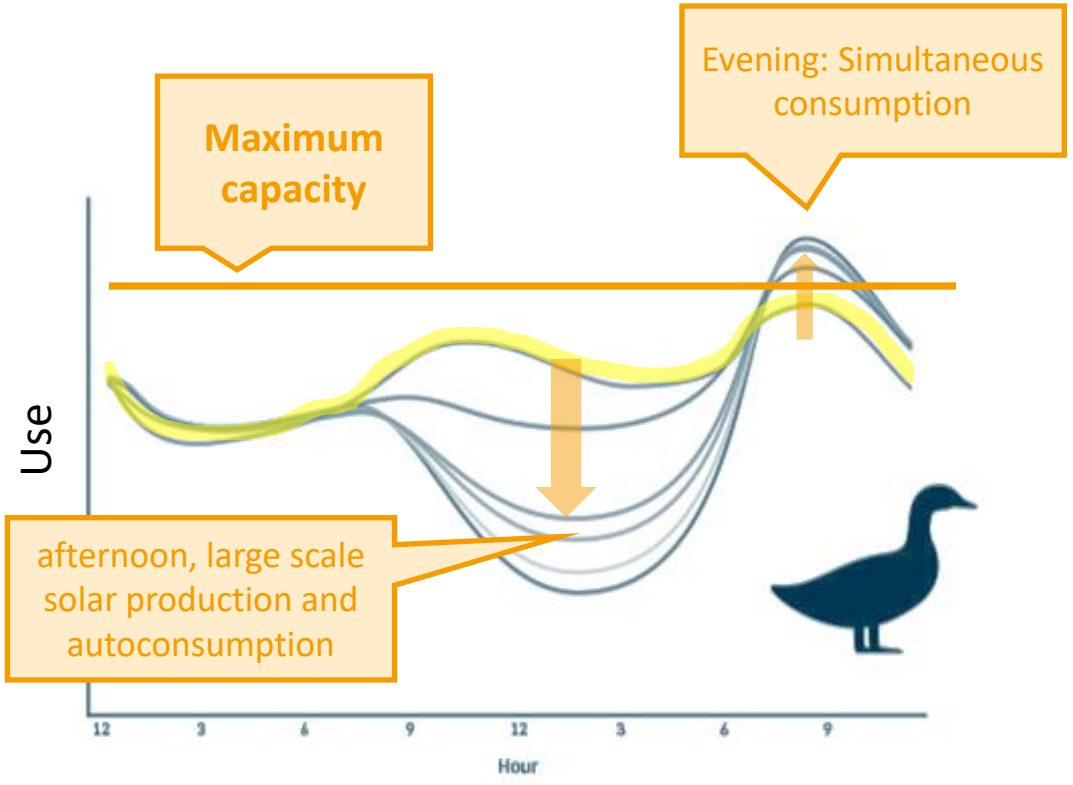
1. System challenges and flexibility

3. Introduction of capacity tariffs

4. Next steps and conclusions

Content

The electricity grid under pressure ?

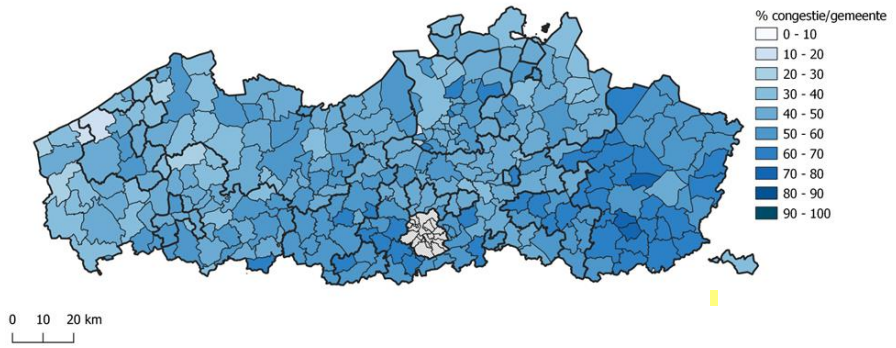


Introduction of production and storage

Change of consumption behaviour

New products and services in the market

Estimated amount of networks with congestion risk



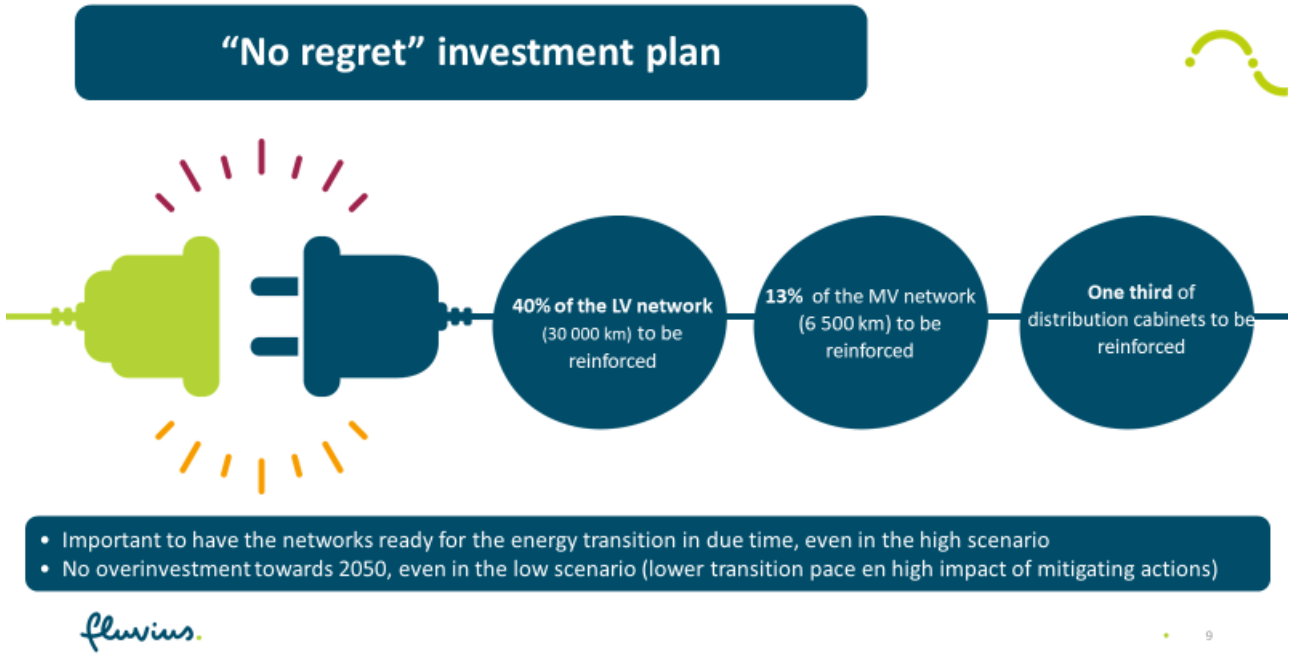
Preparing our grids for the future in order to facilitate the energy transition

fluvius.

The DSO Investment Plan?

- Specific plan with regard to the planned investments in the distribution networks of electricity and gas, for the coming 10 years

What is the aggregated impact on the grid towards 2035 and 2050?



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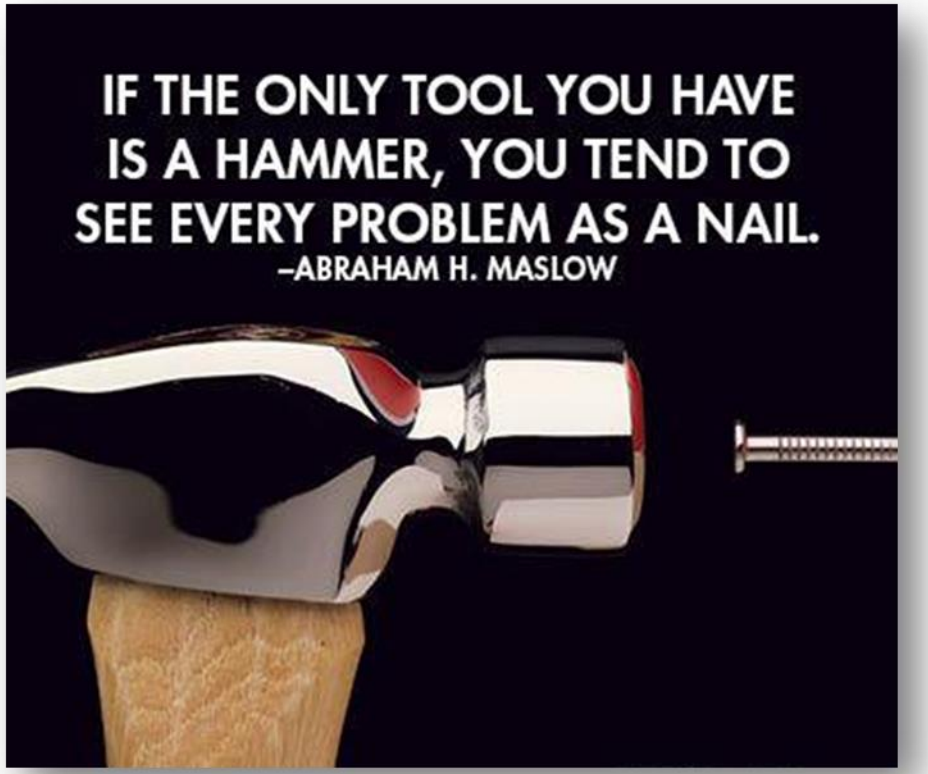
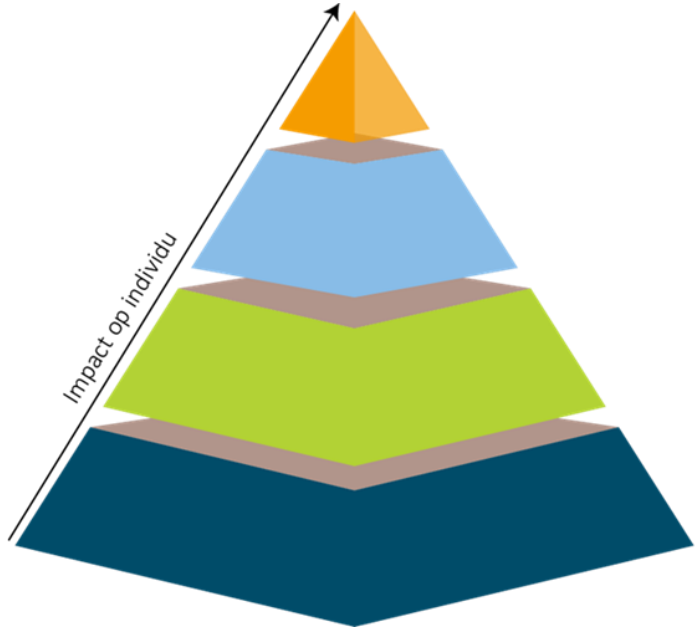
Investment versus flexibility

- System foundation: ‘No-regret’ investments plan
- System optimization: Evolving on every section of the piramid





- Regulated solutions
  - Direct control
- Market based solution
  - Flex Procurement
- Tariff design
  - Implicit flexibility
- Infrastructure
  - Smart Grid

Content

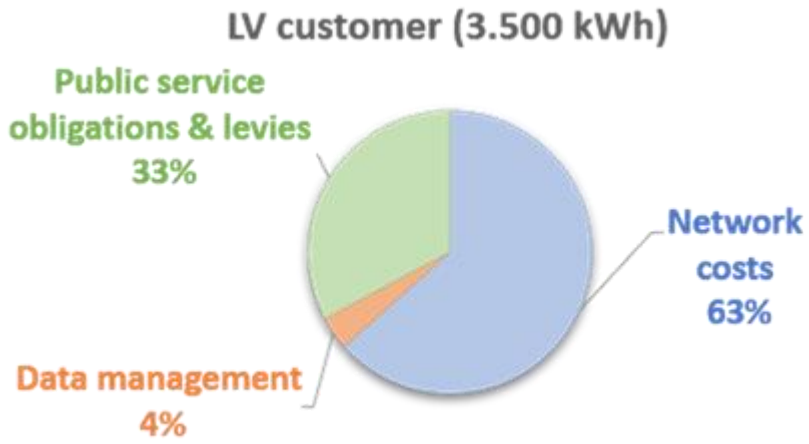
1. System challenges and flexibility

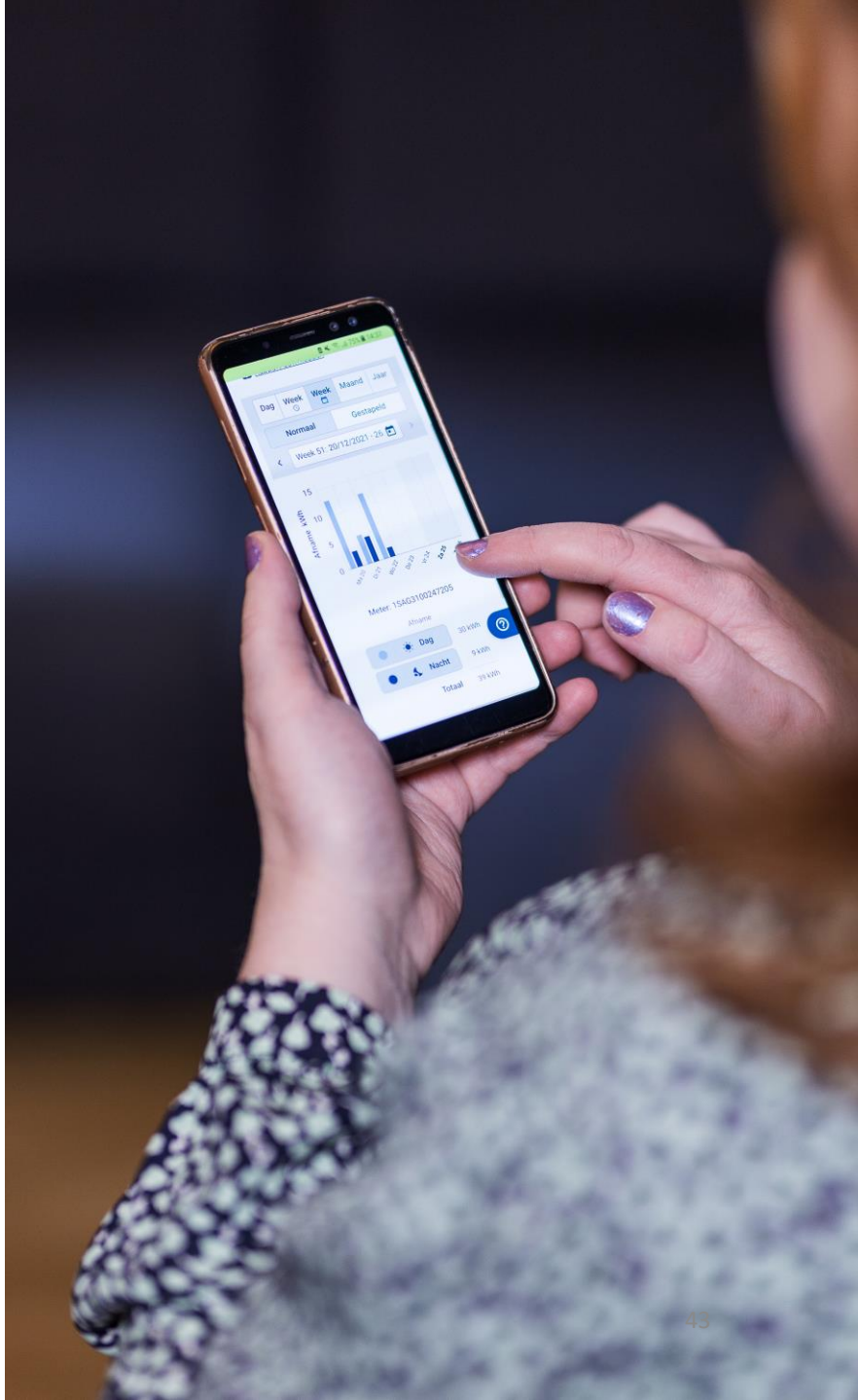
3. Introduction of capacity tariffs

4. Next steps and conclusions

What?

- Introduction of capacity as a cost driver in the grid tariffs
  - Peak tariff (EUR/kW)
  - Applicable from January 1th 2023
- For all customers in Flanders
  - Residential and professional customers
  - Exemption for protected customers
- No additional tariff (for electricity only)
  - Alternative for volume based cost
  - **Allocation grid cost in a different way**





Capacity tariffs

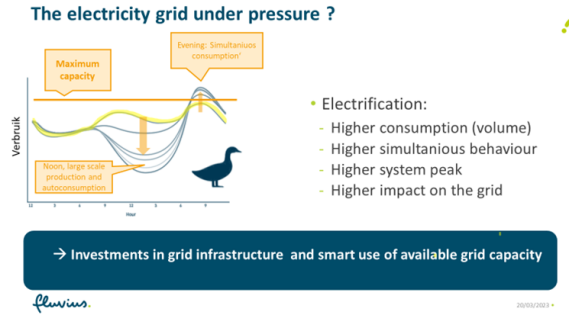
Implicit flexibility

Optimal use of the distribution grid

Introducing capacity component in the grid tariffs

Transparant, Cost reflective grid tariffs

- ✓ *Secure optimal use of the grid*
- ✓ *Reduce system peak, avoid congestion*
- ✓ *Reducing future investments in infrastructure*



- ✓ *Optimizing individual behaviour*
- ✓ *Reduce individual energy bills by shifting consumption and peak reduction*
- ✓ *Share the available grid capacity*

fluvius.

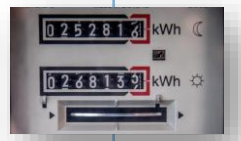
LV capacity tariff → analogue or digital meter tariff

Low voltage customers

Introduction of capacity (kW) based tariff for 80 % of the network cost
No time of use differences (day/night) tariffs
Distinction in classic/analogue meter tariff and digital meter tariff
The capacity tariff is not applicable for protected customers (social/lower tariff)

Analogue meter = peak cannot be measured

- **+ fixed minimum contribution of 2,5 kW** (+/- 100 Euro/annual basis)
- + total offtake * euro/kWh (for a customer with a classic meter this tariff is higher compared to a digital meter customer)



Digitale meter = billing peak

- **+ Measured peak** (calculation based on monthly peak) *** EUR/kW (min. 2,5kW)**
- + total offtake * euro/kWh (for a digital meter customer this tariff is lower compared to a customer with an analogue meter

➔ In general, the **impact** of the capacity tariff is **limited** for most customers, except for:

- Customers with very small consumtion: e.g. second (holiday)stays
  = on average they pay more (due to the minimum contribution)
- Customers with very large consumtion: electric vehicles, heat pumps
  = on average they pay less (if no excessive peak), spreading of consumption is rewarded

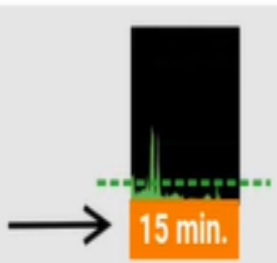
LV capacity tariff – digital meter tariff

QUARTER-HOUR consumption from the digital meter

QUARTER-HOUR power (= average power within the 15')

MONTHLY PEAK (= highest quarter-hour power in every month)

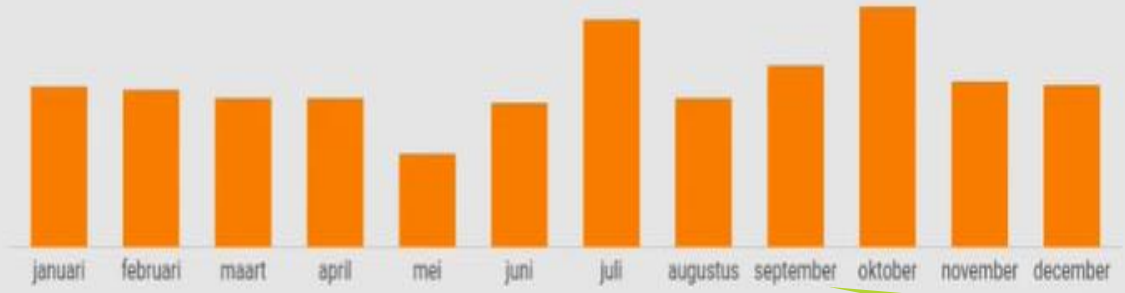
AVERAGE MONTHLY PEAK (= yearly average of the monthly peaks of the last 12 months)



Short peaks within 15' are levelled out by the average per 15'

Injection peaks are registered seperately and are not billed via a capacity tariff

Kwartiervermogen = het gemiddelde vermogen op kwartierbasis (in kW)



Maandpiek = het hoogste kwartiervermogen in de maand (in kW)

With a minimum of 2,5kW

Gemiddelde maandpiek = het gemiddelde van de pieken van de voorafgaande 12 maanden

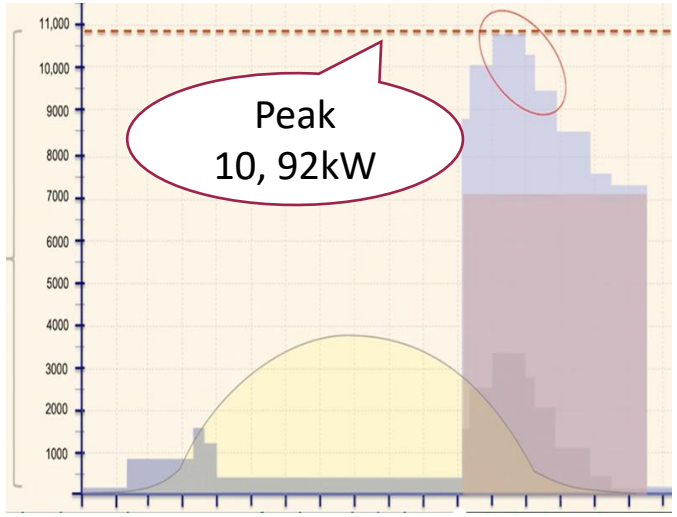
What is finally billed to customers?

BILLING PEAK * EUR/kW

= weighted average of the average monthly peaks since the last invoice

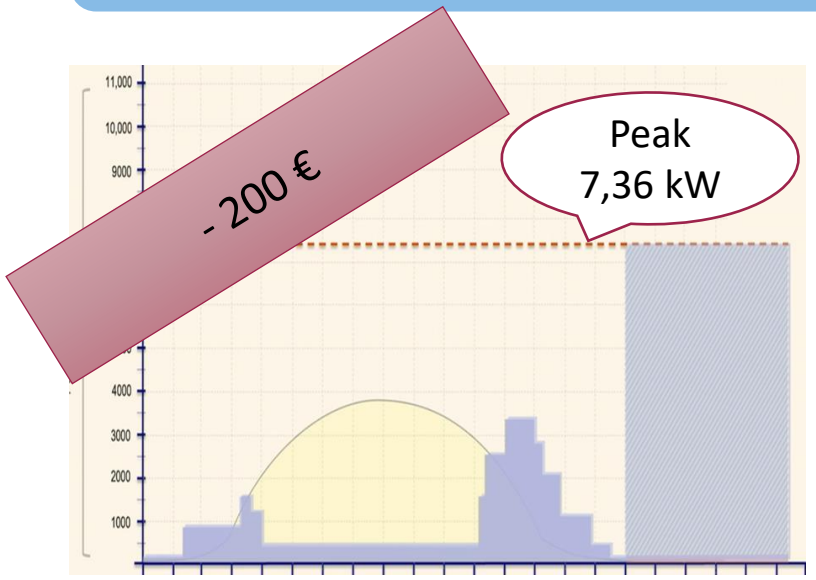
Impact for the customer (ex. EV charging)

No shifting

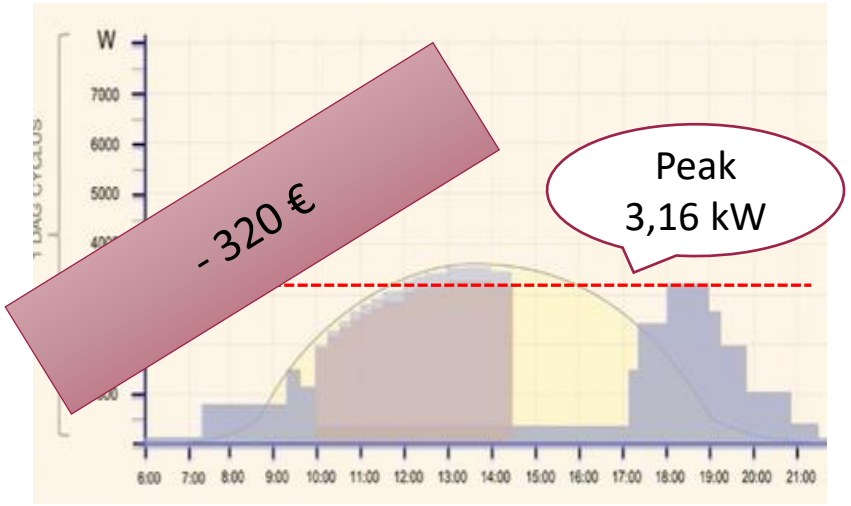


Hi power charging no shifting of consumption:
➔ Significant peak and billing

Shifting



Charging shifted from normal consumption
➔ Less significant peak and bill savings



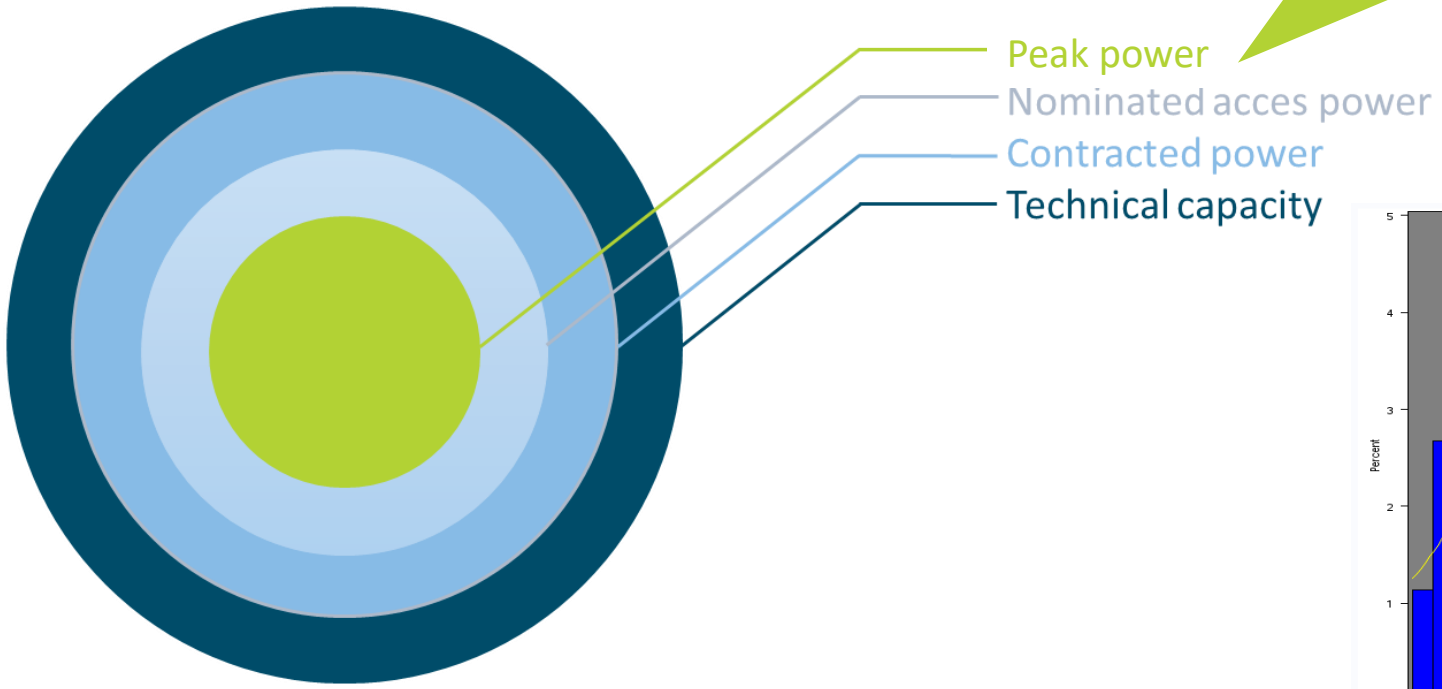
Smart charging, low volume and during solar production:
➔ No additional peak and use of own solar production

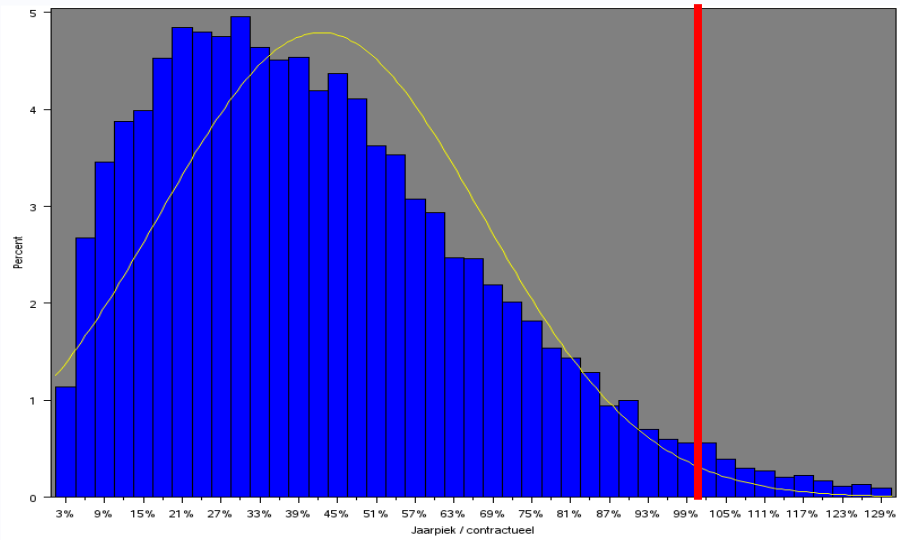
MV capacity tariff – what is the access power ?

Customers at medium voltage

- Before 2023: gridfee tariffs already billed based on via peak tariff (EUR/kW)
- As from January 2023: capacity/peak tariffs term becomes more important and is calculated in a different way, customers will need to nominate an expected peak power (=access power)

= No extra tariff but a replacement of the previous peak tariff system for billing the network costs

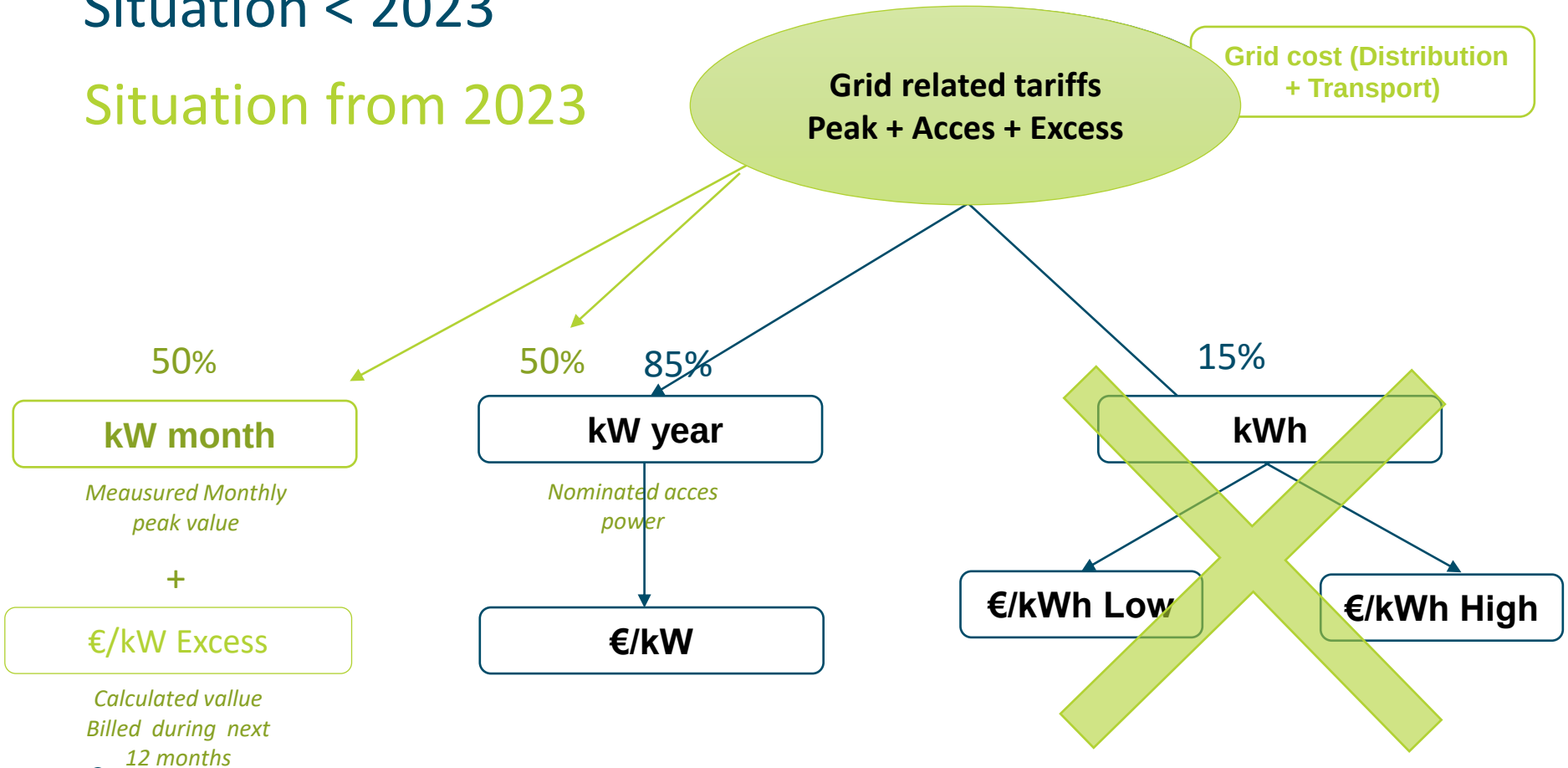




New capacity tariffs for large professionals and industrial customers

Situation < 2023

Situation from 2023



Reactive energy (EUR/kVArh)

From monthly to 15' based calculation

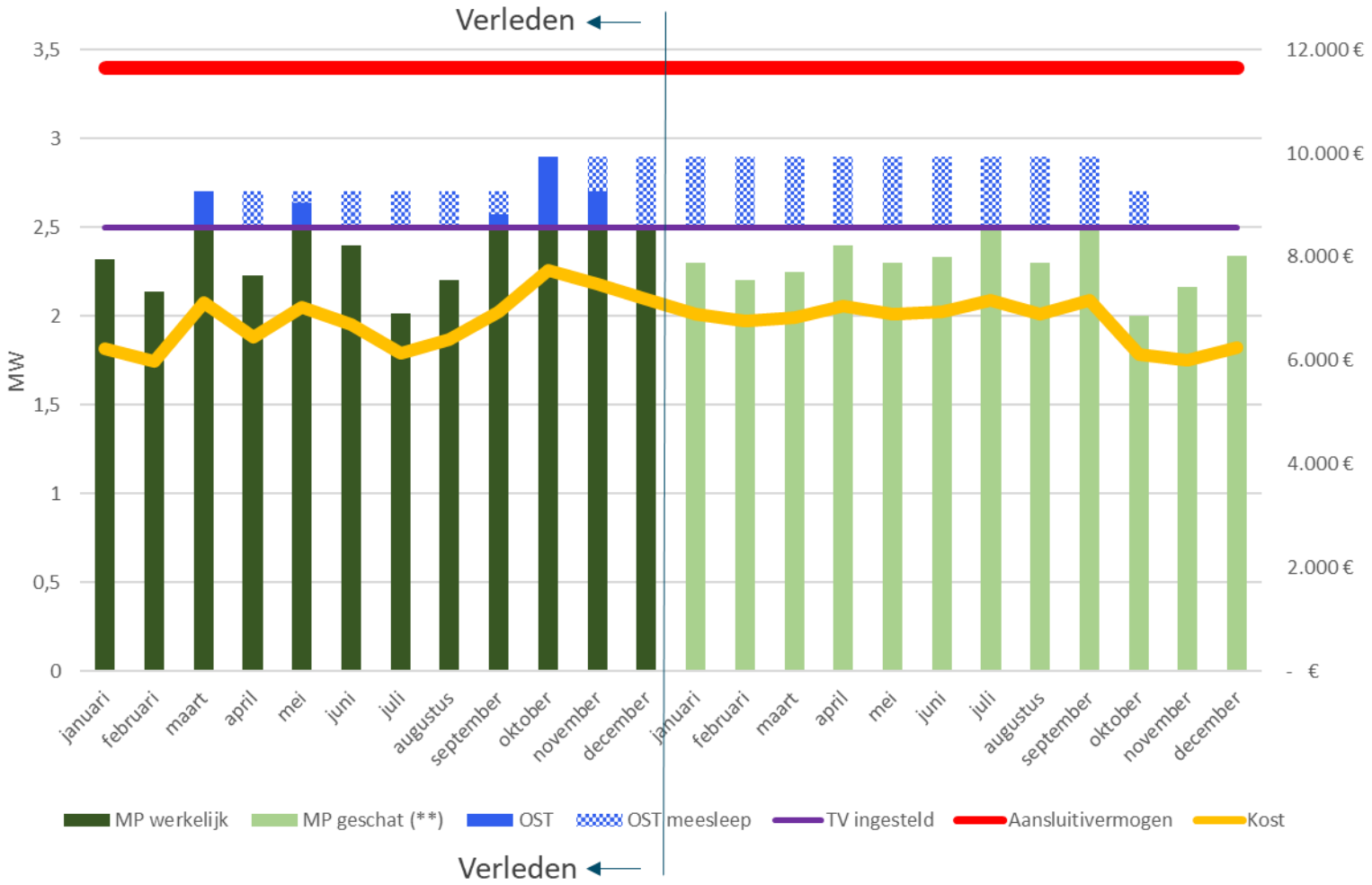
Data Management (EUR/year)

Taxes/ Levies / obligations (EUR/kWh)

Specific Transmission cost (EUR/kWh)

MV capacity tariff – tariff drivers

Capacity tariff for billing network costs to medium voltage customers (= monthly billing), no volume based network costs (€/kwh) anymore



Connection power

Nominated **Access Power (AP)**

- 50% network costs
- Ex ante customer nomination
  - Increase AP: monthly
  - Decrease AP: 12 months after final increase

Monthly (measured) **Piek (MP)**

- 50% budgetted network costs
- Ex Post – highest monthly peak

Penalty for exceeding nomination

- Penalty if MP>AP, calculated by: MP – AP
- 1,5x tariff of AP
- Is billed for the next 12 months

Content

1. System challenges and flexibility

3. Introduction of capacity tariffs

4. Next steps and conclusions

First results

Impact customer (test on 25,000 LV customers)

- First positive trends are visible
- Customers are reacting to the new tariffs (-8,3 % - 150 W)
- In specific customers with new flexible appliances (- 13,6 % -1,5 kW)
- Positive impact on the energy bill

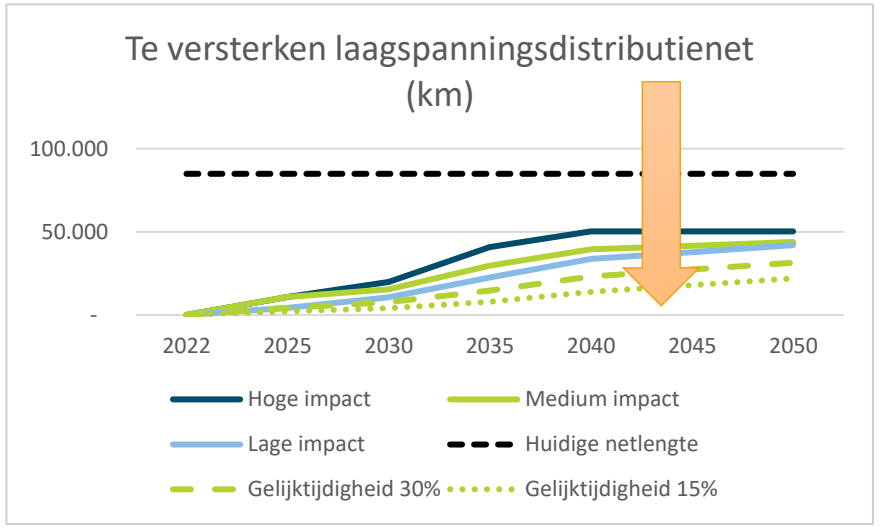
Impact for the DSO

- Lower individual peak leads to lower system peak (1500 kW on substation level)
- Positive outlook on reducing future grid investments

Follow up of results

- On wider population (>100.000 customers)
- On price elasticity and interaction with market

Optimizing individual energy consumption contributes to reduction of the system peak and reduces future investments



Next steps

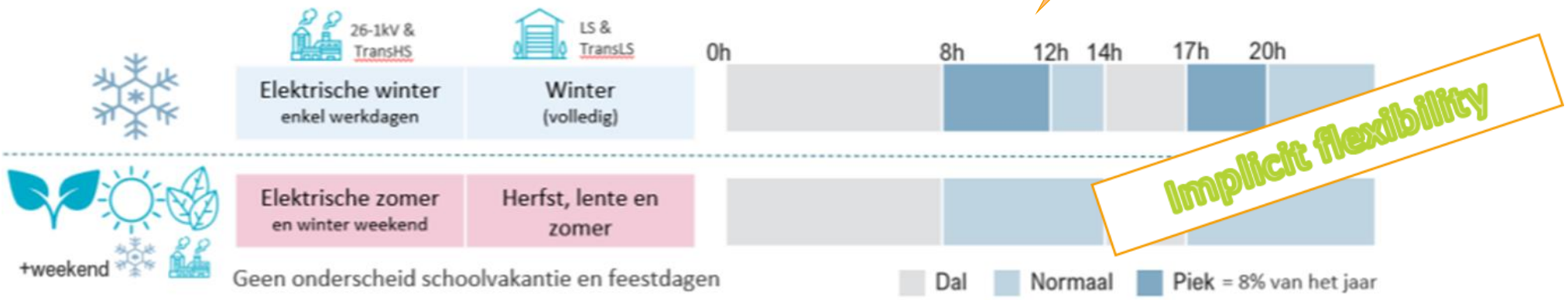
Follow up of first results

- Confirm positive behaviour on wider population
- Translate positive effects in investment plan

Introduction of “Time of Use” tariffs

- Investigate price elasticity
- Investigate further grid optimization opportunities

Additional time frames lead to further optimisation of the individual energy consumption and will contribute to further reduction of the system peak



Conclusions

Electrification will rapidly increase in next decennia

- We need to prepare the grid for the future challenges of the energy transition

We will need to increase investments in electricity networks

- We need to invest in flexibility in order to keep further investments under control

Introduction of a cost reflective capacity tariff leads to individual optimization for the customer and contributes to reducing overall system investment costs.

4. Facing grid capacity challenge: Sharing of best practices from distribution grids

Denmark' s practice: Geo-dependent standard connection fee

Henrik Fiil-Nielsen, Denmark, N1, Director, Head of Regulatory Affairs

Belgium' s practice: Introduction of capacity tariffs

Luc Decoster, Belgium, Fluvius, Regulatory Manager

Netherlands' s practice: Flexible connection agreements

Michiel Roks, Netherlands, Alliander, Senior Advisor Regulatory Affairs

Samira Rotteveel, Netherlands, Alliander, Policy Advisor

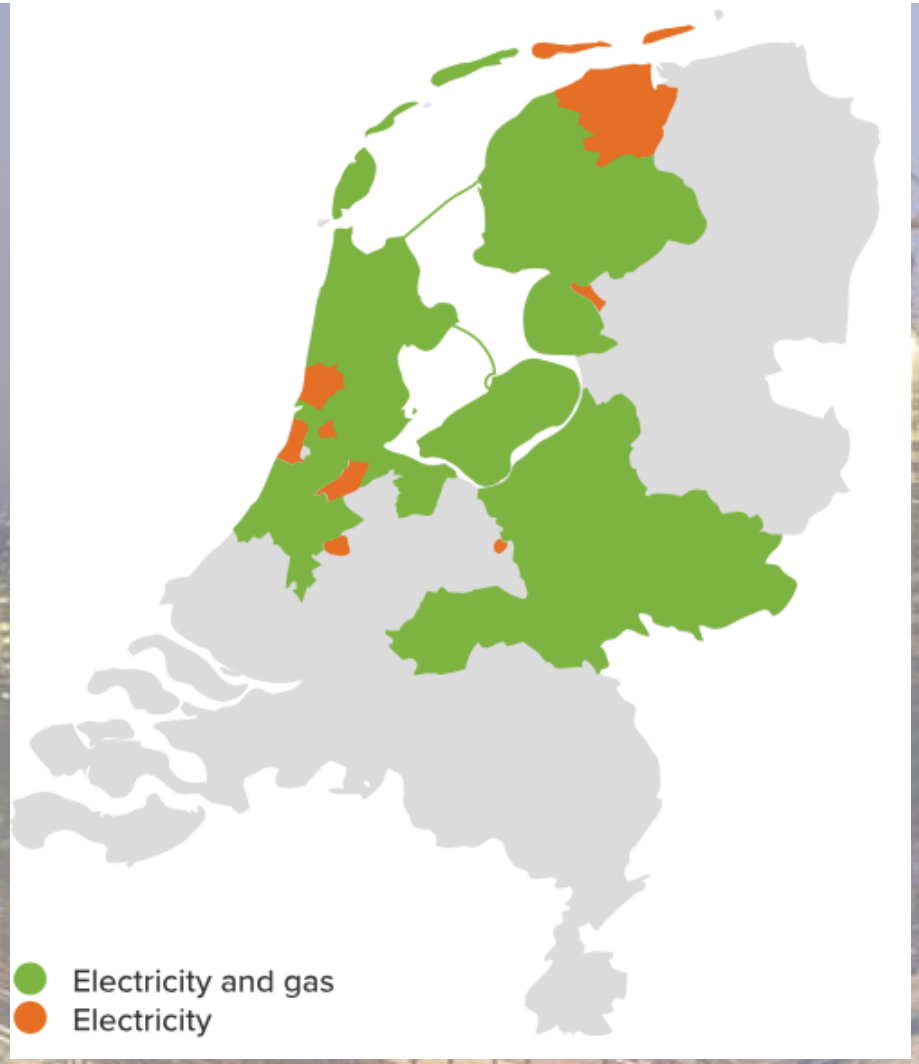
Flexible connections in the Netherlands

Michiel Roks
Samira Rotteveel

Agenda

- Introduction of the Dutch grid challenges
- Flexible connections in the Netherlands

Alliander

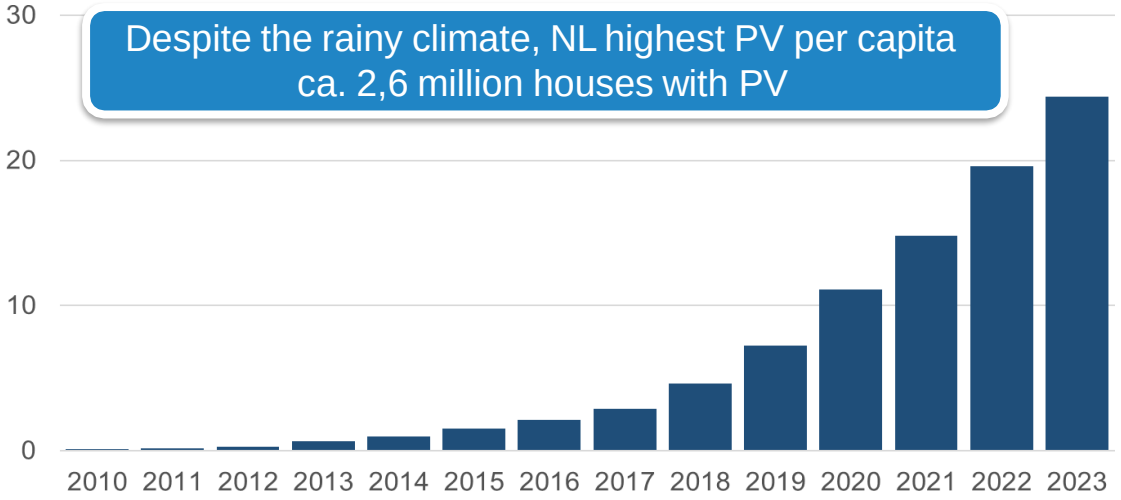


- Liander (DSO), Firan (district heating), Entrnce (platform)
- 95.000 km grid
- 5.9 Million connections
- 7000+ employees
- >1B annual investment
- Reliable grid <21 min/year outage

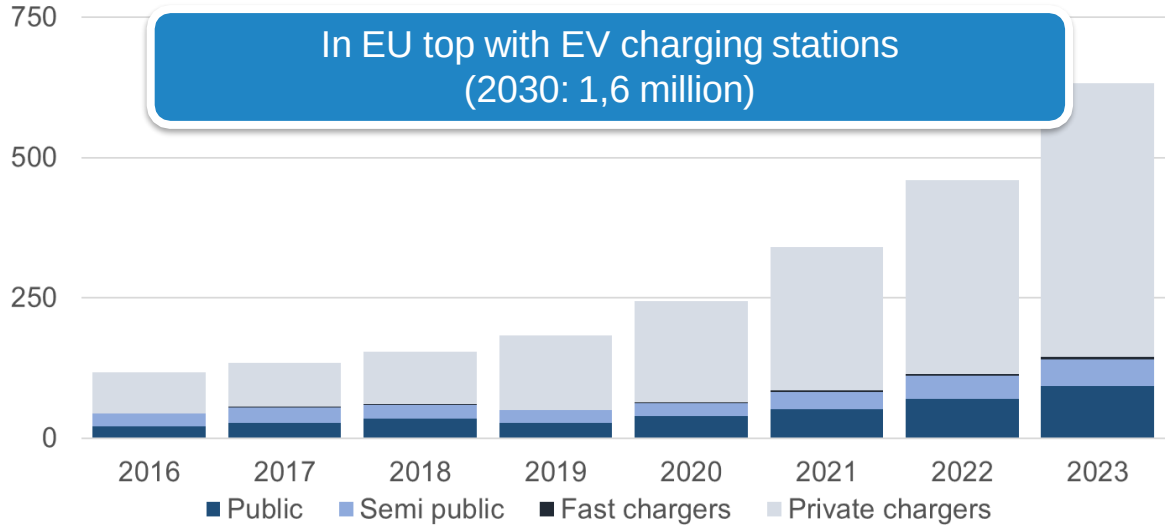
source: CBS & NAL

Sustainable developments faster than new grid capacity

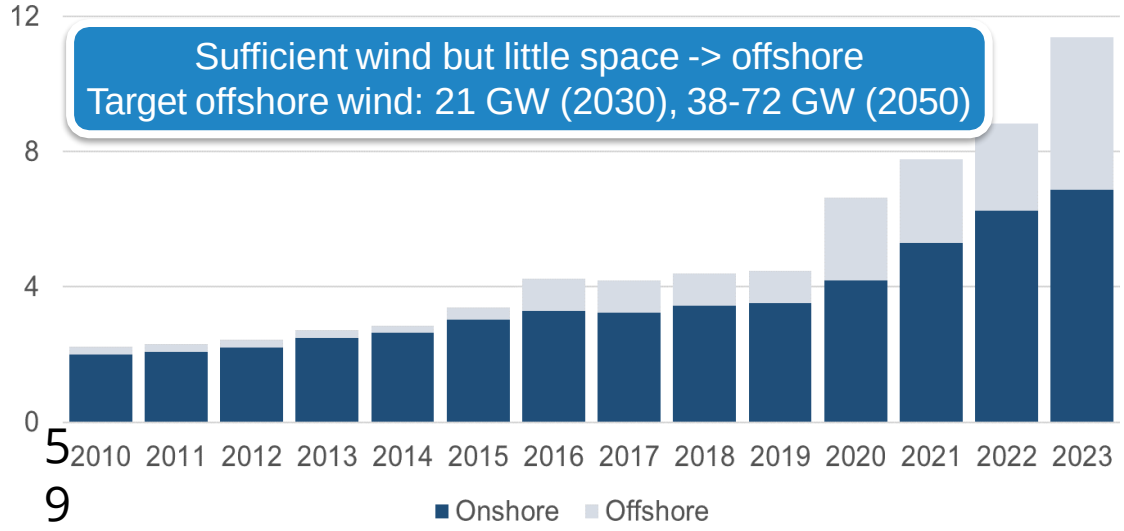
PV [GW]



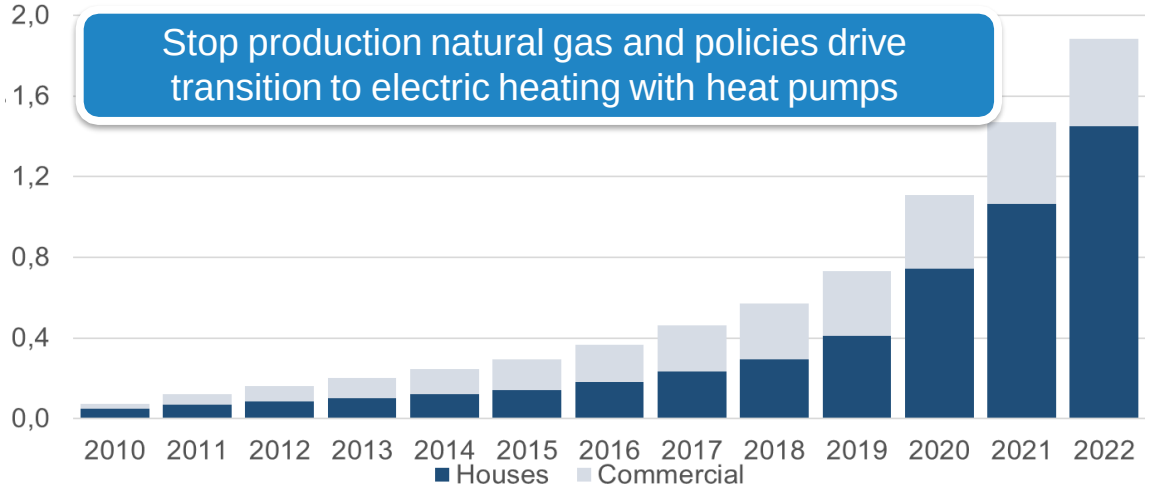
Chargers [# * thousand]



Wind [GW]



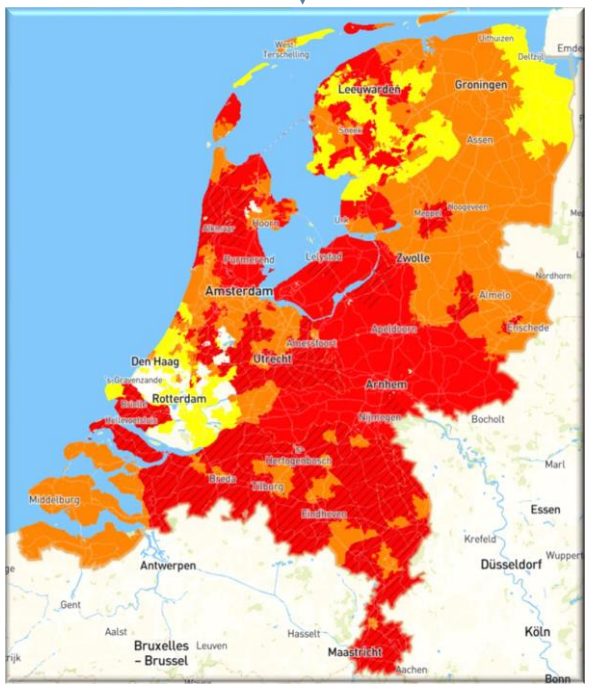
Heat pumps [# * million]

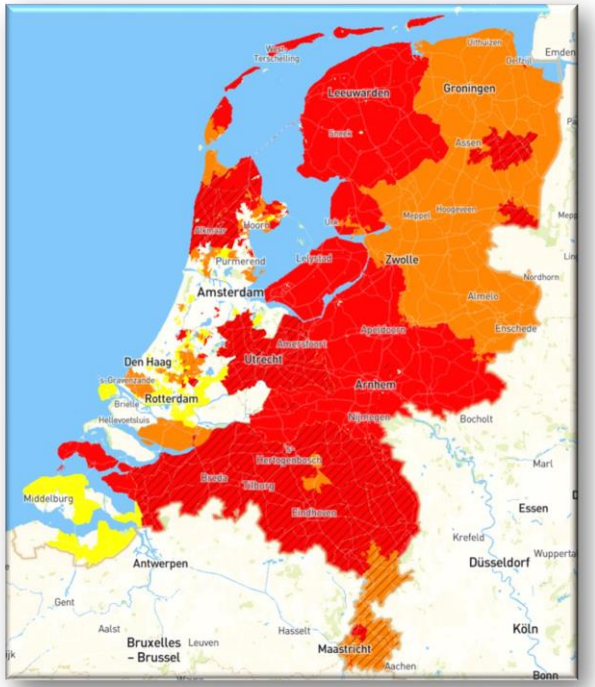


Lack of capacity to connect demand and generation

- Accelerated phase-out of natural gas
- Yearly 50% growth solar-PV
- 1.000.000 new homes all-electric by 2030
- 1.6 million chargers for EV by 2030
- Steep growth of datacenters
- Industry shifting to electricity & hydrogen

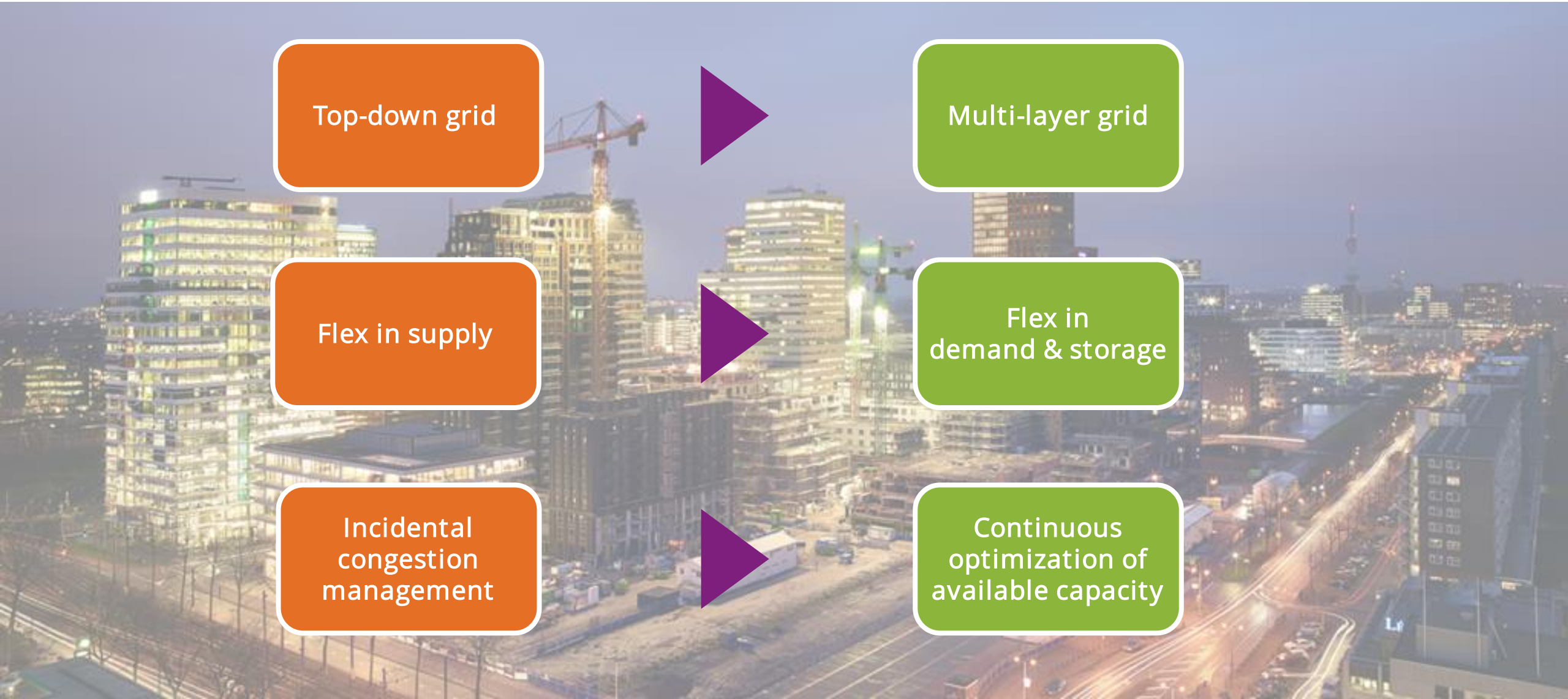
Transport capacity (electricity demand)





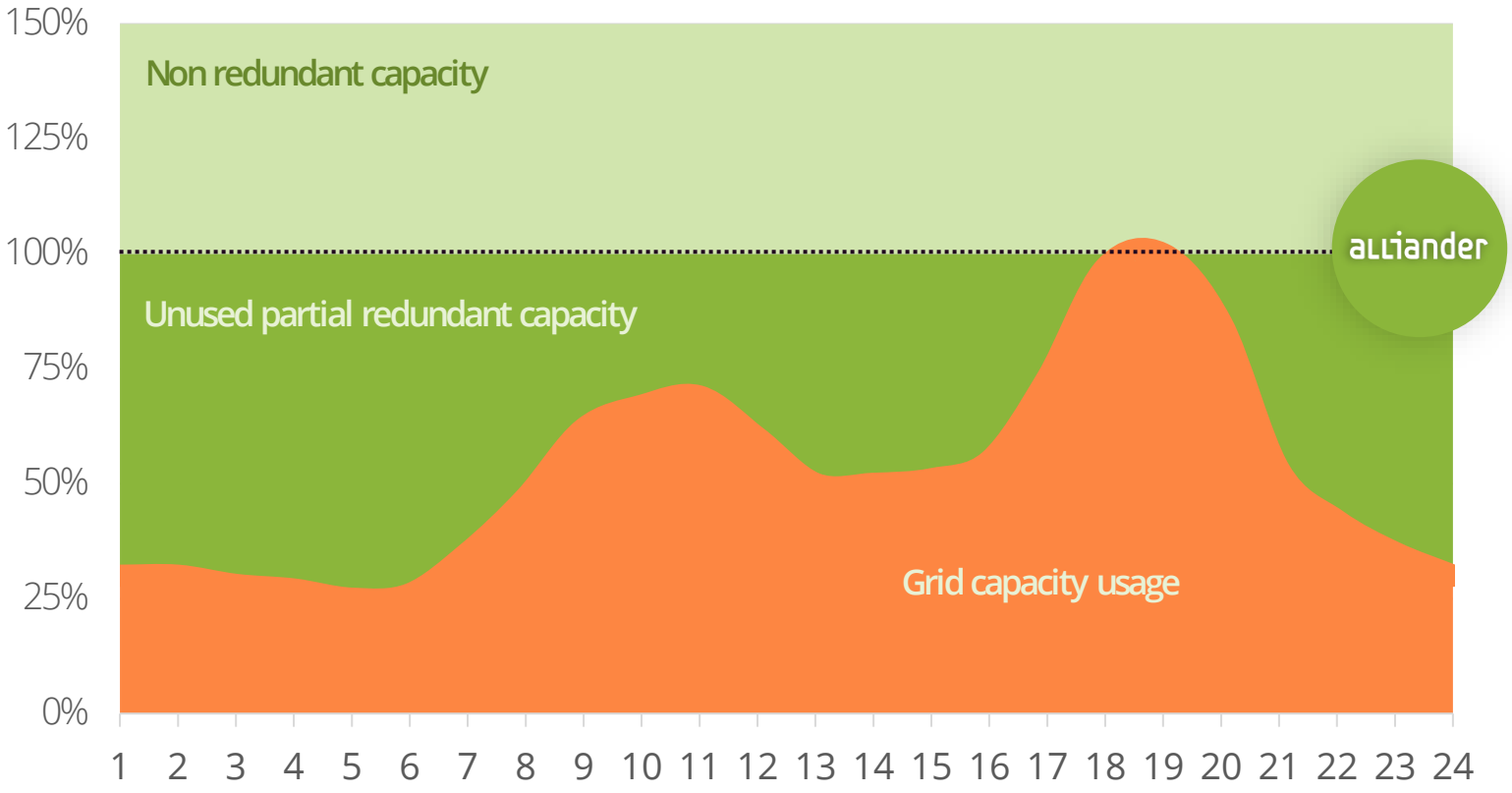
Transport capacity (electricity supply)

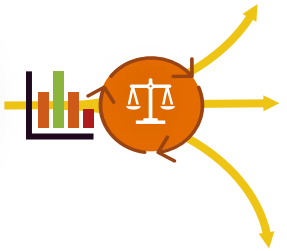
Fundamental changes towards a future-proof grid



Flexible capacity – releasing the maximum potential

The traditional connection agreement grants a 24/7 right to use the grid at a certain capacity. In practice, customers rarely use their full capacity and therefore unused capacity emerges in the night and (increasingly) during midday. Flexible connection agreements range of non-24/7 products with varying guarantees at an attractive price





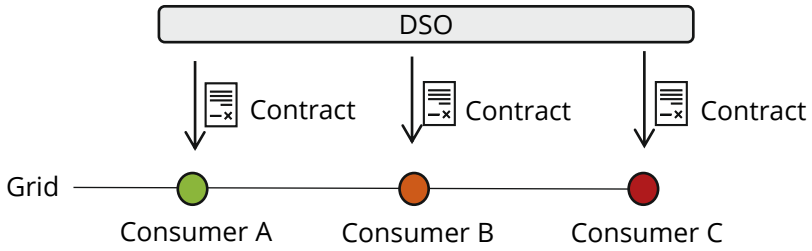
No guarantees

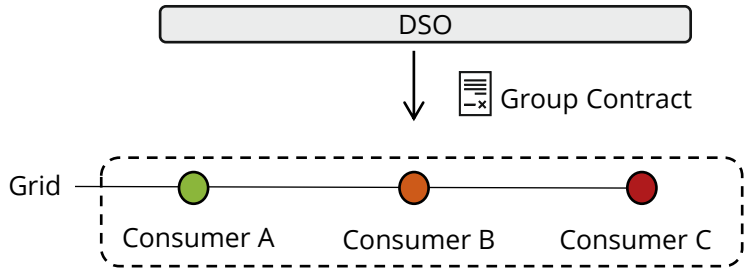
Timeslot agreement

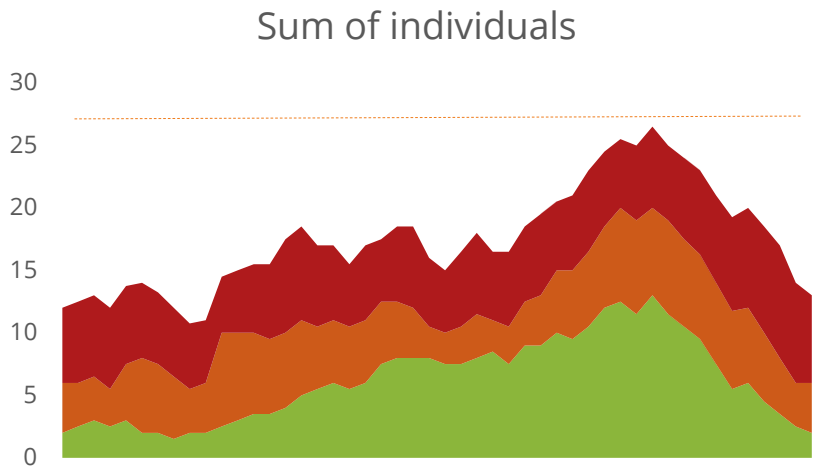
Energy agreement

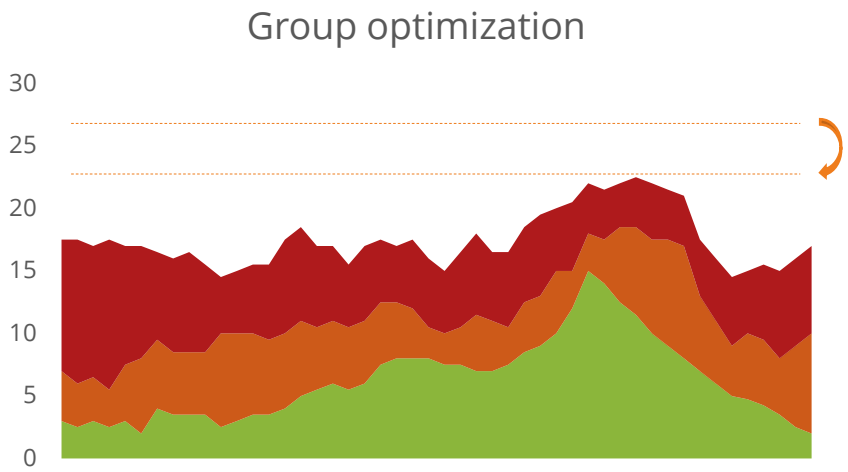
Minimal availability agreement

Group capacity – incentivize local optimization









Use-case: E-boilers for industrial plant

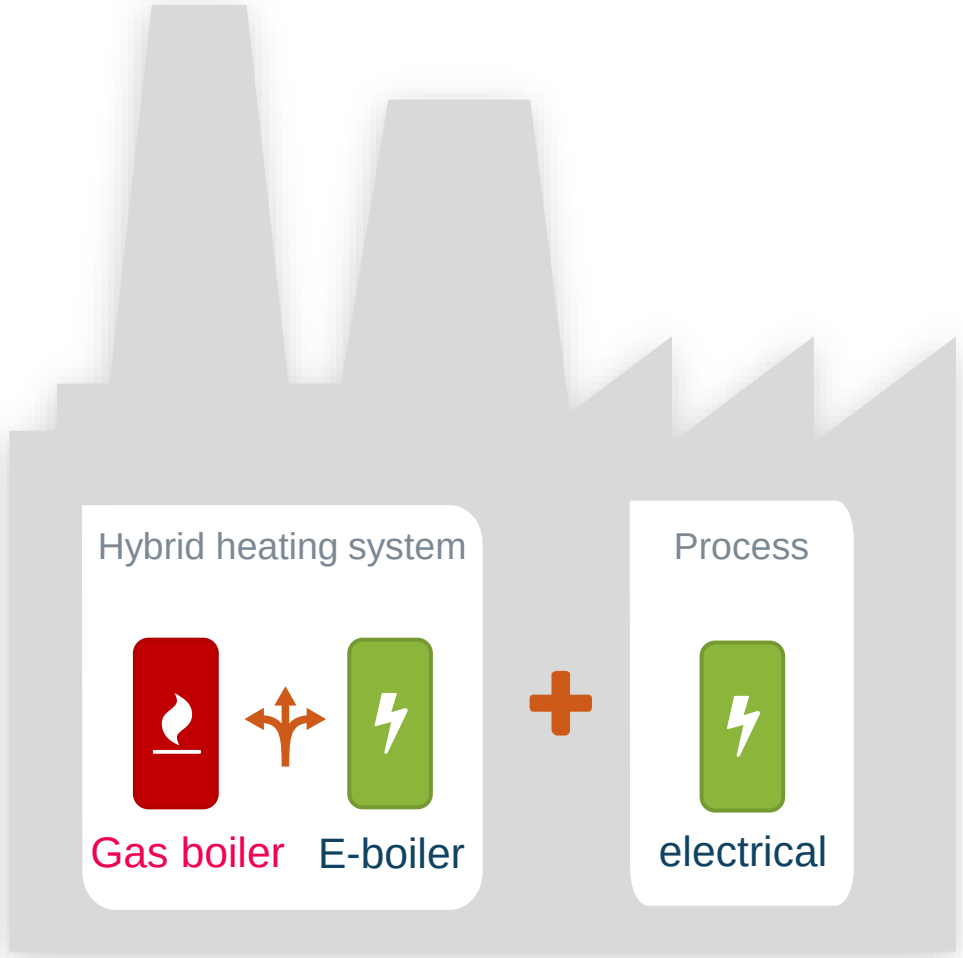
Power to Heat in industrial plants

Hybrid setup: E-boiler switches on based on availability of renewables
Expandable in the future: using heat storage or hydrogen

Grid neutral using a flexible contract

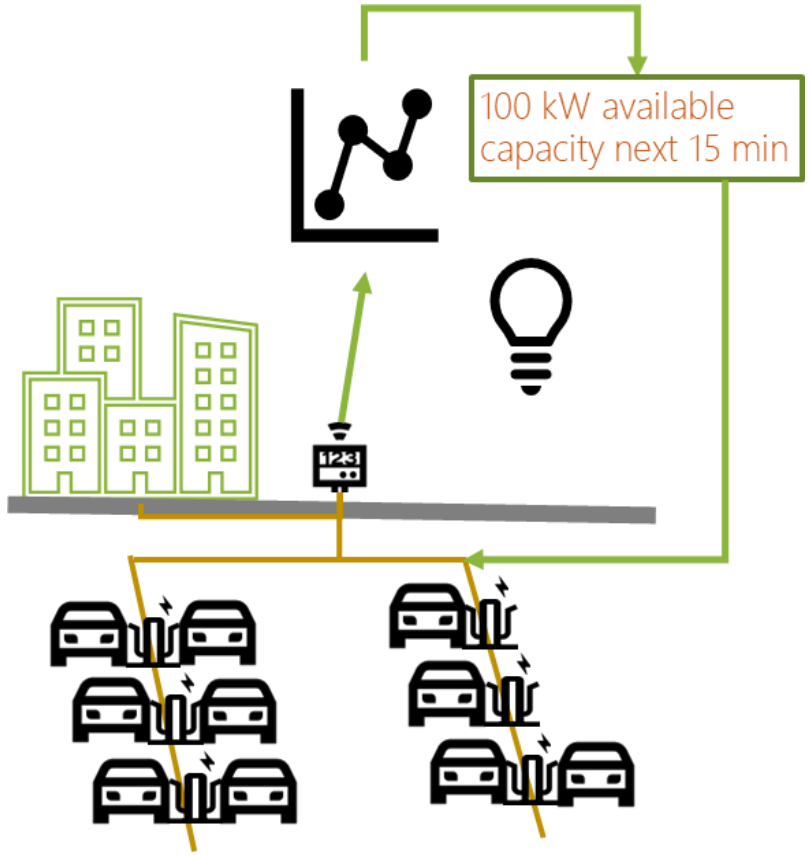
>67% of the time the interests of grid and market are aligned
A daily availability of 50% is often enough
Improved business case by lower tariffs

Enabling the transition within the existing grid



Grid friendly public charging

Optimal accommodation of public charging by group contract and non-firm capacity



Congestion prevented –
factor 3 in hosting capacity
of charge points

Charging comfort > 95% @ 3,5kW
average

Comfort rises by releasing
remaining grid
capacity Day Ahead and intraday


Questions?

DSO ENTITY
DSOs FOR EUROPE

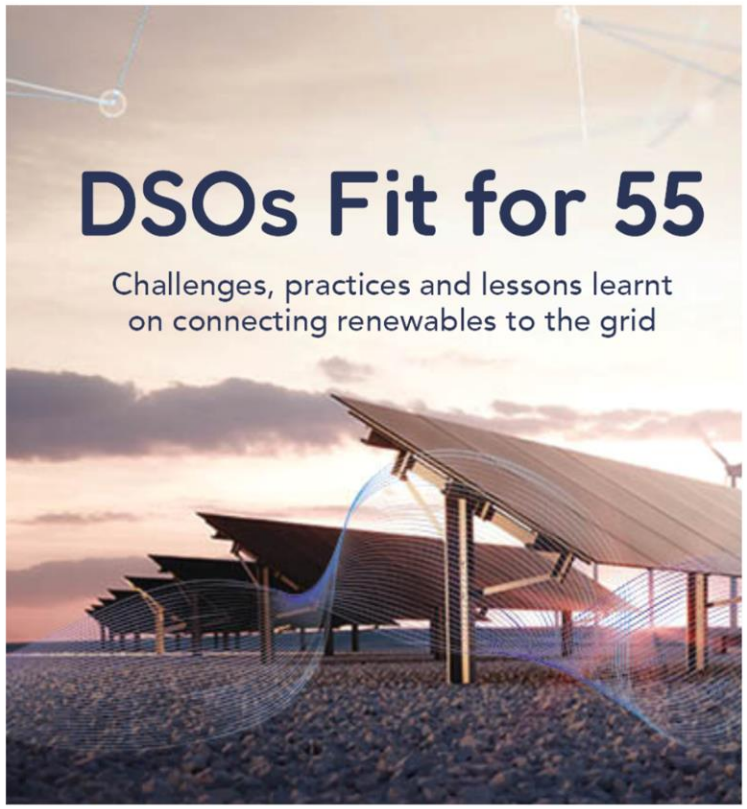
5. Q&A session

Please use the Q&A function of the platform to ask your question.

The chat will be disabled for the time being.

6. Closing remarks

Find out more in our Grid Connection Paper!



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SCAN ME

Stay tune for next webinar on our best practices!

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SEPTEMBER

Thank you!

Contact: Claire Vandewalle
DSO Entity, Advisor – Regulatory Affairs & Strategy
Claire.Vandewalle@eudsoentity.eu