

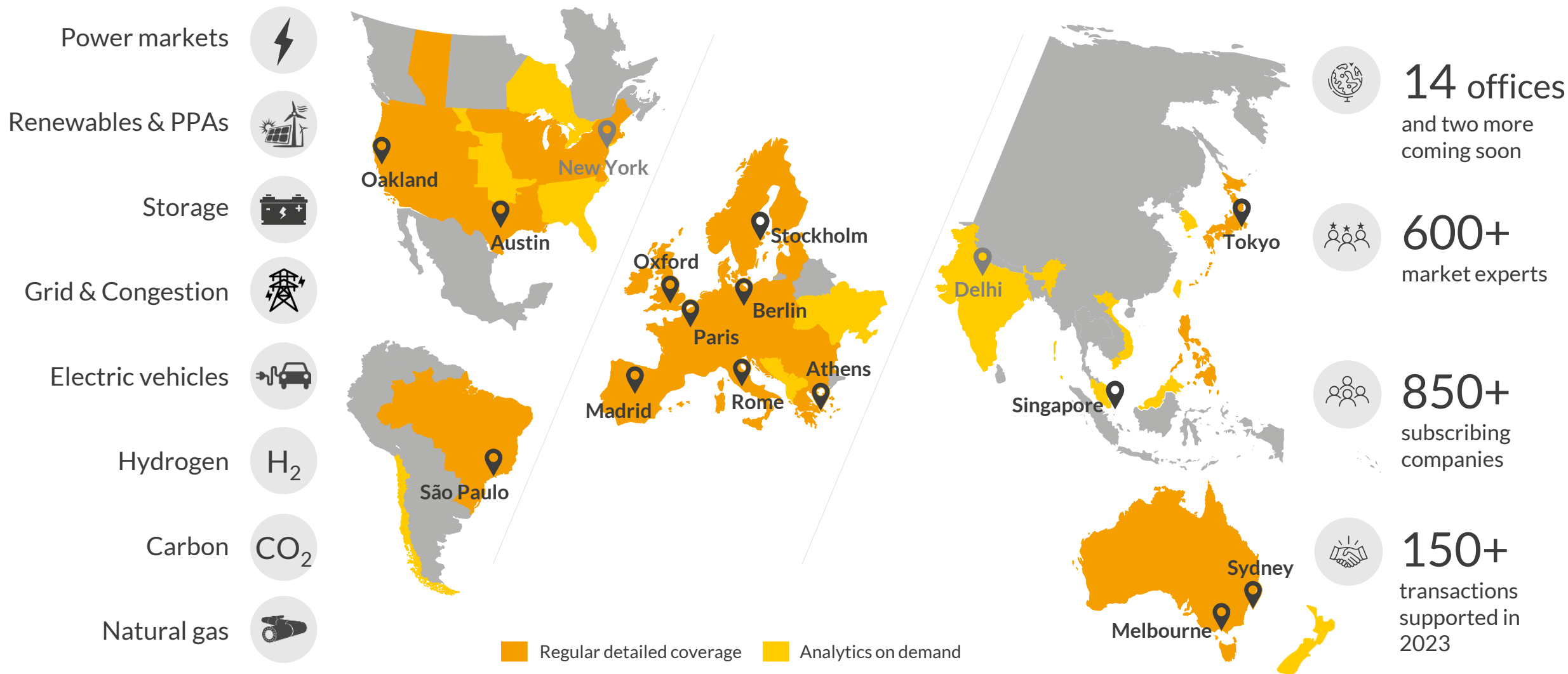
# Grid Overload: The Impact of the Grid on the Dutch Energy Transition

Public Report

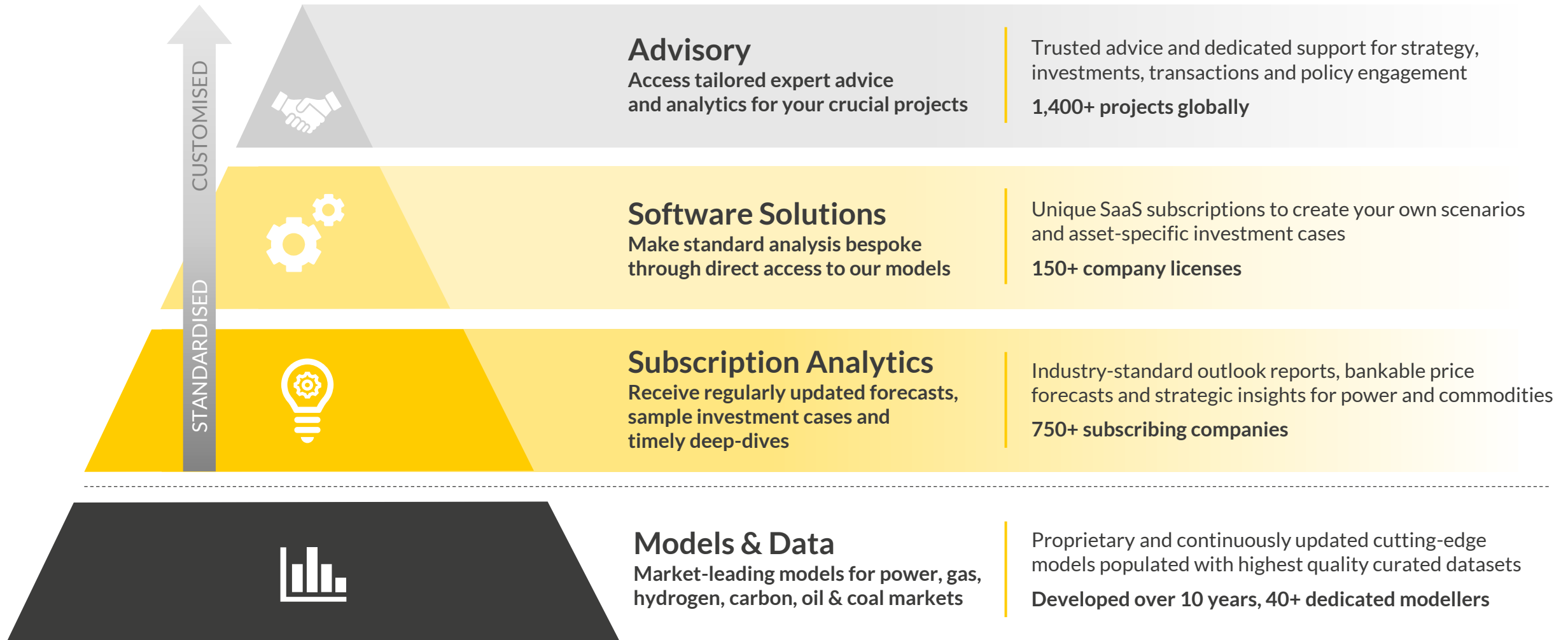
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**Market Lead –  
Netherlands & Belgium**



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**Senior Associate –  
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**Associate –  
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**Senior Analyst –  
Netherlands & Belgium**

## I. Introduction

## II. Congestion and grid availability

## III. Grid fees

## IV. Key takeaways and conclusions

# In large areas of the Netherlands, it has become hard to obtain a new grid connection for both feed-in and offtake projects

Wide-ranging attention

**Netherlands Sees Climate Goals Threatened by Clogged Power Grid**

**Dutch TSO warns of structural grid congestion until 2028**

NIEUWS

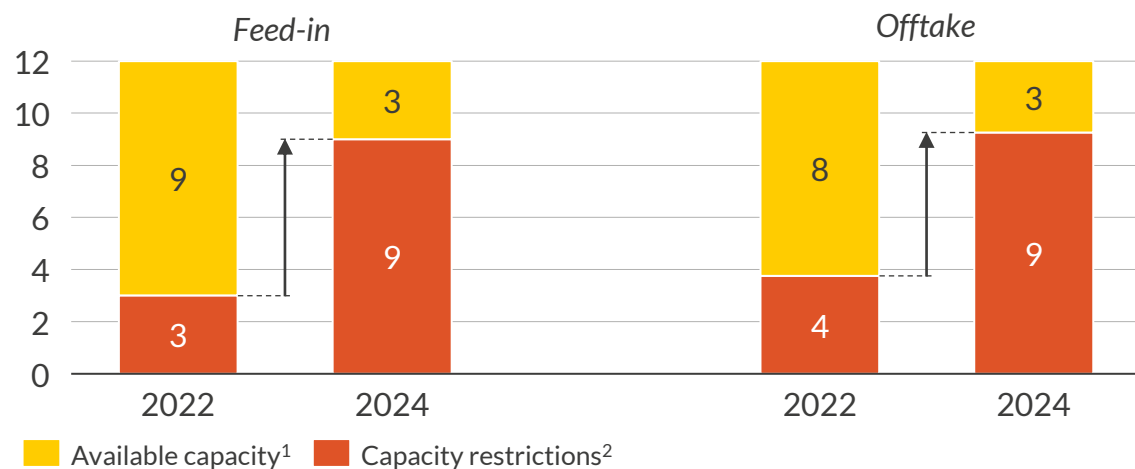
Netbeheerders verklaren Nederlandse stroomnet vol, Jetten kondigt maatregelen aan

Schade voor huishoudens, bedrijven en gemeenten door overvol stroomnet loopt snel op: 'Dit wil toch niemand?!'

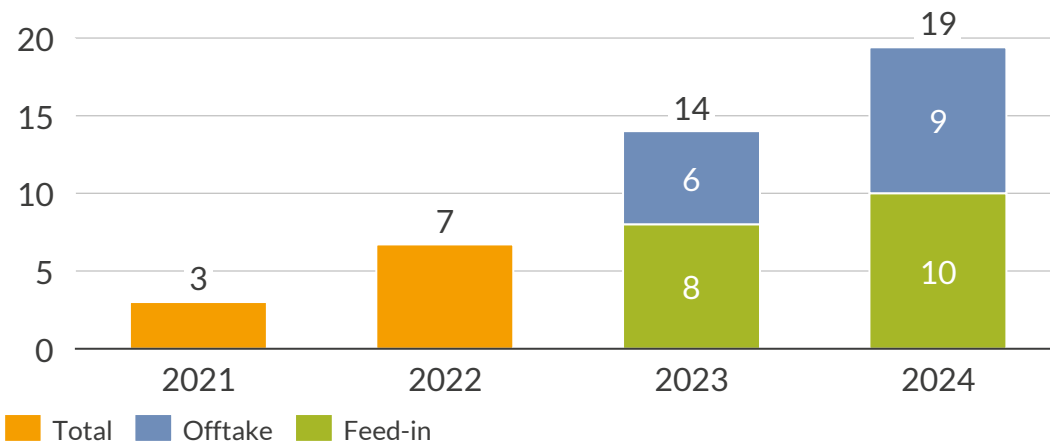
**Waiting list for new or enhanced connection is growing**

Urgent measures announced as Dutch grid creeps to capacity

**Provincial restrictions on the Dutch high-voltage grid**  
Number of provinces



**Connection waiting list<sup>3</sup>**  
Requested connections (x1000)



























1) Combines provinces with available and limited capacity. 2) Combines provinces not currently accepting new applications, i.e., those under capacity moratoriums and those with no remaining capacity. 3) Figures are from November 2021, October 2022, July 2023 and February 2024, where duplicates may exist in the data.



# The grid is becoming a barrier to the Dutch energy transition, though it also presents opportunities for certain technologies

## Opportunities & threats


	Production  		Offtake   		Bi-directional 	
	Existing	New	Existing	New	Existing	New
Grid fees						
Connection availability						
Realtime congestion						



Opportunity



Threat

 Not applicable

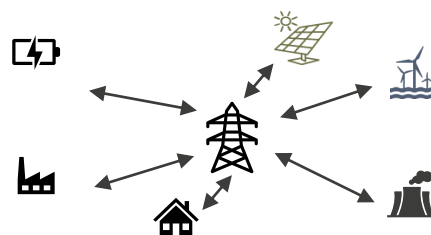
# The government is rolling out a National Grid Congestion Action Program focusing on building faster, optimising grid use, and stimulating flexibility

## 1. Build faster



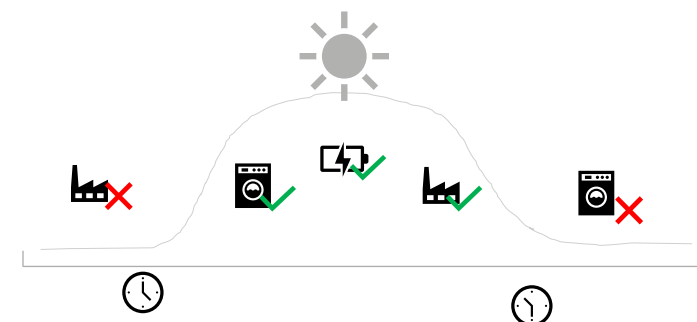
- **Aim:** The solution to congestion is grid expansion; hence, the execution speed must be increased.
- **Key policies include:**
  - Faster permitting
  - Right to challenge
  - Capital injections

## 2. Steer optimal grid use



- **Aim:** As grid expansion takes time, optimisation of current grid use is necessary.
- **Key policies include:**
  - Reform grid fees and contract types
  - Stimulate congestion management
  - Use it or lose it

## 3. Stimulate flexible offtake



- **Aim:** As the energy system becomes production driven, offtaker flexibility is required.
- **Key policies include:**
  - National Plan Energy systems
  - Requirements for solar in SDE++
  - Stimulate Energy Hubs

Want to get more insights into the Dutch power market? Reach out to **Jose Vicente Ramirez Marzullo, Commercial Associate!**

✉ [jose.ramirez@auroraer.com](mailto:jose.ramirez@auroraer.com)

# Agenda

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I. Introduction

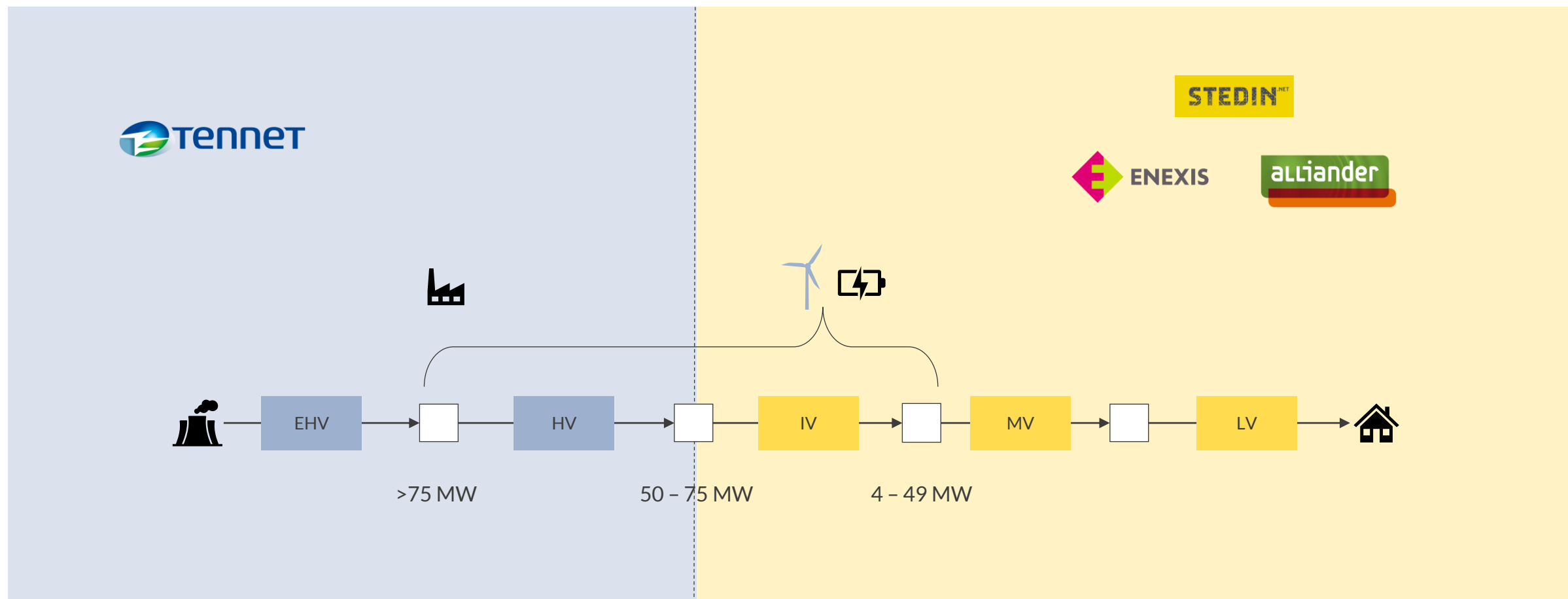
II. Congestion and grid availability

III. Grid fees

IV. Key takeaways and conclusions

# Grid congestion in the Netherlands primarily occurs between mid and high voltage, when transport needs exceed grid capacity

Dutch electricity grid hierarchy<sup>1</sup>

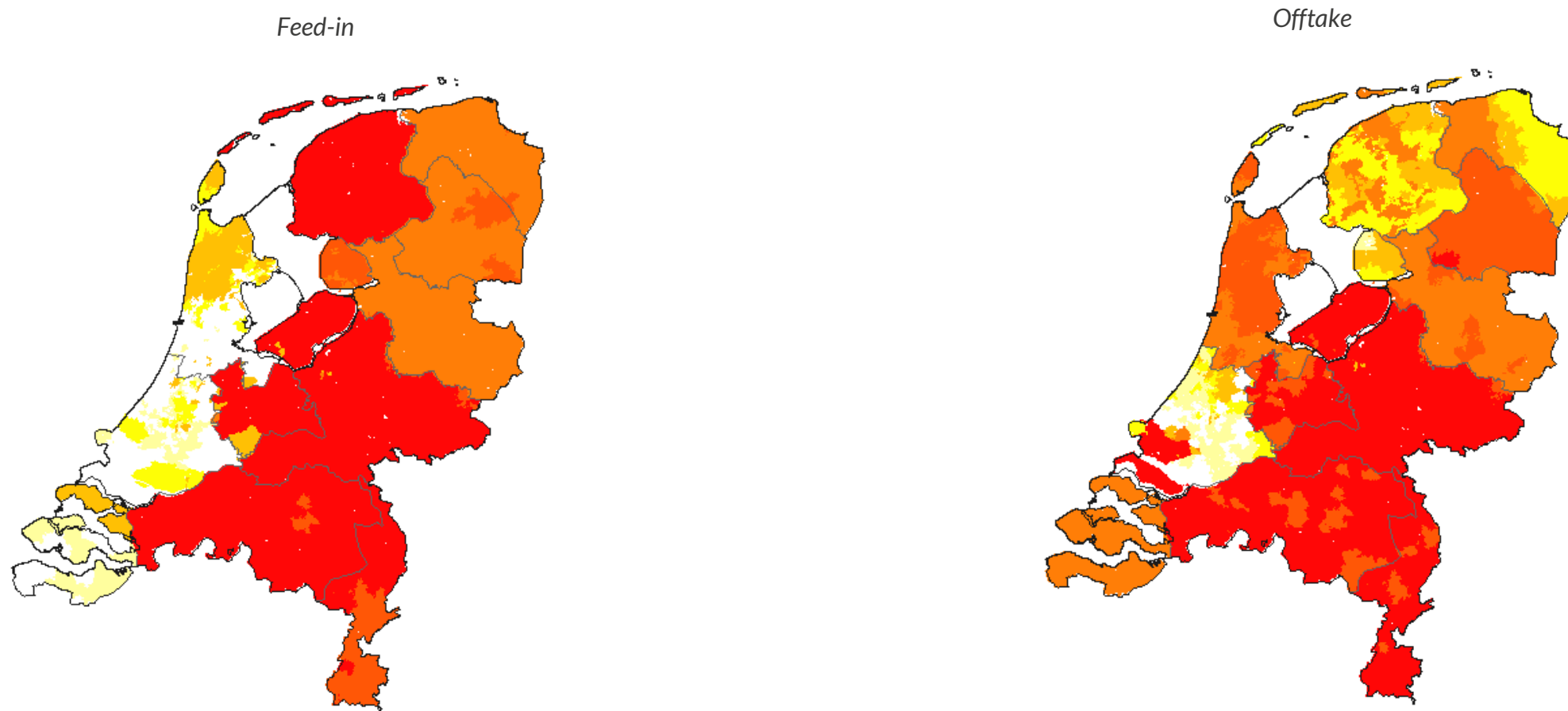


■ Transmission operator ■ Distribution operators

1) EHV, HV, IV, MV, and LV represent extra-high voltage, high voltage, intermediate voltage, mid voltage and low voltage, respectively.

## Congestion is most acute in the Southeast of the country, but it increasingly affects all regions

Connection availability<sup>1,2</sup>



Available capacity Limited capacity Capacity moratorium No capacity

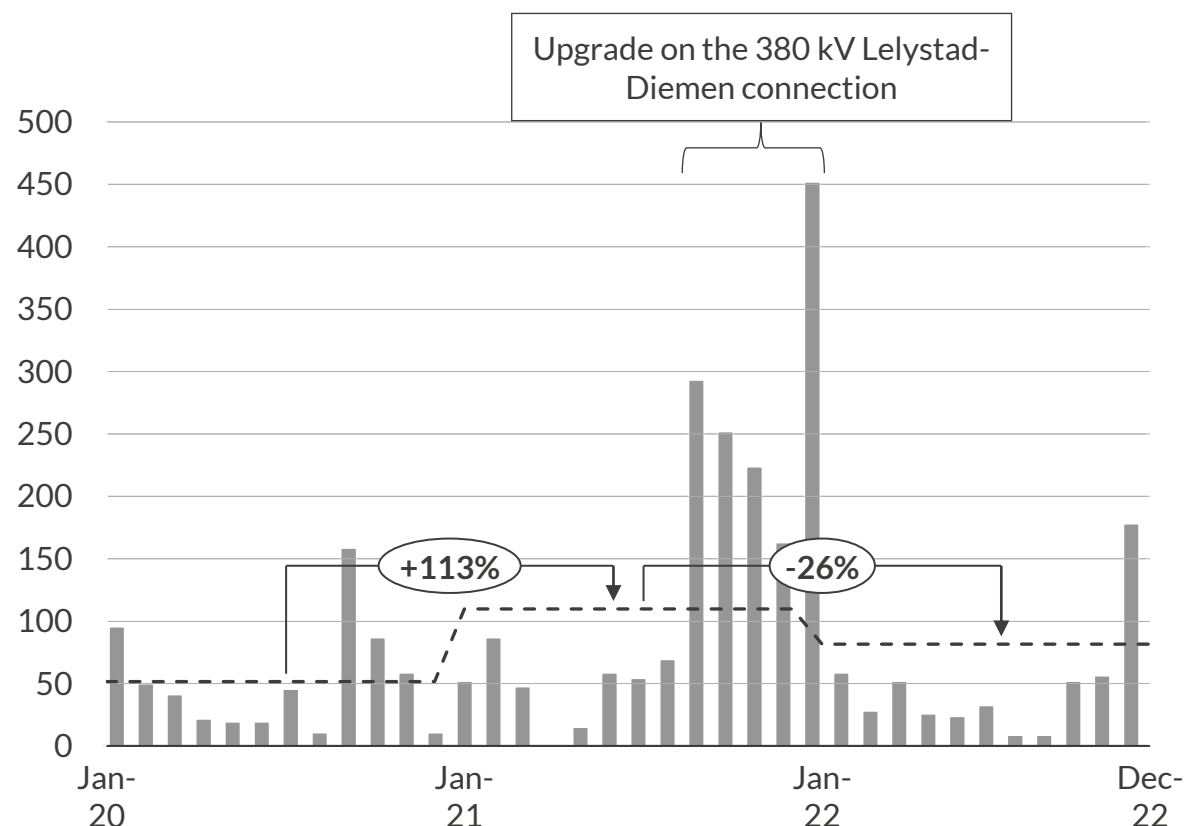
1) The connection availability maps represent a synthesis of the transmission map from [Tennet](#) and the distribution map from [Netbeheer Nederland](#). The latter includes all regional grid operators and connections larger than 3x80A. 2) During the second quarter of 2024, network operators are planning to provide more granular maps including details on nodal connection queues.

Sources: Aurora Energy Research, Tennet, Netbeheer Nederland, Enrgia.

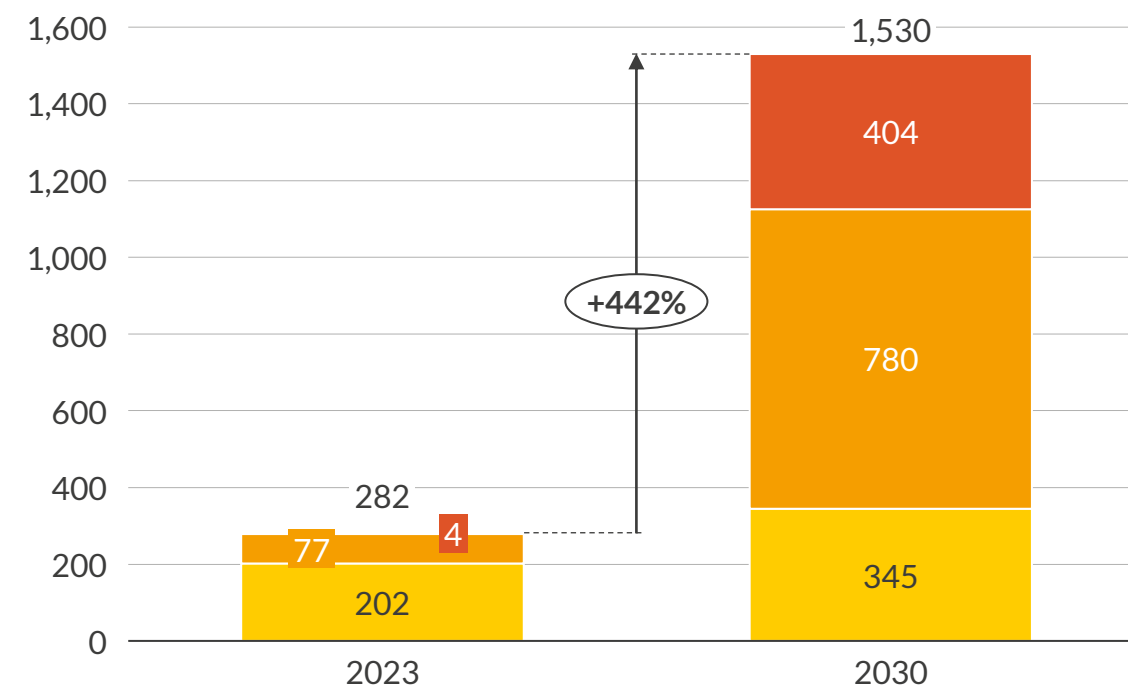


# Redispatch to prevent congestion already occurs; the impact of congestion is expected to grow towards 2030, potentially affecting 1.5 million households

Monthly redispatch volume on transmission grid<sup>1</sup>  
GWh



Dutch households affected by grid congestion<sup>2</sup>  
Number of households (x1000)



■ Monthly redispatch volume - - Yearly average

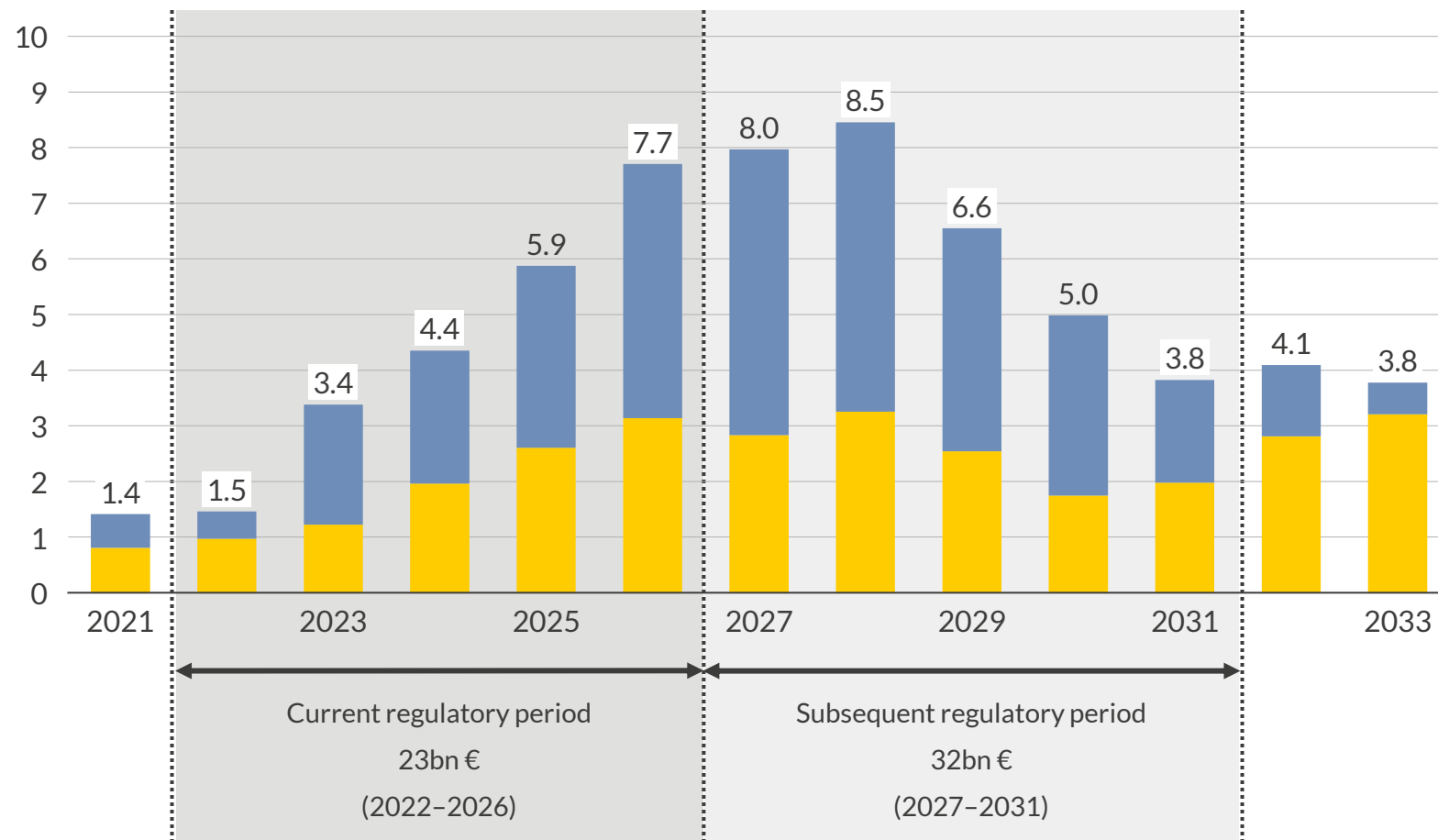
■ Disruption ■ Overvoltage ■ Undervoltage

1) Redispatch volumes exclude restriction contracts (i.e., contracts with market parties for the withholding of production for a designated period) and reactive power. 2) Based on the II3050 - 'Climate ambition' (KA) scenario from Netbeheer Nederland. Data limited to connections on the low-voltage grid.

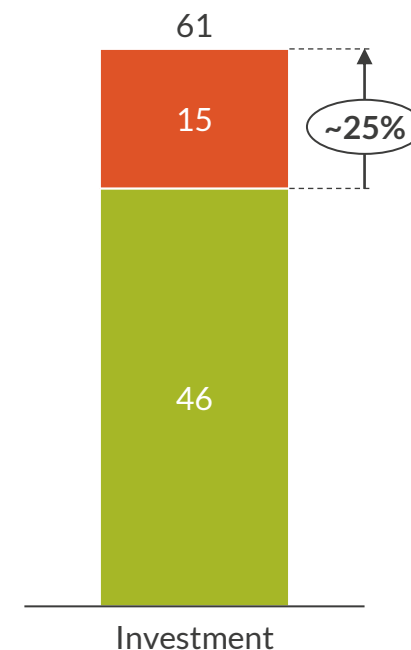
Sources: Aurora Energy Research, Tennet, CBS, Netbeheer Nederland.

# A large expansion of the transmission grid is planned in the coming years, yet it will fall short of Tennet's target scenario for 2030

Tennet maximum planned investments in transmission grid<sup>1</sup>  
bn EUR (real 2022)



Total investment between 2024–2030 compared to II3050 Scenarios<sup>2</sup>  
bn € (real 2022)



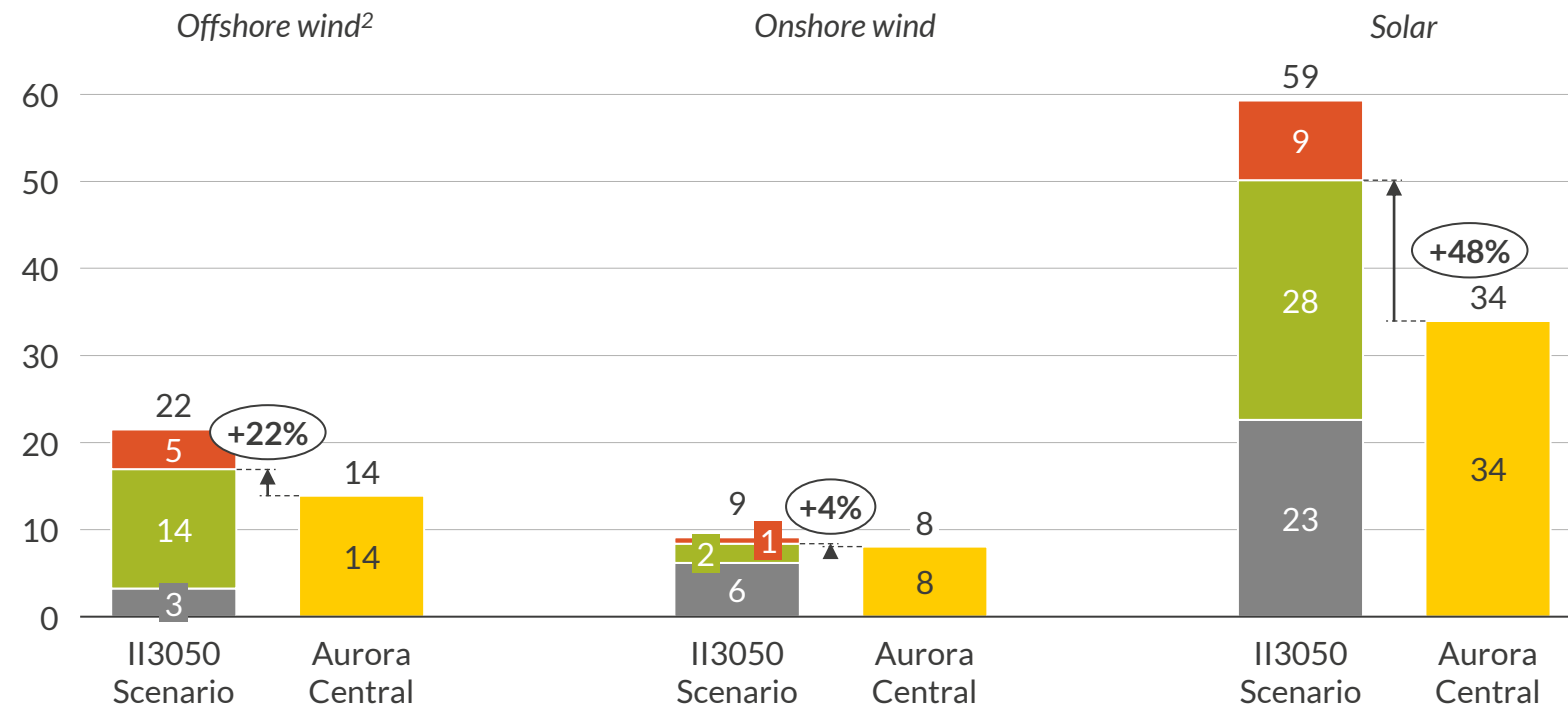
Onshore grid Offshore grid

Feasible Infeasible

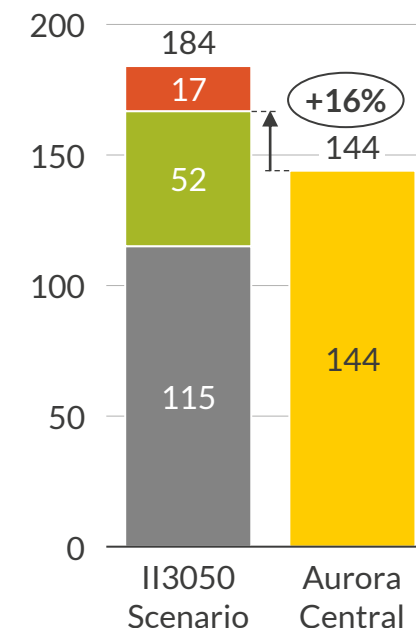
1) Linear growth assumed for inflation factors for 2029–2033. 2) Average over the three scenarios used for the 2024 Investment Plans: National Drivers (ND), Climate Ambition (KA), and International Ambition (IA).

# Since Tennet's plan is based on an ambitious scenario, feasible grid build out still allows for large growth accommodating Aurora Central

Renewable capacity in 2030/2031<sup>1</sup>  
GW



Electricity demand in 2030<sup>3</sup>  
TWh



Capacity and demand increase 2023–2030 in II3050 Scenario (Climate Ambition)

%

568%

47%

163%

69%

■ Current (2023) ■ Feasible ■ Infeasible ■ Aurora Central<sup>4</sup>

1) Data represents end-of-year 2030 except offshore wind which represents end-of-year 2031, in line with Govt road map. We present peak capacity and have included net-metering extensions. 2) Since offshore wind CAPEX has risen and electricity prices fallen, the Govt target will be delayed. 3) Demand includes grid losses but excludes exports and curtailment. 4) Based on Dutch Power and Renewables Market Forecast January 2024, including some preliminary changes planned for the April 2024 update.

Sources: Aurora Energy Research, Netbeheer Nederland, ENTSO-E, CBS.

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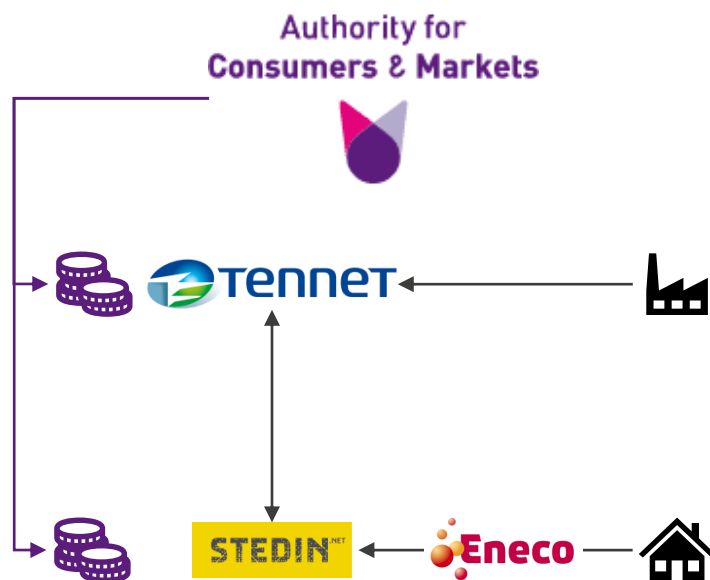
II. Congestion and grid availability

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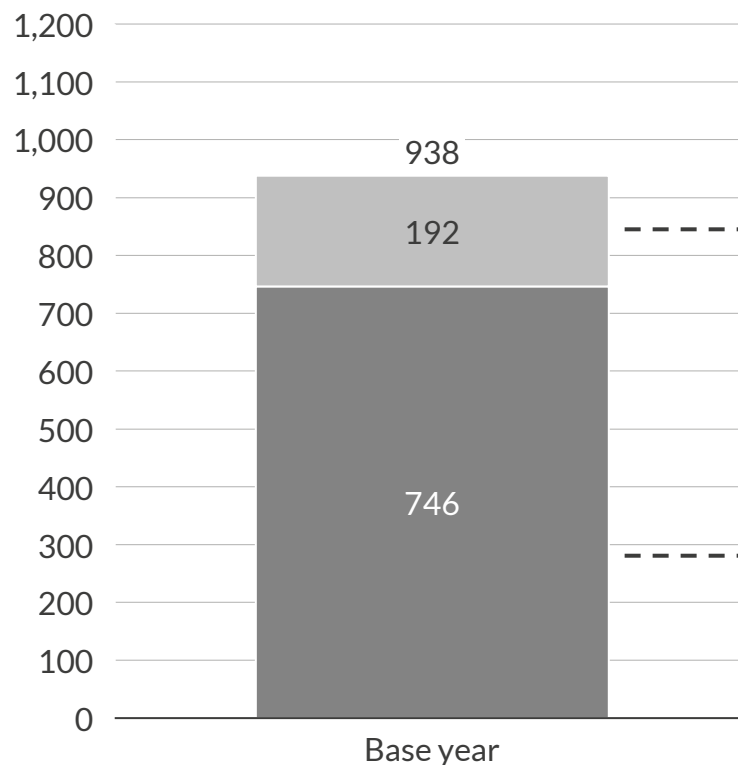
IV. Key takeaways and conclusions

# Grid fees are regulated by ACM, based on a cost-of-service methodology, which includes a combination of transport and system tasks

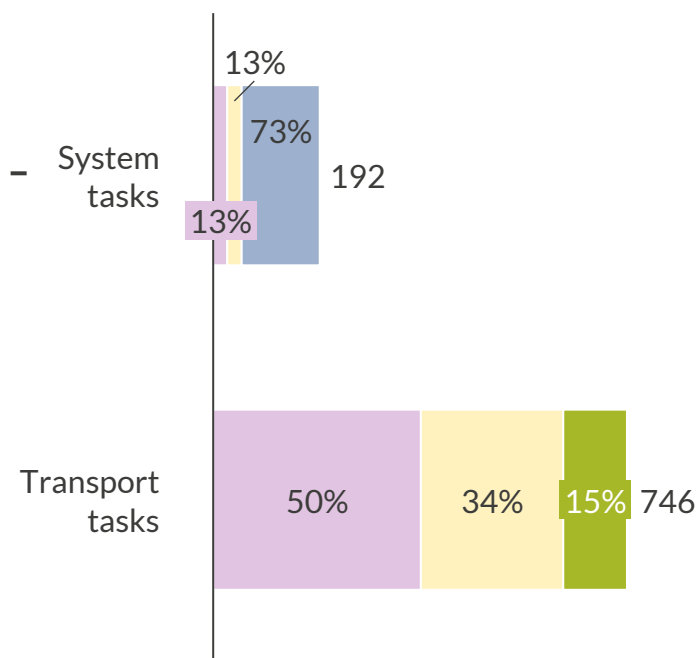
## Stakeholders grid fees



## Efficient TSO cost-of-service 2022–2026 mn € (real 2022)



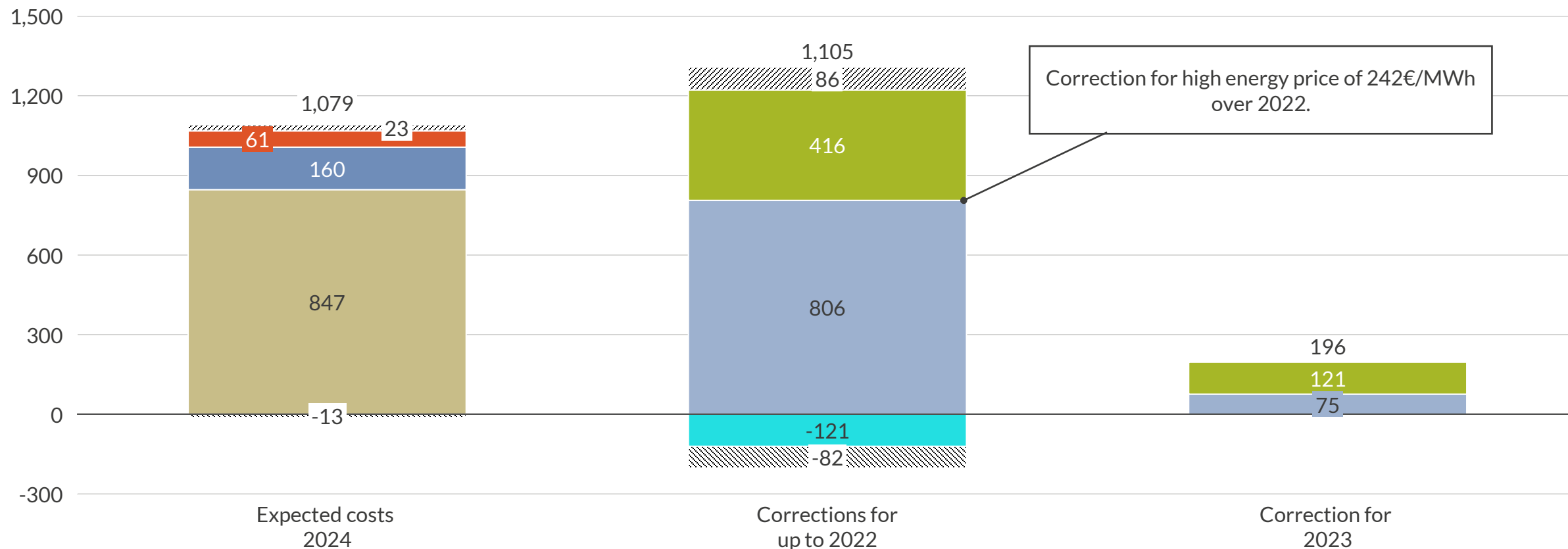
## Efficient TSO cost of service breakdown mn € (real 2022)











# Corrections for higher-than-expected energy prices over 2022–23 tripled Tennet's allowed revenue for 2024 compared to the pre-calculated costs

Allowed revenue in 2024  
mn € (real 2022)

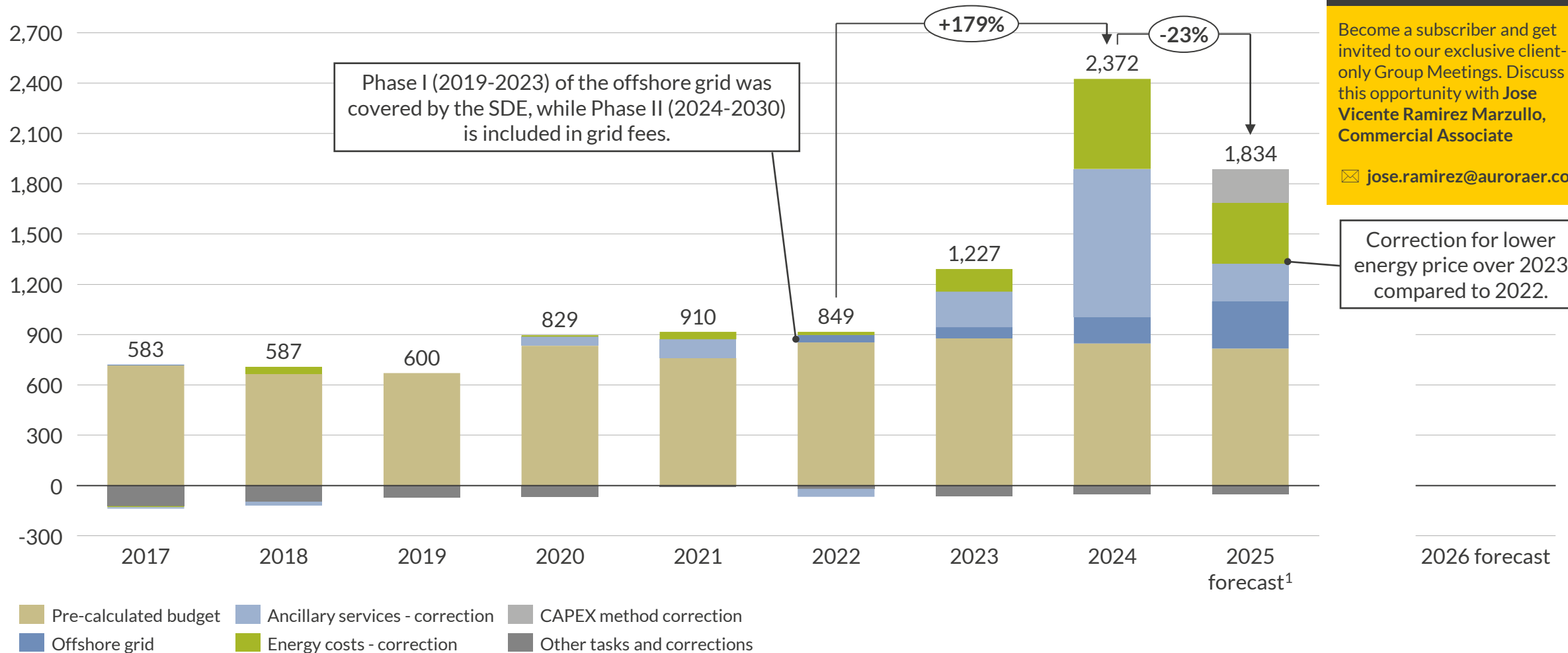


 Other positive   
  Offshore grid   
  Imbalance revenue  
 Onshore RCR projects<sup>1</sup>   
  Pre-calculated budget   
 Other negative

1) Government coordination scheme (in Dutch: Rijkscoördinatieregeling, RCR).














# After a tripling over last 2 years grid fees will drop in 2025, due to lower energy costs, whereas offshore grid cost still increase




Total allowed revenue Tennet  
mn € (real 2022)



1) Assumptions: pre-calculation as 2024 corrected for inflation; offshore grid estimated by Tennet in 2023; corrections for ancillary services, energy costs, and method estimated by the ACM in 2023; other cost components and corrections equal to 2024.

# After 2026, grid costs will likely increase towards 2030 due to higher CAPEX resulting from large investments in both the onshore and offshore grid

	Relative size in 2026	Expected trend 2030	Driver
Ancillary services			FCR and aFRR capacity prices
CAPEX			Tennet's onshore investments
Energy cost transport			Energy prices and redispatch and reactive power volumes
Offshore grid			Tennet's offshore investments
Other OPEX			Volume of operation
Other tasks and corrections			Regulation method after 2026
Total cost of service			Asset base and energy prices

 Increase
  Constant
  Decrease

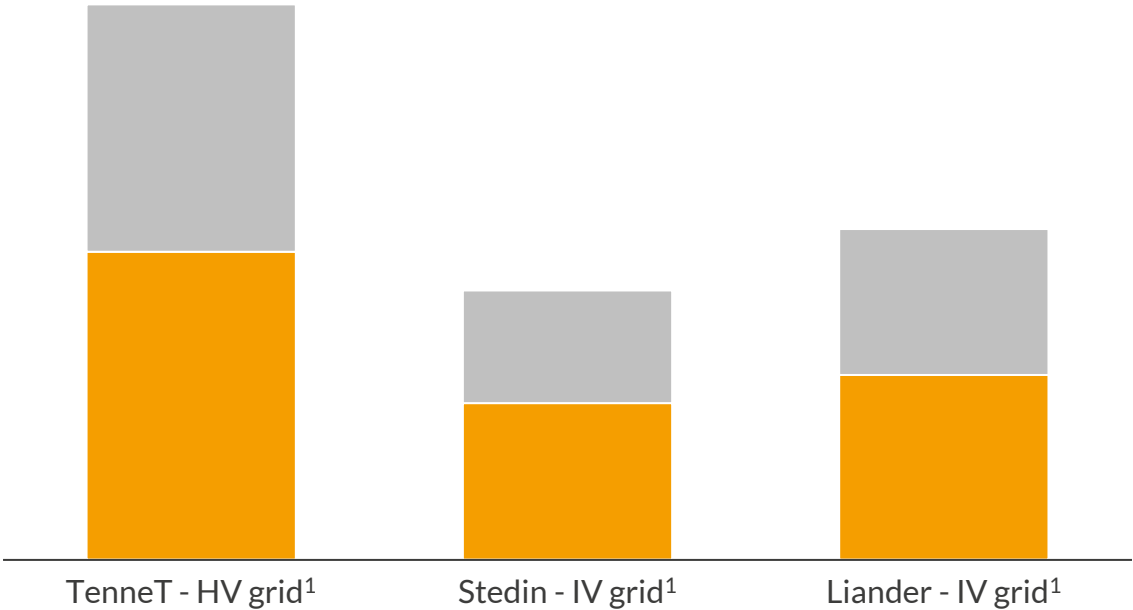
# Tennet’s allowed revenues are used to set grid fees, which have a contracted and a usage component; fees also differ between the TSO and DSOs


Grid fee structure

Component	Subcomponent	Unit
Transport of electricity	Fixed charge	€/month
	Contracted capacity	€/kW/year
	Peak offtake	€/kW/month
	Consumption	€/kWh/year
Connection	One-off connection fee	€
	Periodic connection fee	€/month
Meter	Meter rate	€/year

Total grid fees 2024 for 30MW battery  
€/kW/year (real 2022)

All data is provided  
in our Group  
Meeting report for  
clients.

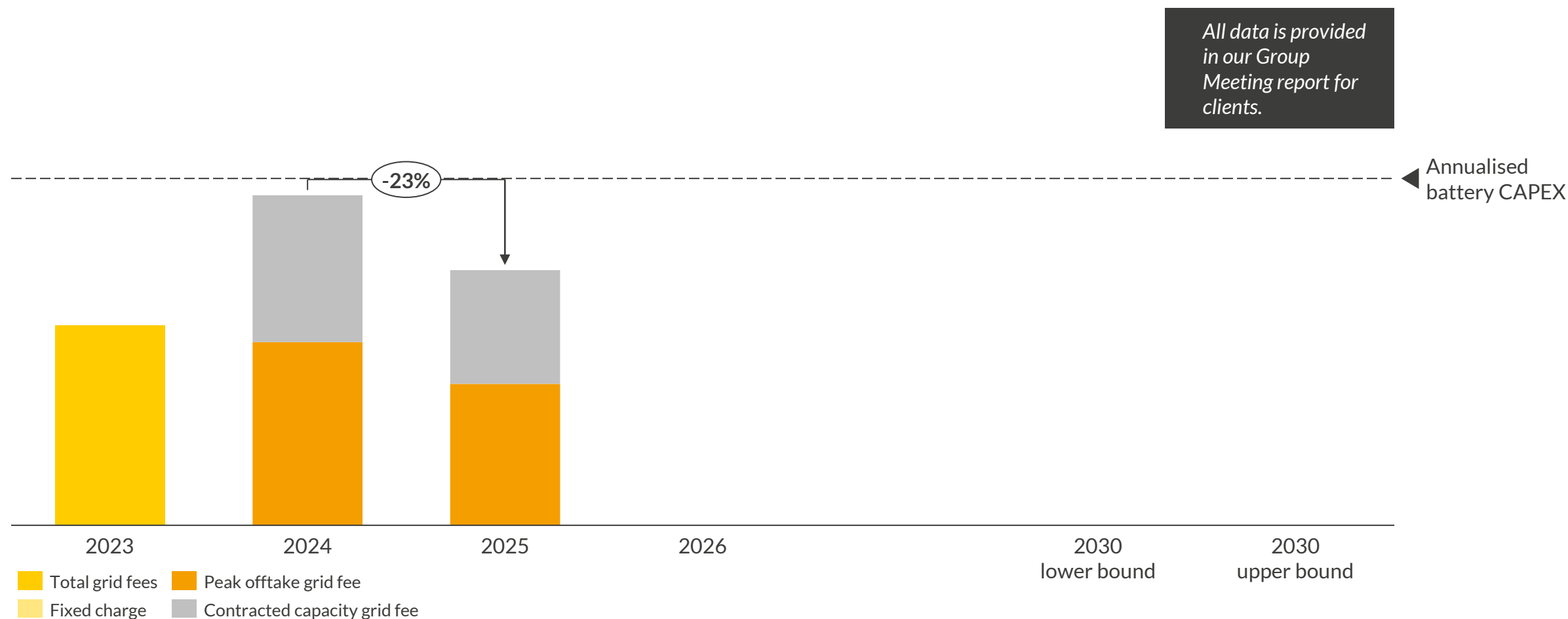


 Determined by cost of service methodology  
1) HV and IV, represent high voltage and intermediate voltage, respectively.

 Contracted capacity  Peak offtake  Fixed charge

# In 2024, grid fees are similar to battery CAPEX; in 2025 fees will drop, but longer term they might go up again

Battery grid fees vs annualised CAPEX<sup>1,2</sup>  
€/kW, real 2022



1) Annualised CAPEX of a battery commissioned in 2024, calculated with a 11.5% WACC (real, pre-tax). 2) We consider an 80MW, 2-hour battery with 15 years lifetime or 8,500 cycles and stand-alone connection to the HV grid.



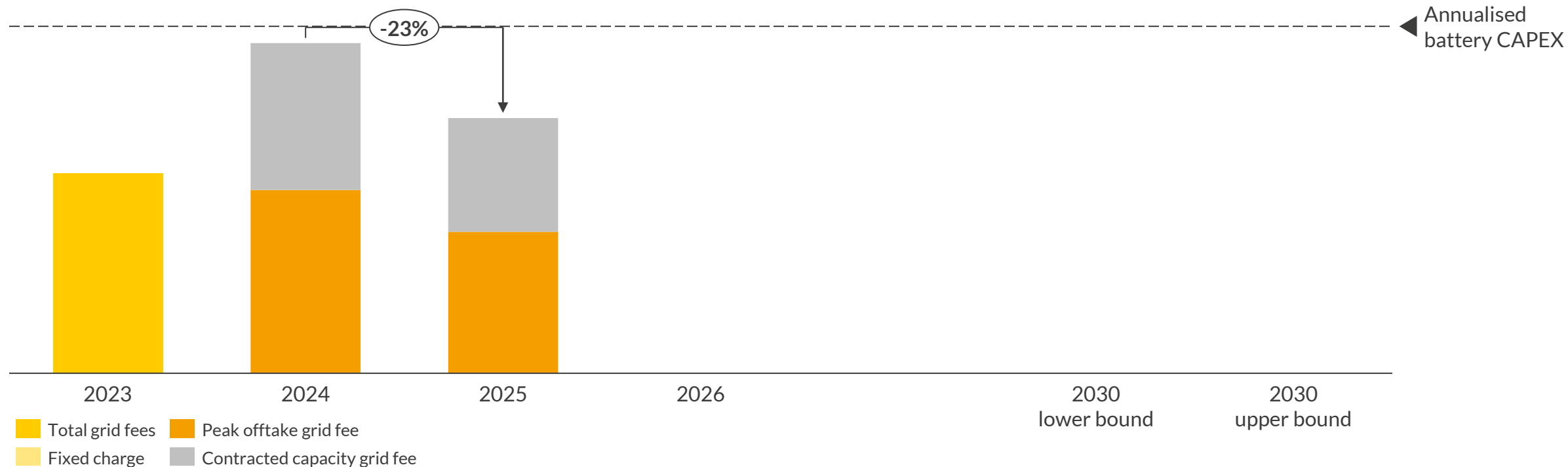
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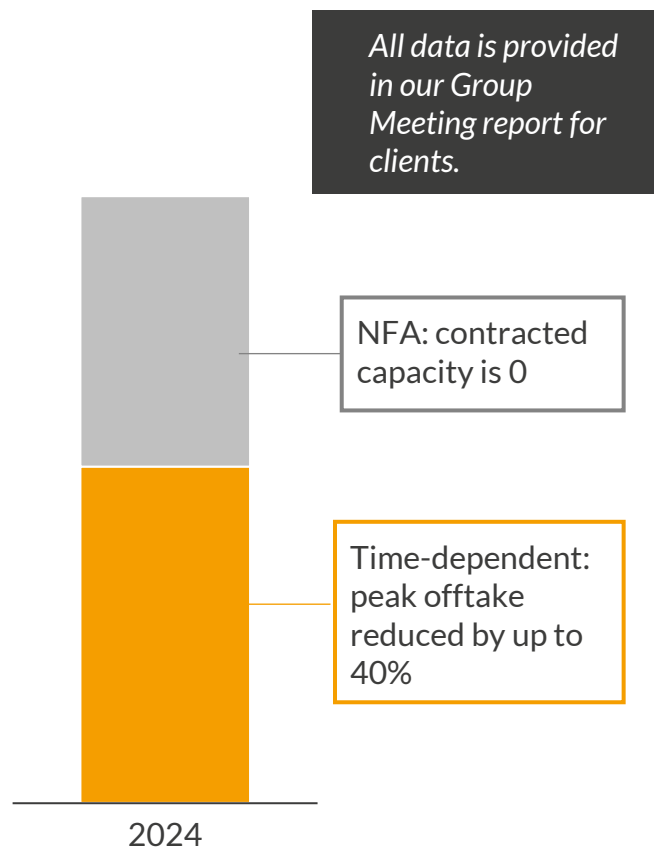
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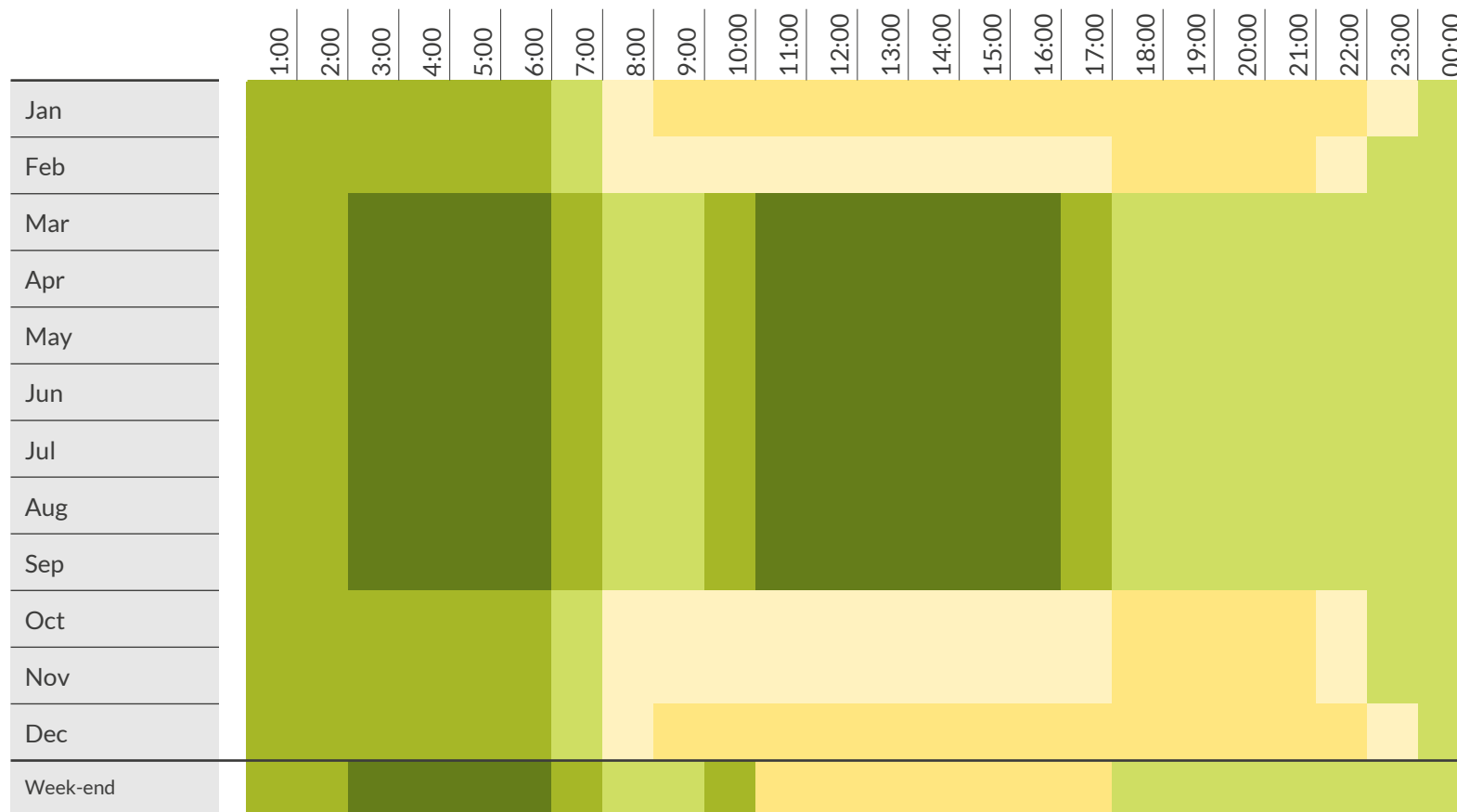
1) Annualised CAPEX of a battery commissioned in 2024, calculated with a 11.5% WACC (real, pre-tax). 2) We consider an 80MW, 2-hour battery with 15 years lifetime or 8,500 cycles and stand-alone connection to the HV grid.

# The recently introduced NFA<sup>1</sup> eliminates the contracted capacity fee, and the time-dependent proposal offers a discount on the peak offtake fee

Grid fees for battery on HV grid  
€/kW/year (real 2022)



Weighting factors time-dependent proposal  
%



Fixed charge Peak offtake Contracted capacity

60% 70% 80% 90% 100%

1) Non-firm connection and transmission agreement.

- 1** Congestion is increasing at all levels of the Dutch grid, where 9 out of 12 provinces suffer from either a moratorium or a suspension of new grid connections. This situation leads to disruptions for existing users and long waiting times for new ones hoping to connect.
- 2** Tennet and the DSOs have published ambitious investment plans but acknowledge that it is feasible to only meet around 75% of the grid investment required to reach their power market scenarios for 2030. In this report, we compare the grid operators' scenario with the Aurora Central scenario and find that grid capacity might be less scarce than expected by 2030.
- 3** Following their large increase in 2024, grid costs are expected to be lower by 23% in 2025. This is primarily due to lower electricity prices. Towards 2030, total grid costs are expected to rise again due to increasing CAPEX. Since demand is also expected to grow towards 2030, the increased costs would be distributed over a larger demand pool reducing fees.



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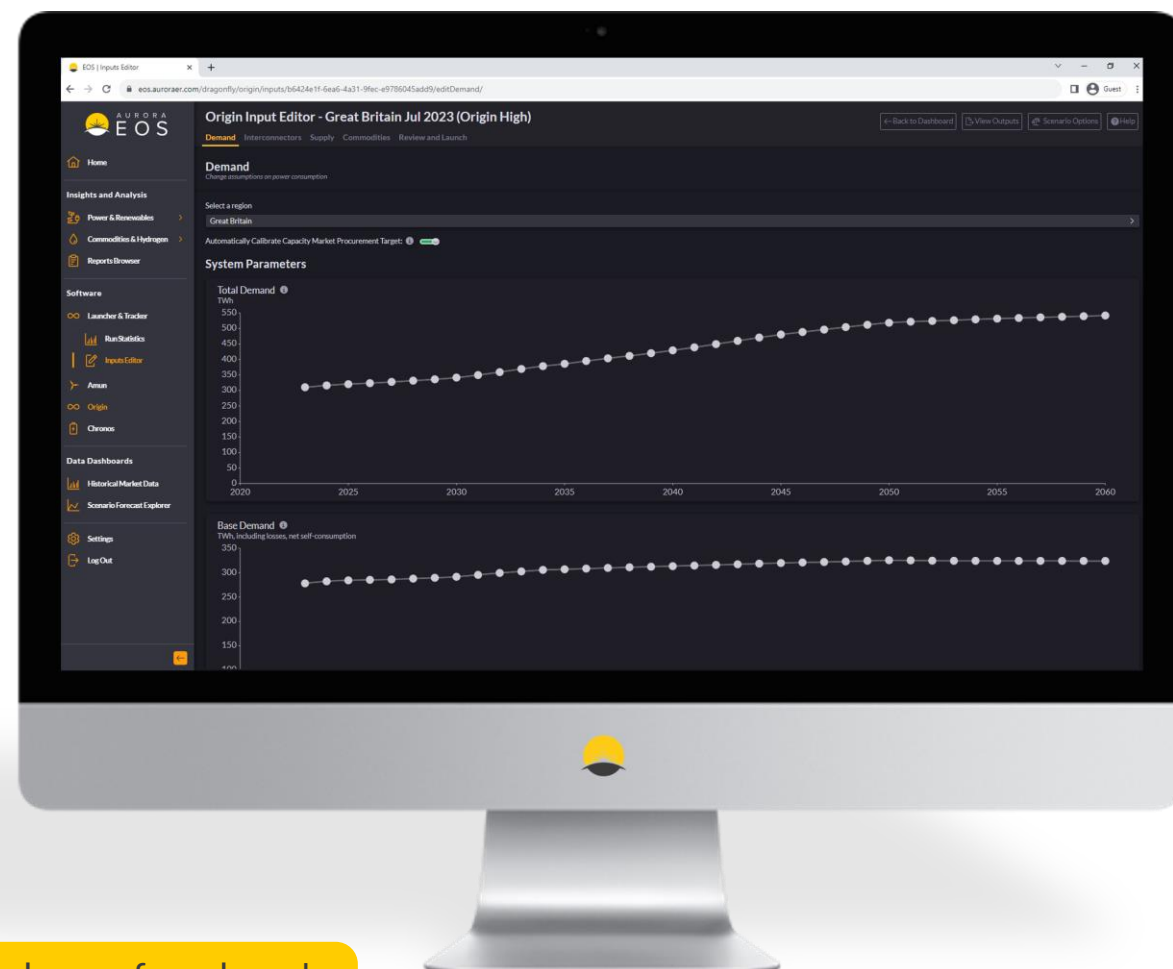
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✉ [jose.ramirez@auroraer.com](mailto:jose.ramirez@auroraer.com)



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### Publication

Grid overload: The impact of the grid on the Dutch energy transition

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07 March 2024

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