AURORA ENERGY RESEARCH

# Innovative strategies to boost renewable revenues in the Netherlands

Public Report

13 September 2024

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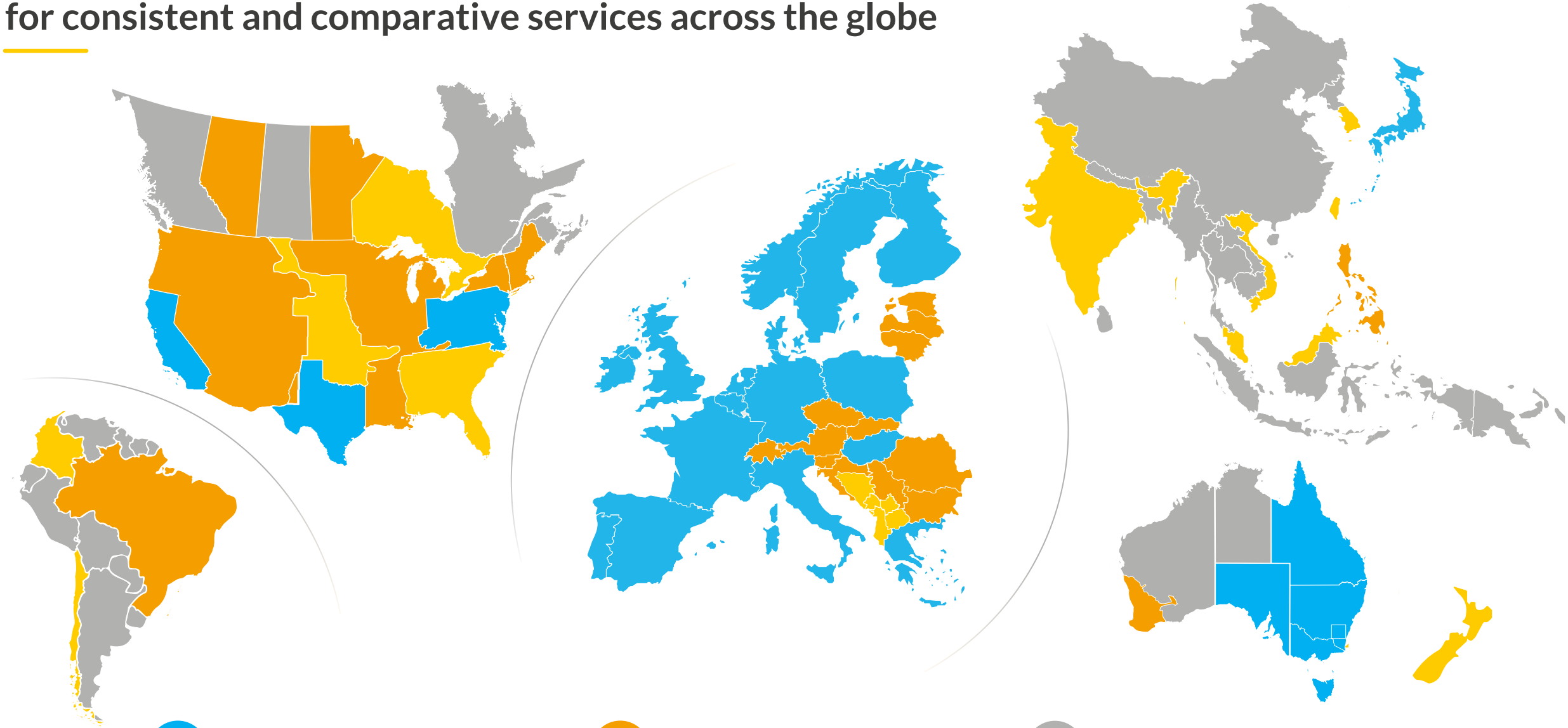

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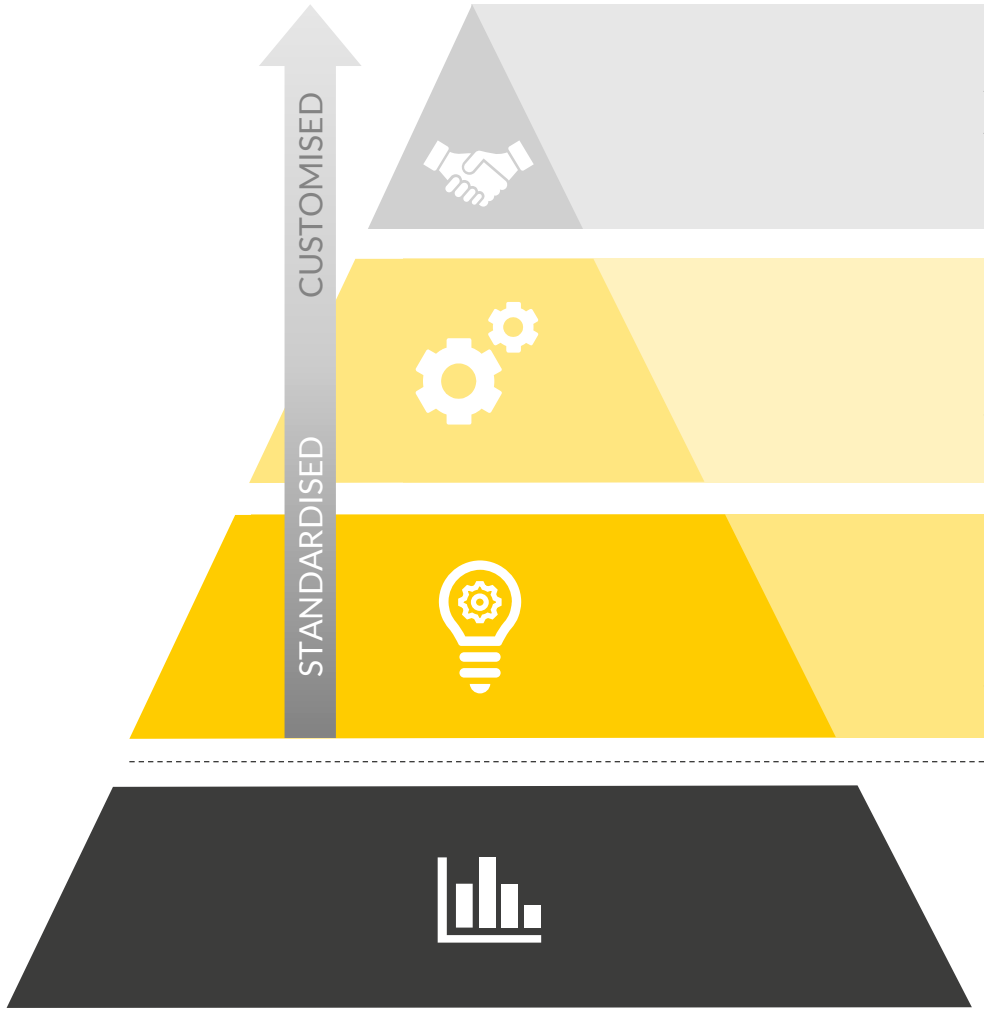


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Source: Aurora Energy Research

# Join key players from across the Dutch Power sector at our subscriber-exclusive Group Meetings

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Source: Aurora Energy Research

# Agenda

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I. Introduction

II. Emerging risks for renewables

III. Aurora's flexible dispatch for renewables

IV. Key takeaways

# The buildout of renewables in the Netherlands has sped up, especially for solar PV, leading to a strong reduction in RES capture prices

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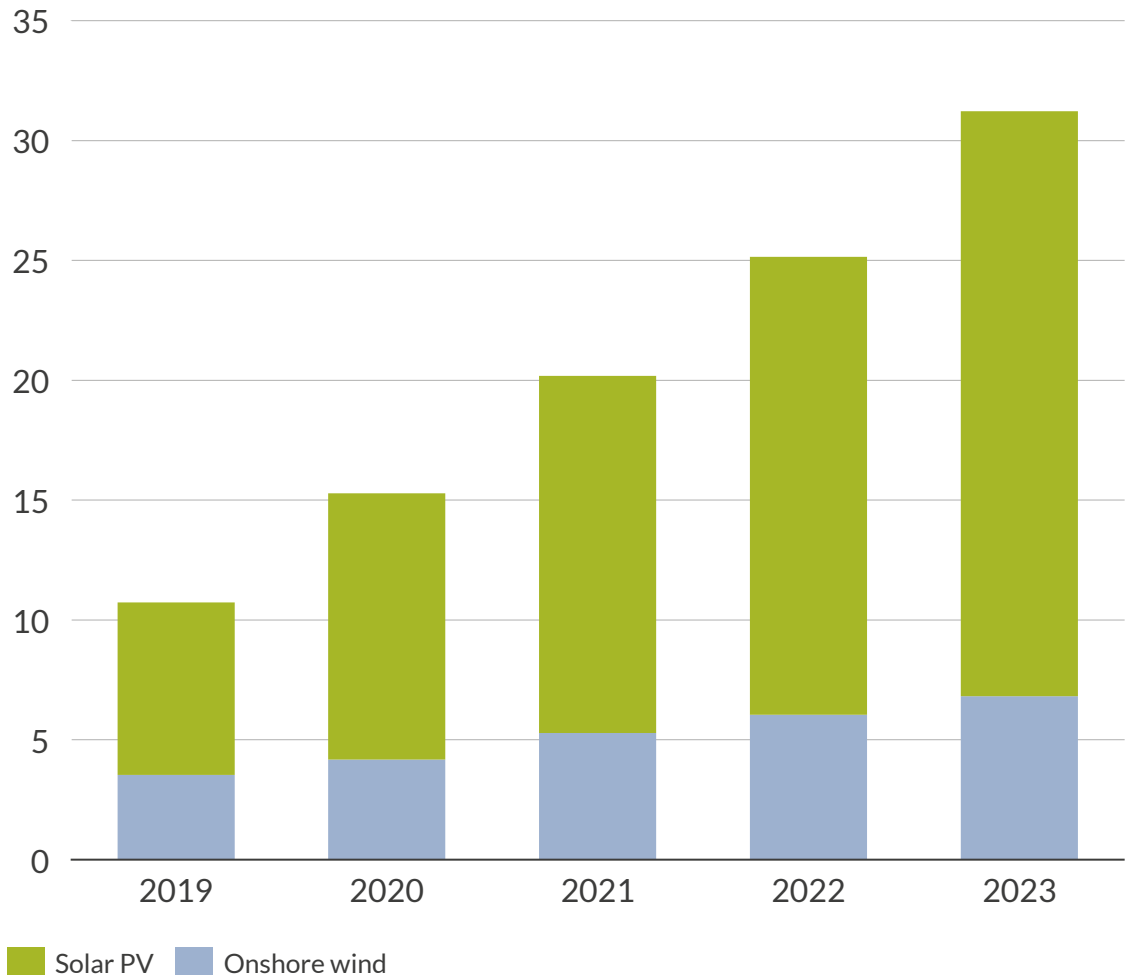
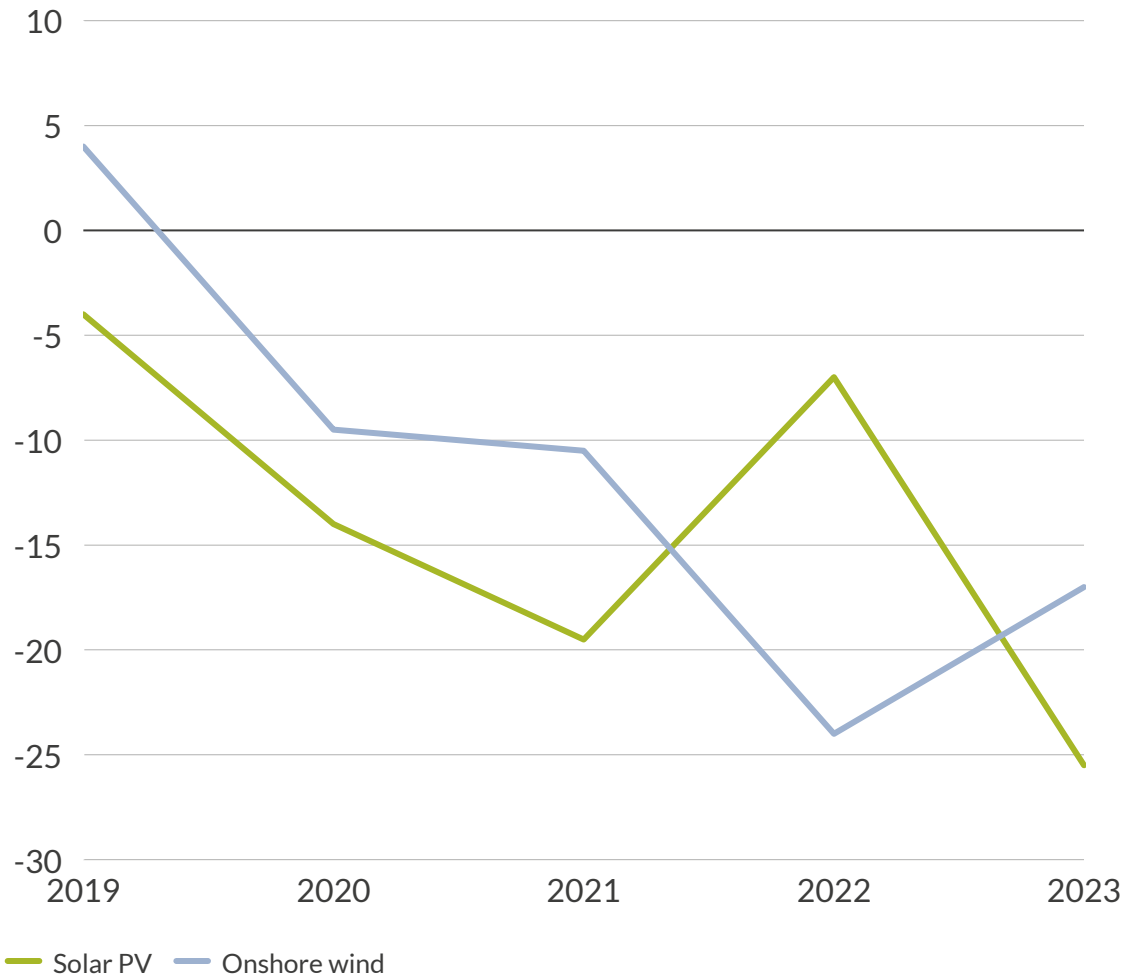
**Installed renewable capacity**

GW




**Fleet-average profile discount - solar & onshore wind**

%




Sources: RVO, Solar Trendrapport, PBL

# The increasing profile discount is driven by a sharp rise in the number of negative price hours over the past years, with over 300 hours in 2024 already

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**The sharp increase in negative price hours in the Netherlands made headlines in 2023 and first half of 2024**

pv magazine

**Netherlands posts more negative energy prices**

16/08/2024

Energeia

**STEMMING Zes dagen op rij duikt stroomprijs onder nul**

16/05/2024

MONTEL News

**Dutch solar surplus will intensify negative prices – analyst**

14/02/2024

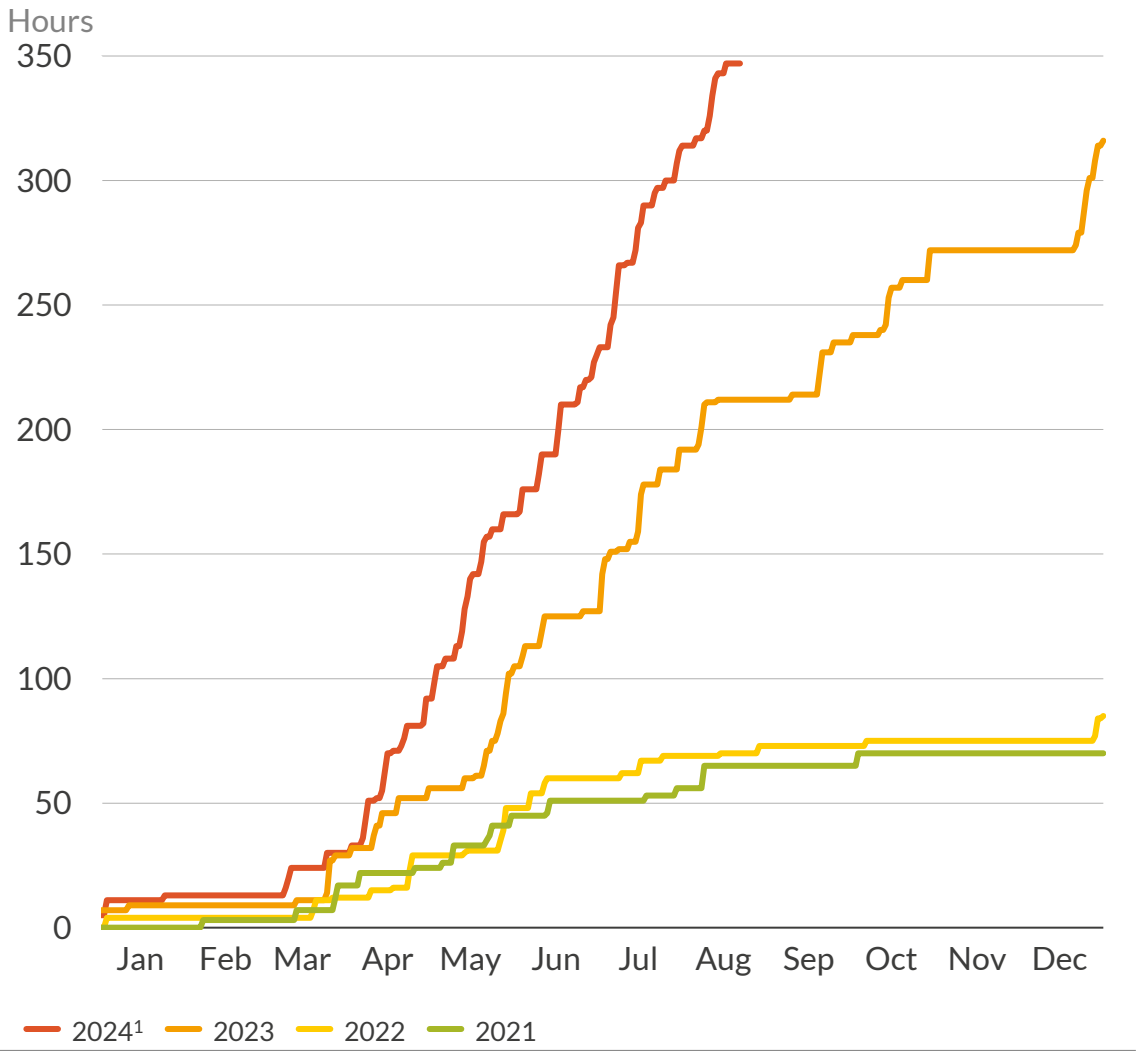
Bloomberg

Green

**Dutch Power Prices Turn Negative as Green Power Floods Grid**

19/04/2023

**Cumulative occurrence of negative price hours**




1) Until 20/08/2024.

Sources: Energeia, Montel News, Bloomberg, ENTSOE

# The renewable build out does not only impact prices on the Day Ahead market, but has also led to higher imbalance costs for renewables

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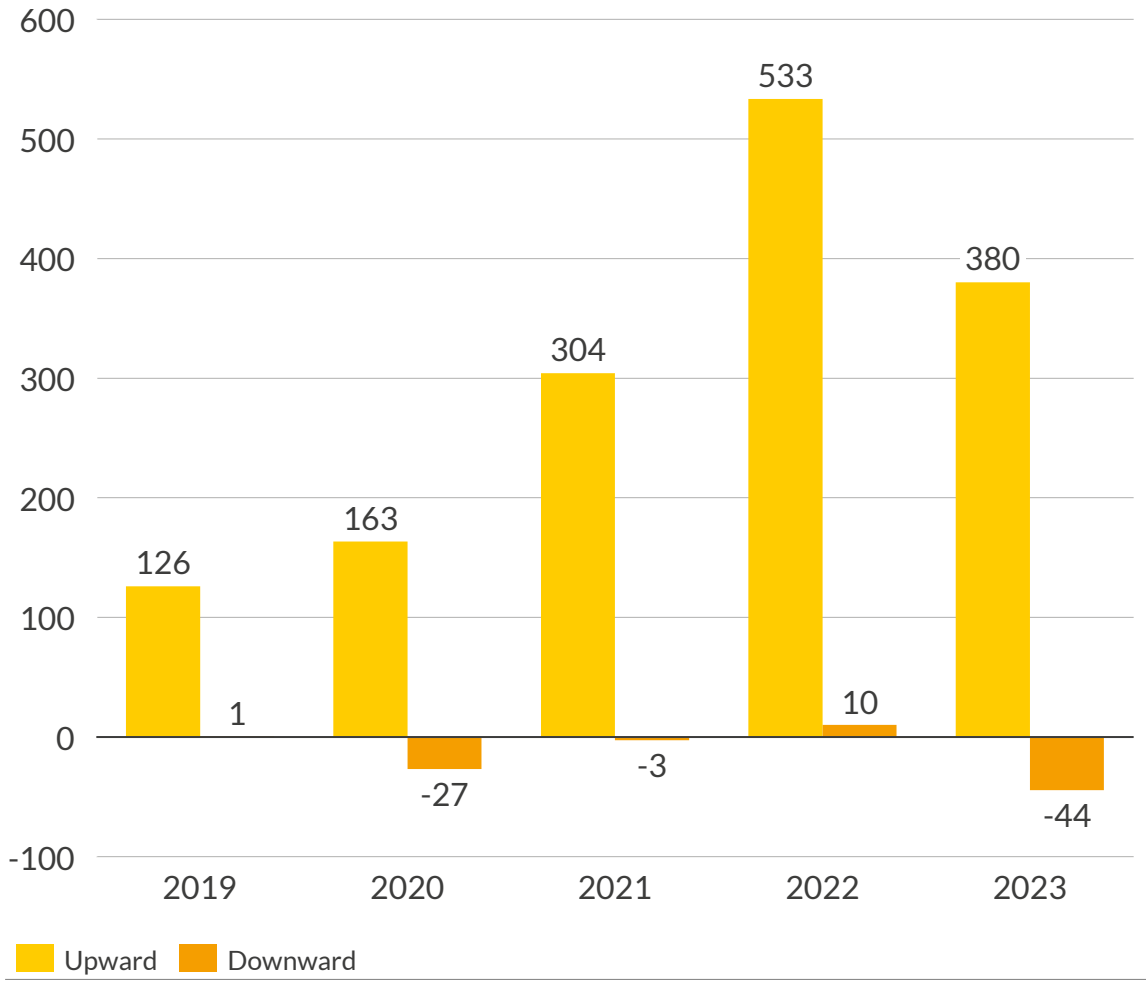
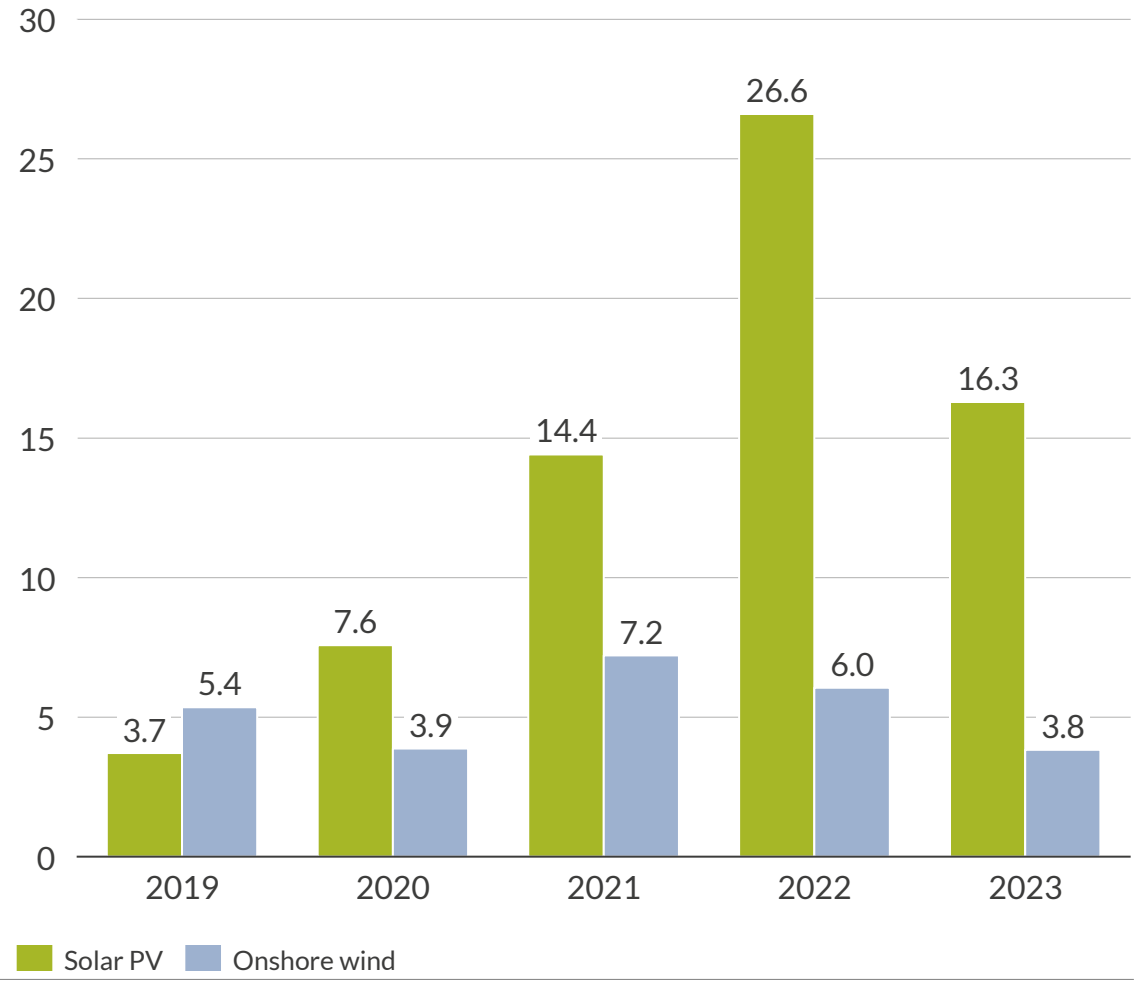
**Volume weighted imbalance prices**
€/MWh (nominal)




**Fleet-average imbalance cost – Solar & onshore wind**
€/MWh (nominal)




Sources: Tennet, PBL

# In this report, we present our insights on the emerging risks for renewables in the Netherlands and innovative strategies to boost renewable revenues

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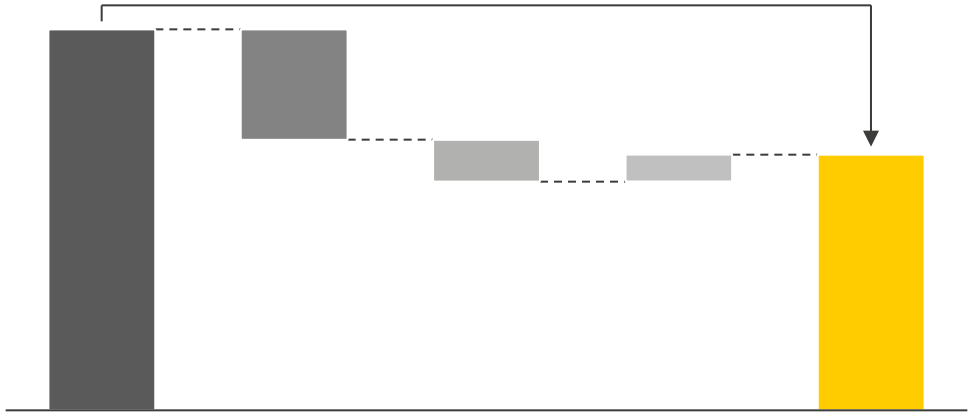
### Emerging risks for renewables

- We discuss the transition of the Dutch power system and identify the emerging risks for renewables in the Netherlands.
- We discuss the impact of price cannibalisation, negative price hours and imbalance costs on renewable revenues.

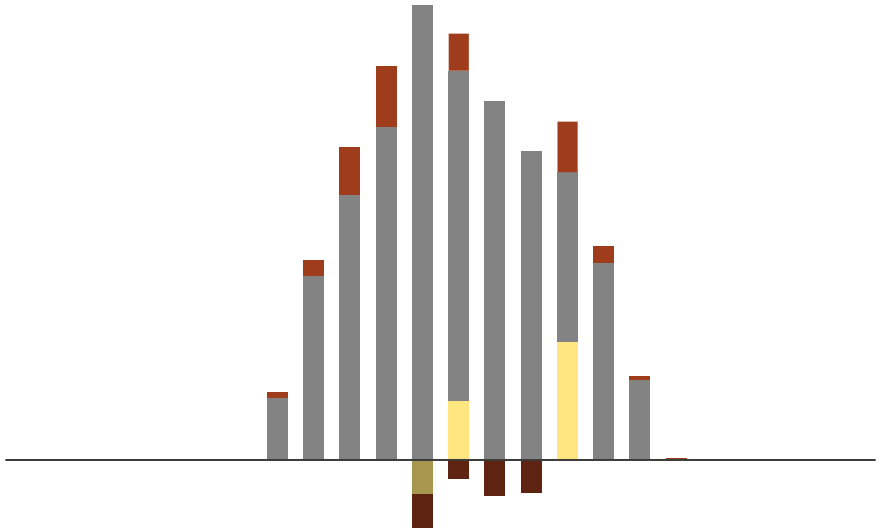
### Aurora's flexible dispatch for renewables

- We discuss the additional markets on which renewable assets can participate to diversify their revenues.
- We establish a flexible trading strategy for renewables and analyse how the additional revenues for a solar asset develop in the next 5 years.

### Renewable's revenues



### Aurora's flexible dispatch forecast



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# The transition of the Dutch power system will include the phase out of coal and gas and a fourfold increase in renewable generation

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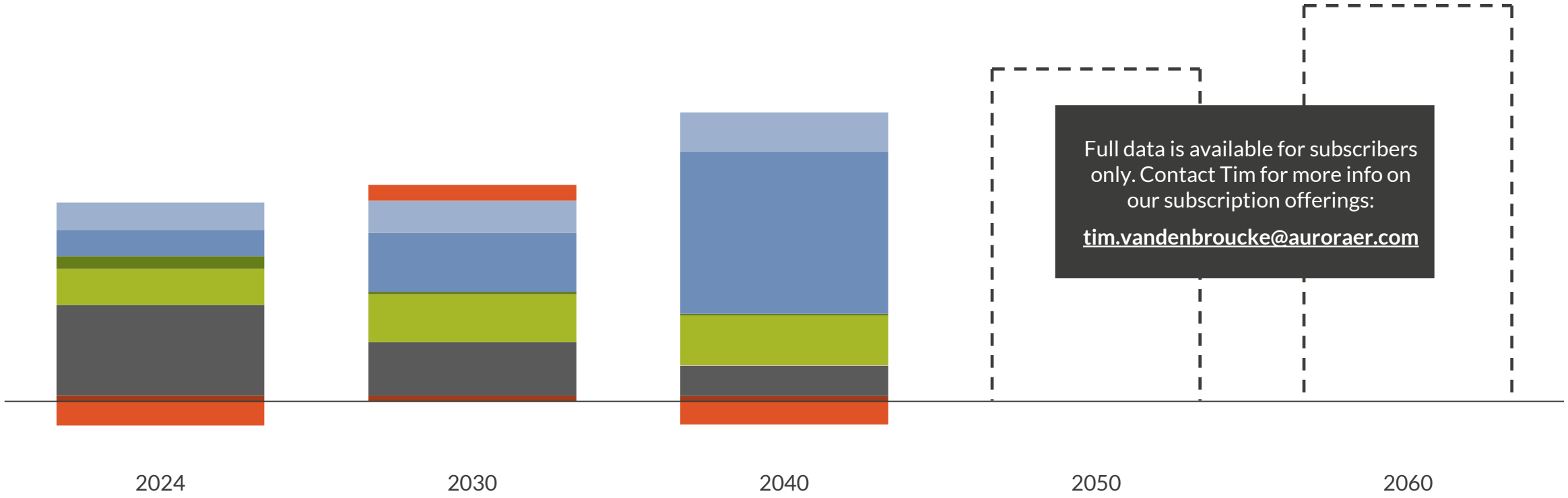
**Electricity Production and Net Imports**
TWh




**Low Carbon Generation Share of Total Demand**
%

| 2024 | 2030 | 2040 | 2050 | 2060 |
|---|---|---|---|---|
| 62 | 68 | >90 | >90 | >90 |

Nuclear | Conventional thermal | Hydrogen | Solar | Other RES | Offshore wind | Onshore wind | Net imports

Source: Aurora Energy Research

# Negative price hours have a strong impact on renewable revenues, especially for solar, due to a highly correlated production profile

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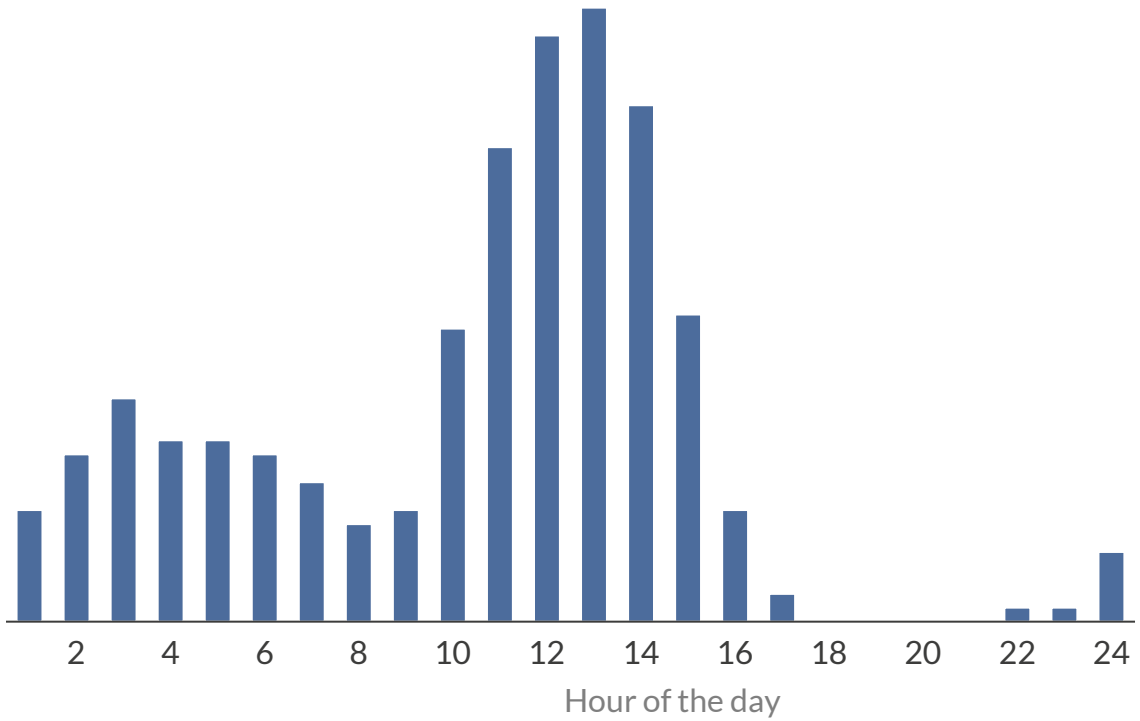
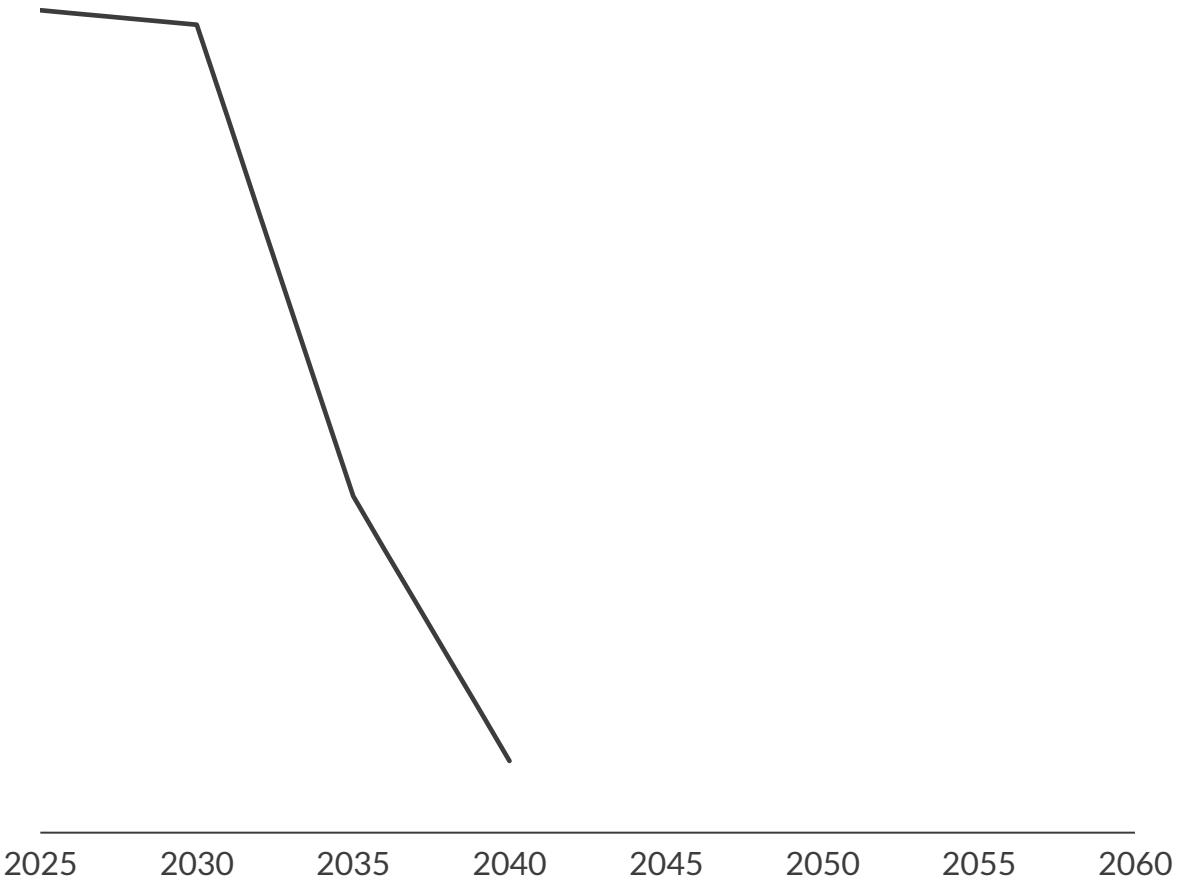
**Hourly distribution of negative price hours in 2023**
Number of negative price hours




**Number of negative price hours**
Hours p.a.




Source: Aurora Energy Research

# While imbalance costs are currently high, we expect a decrease due to better forecasting and convergence of European balancing markets

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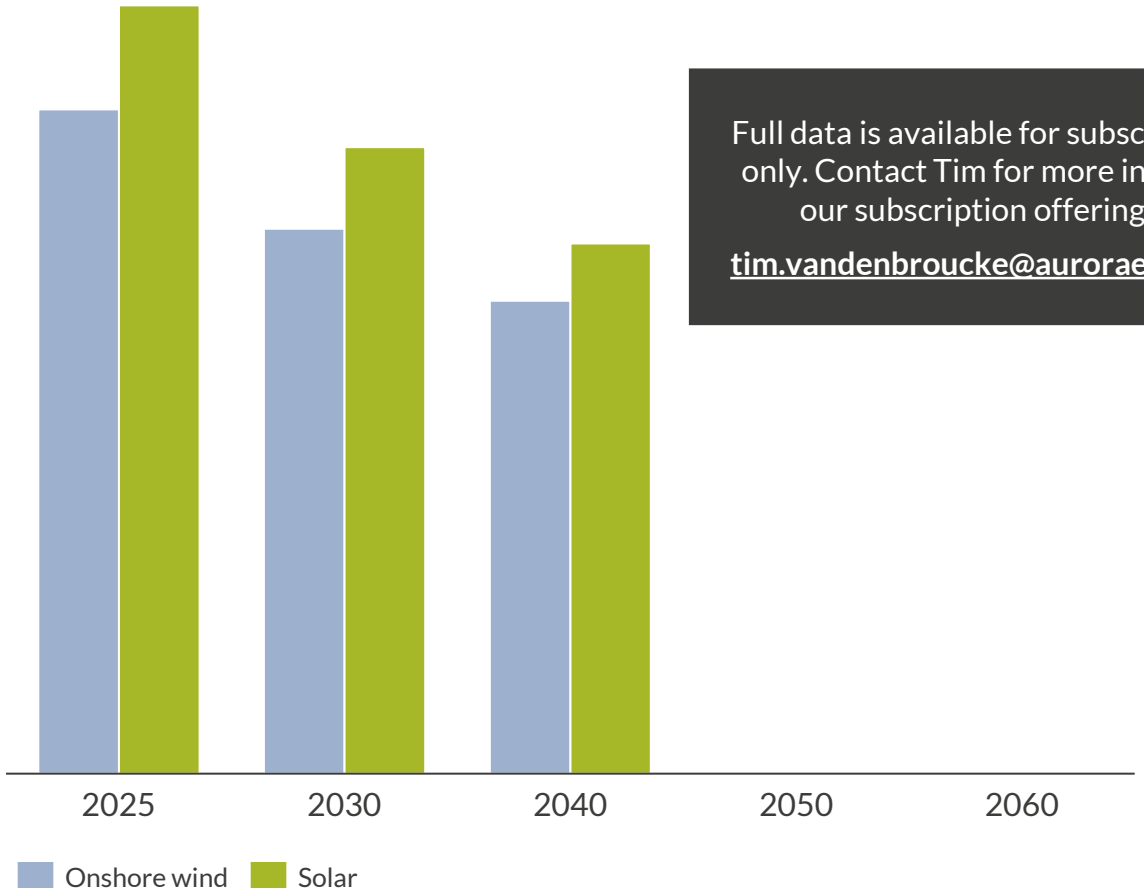
**Fleet-average imbalance cost – Solar & onshore wind**
€/MWh (real 2023)




Full data is available for subscribers only. Contact Tim for more info on our subscription offerings

tim.vandenbroucke@auroraer.com

**Drivers of developments in imbalance costs**

| Driver | Price effect |
|---|---|
| Growth in RES generation | ↑ |
| Improved weather forecast | ↓ |
| Flexible technologies | ↓ |
| Harmonisation of balancing markets | ↓ |

Source: Aurora Energy Research

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# Renewable assets can optimise across markets with different gate closure times, based on estimated generation and forecasted prices

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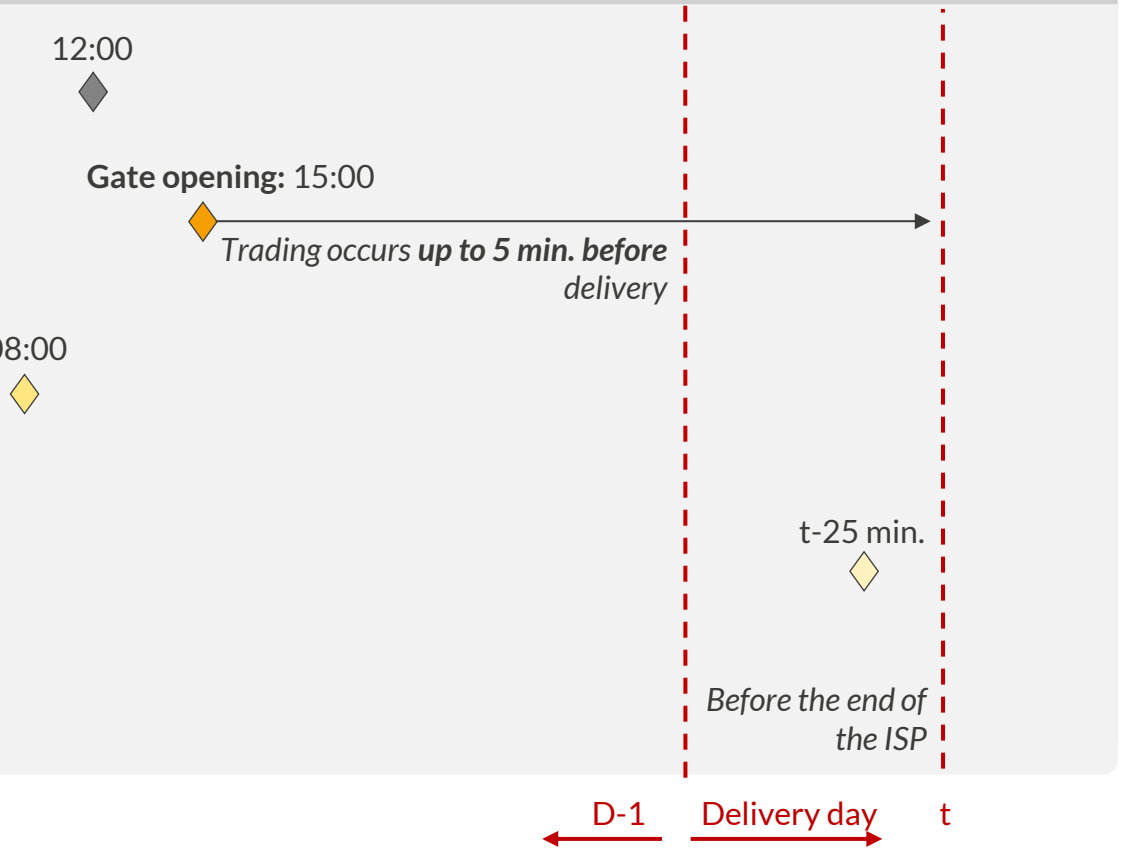
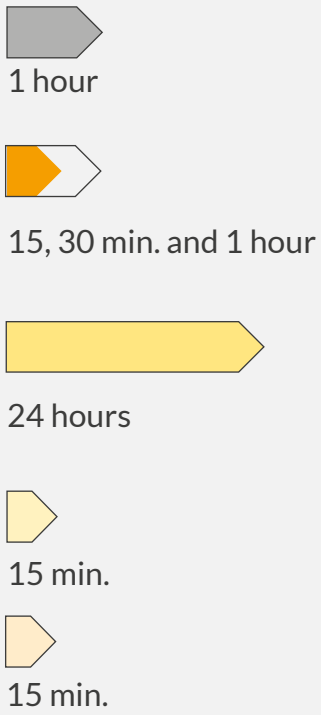
## Markets

- Day-Ahead
- Intraday
- aFRR capacity
- aFRR energy
- Reactive balancing

## Gate closure times




## Product length




Sources: Aurora Energy Research, Elia, TenneT, Regelleistung

# The potential for RES to participate on aFRR capacity is limited due to the 24h product, switching to a 4h product would offer opportunities

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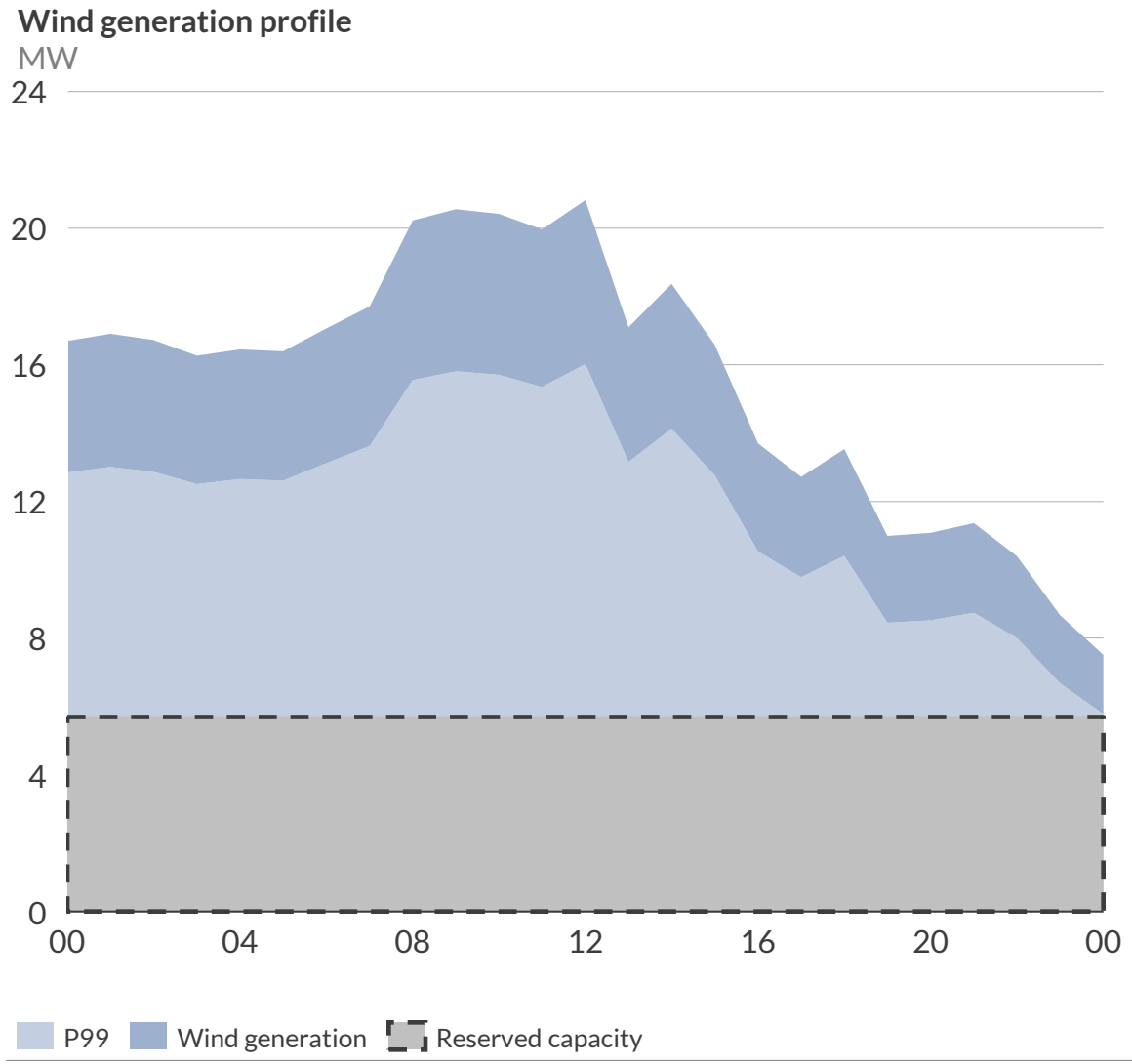



Sources: Aurora Energy Research, ENTSOE, CBS

# Reactive balancing offers an upside to renewables that contribute to balancing the system, but the risk of dual pricing means that revenues are not guaranteed

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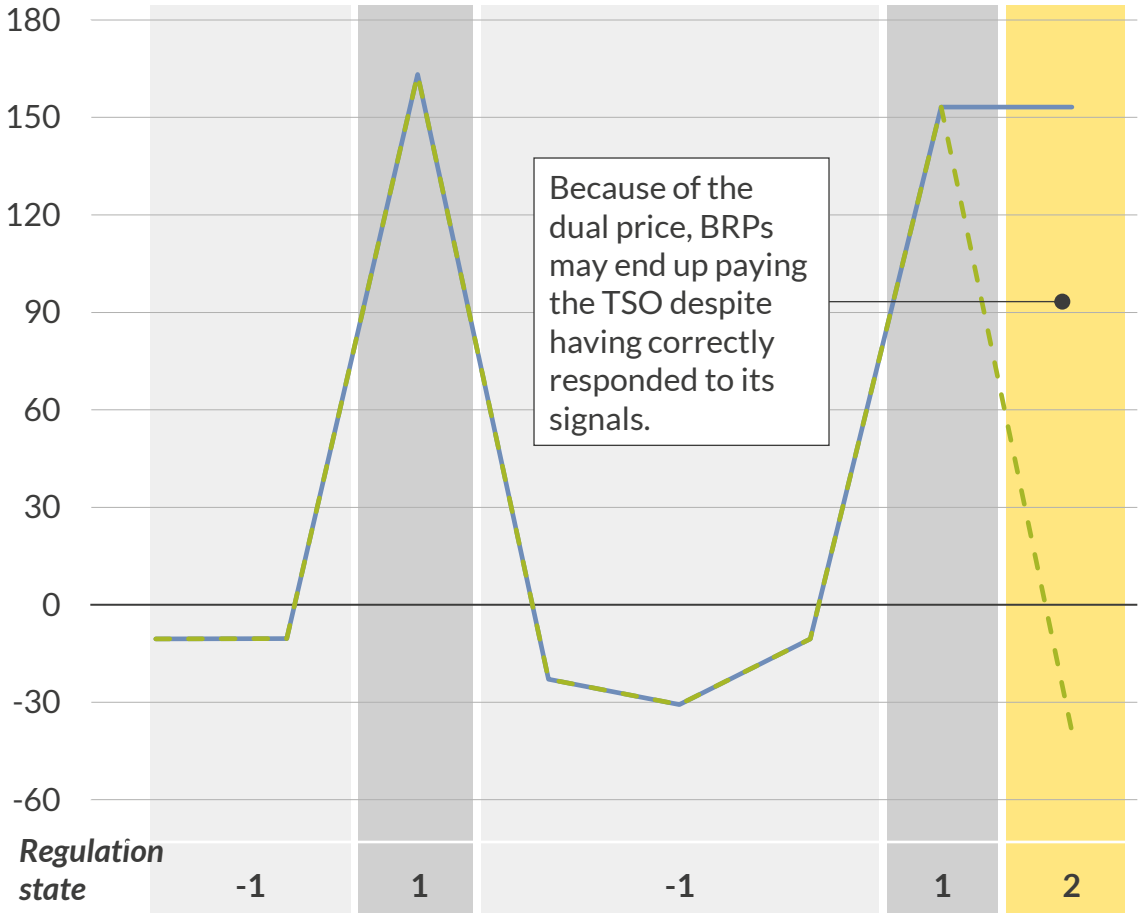
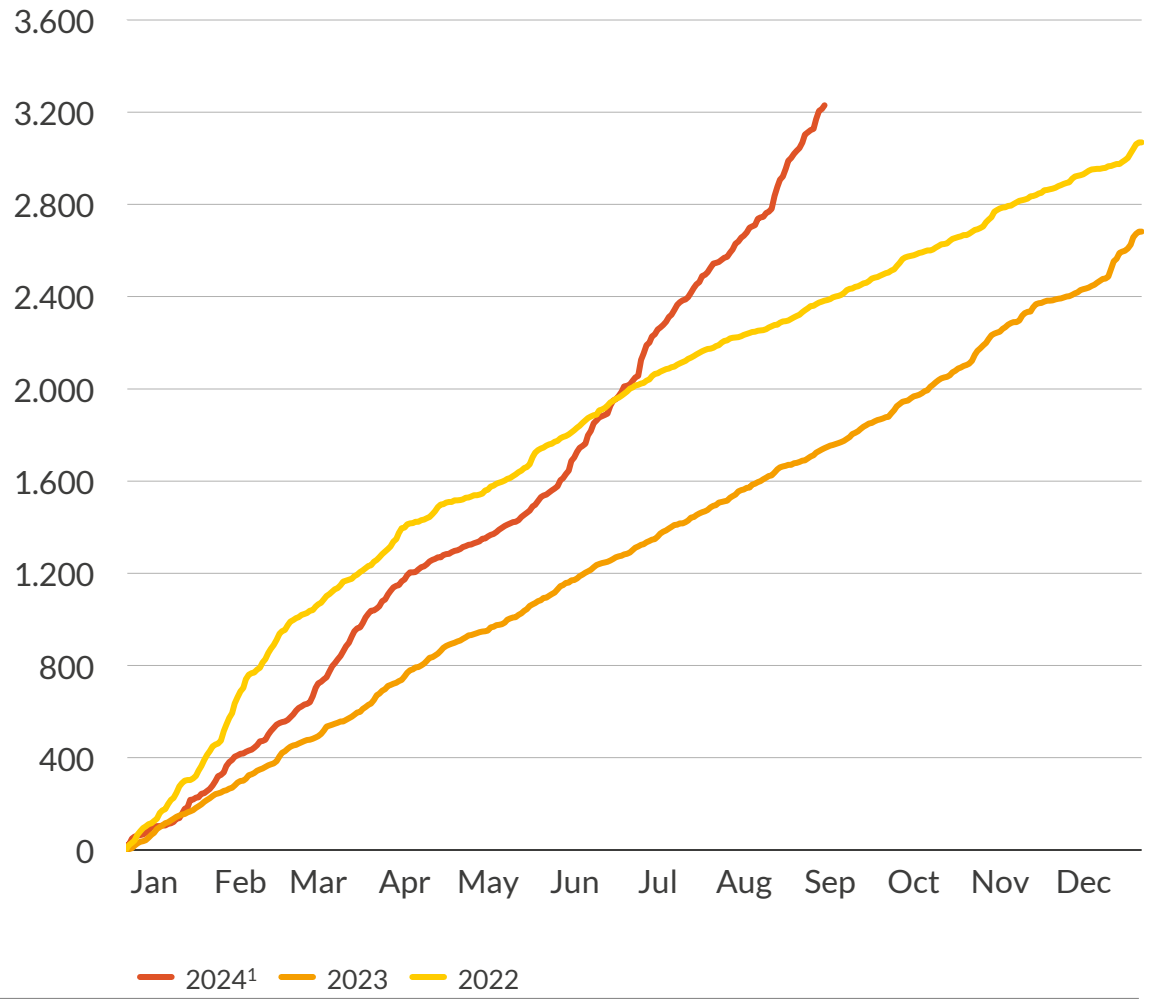
**Quarter-hourly imbalance prices and regulation state**
€/MWh (real 2023)




**Cumulative occurrence of regulation state 2**
Number of quarter-hour occurrences




1) Until 08/09/2024

Sources: Aurora Energy Research, Tennet

# We establish a flexible trading strategy, considering that 30% of the production volume participates on aFRR and imbalance markets

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## Base case: conditional Day-Ahead bidding

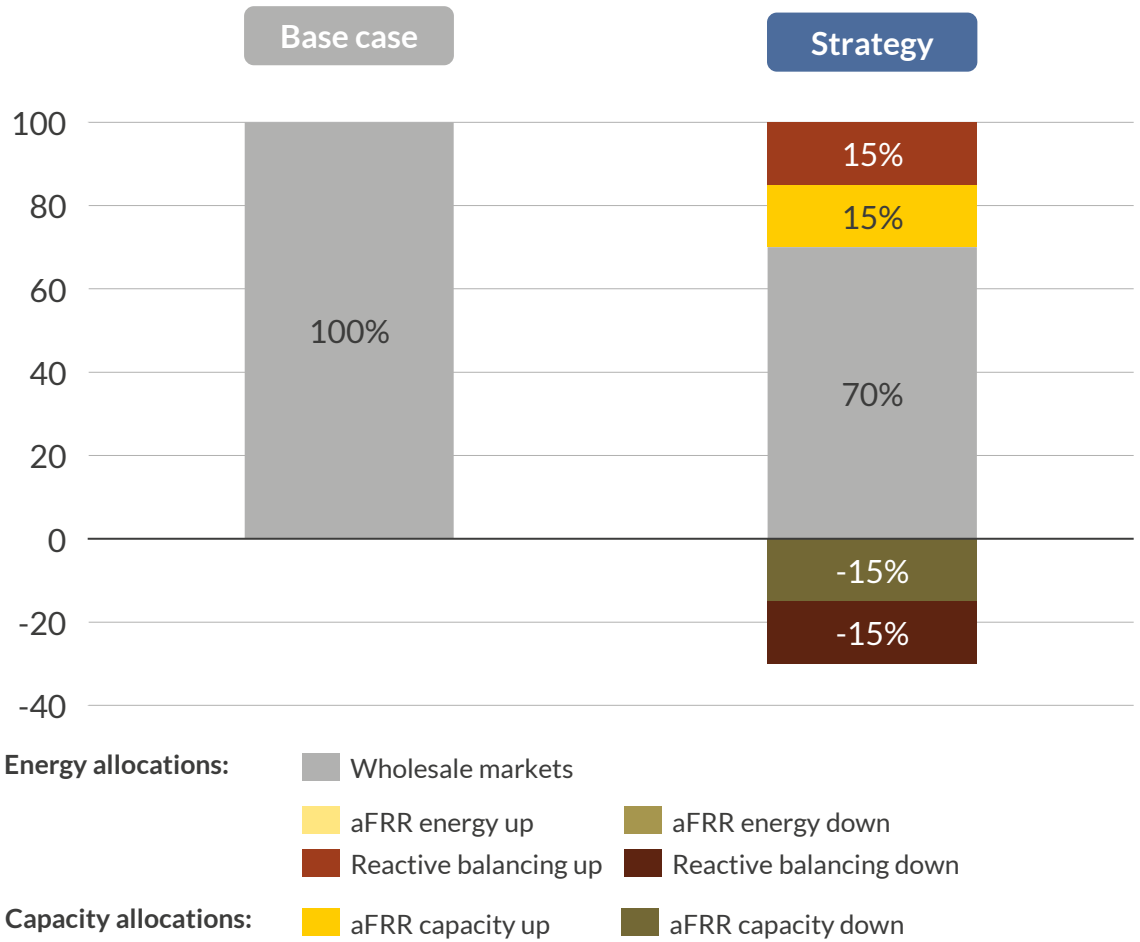
- The asset bids its entire production into the Day-Ahead market when the DA price is above the Guarantees of Origin (GOs) price.
- For DA prices below the GO price, the asset curtails completely. The available energy can be traded in real-time in the Intraday market (ID).

## Strategy: Future market design

- The asset bids 70% of its production volume into the DA market and optimises its participation on the aFRR capacity market and reactive balancing in both directions.
- The asset reserves capacity to participate on the aFRR capacity market, considering the switch to a 4h product. Only selected capacity bids are called for energy activations.

**Indicative volumes per market for each strategy**

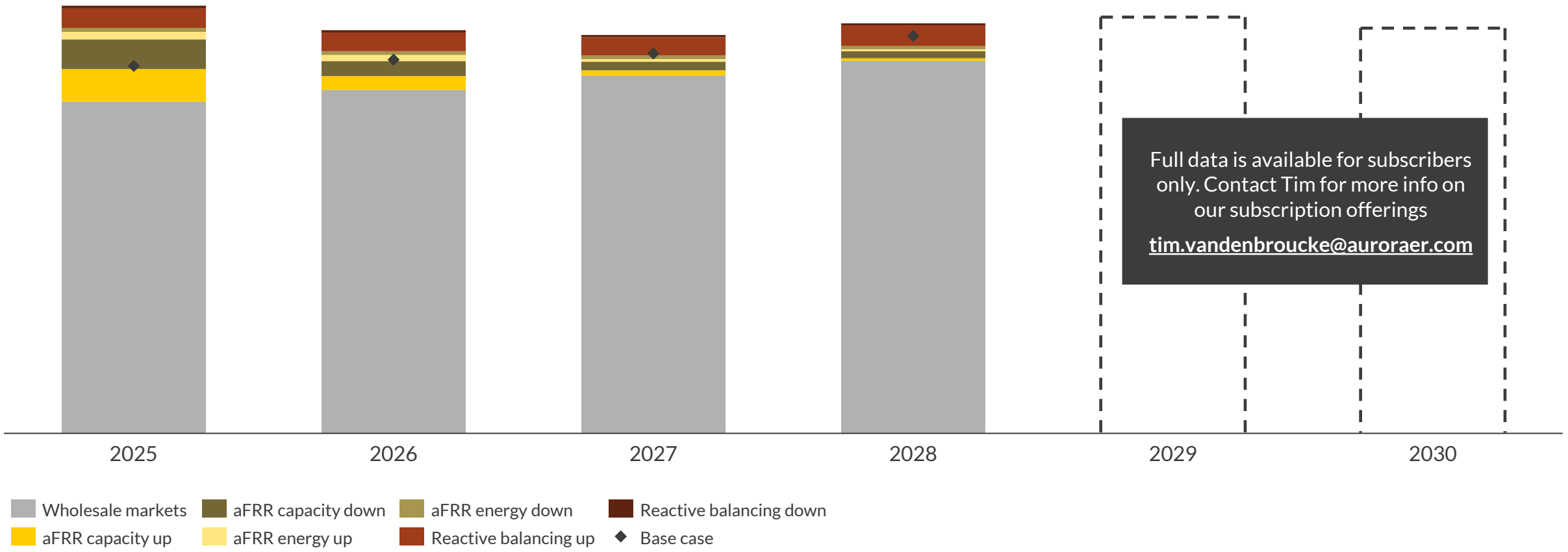
%




Source: Aurora Energy Research

# Flexible dispatch of solar assets leads to additional revenues in 2025-2030, mainly from participation in aFRR capacity and reactive balancing

**Solar PV revenue breakdown –** Base case **vs.** Future market design
€/MWh (real 2023)




Source: Aurora Energy Research

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# Key Takeaways

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1. The business case for RES in the Netherlands is affected by price cannibalisation and imbalance costs. Towards 2030, solar and wind capacity is expected to further increase, leading to higher discounts to baseload. Negative price hours have a strong impact on renewable revenues, especially for solar, due to a highly correlated production profile. We expect imbalance costs to decrease due to better forecasting and convergence of European balancing markets.

2. Historically, the highest additional revenues for solar and wind assets could have come from reactive balancing and participating in aFRR energy down.
   - Upward reactive balancing offers the highest revenues, due to the higher price for upward balancing than for downward balancing. Revenues from reactive balancing are, however, uncertain due to the risk of dual pricing.
   - Free bids on aFRR energy down can lead to additional revenues, especially for solar, as negative prices on aFRR energy down are correlated with high solar generation.
   - The switch to the 4h product for aFRR capacity is expected to lead to additional opportunities for renewables.

3. Flexible dispatch strategies that optimise across multiple markets continue to offer interesting revenues in the next few years. In 2025-2026, aFRR capacity contributes most to the additional revenues. Afterwards, reactive balancing leads to the highest additional revenues.

4. In the medium and long term, we expect the upside to reduce as additional participation of batteries and renewables cannibalises prices and reduces activations on balancing markets.

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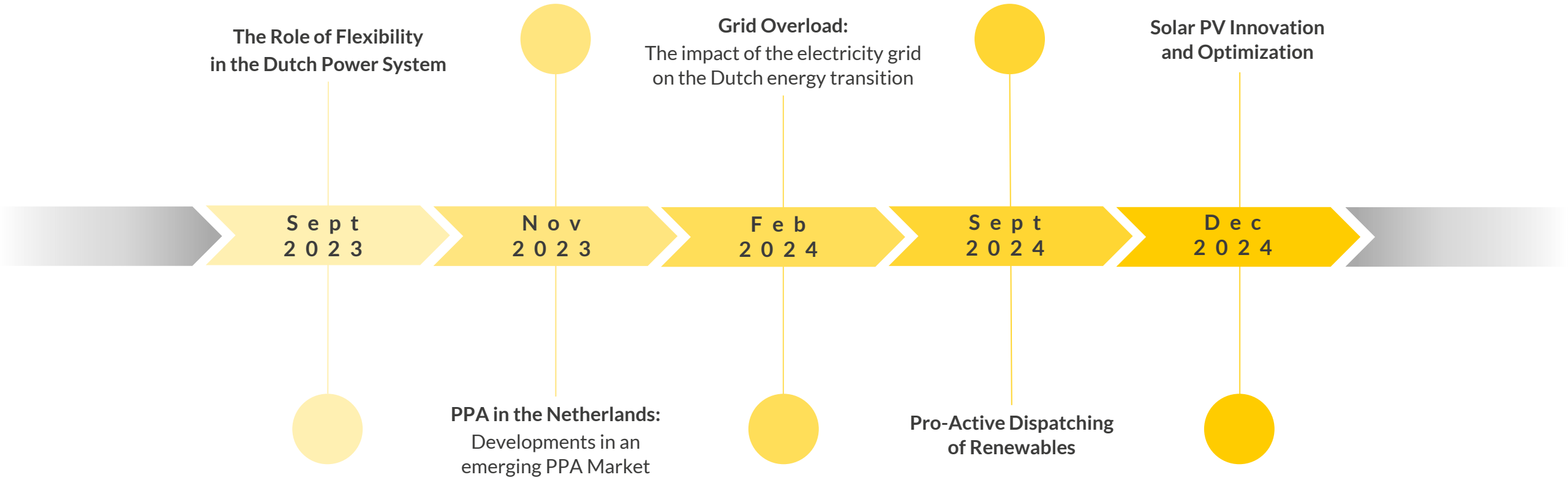


Source: Aurora Energy Research

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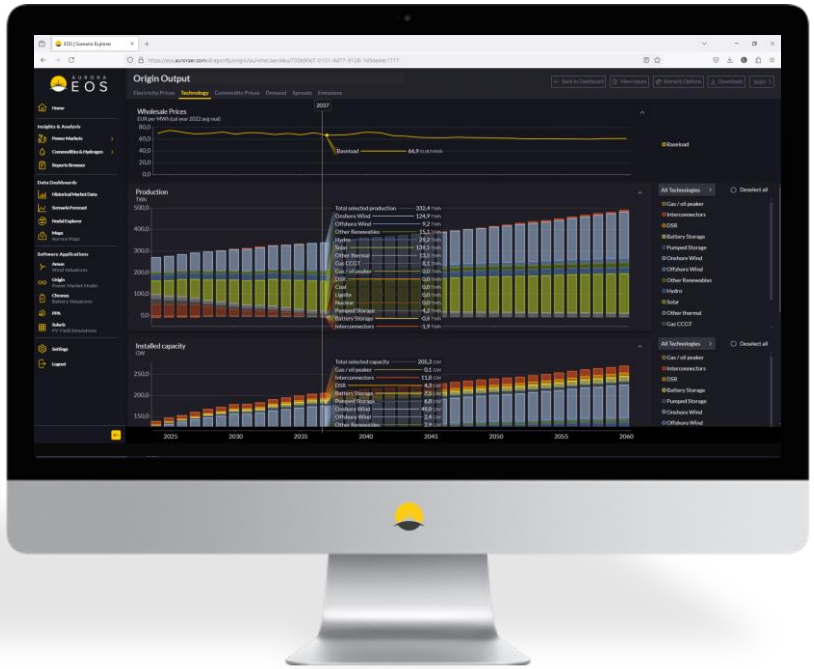
**Best in class:** Used by leading utilities, developers, funds, TSOs and consultants

**Accurate:** Unique iterative investment module, capturing real investment behaviour




**Intuitive 4-step process:**

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# Details and disclaimer

**Publication**
Innovative strategies to boost renewable revenues in the Netherlands

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