AURORA
ENERGY RESEARCH

Exploring the New Wave of Subsidy Support in Romania and Hungary

Public Report

October 2023

Agenda

AURORA

I. About Aurora

II. Latest updates on the Romanian CfD scheme

III. How can we help potential bidders in the Romanian CfD auction?

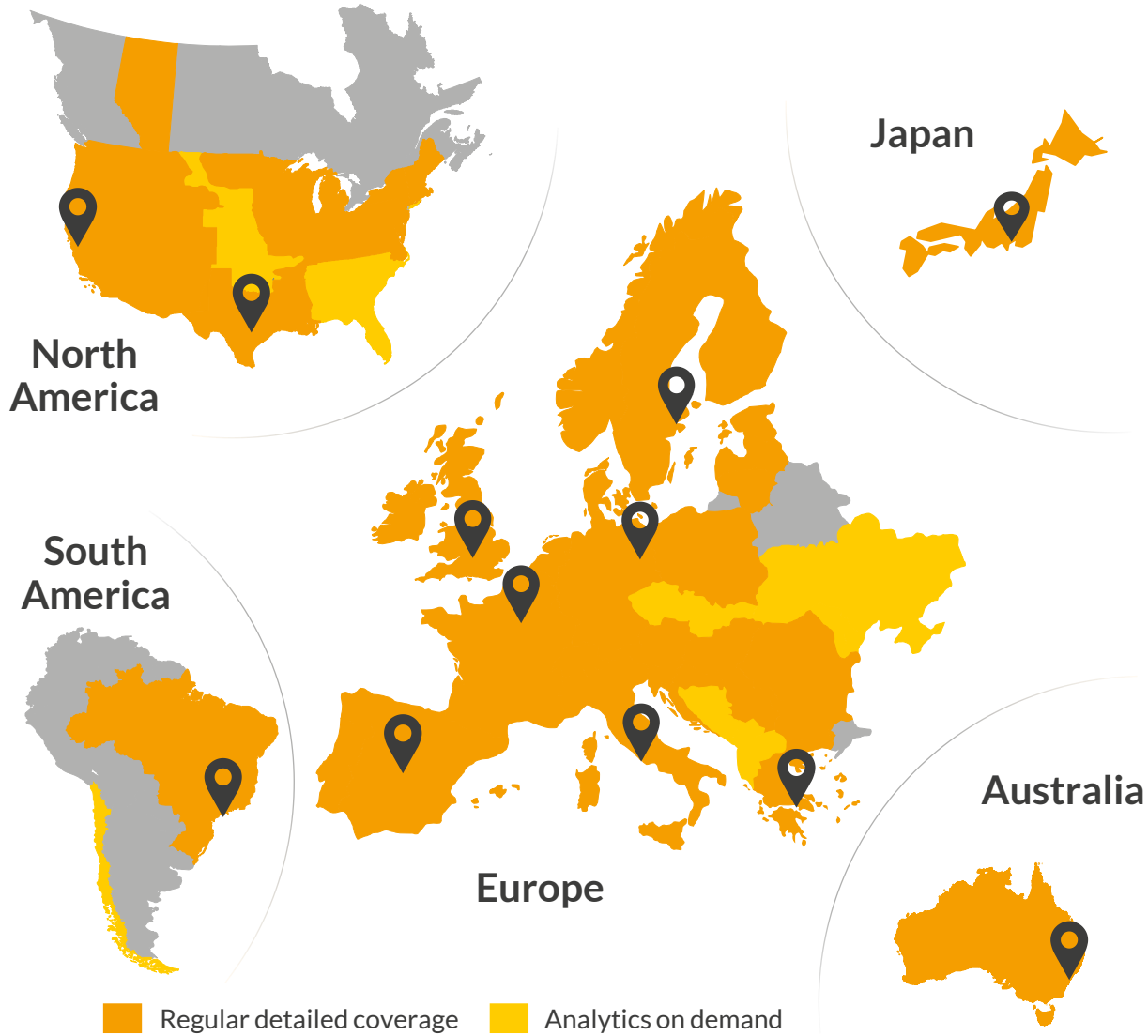
IV. What do we know about the Hungarian battery auction scheme?

V. Our contribution to understanding flexibility market revenue streams

Aurora provides market leading forecasts & data-driven intelligence for the global energy transition

AURORA

- Power markets
- Renewables
- Storage
- Electric vehicles
- Hydrogen H_2
- Carbon CO_2
- Natural gas



12 Offices

Oxford | Berlin | Madrid | Athens
Paris | Sydney | Austin | Oakland
Rome | Stockholm | Tokyo
São Paulo

500+

market experts

750+

subscribing companies

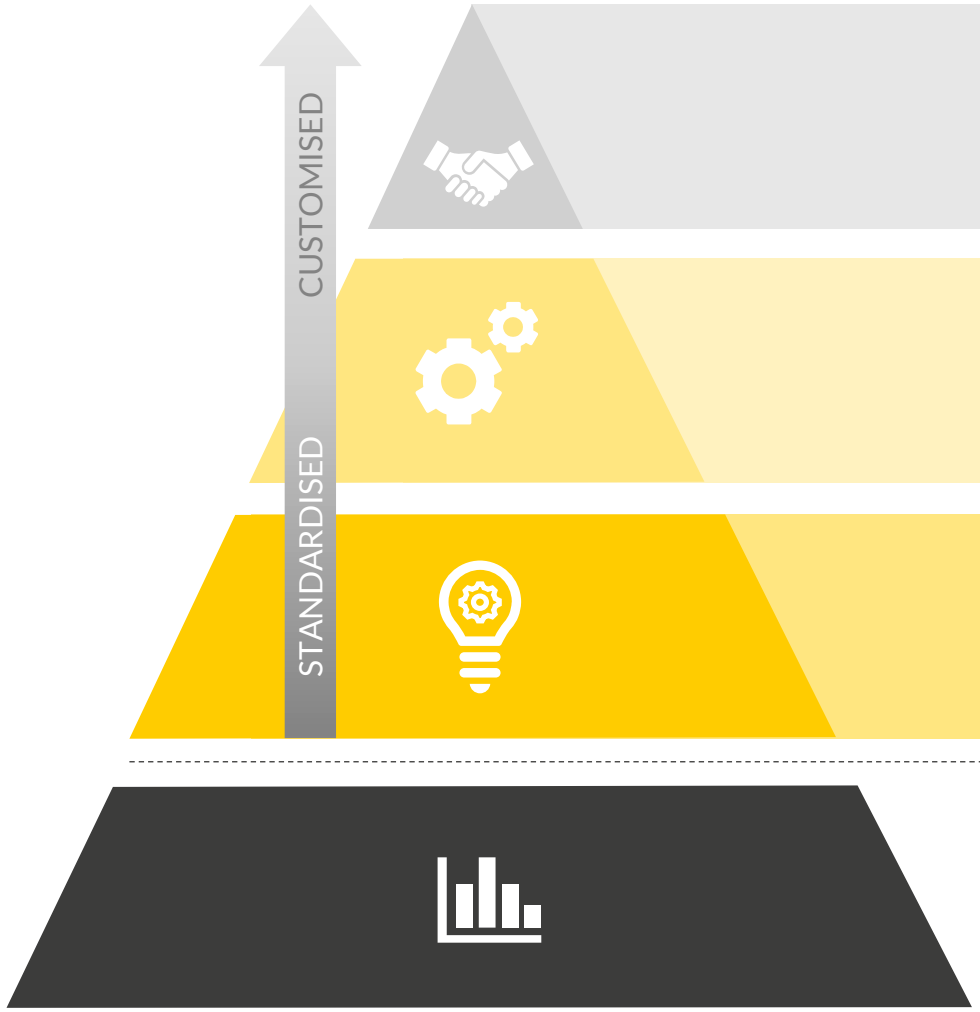
150+

transactions supported in 2022

Source: Aurora Energy Research

Our market leading models underpin a comprehensive range of seamlessly integrated services to best suit your needs

AURORA



Advisory

Access tailored expert advice and analytics for your crucial projects

Trusted advice and dedicated support for strategy, investments, transactions and policy engagement

1400+ projects globally

Software Solutions

Make standard analysis bespoke through direct access to our models

Unique SaaS subscriptions to create your own scenarios and asset-specific investment cases

100+ company licenses

Subscription Analytics

Receive regularly updated forecasts, sample investment cases and timely deep-dives

Industry-standard outlook reports, bankable price forecasts and strategic insights for power and commodities

600+ subscribing companies

Models & Data

Market-leading models for power, gas, hydrogen, carbon, oil & coal markets

Proprietary and continuously updated cutting-edge models populated with highest quality curated datasets

Developed over 10 years, 40+ dedicated modellers

Source: Aurora Energy Research

We work with a very broad range of clients … their constant challenge keeps us up on our toes and ensures our independence

AURORA

> *"With its capabilities, intellect and with its credibility Aurora plays an essential role bringing the dialogue [in the global energy transition] to a different plane"*
>
> **Ben van Beurden, CEO, Shell**

> *"Aurora analysis and the provision of reliance was crucial for our debt funding. Their ability to explain market logics and revenue streams was vital for this successful financing."*
>
> **Jeremy Taylor, Director, Green Frog Power**

Power & utilities

fortum, FORSA ENERGY, edp, e·on, IBERDROLA, Tesla, Urenco, centrica, CALPINE, 50hertz, RWE, Ørsted, drax, enel, InterGen, uniper, EDF, UK Power Networks, ESB, Enea, Viridor, EnBW, axpo, sorgenia, Energa, Eneco, SSE, nationalgrid, ukpowerreserve, ENGIE, Terna, VATTENFALL, Statkraft, enviva

Energy consumers

BASF We create chemistry, Port of Rotterdam, GLENCORE, Heineken, BOC Member of The Linde Group, MITSUBISHI POWER, umicore, SIEMENS, EVONIK, Google, ITM POWER Energy Storage | Clean Fuel, INEOS, UPM, SALZGITTER AG, Unilever, SNCF, SIMEC, AlzChem, DB, wieland, orange

Financial sector & investors

GREENCOAT CAPITAL, Close Brothers Asset Finance, 北京控股有限公司, CIP, JLEN, equitix, Allianz Global Investors, SOCIETE GENERALE, Commonwealth Bank, CaixaBank, NatWest, Foresight, BARCLAYS, LLOYDS BANK, Crédit Agricole, MUFG, Partners Group, InfraRed, CPP INVESTMENT BOARD, ENERGY INFRASTRUCTURE PARTNERS, Marubeni, OCTOPUS INVESTMENTS, ONTARIO TEACHERS' PENSION PLAN, Legal & General, RBC, 中国投资有限责任公司, bluefield Partners LLP, NTR, mirova, UniCredit, COMMERZBANK, Moody's, DALMORE CAPITAL, Downing, RIVER STONE, National Australia Bank, HSBC, MACQUARIE

Oil & gas

ORLEN, Vitol, GASAG, equinor, eustream, OGE, SW//M Stadtwerke München, bp, snam, centrica, nationalgrid, Thyssengas, Naturgy, fluxys, Shell

Project developers

BELECTRIC, CanadianSolar, POLENERGIA, GreenFrog Power, solarcentury, brockwell energy, NEOEN, enlight, PACIFICO, tagenergy, BORALEX, British Solar Renewables, BayWa r.e., Good Energy, low carbon, BANKS Group, greentech, Invenergy, res power for good, bnrg, powercapital renewable energy, Anesco, HIVE ENERGY, TECHNIQUE SOLAIRE, EnergieKontor, lightsource bp, bp

Policy & regulation

Bundesnetzagentur, Bundesministerium für Wirtschaft und Klimaschutz, Ministerie van Economische Zaken en Klimaat, seai, Climate Change Committee, DRC Development Research Center of the State Council of the People's Republic of China, Roinn Cumarsáide, Gníomhaithe ar son na hAeráide & Comhshaoil Department of Communications, Climate Action & Environment, European Climate Foundation, European Commission, HM Treasury, Energy Regulatory Office, JETRO Japan External Trade Organization, National Audit Office, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, NATIONAL INFRASTRUCTURE COMMISSION, AEMO, LOW CARBON CONTRACTS COMPANY, Electricity Settlements Company, Department for Business, Energy & Industrial Strategy

Source: Aurora Energy Research

Agenda

AURORA

I. About Aurora

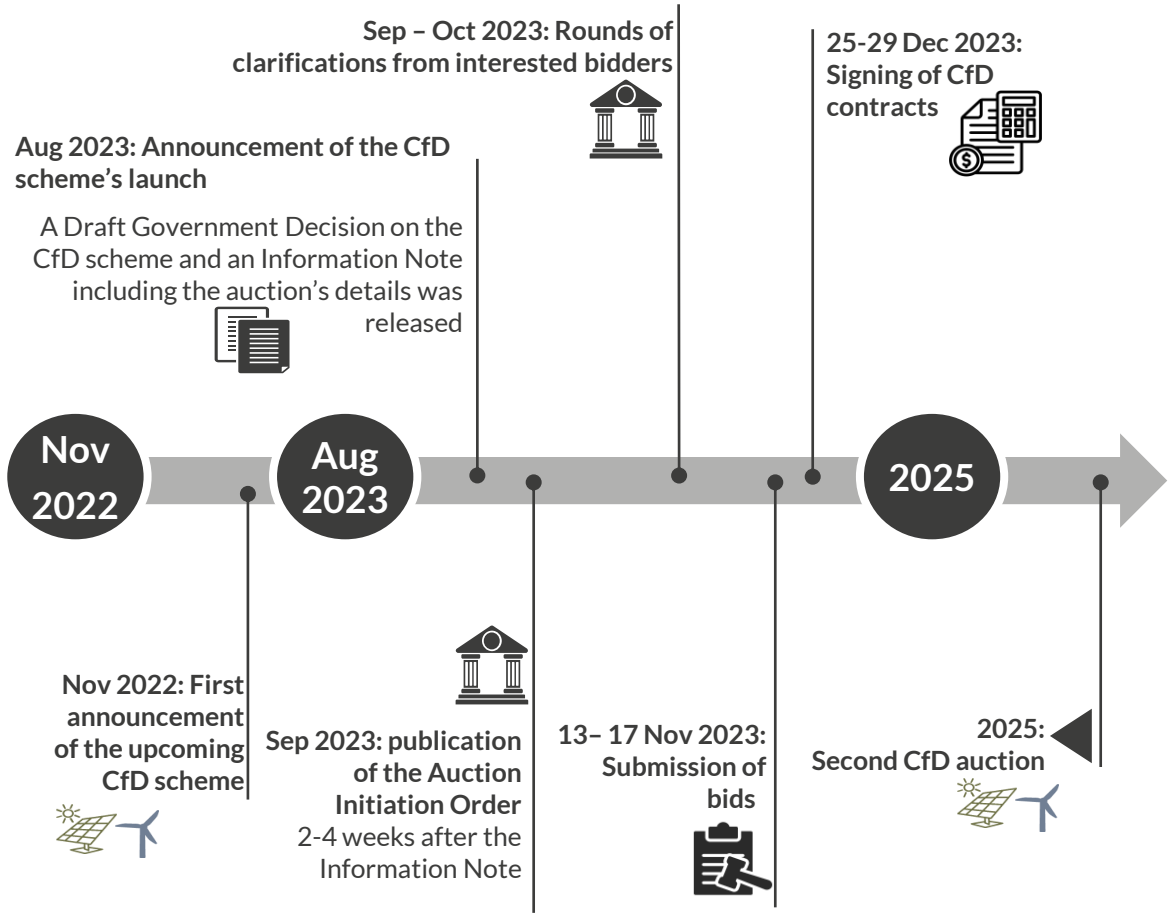
II. Latest updates on the Romanian CfD scheme

III. How can we help potential bidders in the Romanian CfD auction?

IV. What do we know about the Hungarian battery auction scheme?

V. Our contribution to understanding flexibility market revenue streams

Romania's first RES auction is planned for Oct/Nov 2023, with successful bidders to be announced before the end of the year



This auction scheme is the first part of a multi-year plan, which envisages supporting a total of 10 GW newly installed capacity by 2030

The **Auction Initiation Order** will define the final eligibility requirements and bidder selection criteria

Project eligibility requirements
Minimum capacity is 5 MW , maximum capacity to be set out in the Auction Initiation Order
An already obtained grid connection permit (ATR - *aviz tehnic de racordare*[2]) , with connection date no later than December 2026 in necessary
Projects for which the EPC contracts or equipment supply contracts were concluded are still eligible if concluded after July 20, 2022
Projects with behind the meter storage capacities or hybrid projects with single meter will not be eligible
Projects benefiting from other support schemes will not be eligible – however, applying for multiple support schemes, and a decision afterwards is a possible strategy
Bidder selection criteria
According to previous announcements the selection is done **solely based on the offered price**
In case of tied bids offered capacity, commissioning date, application date could play a decisive role

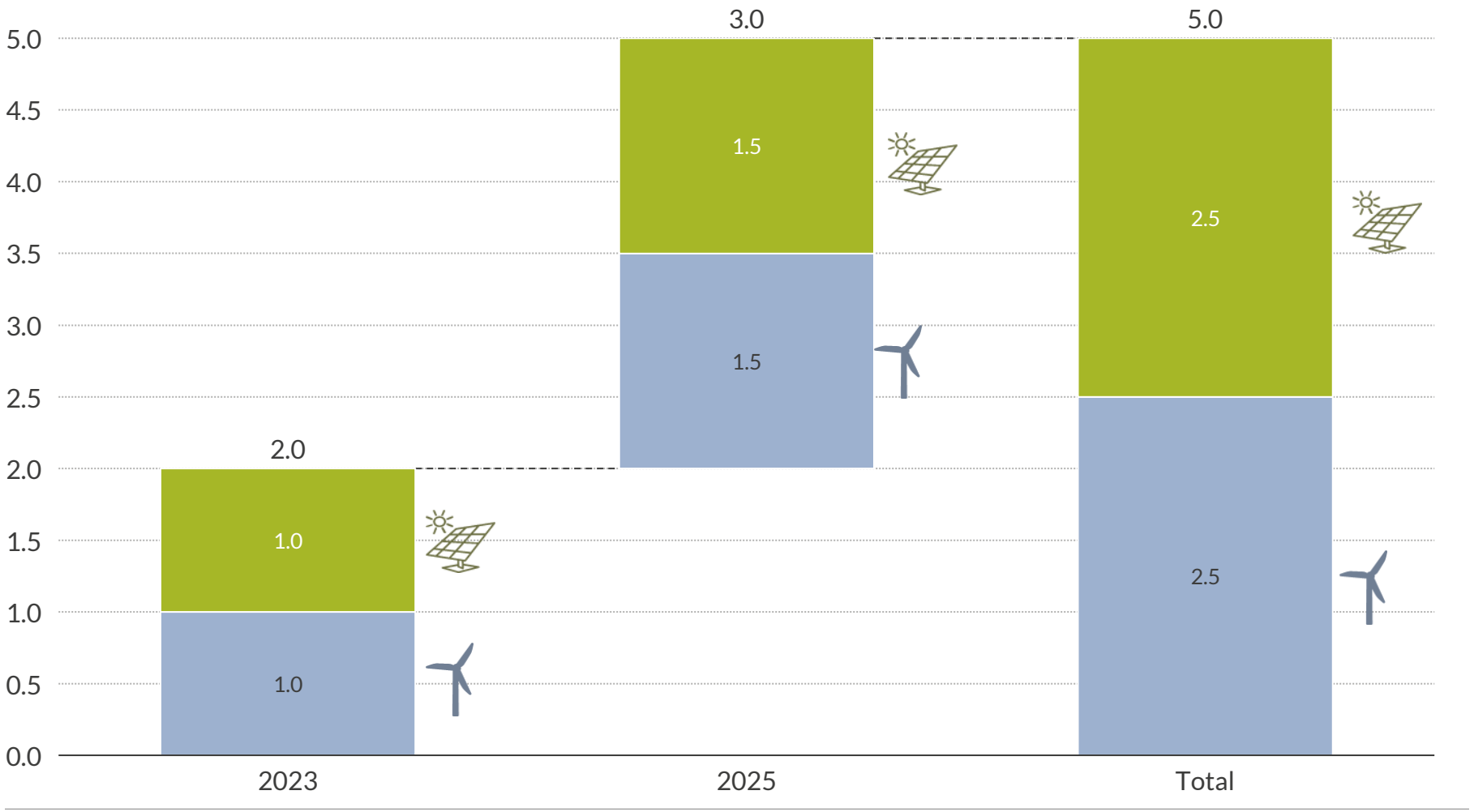
1) The auction calendar might be updated after the publication of the Auction Initiation Order.

Source: Aurora Energy Research

The first scheme will support in total 5 GW of wind and solar projects, split in two auctions, 2 GW in 2023 and 3 GW in 2025

Potential solar PV and onshore wind capacities eligible for the CfD auctions

GW



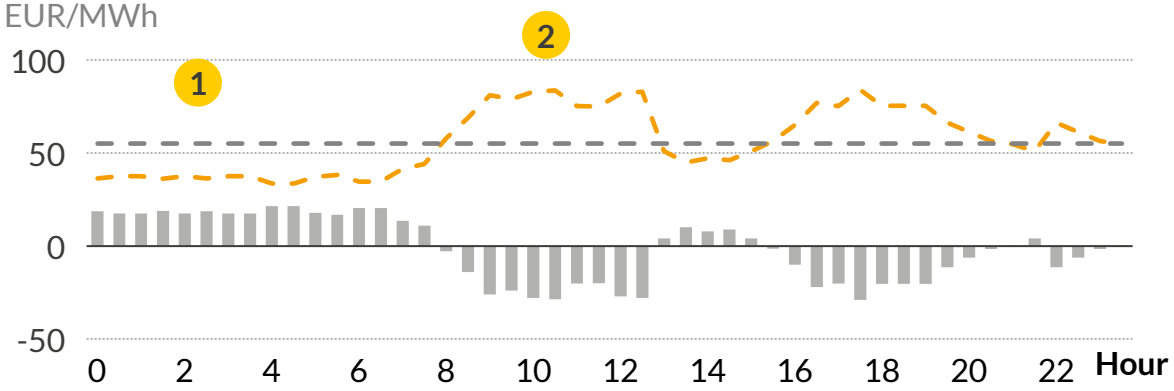
Source: Aurora Energy Research

- The first stage of the CfD scheme will support onshore wind and solar PV projects with a total capacity of 5 GW
- It is split in two auctions, the first auction in 2023 for 2 GW and the second auction in 2025 for 3 GW
- Each auction will be equally split between the two technologies
- The **duration of the CfD contract is set for 15 years**
- The **commissioning date must be set by December 2026**
  - Should the project be commissioned after the set target date without exceeding 24 months, the delay will be deducted from the CfD contract duration
  - If the delay exceeds 24 months, the CfD contract is terminated

The long-awaited Romanian Contracts for Difference (CfD) scheme is a floating feed-in premium, inspired by the UK model

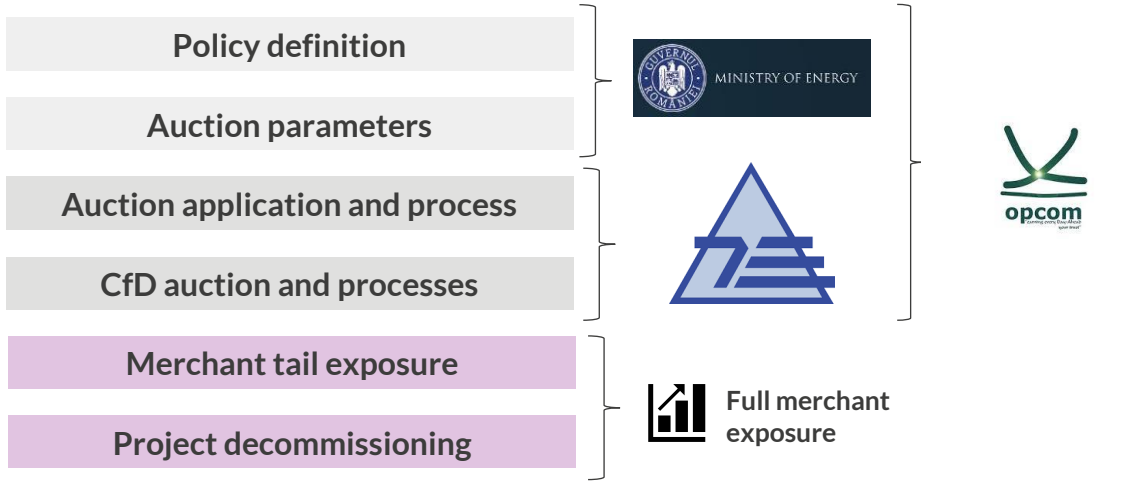
The Contracts for Difference (CfD) scheme operates as a two-way floating premium, guaranteeing a price for generators

Floating Feed-In Premium for an illustrative across a day



The support is structured as a two-way floating feed-in premium and is secured via competitive auctions

The Romanian CfD scheme is administrated by a number of regulatory bodies who have different responsibilities



For a given settlement period, if the Market Reference Price is:

1. Lower than the generator's Strike Price, then the generator will be paid the difference
2. Higher than the generator's Strike Price, then the generator will have to pay back the difference payment to the supplier

Generators with CfD contracts are free to sell the electricity based on their own trading strategy, on the organised markets or via PPAs

- The European Bank for Reconstruction and Development (EBRD) supported the Ministry of Energy creating the auction scheme
- The CfD scheme is planned to be financed both from the Modernization Fund and via a levy paid by the final consumers, collected by the suppliers; this levy will be already implemented starting January 1, 2024

Strike price Market Reference Price Support payment

Source: Aurora Energy Research

We expect a strong interest towards the first CfD auctions as they could freshen up the stagnating RES landscape of Romania

Driver	Description	Impact on pricing	Impact on the potential participation
1 **Existing RES pipeline and potential for participation**	▪ From the end of April until last month, over 2 GW of wind and solar projects have obtained the ATR (grid connection permit), needed for the participation in the auction. In total there are already over 4 GW of wind and over 5 GW of solar PV projects that have received the connection permit and are therefore theoretically eligible to apply (although not all projects are expected to be viable)		
2 **Ceiling price of the auction**	▪ If the price is set low, it might decrease the attractiveness of the auction while if it's set high it could lead to higher overall strike prices. Given the higher starting prices in auction through the EU, it is expected Romania will follow		
3 **PPA landscape of Romania**	▪ PPAs could be an alternative to receiving CfD support, however the PPA market in Romania is not mature enough yet and offtaker availability is not plentiful. As a result, a CfD contract could be a safer alternative for materialising a project, therefore increasing competition		
4 **Market prices and merchant projections**	▪ Market prices have been at historical highs and while 2022 saw a drop, there is no expectation to return to pre Covid levels in the short and medium term		

We expect the first auction to be oversubscribed, as there is a pool of 5 GW solar and 4 GW of wind projects which are eligible to participate and will most likely aim for the security a 15-years CfD contract is able to provide. However, this depends on auction starting prices, the real number of eligible projects and overall rules of the auction.

Source: Aurora Energy Research

Romania has recently published a preliminary legal framework for offshore wind deployment in the country; 3 GW to be granted via auctions

AURORA

Main stakeholders 	▪ **Ministry of Energy:** Responsible party for defining exploration zones and organising auctions ▪ **ACROPO:** Develops regulations regarding the exploration, construction, operation and decommissioning activities ▪ **ANRE:** Responsible party for projects' licensing ▪ **Transelectrica (TSO):** Issues the technical approval for the project's connection to the grid
Exploration zones & exploration licenses 	▪ A 24 months dedicated study to be **completed by 2025** is planned by the Ministry of Energy, with an aim to define potential wind offshore areas to be auctioned for exploration . The study will be supported by a specialised consultant ▪ Selection criteria will include wind load factors, power plants construction feasibility, water uses (based on the Strategic Environmental Assessment of the Maritime Space Planning Committee) and environmental impacts. The definitive list of exploration zones will be announced in 2026 ▪ Subsequently, **exploration licenses** of **2 years duration**[1] are to be issued. The exact procedures for granting them are to be published by January 2027 ▪ **Exploration costs** are to be undertaken by interested parties and **later reimbursed** (reimbursement limits will be defined by the Ministry of Energy)
Renumeration (CfD scheme) 	▪ A **3 GW** wind offshore capacity will be supported by a **CfD scheme**. The respective capacity will be granted via a public tender, which will take place by 2027 ▪ Selection criteria will be also considered and may include participants' demonstrated experience, financial and organisational performance. The exact procedures to award offshore wind concession through the aforementioned auction is expected until July 2027
Grid connection 	▪ **Expenditures** for constructing the project's internal electrical grid, the substation and the power lines to the TSO point need to be covered by **the project developer** ▪ **Ownership and maintenance** of grid connection facilities will be agreed between the developer and the TSO on the basis of a **dedicated contract**

1) Exploration licenses will be issued for a maximum duration of 2 years, plus 1 year of possible extension

Sources: Aurora Energy Research. Ministerul Energiei.

Agenda

I. About Aurora

II. Latest updates on the Romanian CfD scheme

III. How can we help potential bidders in the Romanian CfD auction?

IV. What do we know about the Hungarian battery auction scheme?

V. Our contribution to understanding flexibility market revenue streams

Dive deeper into the CfD auction dynamics and the competitive landscape in Romania with our bespoke report

AURORA

Explore how your business can benefit from our bespoke Romanian CfD Wind and Solar auction reports and forecast from our Commercial Associate Petro Ylli: petro.ylli@auroraer.com

The deliverables will include a slide-based report with key insights and analysis as well as customisable Excel tool with the supply stack

Initial analysis of eligible wind & solar assets

- Report on Romanian RES landscape
- Overview of CfD regulatory context and analysis of main points of interest
- Shortlisting of eligible assets
  - Using Transelectrica data for the identification of projects at different stages of development
  - Project probability assessment using success rates analysis
- Amun analysis for clusters of projects:
  - Use of Aurora's market leading wind asset valuation software – Amun – to calculate average load factors of different assets
  - Use Amun to calculate the post-CfD capture price (merchant tail) of different asset groups to develop auction supply stack

Competitive landscape analysis

Competitive landscape analysis including high-level assessment of the general characteristics of the main potential participants including:

- Potential CAPEX/OPEX advantages/disadvantages due to existing/pipeline capacity in the region
- WACC based on general financial characteristics
- Bidding behavior (aggressive/conservative) based on analysis of behavior in other markets
- Load Factor advantages/disadvantages, based on location and characteristics, using more than 120 location specific dispatches from Amun

Supply stack and bidding assessment

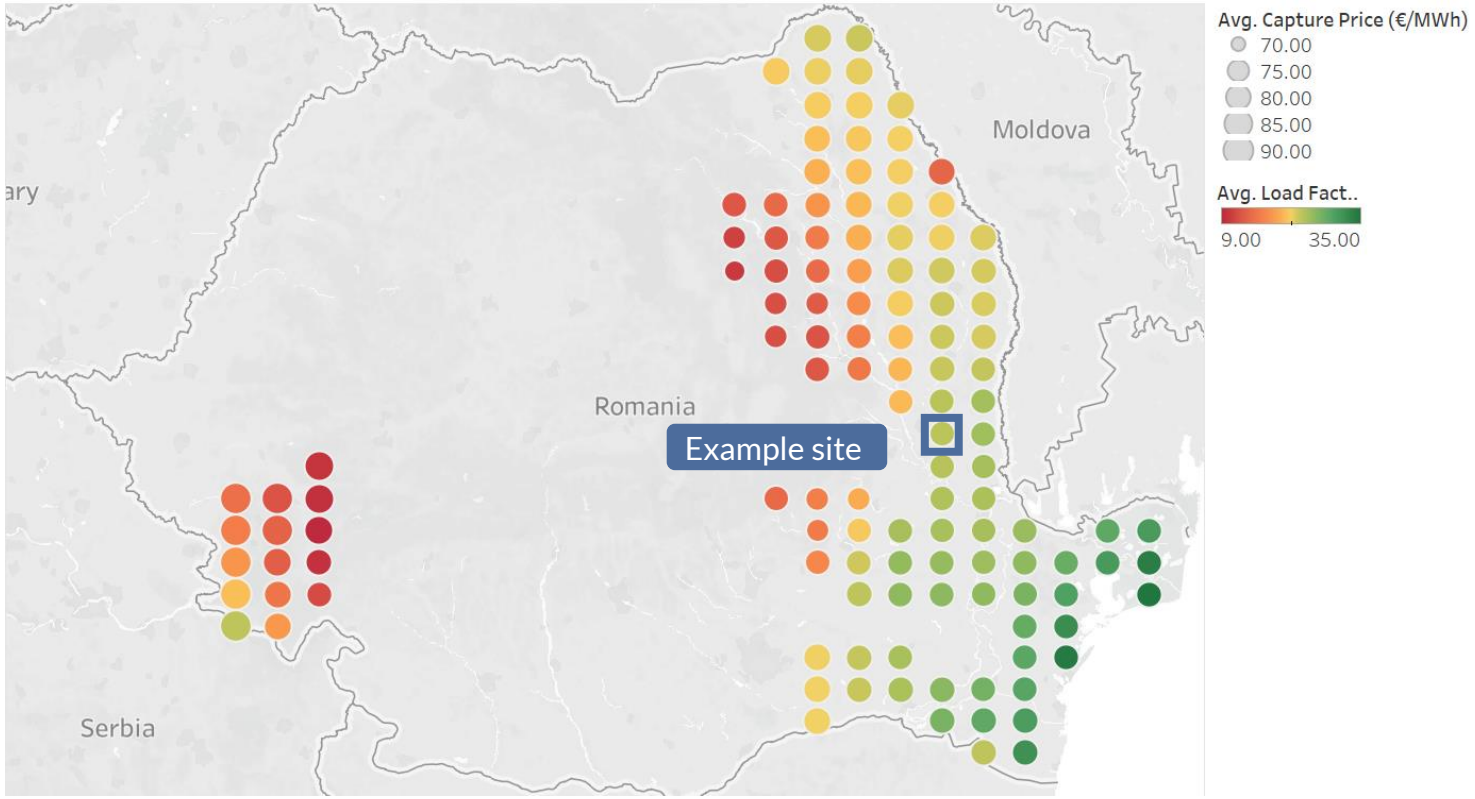
- Combine previous analysis to construct a basic supply stack of the assets, and estimate required strike prices for the assets
- Development of excel tool, which will also feature options to modify certain assumptions, e.g. WACC ranges, CAPEX, OPEX, location, bidding aggressiveness etc.
- Application of the tool to calculate ranges for auction clearing prices to assist your bidding strategy
- Deep-dive into any particular project, to assess how it would perform against the competition

Source: Aurora Energy Research

Load factors vary by 25% across the Romanian onshore wind CfD auction regions– strongly depending on location and turbine choice

Our Amun tool forecasts the site-specific capture price by considering the wind speed and profile at the site, turbine choices and typical losses such as wake effect

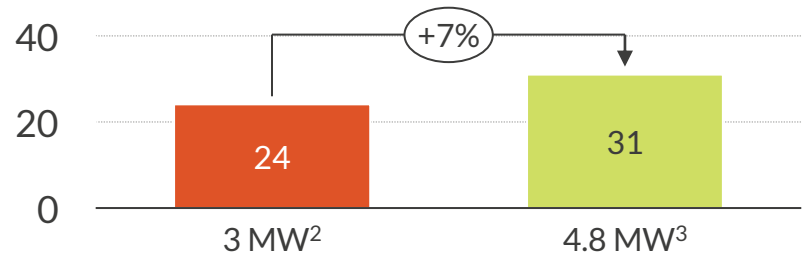
Variation in load factor over regions is 25%



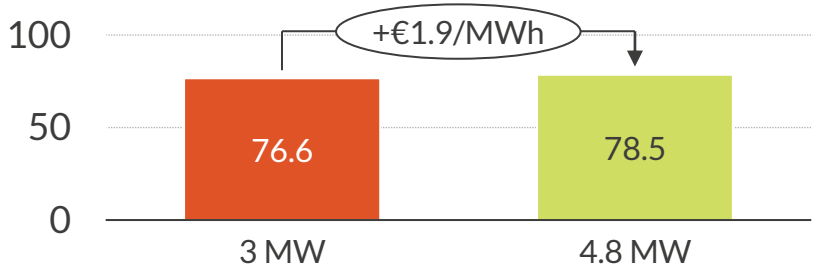
- Correlation of the wind profile with the rest of the onshore fleet affects cannibalisation of the potential new wind sites, with sites in the north and west having higher capture prices
- According to in-built ERA5 data, load factors are highest for sites along the coast – this can be refined by using your own energy yield assessments

Variation in load factor for different turbine is 7%

Load factor of the Example site,
%



Average capture price of example site,
EUR/MWh (real 2022)



- Increasing the turbine's rated capacity, rotor diameter and hub-height drives up load factors
- This load factor advantage leads to greater production in less windy hours, which are correlated with higher prices

Preliminary findings from Aurora's analysis based on public input data. 1) Average capture price between 2040-2060. 2) Rated capacity 3MW; Rotor diameter 112m; Hub height 105m. 3) Rated capacity 4.8MW; Rotor diameter 158m; Hub height 125m.

Source: Aurora Energy Research

AMUN

The #1 wind valuation software

Amun delivers bankable asset-specific revenue forecasts for wind assets in minutes

- Over 50 subscribers across 17 markets including leading banks, funds, utilities and developers
- Access an unlimited number of offshore/onshore valuations
- With greenfield and operational assets
- Backed by Aurora data and supported by experts
- Used on the largest wind deals, including Hornsea One
- Powered by the most accurate proprietary wind atlas

Transactions

Site Selection and Optimisation

Portfolio Valuation

PPAs

Agenda

AURORA

I. About Aurora

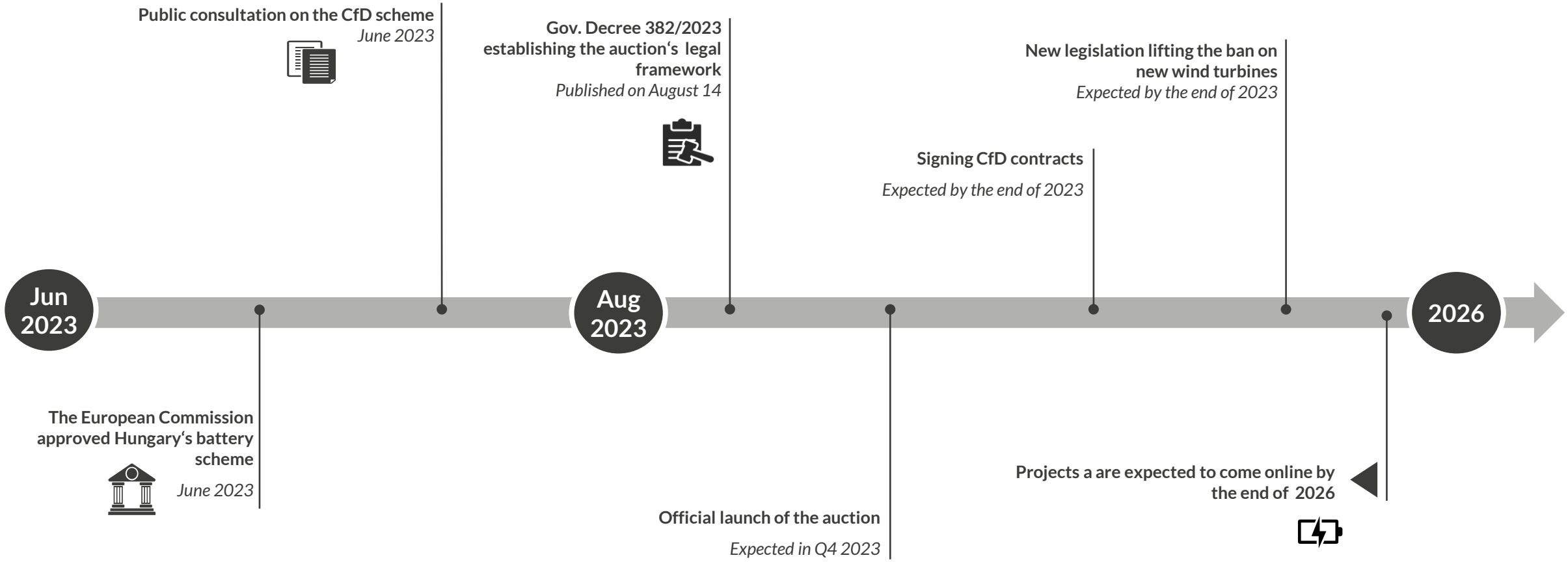
II. Latest updates on the Romanian CfD scheme

III. How can we help potential bidders in the Romanian CfD auction?

IV. What do we know about the Hungarian battery auction scheme?

V. Our contribution to understanding flexibility market revenue streams

The storage CfD scheme will boost investments in new storage units - essential complementary elements of the rapidly growing solar generation



Currently, Hungary has less than 40 MWh installed BESS capacity. The new Storage CfD Scheme, together with the accompanying CAPEX scheme is expected deliver a much-needed boost to investments in new electricity storage units on the Hungarian market

1) The auction calendar might be updated after the publication of the Auction Initiation Order.

Source: Aurora Energy Research

The storage CfD scheme, together with an additional CAPEX support scheme – will support 885 MWh new electricity storage capacities by the end of 2026

AURORA

Participation criteria

- **Participating technologies:** Standalone & co-located BESS
  - The award of the contracts to the selected projects should take place before the end of 2023 and the storage facilities should be completed by the end of 2026
  - Eligibility criteria is yet to be clarified, batteries with **at least 2h duration** are expected to be eligible
  - The CfD scheme will also be available to for projects providing storage services to a single consumer behind the connection point, not only for units feeding power into the public grid
- **Other requirements:**
  - Licensing maturity is expected be a requirement to participate in the auctions
  - Participating projects must be able to participate in aFRR

Auction design

Expected timeline

First auction to be announced by the end of **Q3 2023**

Budget and funding sources

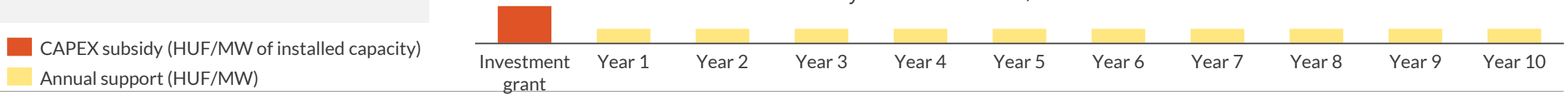
- The European Commission approved a 1.1 billion € scheme to support large-scale energy storage projects in Hungary, financed by the Recovery and Resilience Facility

Capacity to be awarded:

- 885 MWh could be awarded in the first auction although there are rumours for front-loading capacity in the first auction

Structure of the aid:

- Annual support plus CAPEX subsidy, paid in HUF
- *"The aid will be granted, cumulatively, in the form of:*
  - *(i) an investment grant, which will be paid during the construction phase of all supported projects;*
  - *and (ii) an annual support in the form of a CfD contract for a 10-year period"*[1]
- *"The total amount of annual support per beneficiary will be determined in a competitive tender and adjusted through a claw-back mechanism in case the project has excess market revenues from its participation to the market during the operations phase"*, the minimum and maximum amounts of the CfD premium will be 16 €/kW and 160 €/kW
- The CAPEX subsidy, with a budget of 160 M €, will be available for new projects, with a maximum aid intensity of 30% and a maximum annual subsidy amount of 350 €/kW



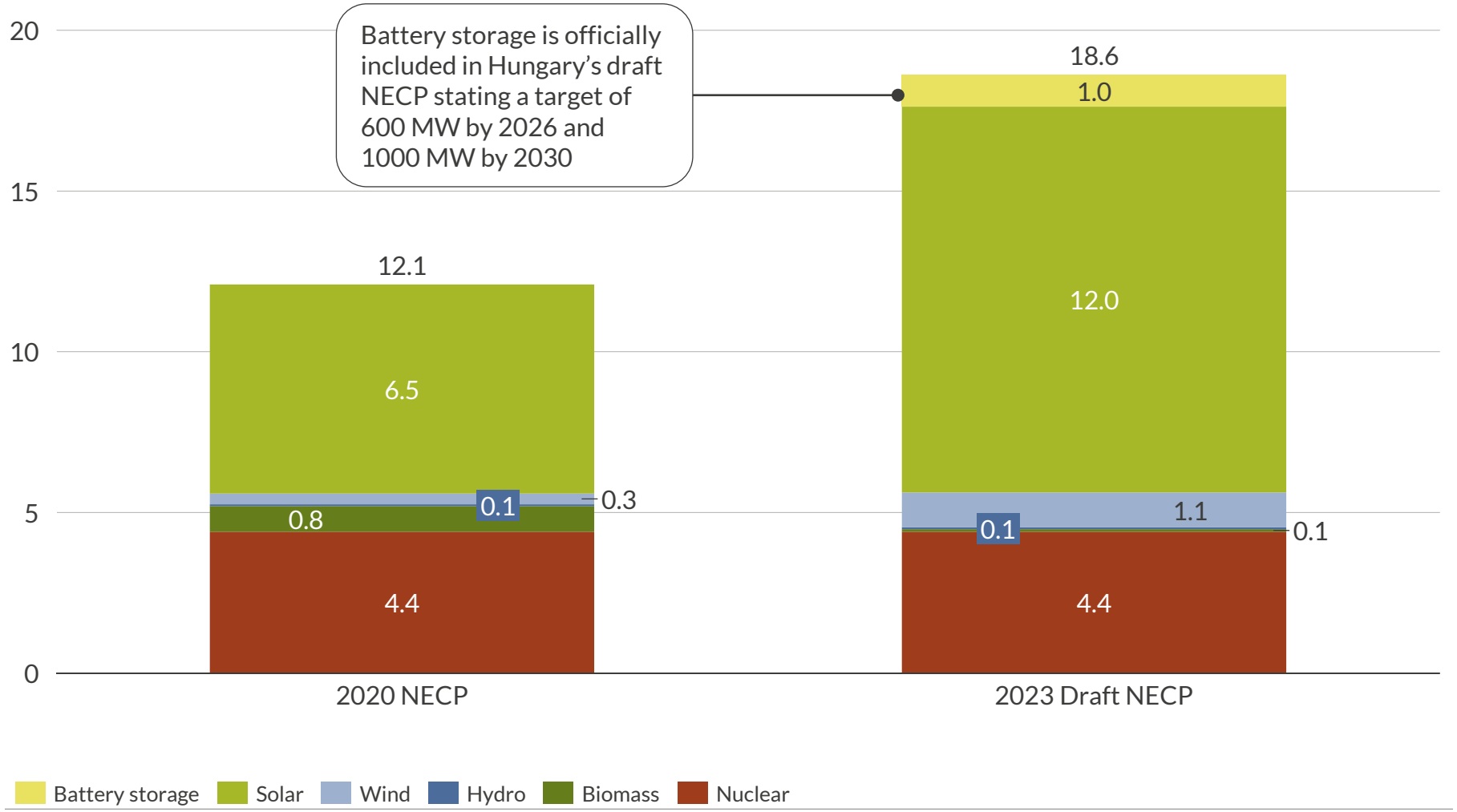
1) The total amount of annual support per beneficiary will be determined in a competitive tender and adjusted through a claw-back mechanism in case the project has excess market revenues from its participation to the market during the operations phase.

Sources: Aurora Energy Research, European Commission

Hungary published a revised new NECP in 2023, it contains more ambitious targets than the previous one

Capacity targets in 2030

GW



1) We assume 30% of 2030 capacity to stem from rooftop solar, down from current share of about 50%

Sources: Aurora Energy Research, NECP, European Commssion

- According to the new NECP share of RES in the domestic electricity consumption could reach 31%, significantly higher than the previous target of 22%
- The NECP focuses on the expansion of solar generation, aiming for an ambitious 12 GW. However, the revised draft also foresee an increase of wind capacity, surpassing 1000 MW
- **The new NECP also foresees 1000 MW of battery storage capacity by 2030, from which 600 MW is expected to come online by 2026**
- A key aim of Hungary's energy strategy is to reduce the import dependence of the electricity system; which cover around 1/3 of the domestic consumption currently

Agenda

AURORA

I. About Aurora

II. Latest updates on the Romanian CfD scheme

III. How can we help potential bidders in the Romanian CfD auction?

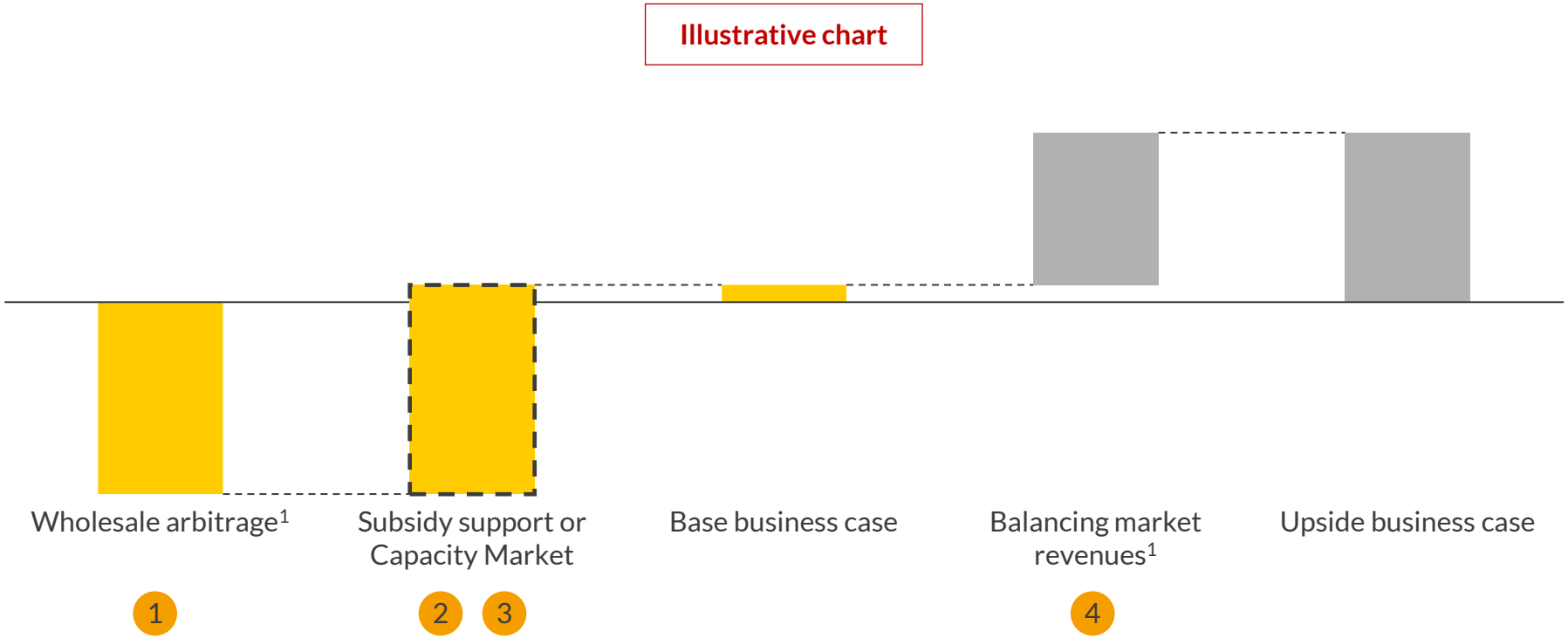
IV. What do we know about the Hungarian battery auction scheme?

V. Our contribution to understanding flexibility market revenue streams

Fully understanding revenue stacking for batteries is crucial for developing battery projects; Aurora deep dives into these markets

As new markets open in Hungary, join us in our analysis of business cases for batteries based on revenue stacking across different market segments: **Reach out to Petro Ylli, Commercial Associate, today!**
petro.ylli@auroraer.com

Illustrative revenue streams for new-build Hungary battery entering in 2025
IRR%, pre-tax real



1) Day Ahead and Intraday market revenues. 2) FRR markets, FCR markets with both capacity and energy payments.

Source: Aurora Energy Research

AURORA

Key Market Segments

1. Wholesale market volatility is rising due to high commodity prices and fast renewable buildout and capacity tightness
2. **The expected auctions and subsidy support** are key to the first few projects that will enter the Hungary market
3. A potential launch of a **capacity market** could also act as a base payment method however there is **no indication of launching one**
4. The participation of batteries in the balancing services markets can provide additional revenue for battery projects and will be a key source of revenue for merchant assets

You will be able to discuss our analysis during multiple interactions in Q1 2024 and then receive regular market updates and business cases

AURORA

Kick-off calls	Workshop 1 Regulation and status quo of flexibility markets	Workshop 2 Outlook for flexibility markets in Hungary	Workshop 3 Outlook for battery storage economics	Subscription Service Launch Hungary Flexible Energy Market Service

▪ Calls held one-to-one or in focus groups, will allow clients to ask questions and give feedback on the scope
▪ The analysis done for workshops 1 to 3 can thus be steered by participants' interests and priorities
	▪ Overview of regulatory requirements for participation in different markets with a focus on battery participation
	▪ Impact of future regulations
	▪ Battery cost assumptions and business models
	▪ Harmonised products and procurement rules
		▪ Outlook of flexibility markets in Hungary, including:
		  ▪ Day-ahead market
		  ▪ Intraday market
		  ▪ FRR
		  ▪ FCR
		▪ Overview of key risks and drivers of markets
			▪ Outlook of revenue stacking opportunities:
			  ▪ Gross margin outlook for different battery configurations
			  ▪ Comparison across various cycling patterns and storage durations
			  ▪ Overview of investment cases, technology parameters and assumptions
				▪ Forecasting Reports on flexible assets and underlying data, published bi-annually
				▪ Ongoing interaction through workshops and analyst support

December 23 – January 24	**End - January**	**Mid - February**	**Mid - March**	**Bi-annual updates**
Key deliverables	**Workshop**	**Workshop**	**Workshop and Databook**	**Forecast updates & analyst support**

Source: Aurora Energy Research

Access power market analysis and investment case data for batteries with our Flexible Energy Add-On

AURORA

Flexible Energy Add-On

Forecasts Reports & Data

Technology and market development reports

- Overview of regulatory framework for batteries
- Revenue stacking models for batteries
- Projections for battery CAPEX and OPEX by delivery year
- Reports and datasets follow the same format with content tailored to specific markets

Forecast Data

- Central case forecast prices provided at hourly granularity until 2060
  - Day-ahead and Intra-day (DAM & IDM) power prices
  - FRR market prices
  - FCR market prices

Investment Cases

Standalone battery

- Multiple investment cases per country or zone including:
  - Arbitrage of wholesale market and balancing market
  - Focused participation in the frequency control market (if applicable)
- Annual project margins to 2060. IRR and NPV for multiple scenarios

Source: Aurora Energy Research


AURORA
ENERGY RESEARCH