RWE‘s strategic role in the energy transition - focus on grid scale battery storage

2025 IERE-TPC Net-Zero Workshop | May 2025

Ingo Birnkraut, RWE Generation SE, Head of Strategic Development
Dr. Jan Figgener, RWE Technology International, Senior Design Engineer
Dr. Lexuan Meng, RWE Technology International, Senior Product Manager
Kevin Pasch, RWE Technology International, Head of Battery

RWE's business model is fully aligned with its strategic commitment to the energy transition

RWE

RWE Offshore Wind GmbH

Offshore Wind

Offshore wind activities in Europe, North America and APAC

Adj. EBIDTA 1.6 bn€

RWE Renewables Europe & Australia GmbH & RWE Clean Energy LLC

Onshore Wind & Solar

Onshore wind, solar in Europe, North America and APAC

Adj. EBIDTA 1.5 bn€

RWE Generation SE

Flexible Generation

- **4 Operational Division** Gas, Biomass, Hydro & Storage, and Hydrogen
- **20 GW installed capacity**
- **25 GW in development**
- **4 Markets** (D, NL, UK, TR)
- **~3,500 Employees**

Adj. EBIDTA 1.9 bn€

RWE Supply & Trading GmbH

Supply & Trading

Trading/origination, Gas & LNG, Commodity solutions, Gas storage

Adj. EBIDTA 0.7 bn€

RWE Power AG

Phaseout Technologies

Lignite operations (planned exit by 2030)

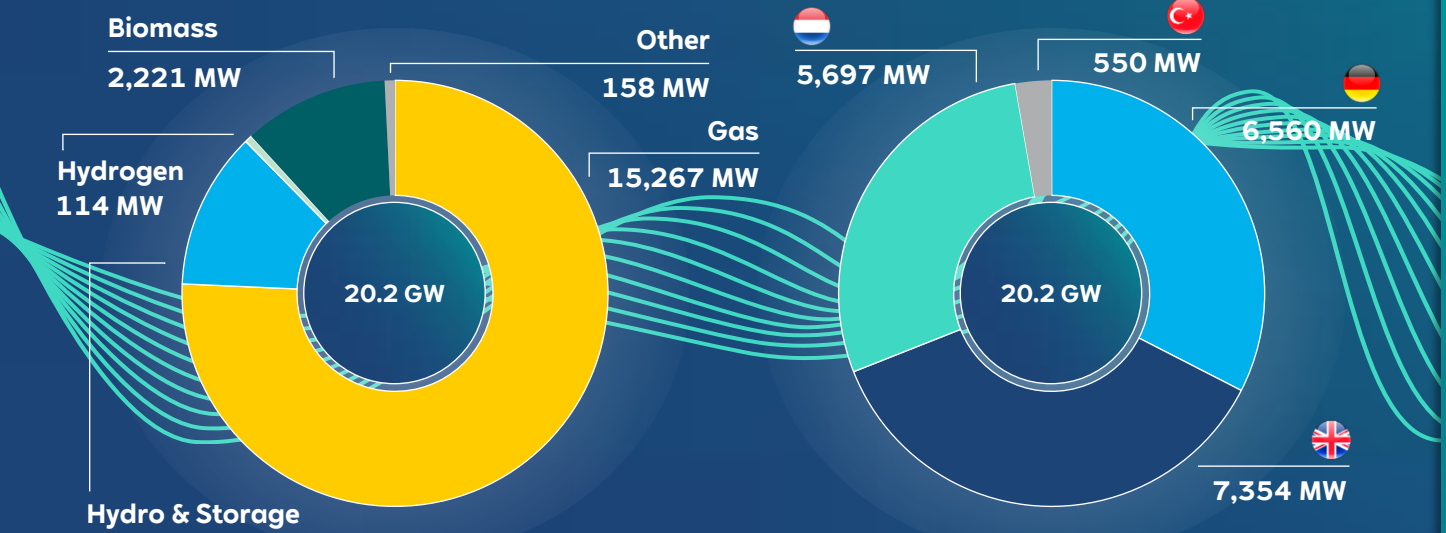
Nuclear power plants (exit 04/2023, now dismantling)

Not included in Adj. EBITDA

Annual Report 2024, RWE AG

Our flexible asset fleet serves as the secure backbone of the energy supply in our European core markets

Installed capacity by technology, in MW



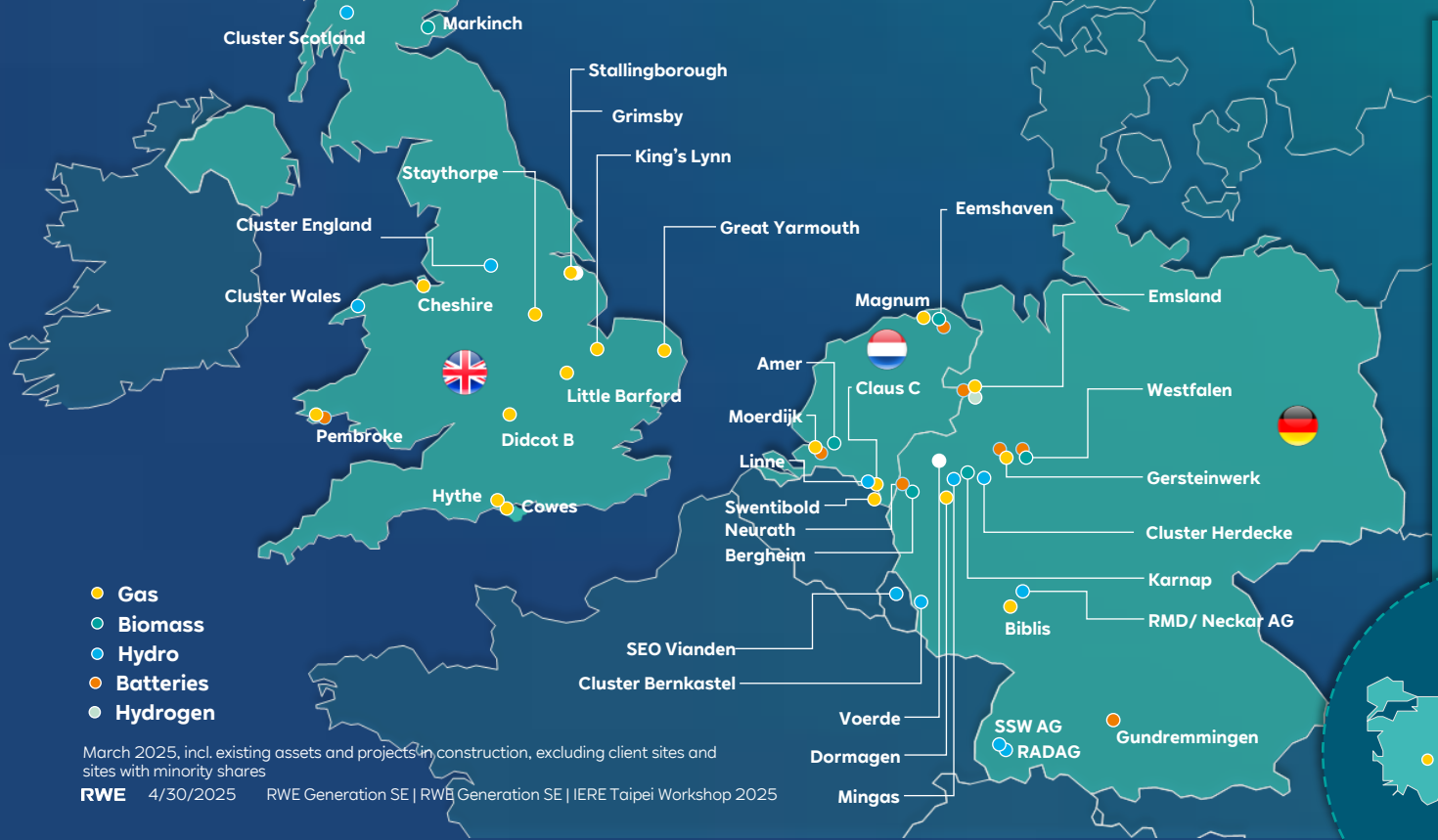
Installed capacity by country, in MW

Largest opportunities seen in Germany and mainly driven by demand for security of supply ("Kraftwerkssicherheitsgesetz") and **flexibility** (esp. batteries). Additionally, strategic investments are planned in **Hydrogen projects.**

Production in 2024
by technology

- Gas **28 TWh**
- Hydro & Storage **1.7 TWh**
- Biomass **6.4 TWh**

RWE Generation SE operates more than 40 sites, with a growing number combining multiple technologies



Key takeaways

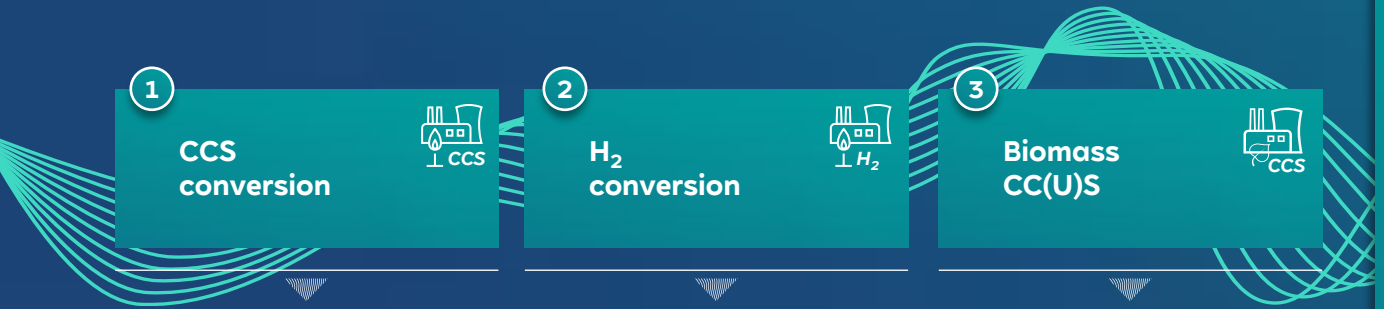
While in the **past,** only one technology was usually present **at one location,**

different technologies are already being used at many of our sites **today.**

March 2025, incl. existing assets and projects in construction, excluding client sites and sites with minority shares

To deliver on our Net Zero 2040 target, we prepare to decarbonize our conventional fleet

Decarbonization measures implemented at RWE Generation sites



Zero / low emissions

Projects in UK and NL

Zero emissions

Projects in UK, NL and DE

Negative emissions

Projects in NL and DE

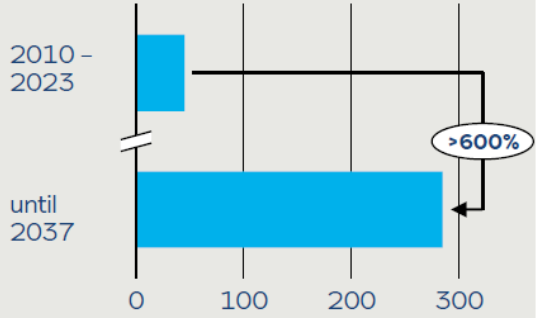
growth ambitions for 2030

- Ramp-up of **Battery** activities
- **Gas** new build in Germany
- Development and ramp-up **H2-electrolysers**

Germany's challenge of integrating renewables in the next 2 decades
Reaching NET ZERO and delivering competitive prices.

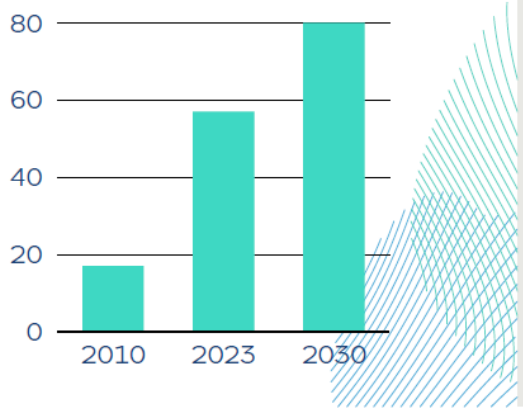
Expensive integration of renewables into the grid

Historic and required investment into the German transmission grid in bn EUR[1]



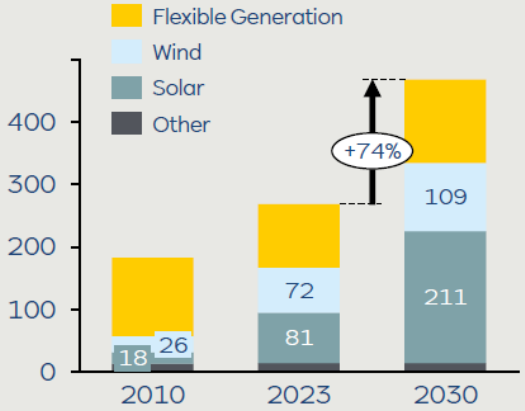
Share of renewables increasing

Renewable share of power load in Germany in %[2]



Capacity build-out focusing further on renewables

Installed and forecast gross capacity in Germany in GW[3]



[1] Netzentwicklungsplan Strom 2023-2037/2045 | [2] Statistisches Bundesamt | [3] BloombergNEF New Energy Outlook 2024 (Economic Transition Scenario)

RWE Commitment and Effort in Entire Value Chain for NET ZERO

Tech Scouting & Validation

Speed up new technology commercialization with thorough validation, testing and qualification

Origination & Development

Site selection & development with full consideration of environmental impact

Engineering & Procurement

Work with ESG top rating suppliers and high focus on innovation

Construction

Streamlined project execution and modular construction/building blocks

Commercialization

Multi-service provision and contribute to grid stability, energy flexibility and power quality

Operation

Digitalization for higher availability, safety and extended lifetime.

Initiative on preparation for responsible recycling.

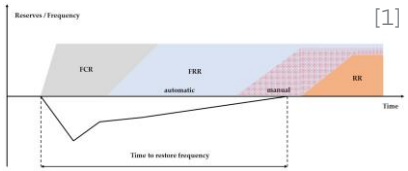
The NET ZERO challenge

BESS contribution in applications

NET

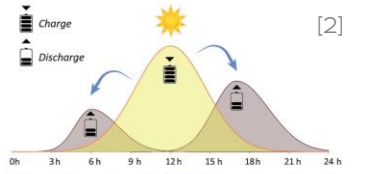
Network Stability

To strengthen the **backbone** of Net Zero transition



[1]

- *Grid Strength*
- *Grid Forming*
- *Black Start*
- *Inertia*

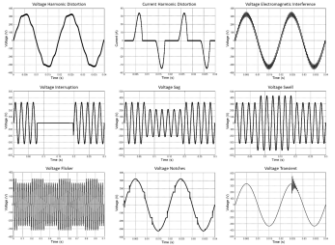


[2]

- *Time-Shifting*
- *Grid Balancing*
- *Energy Arbitrage*
- *Freq Regulation*

Energy Flexibility

To enable higher **renewable penetration**



[3]

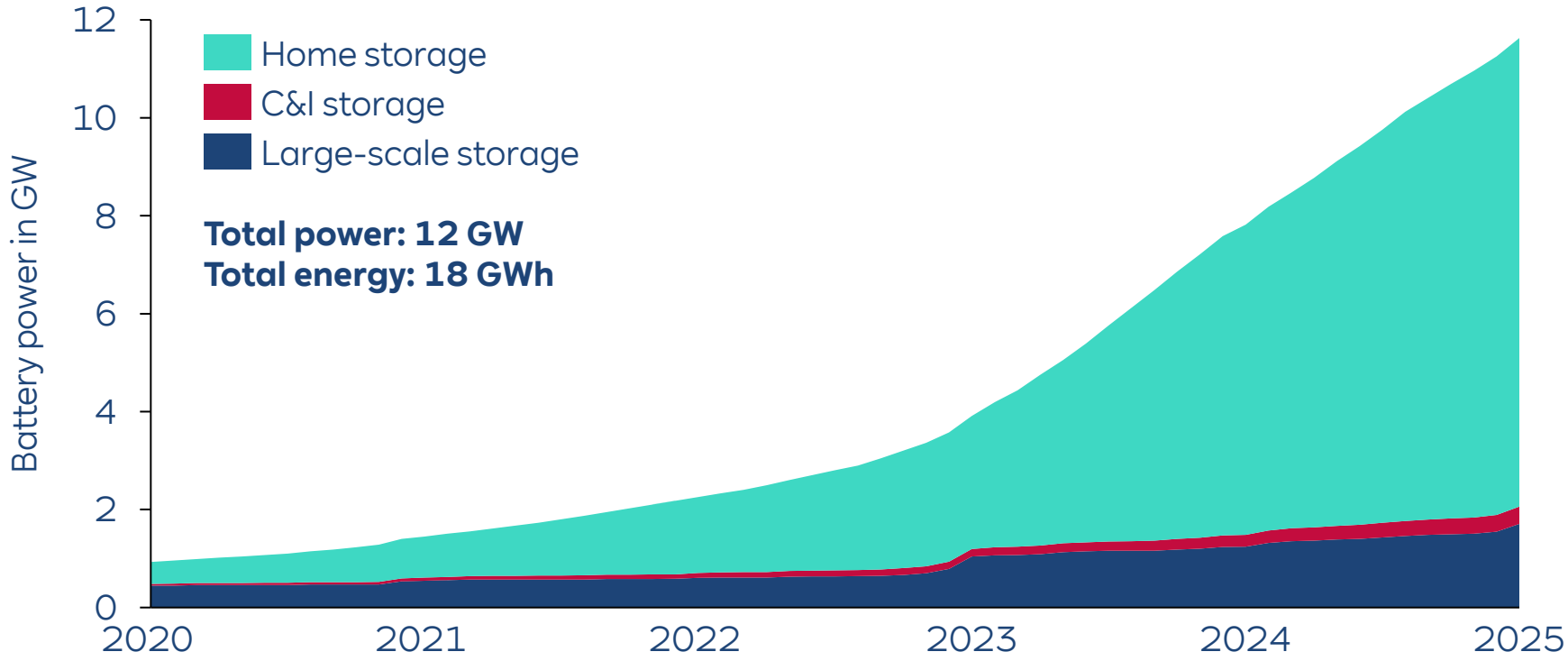
- *Reactive Power*
- *Active Filtering*
- *Fast Response*

Transmission Grid Power Quality

To enhance energy **efficiency and reliability**

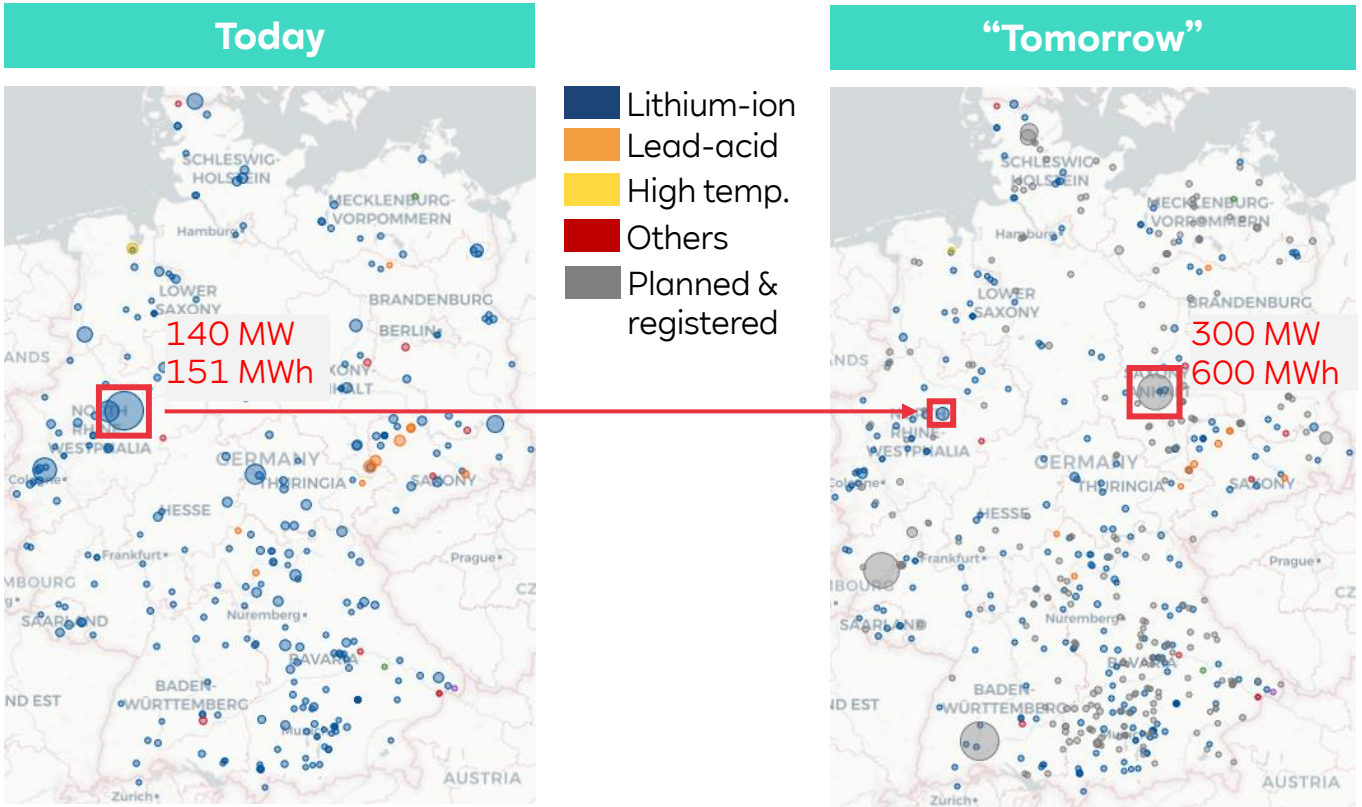
[1]: Roumkos et al., https://doi.org/10.3390/en14185793, (CC BY 4.0)
[2]: Nikiforidis et al., https://doi.org/10.1039/C8RA08658C (CC BY 3.0)
[3]: Afonso et al., https://doi.org/10.3390/en14248585, (CC BY 4.0)

Market development of battery storage systems in Germany



Source: Based on Figgener et al., www.battery-charts.de, used under CC BY 4.0

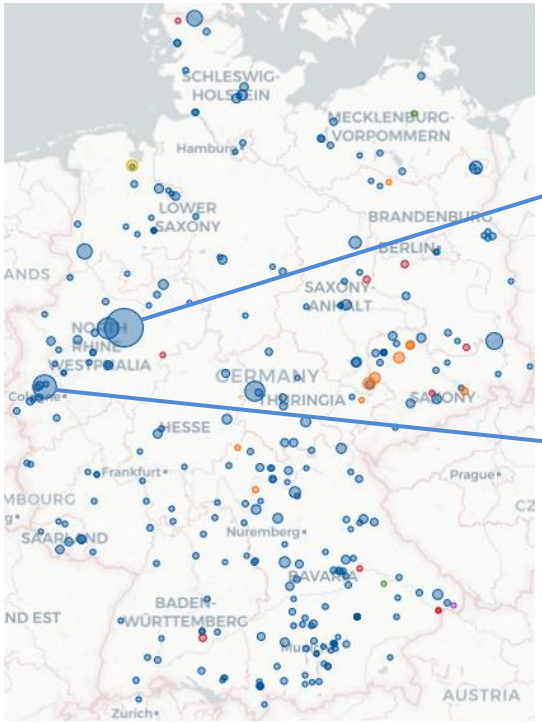
Geographical distribution and project size in Germany



Source: Based on Figgener et al., www.battery-charts.de, used under CC BY 4.0. Note: "Tomorrow" contains only pre-registered BESS projects at Bundesnetzagentur.

Recently commissioned BESS sites by RWE

Today



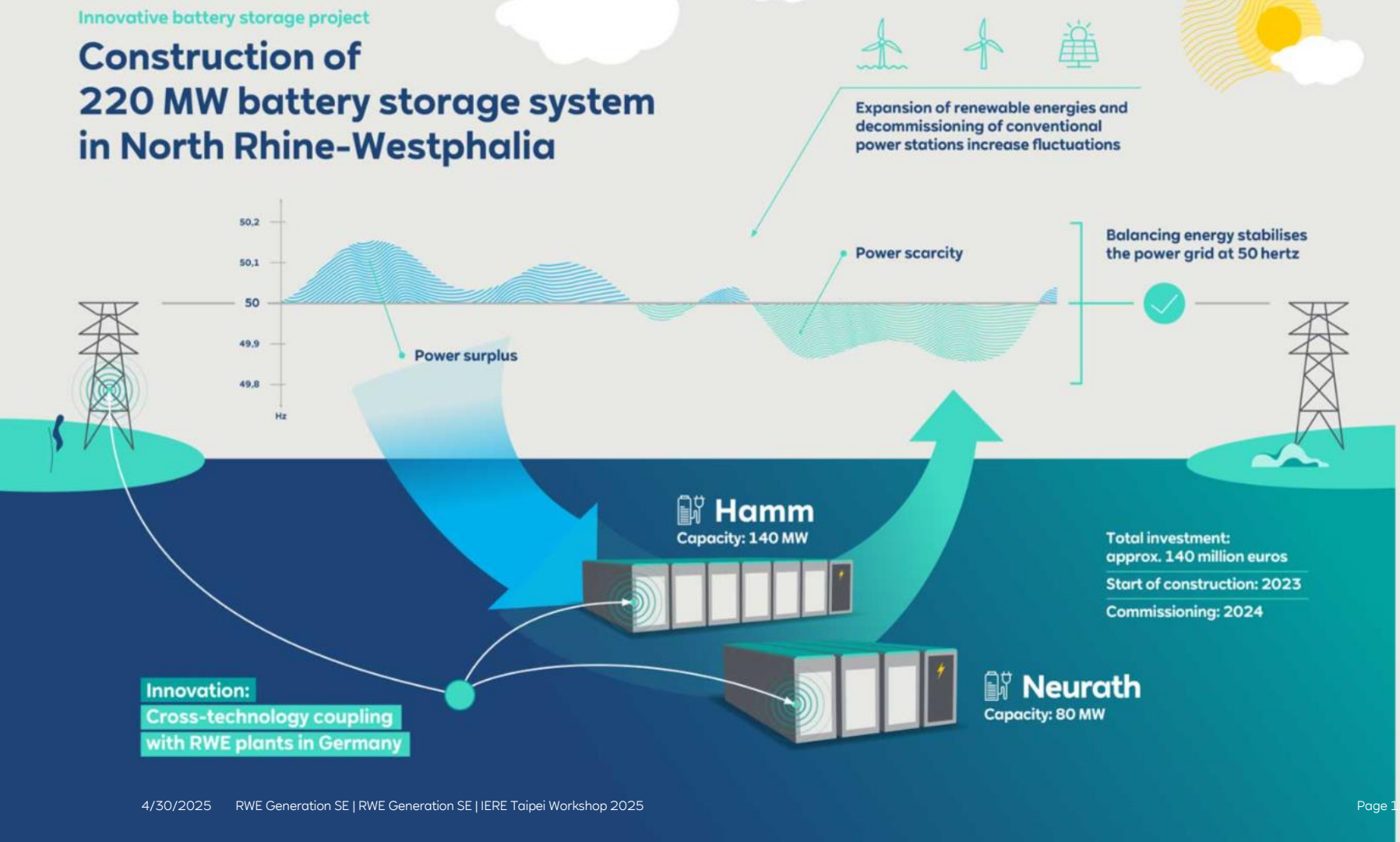
Hamm site
- 110kV grid connection
- 140 MW
- 151 MWh

Neurath site
- 110kV grid connection
- 80 MW
- 84 MWh

Source: Map based on Figgener et al., www.battery-charts.de, used under CC BY 4.0.

Innovative battery storage project

Construction of 220 MW battery storage system in North Rhine-Westphalia



Batteries hold increasing importance and attractive return profile

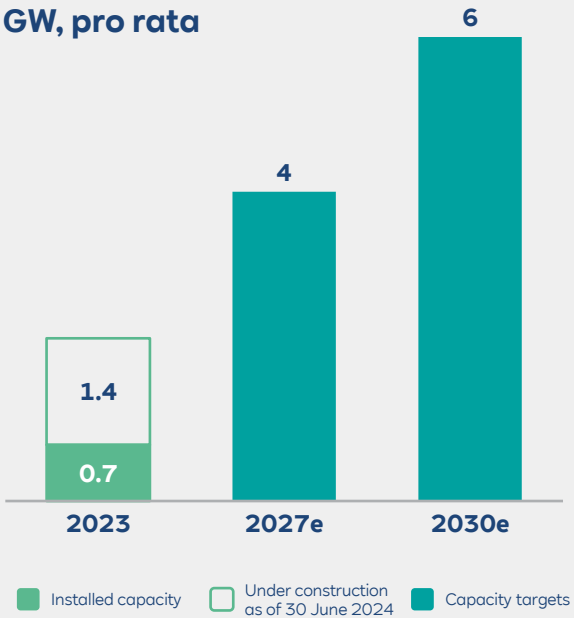
Value stacking of batteries revenue streams

Wholesale markets
Storage of excess electricity to sell in periods when wind/solar power is unavailable and prices are elevated

Capacity markets
Stable income streams via the **provision of firm capacity**

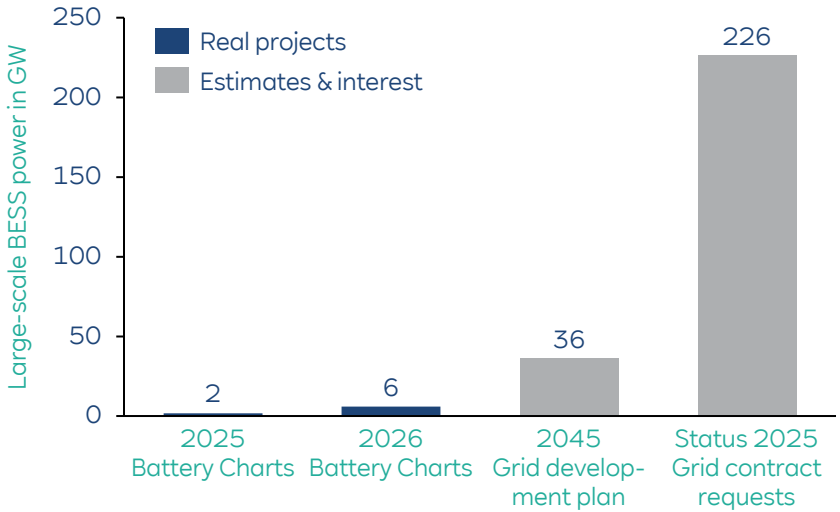
Ancillary markets
Provision of **inertia, reactive power** or **frequency response** services for grid stability

Batteries targets
GW, pro rata



Toward NET ZERO goal
Challenges in speeding up the roll-out

Installations status quo, forecasts, and grid connection requests (Germany)



Regulatory framework Uncertainties & challenges

Grid infrastructure & integration limitations
Regional/country specific connection rules, transmission bottlenecks, long grid permitting process

Geopolitical risks & supply chain security
Public discussion on geopolitical safety concerns regarding remotely controllable generation (cyber-security) and concentrated supply chain (strong dependency to China)

Economic uncertainties
High upfront costs, evolving and varying value streams emerging while unmature ancillary market, etc

Public perception & environmental concerns
Public concerns over fire safety risks, potential pollution, noise emissions, and inadequate recycling infrastructure lead to stricter regulations, prolonged permitting, and community opposition.

Sources: Figgener et al., www.battery-charts.de | Grid development plan (NEP) | Grid contract requests: pv magazine

Toward NET ZERO goal

Challenges and technology advancement

Innovation

Scouting and early adopting new technology

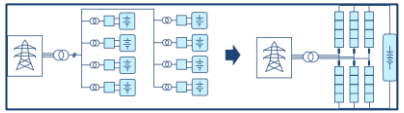
Key technology scouting and assessment of high potential net-zero contributing solutions, e.g.

Battery technologies

– Na-ion, Iron air, Redox Flow, etc

Innovative infrastructure

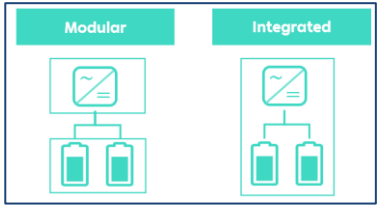
– Flexible DC infrastructure, modular multilevel converter, etc



Scale up

Quality and efficient project delivery

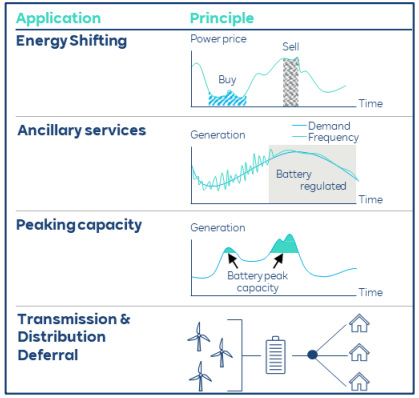
Equipment independent **standardized building blocks** for quality and efficient engineering execution with footprint & cost reduction



Utilization

Power & energy system backbone

BESS plant is developed to provide **multiple grid services and use cases**



Operation

Economic and ecological operation

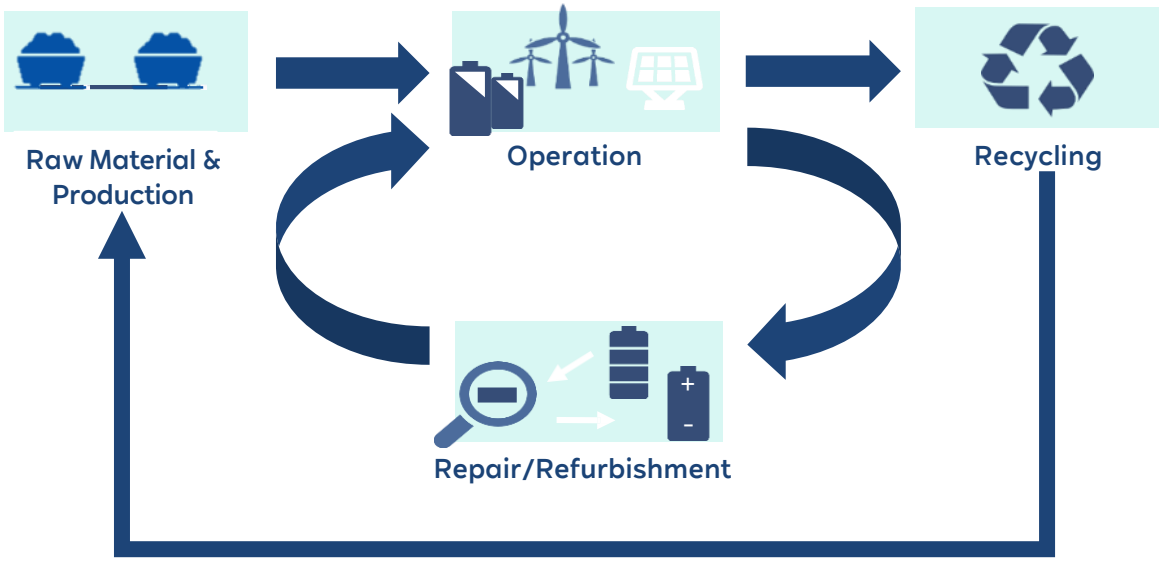
Digitalization with advanced battery modelling, testing and analytics solutions to gain improved operational performance, such as lifetime, efficiency, availability, etc

BESS digitalization based on
Modelling
Testing
Analytics

Sustainability challenge
Establishing a closed circular economy

Key tasks of RWE within a circular economy

- Ensuring products meet European ESG requirements
- Keep assets as long as possible in operation through repair and refurbishment
- Ensuring recycling targets are met



Conclusion

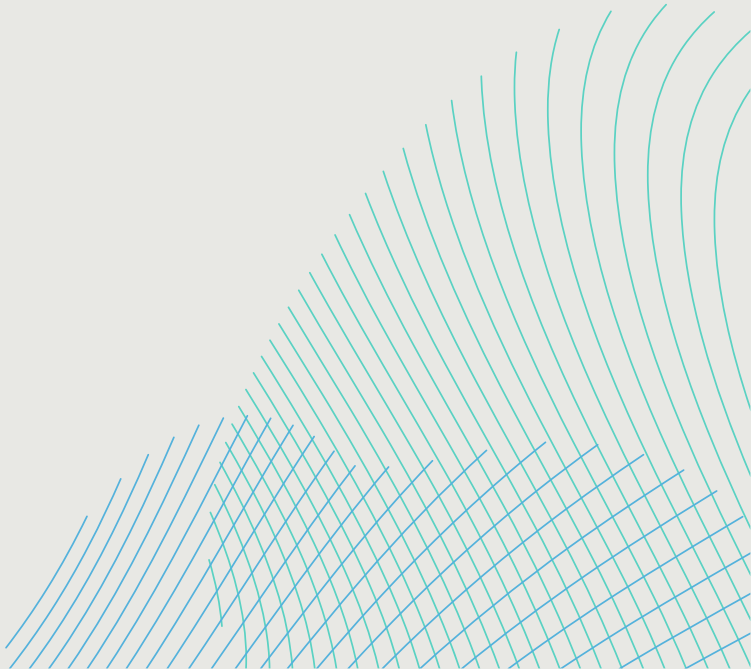
Key messages

- BESS **enables energy transition** and achieving **net-zero** goal
- **RWE** plays a major role in **accelerating the technology roll-out**
- New markets and regulation make **continuous product development and strategy adjustment** necessary

RWE

RWE‘s strategic role in the energy transition - focus on grid scale battery storage

Backup

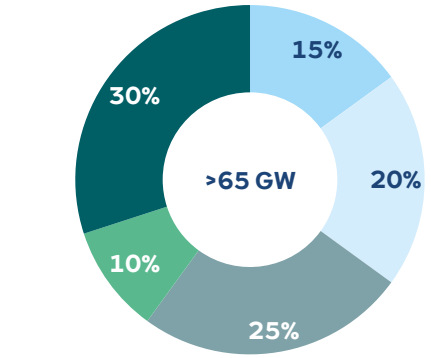


RWE will operate a well diversified portfolio in 2030

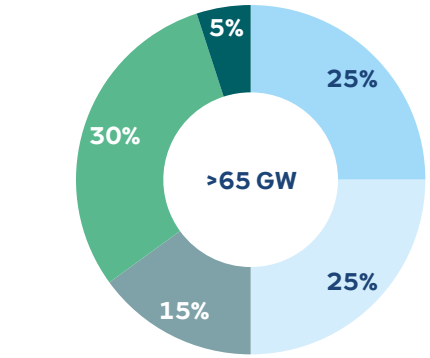
Installed net capacity target 2030

>65 GW

Diversified portfolio across technologies



and regions



Early examples of RWE Generations extensive development pipeline

Our growth ambitions for 2030 include:

- **6 GW*** of **battery** new build
- **3 GW** of **gas** new build in Germany
- **Decarbonisation** of existing gas assets: Retrofit to H2 combustion or CCS
- **1.6 GW** of **BECCUS** conversion in the Netherlands
- **2 GW** of **H2-electrolysers**

Examples in Germany:

Flexible generation

Development of **gas** projects:
- **H2-ready CCGTs** with Weisweiler and Gersteinwerk as sites already announced

Batteries

Ramp-up of **battery activities**, in construction:
- 80 MW at Neurath
- 140 MW in Hamm

H2 electrolysis

Going ahead on **making hydrogen a reality**:
- 14 MW pilot plant in Lingen
- 300 MW electrolysis planned in Lingen until 2027 (FID taken)

* Total RWE-target