How Much Energy Storage Does Europe Need?

Defining Energy Storage Targets in Line with Europe's Decarbonisation Goals

Webinar
12 July 2022
14:00–15:00 CEST

Welcome and Introduction

David Post

EASE President,

Head of Marketing and Sales

Distributed Energy Solutions at Enel X

Welcome

- The questions for the speakers will be collected via the Q&A section. Please send it your questions there.
- If you experience any technical issues, please reach out to Elina Cirule writing email to e.cirule@ease-storage.eu
- A recording of this event will be available in the upcoming days on EASE website: https://ease-storage.eu/publications/event-reports/

About EASE

The European Association for Storage of Energy (EASE), established in 2011, is the leading member-supported association representing organisations active across the entire energy storage value chain.

EASE represents over 60 members including utilities, technology suppliers, research institutes, distribution system operators, and transmission system operators.

EASE supports the deployment of energy storage to enable the cost-effective transition to a resilient, carbon-neutral, and secure energy system.

- Awareness raising
- Information-sharing
- Market design

EASE Members

European Association for Storage of Energy

Agenda

14:00 – 14:10	**Welcome and Introduction** David Post, *EASE President, Head of Marketing and Sales Distributed Energy Solutions at Enel X*
14:10 – 14:30	**How Much Energy Storage Does Europe Need?** Susan Taylor, *EASE Energy Storage Analyst*
14:30 – 14:55	**Panel Discussion and Q&A** Moderator: David Post, *EASE President* • Joris Koornneef, *TNO Strategy Consultant–Sustainable Geo Energy* • Jannis Burger, *EDF Research Engineer* • Amir José Daou Pulido, *Fluence Market Development Manager*
14:55 – 15:00	**Closing Remarks** David Post, *EASE President, Head of Marketing and Sales Distributed Energy Solutions at Enel X*

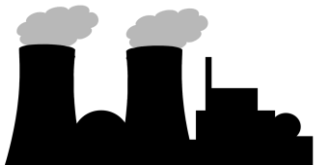
How Much Energy Storage Does Europe Need?

Susan Taylor,

EASE, Energy Storage Analyst

Europe is Moving Away from Centralised Energy Generation

Driven by Decarbonisation Goals → *Accelerated* by REPowerEU



Centralised Dispatchable Generation

Increase and decrease production based on demand

'Energy Transition'

Today's Climate Goals:

2030

- ✓ 40% RES → **45% RES** proposed **REPowerEU***
  - ✓ >1200 GW in 2030 wind+solar → X3 today's capacity
- ✓ 55% GHG reduction

Net Zero by 2050

Decentralised Variable Generation

Reliant on weather → need flexible, dispatchable back-up to fill the gaps

*EUROPEAN COMMISSION, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS REPowerEU Plan. (2022).

What does This Mean for the Energy System Today?

Key Challenges:

1. Grid support and resilience
2. Rising curtailment
3. Reliance on fossil fuels to fill the gaps, often gas peakers
4. Need to shift energy over days, weeks, seasons

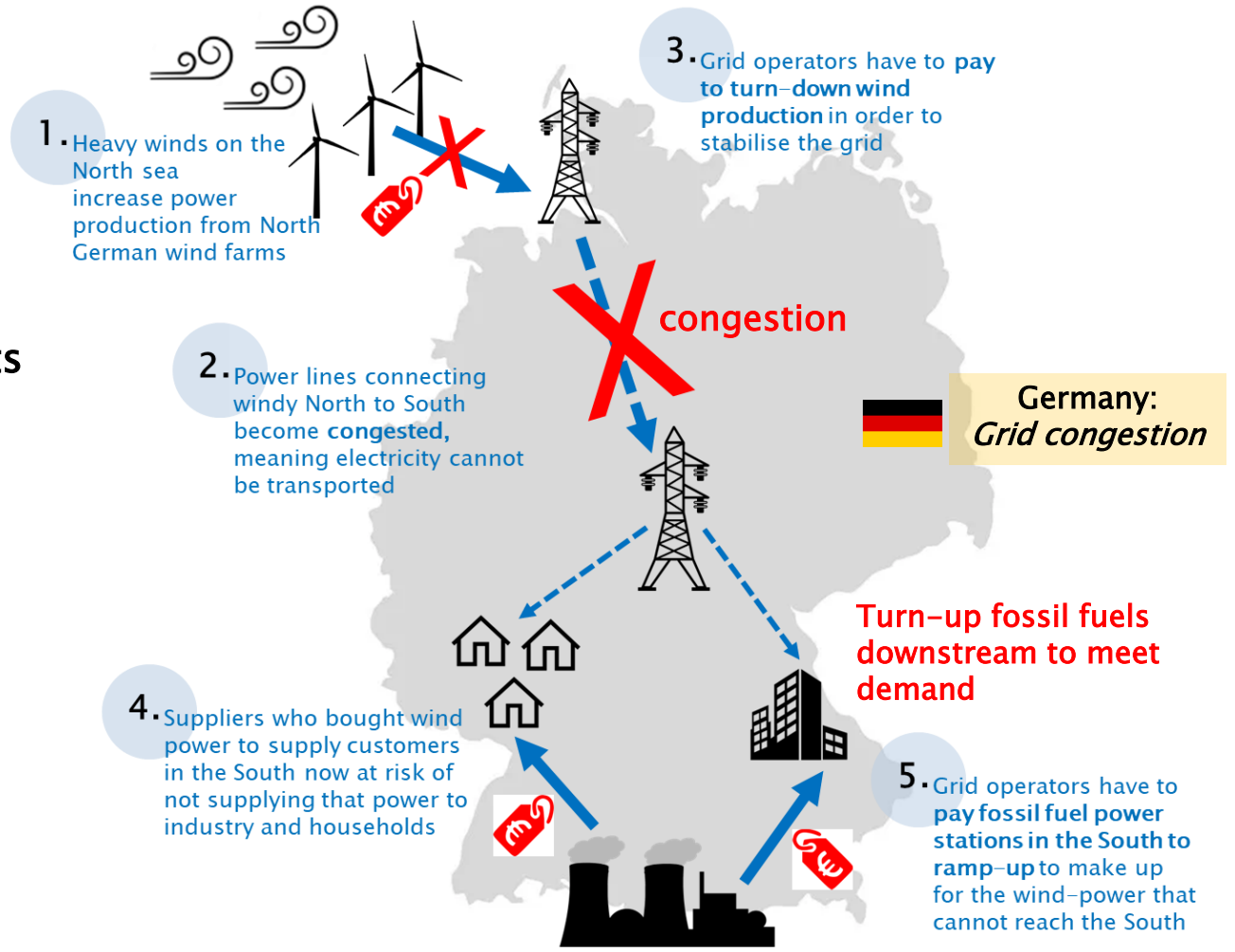
Already seeing these challenges today…

Key Challenges in the Energy System Today

Rising Curtailment

- **Grid congestion** → transmission lines cannot transport electricity due to **thermal constraints** → resulting in curtailment

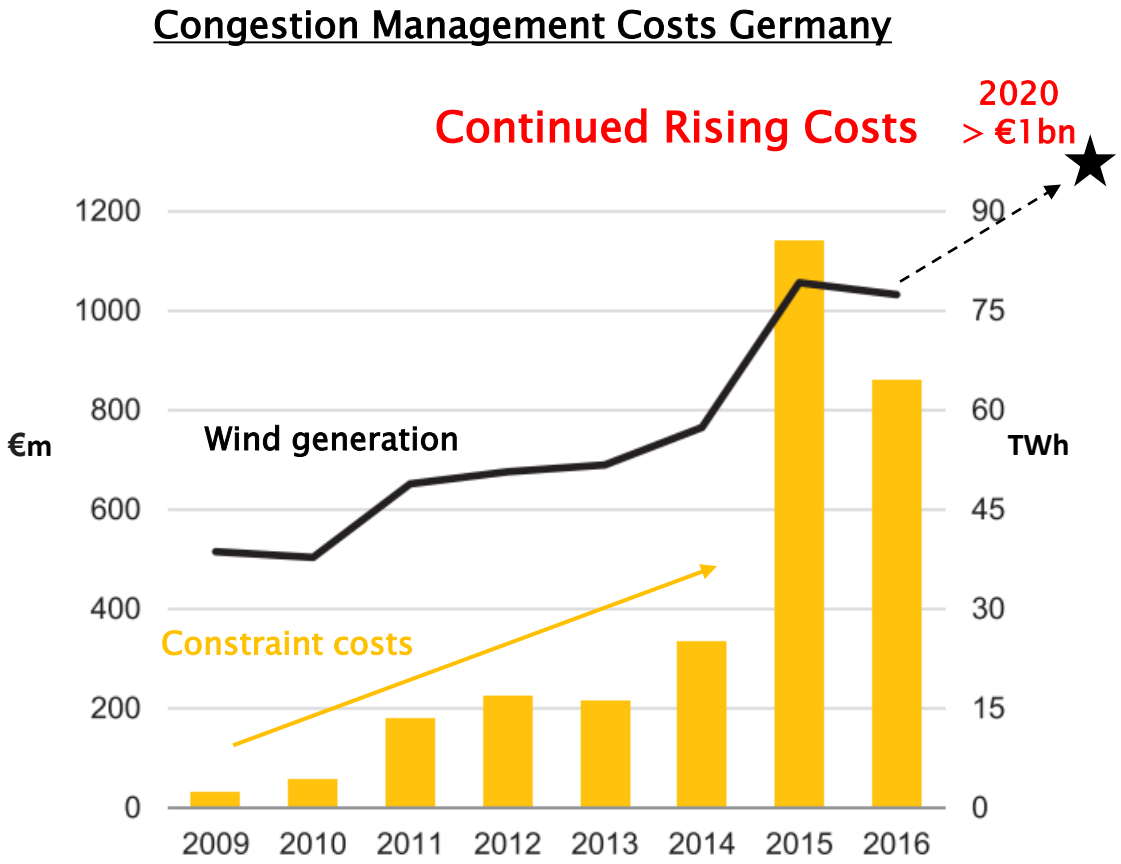
- **Supply-demand mismatch** → Renewables overproduction, when more wind or solar is produced than is needed to meet demand → excess energy is curtailed



Source: Adapted from https://www.cleanenergywire.org/factsheets/re-dispatch-costs-german-power-grid

Key Challenges in the Energy System Today

Rising Curtailment



Source: Joos, M. & Staffell, *Renew. Sustain. Energy Rev.* **86**, 45–65 (2018).
https://www.wind-energie.de/english/statistics/statistics-germany/

Negative impacts

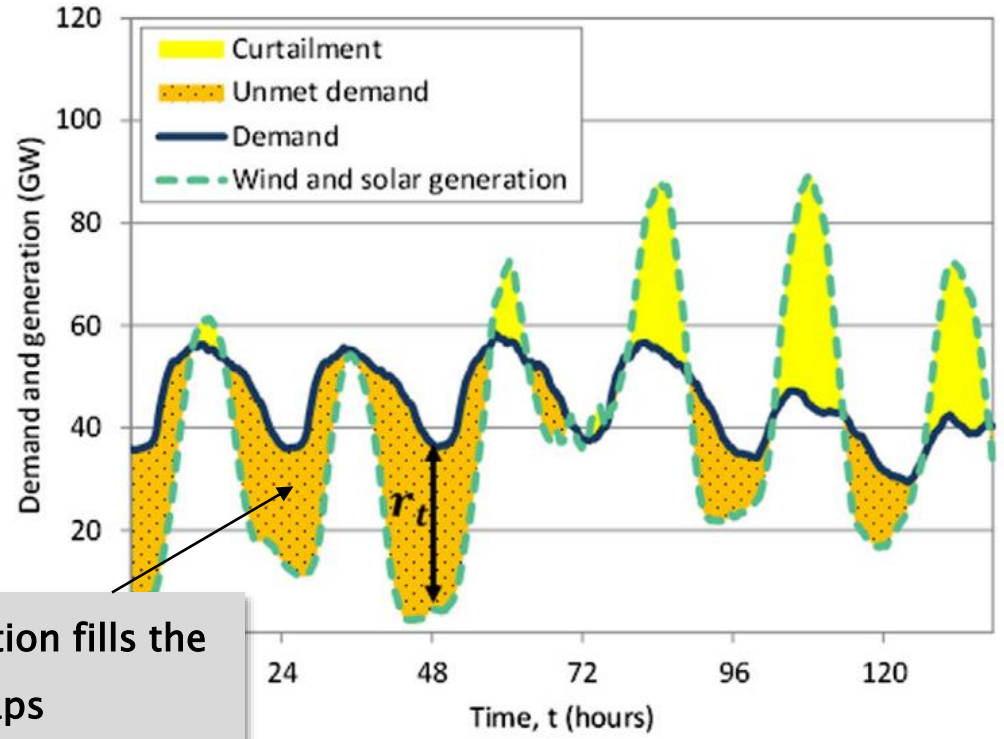
- **High cost** to pay generators to turn-up/down
- Turning-up fossil-fuel generators (usually gas) → **high gas prices**
- Continued **reliance on fossil fuels**
- Continued **GHG emissions**
- **Wasting clean energy** produced from **local wind generators**

Key Challenges in the Energy System Today

Reliance on fossil fuels to fill the gaps

Daily timescale

- ✓ Balance variability of wind and solar production e.g. day/night cycle of solar
- ✓ Meet peak demand periods



Fossil fuel generation fills the unmet demand gaps

Fig. 2. Example of curtailment and residual demand in a power system.

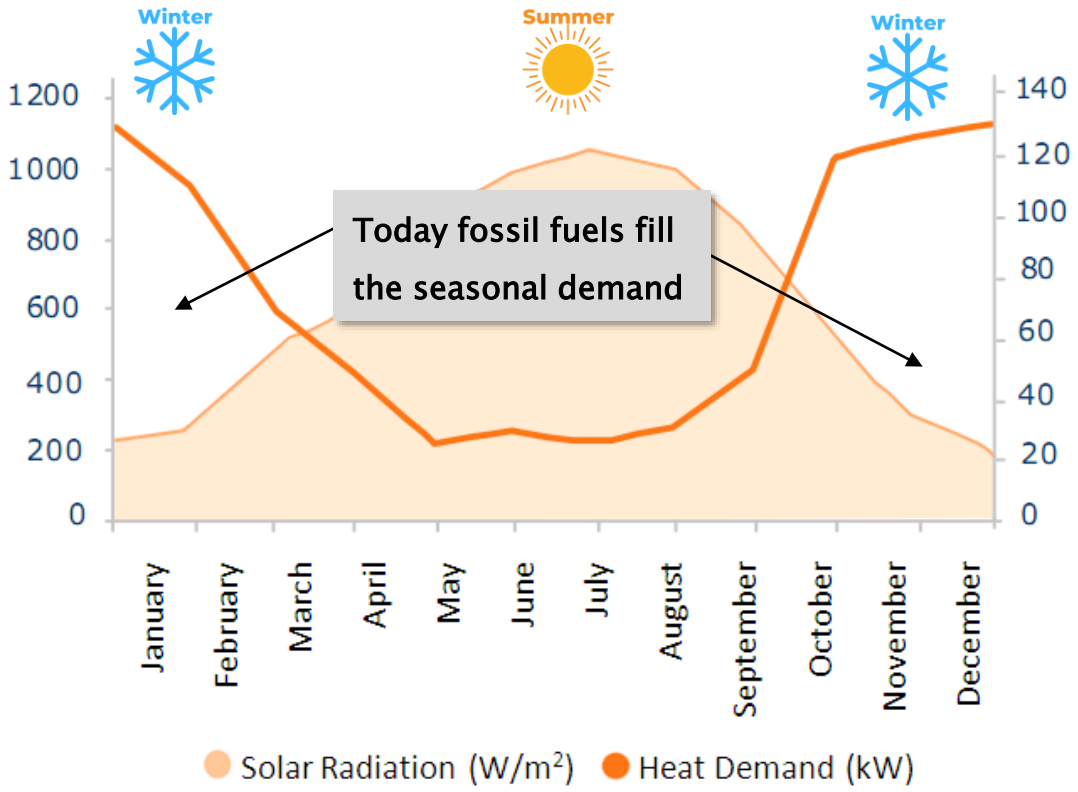
Source: Zappa, W.et al. Renew. Sustain. Energy Rev. 94, 1192–1216 (2018).

Key Challenges in the Energy System Today

Reliance on fossil fuels to fill the gaps

Seasonal timescale (longer durations)

- ✓ Traditionally fossil fuels meet seasonal demand especially heating
- ✓ Need a **clean, dispatchable energy backup** supply to meet longer duration needs

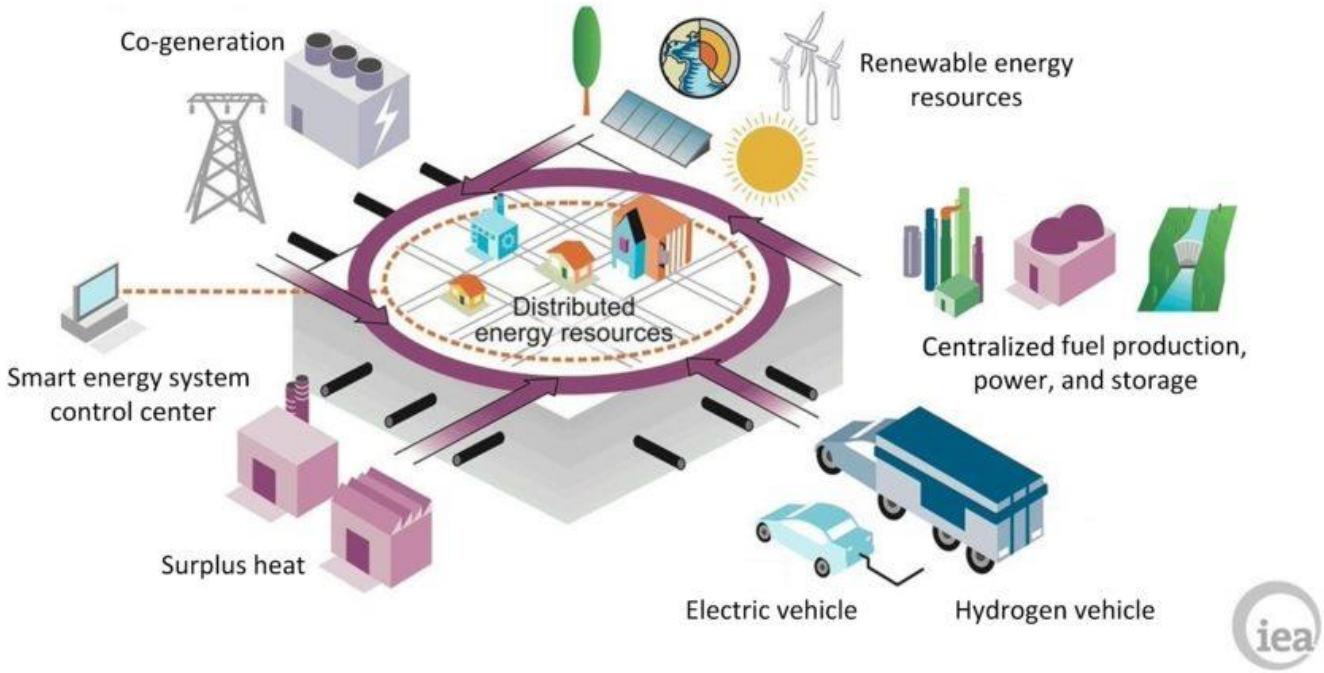


Source: https://www.icax.co.uk/Heat_Recycling.html

Overcoming Energy System Challenges

The Ideal Case

Clean, decentralised energy generation



- ✓ **24/7 Carbon neutral powered society** → Maximise utilisation of indigenous renewable energy sources
- ✓ **Affordable energy** based on cheap clean generation
- ✓ **Energy security** with independence from external energy imports
- ✓ **Resilient and reliable energy system**

Energy Storage Offers a Solution to Key Challenges

Providing Flexibility and Energy shifting

Key Challenges:

1. Grid support and resilience
2. Rising curtailment
3. Reliance on fossil fuels to fill the gaps, often gas peakers
4. Need to shift energy over days, weeks, seasons

Solutions with *Energy Storage*:

- ✓ Provide fasted response grid support services
- ✓ **Minimise curtailment** by storing excess renewable generation to be used when needed
- ✓ **Provides a clean, dispatchable backup energy supply,** reducing the need for fossil generators i.e. Natural gas
- ✓ **Energy shifting** over different timescales

Energy Storage Offers a Solution to Key Challenges

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How much energy storage?

EASE Approach

Defining Energy Storage Needs in 2030 and 2050

1. **Review over 40+ studies**
   - ✓ EU-funded studies
   - ✓ Non-EU Assessments (NREL, etc.)
   - ✓ Academic literature
   - ✓ Market intelligence data
   - ✓ …

2. **Engagement** with EASE members, research centers, other associations and energy storage stakeholders

3. **Map energy storage needs for 2030 and 2050** reported across different sources

4. **Identify gaps** e.g. not all storage technologies considered, missing applications etc.

5. **Update Assumptions in** line with e.g. current climate targets, considering all storage technologies etc.

6. **Classification of Energy Storage** P2X and P2X2P

Estimate Energy storage requirements for 2030 and 2050 based on energy system needs

Updated Assumptions

Included in Our Analysis

- ✓ Align storage needs with most recent decarbonisation targets
  - ✓ 55% GHG
  - ✓ 45% RES
- ✓ Technology neutral approach – consider all energy storage technologies and sector integration
- ✓ Flexibility needs across seconds, hours, days, weeks, seasons
- ✓ Account for other flexibility solutions
- ✓ Assumptions on replacing gas flexibility in 2030 with energy storage
- ✓ Hydrogen mainly used to decarbonise industry in 2030 time-horizon
- ✓ Take into account studies with nodal level grid analysis
- ✓ Up to date cost assumptions for different technologies
- ✓ ….

Example Study

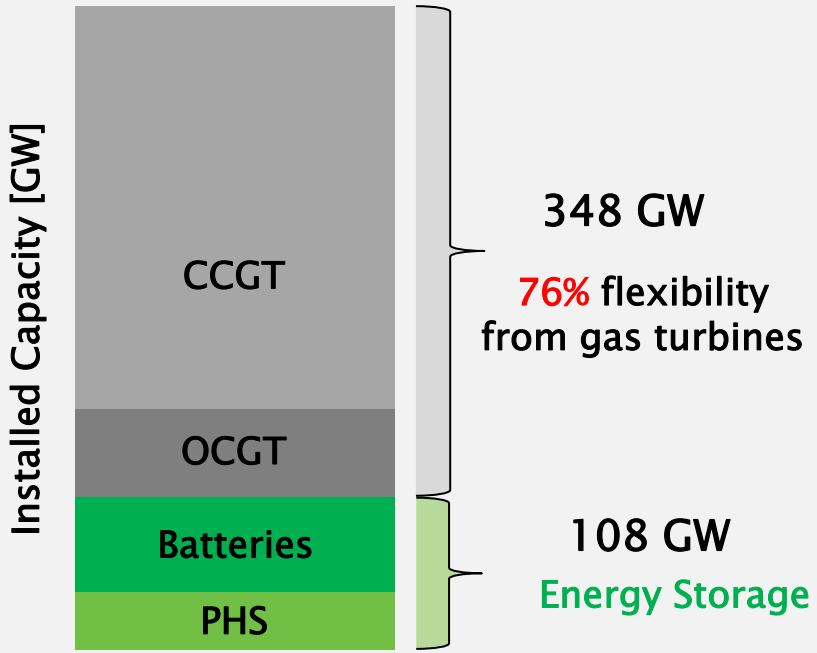
European Commission Study on Energy Storage (2020)

Daily, weekly, seasonal flexibility Needs 2030:

TOTAL = 456 GW

Energy System based on:

- ✓ 40% GHG reduction
- ✓ 32% RES
- ✓ **~670 GW** wind + solar



CCGT – Closed Cycle Gas Turbines, OCGT– Open Cycle Gas Turbines

- Detailed identification of flexibility needs based on climate targets and circumstances at the time

Adapted from: European Commission. *Study on energy storage – Contribution to the security of the electricity supply in Europe.* (2020).

Example Study

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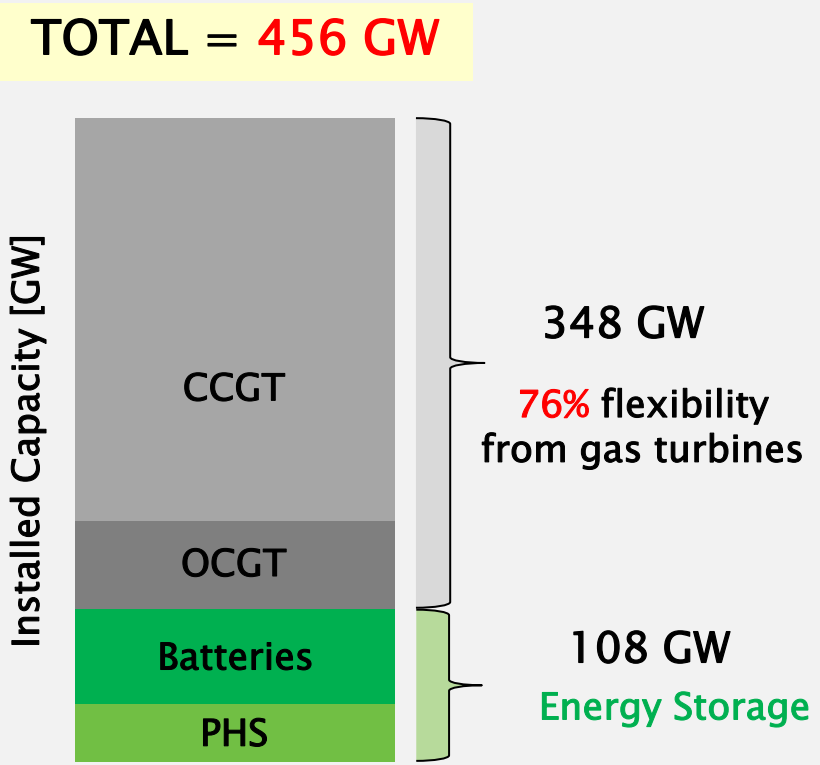


CCGT – Closed Cycle Gas Turbines, OCGT– Open Cycle Gas Turbines

Very different circumstances today...

- ✓ 55% GHG reduction
- ✓ 45% RES system
- ✓ >1200 GW wind+solar

Need alternative clean flexibility solutions

Adapted from: European Commission. *Study on energy storage – Contribution to the security of the electricity supply in Europe.* (2020).

Flexibility from Different Solutions

- ✓ Interconnections
- ✓ Demand side management (e.g. Adjustment of consumption)
- ✓ Flexible Generation (mainly fossil fuel)
- ✓ .....

+

Energy storage

Two Types of Flexibility From Energy Storage

Energy Storage

1. Power-to-X

→ one-directional
System flexibility

Electricity flows in one direction and is not given back to the system as electricity – it is converted into another energy carrier.

E.g.: Power-to-heat, Power-to-gas, V1G etc...

2. Power-to-X-to-Power

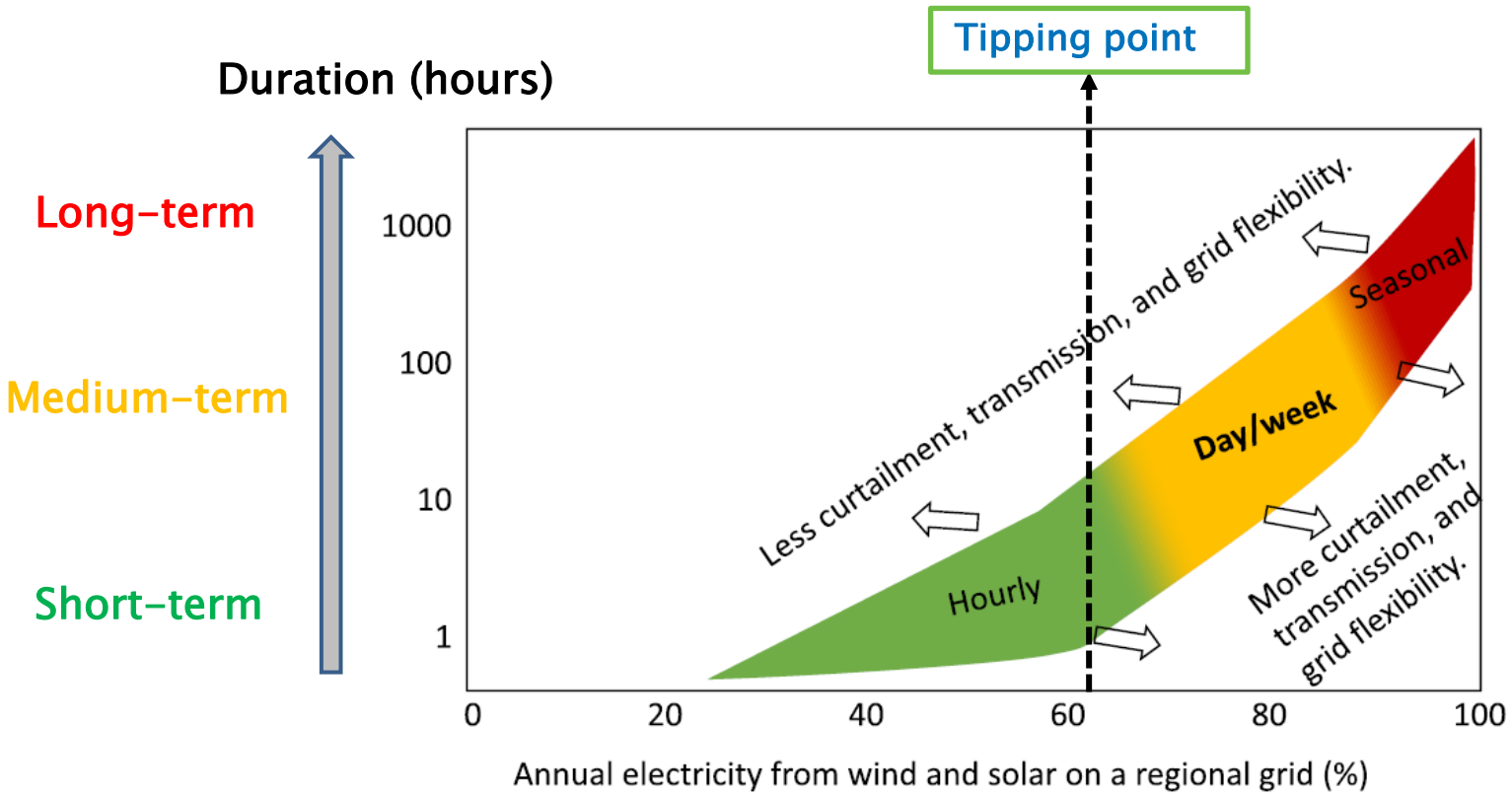
⇄ bi-directional
Energy Shifting

shifting electricity storing at times of surplus and giving electricity back to the system at times of deficit across different timescales (seconds, hours, days, weeks seasons) – to 'fill the gaps'

E.g. Batteries, flow batteries, V2G, Flywheels, PHS, CAES, LAES, Supercapacitors, Gravity storage, Thermal energy storage (P2H2P) etc .....

Storage Duration vs. Wind and Solar in the Generation Mix

Hourly, Daily, Weekly, Seasonal Duration Needs



- Other flexibility solutions either increase or decrease storage duration needs
- >60% tipping point → multiple hour duration storage needed
- Need to look at nodal/local level balancing

Source: Albertus, P., et al. Long-Duration Electricity Storage Applications, Economics, and Technologies. *Joule* **4**, 21-32 (2020).

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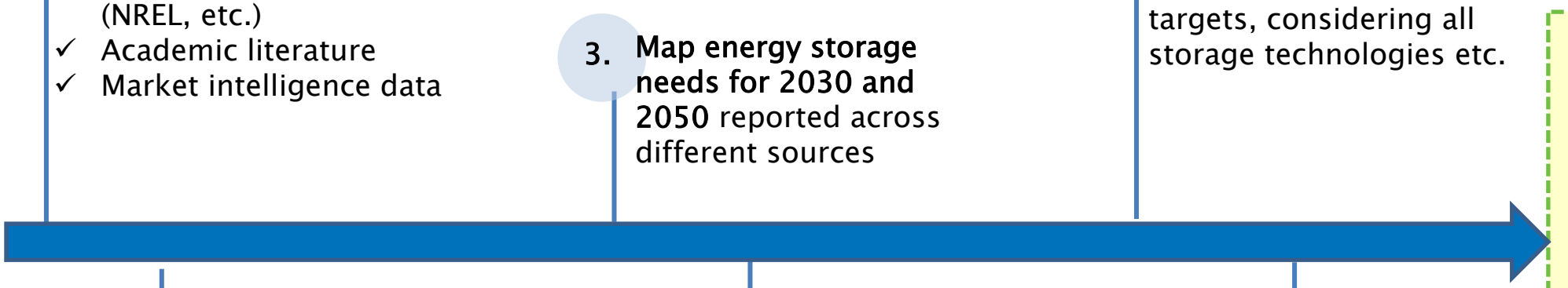
3. **Map energy storage needs for 2030 and 2050** reported across different sources

4. **Identify gaps** in key assumptions and inputs that underestimate energy storage requirements

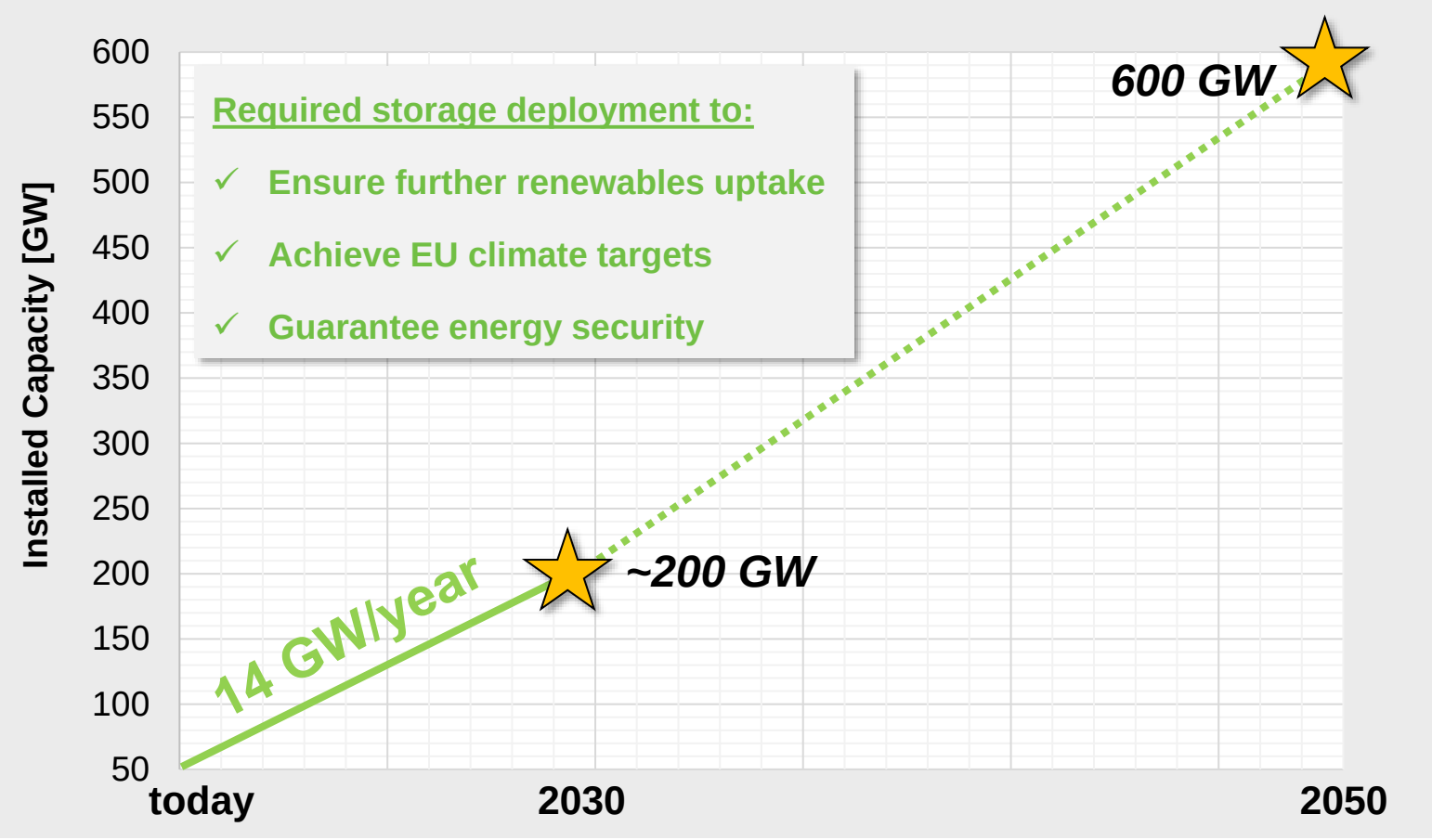
5. **Update Assumptions in** line with e.g. current climate targets, considering all storage technologies etc.

6. **Classification of Energy Storage** P2X and P2X2P



Estimate Energy storage requirements for 2030 and 2050 based on energy system needs

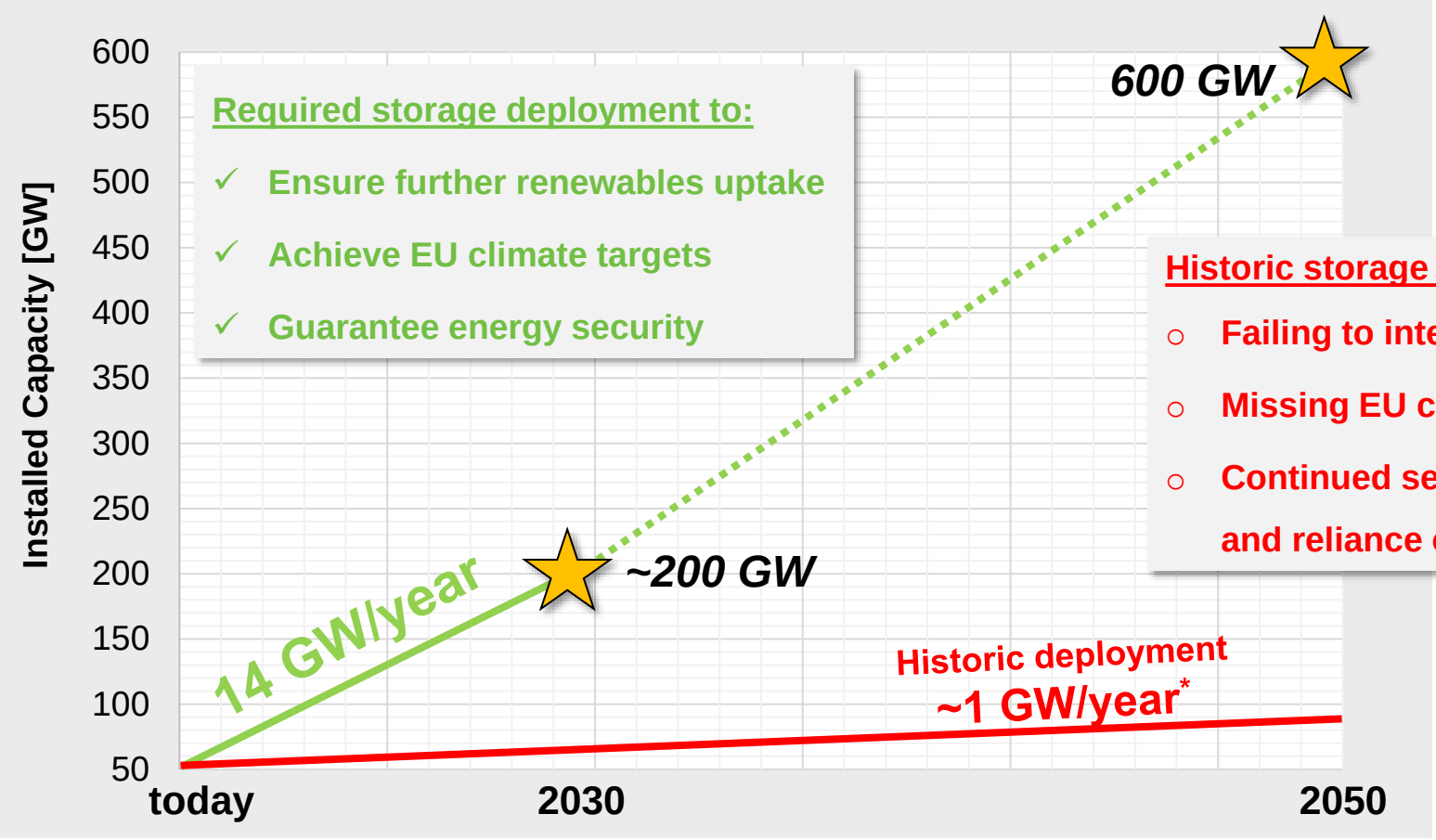
Energy Storage Estimates 2030 and 2050



*https://www.iea.org/reports/energy-storage

Energy Storage Estimates 2030 and 2050

Compared to Historic Market Deployment

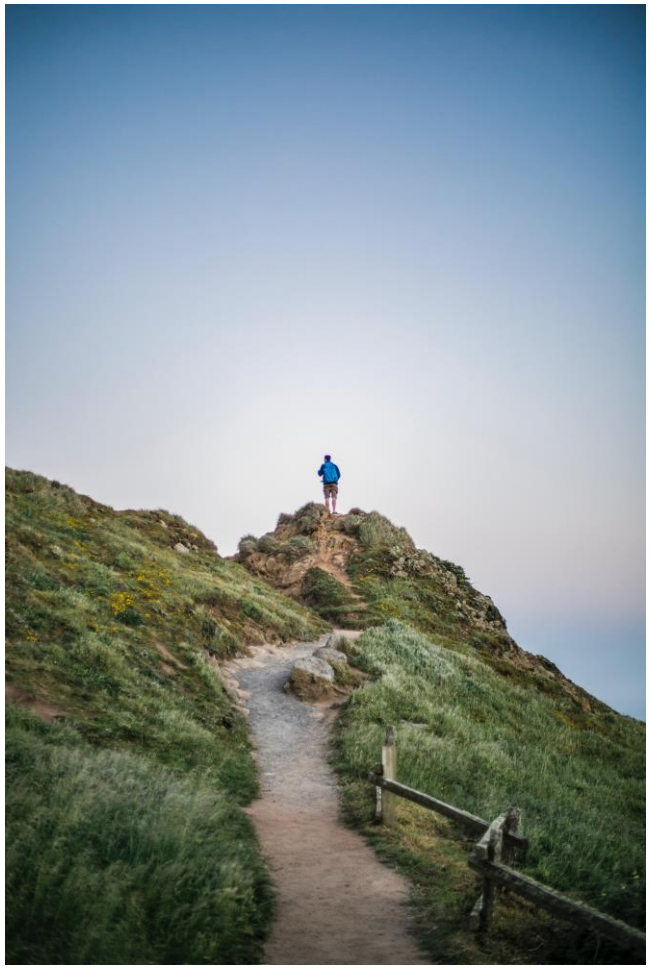


*https://www.iea.org/reports/energy-storage

How will we Achieve this?

With a Comprehensive Energy Storage Strategy and Targets

- ✓ **Clear political commitment: Set energy storage strategy with targets for 2030 and 2050**
  - ✓ Create long-term investment signals
- ✓ **Strengthen the business case for energy storage – reviewing current market design**
  - ✓ Ensuring that all services that energy storage provide are remunerated and that markets for both short-term and longer-term energy storage exists
- ✓ **Mainstream energy storage in the European Commission's implementation of the REPowerEU Plan**
  - ✓ By improving permitting, addressing lack of implementation of EU legislation in Member States, facilitating demonstration projects for storage etc.



Panel Discussion and Q&A

Jannis Burger

EDF Research Engineer

Joris Koornneef

TNO Strategy Consultant–Sustainable Geo Energy

Moderator: David Post

EASE President, Head of Marketing and Sales

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Amir José Daou Pulido

Fluence Market Development Manager

Closing Remarks

David Post

EASE President,

Head of Marketing and Sales

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If you want to endorse these targets contact EASE team at e.cirule@ease-storage.eu

https://ease-storage.eu/publication/call-for-endorsement-energy-storage-targets/

Thank you for joining the webinar!

We're ready to answer your questions.

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