

# Session 2.5 The 2025 Route-to-Market for LDES



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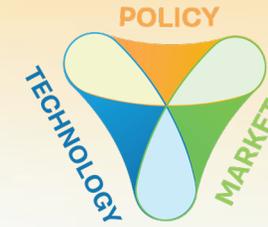


*Moderator:*

**Cillian Totterdell**

Policy Manager / Form Energy

# Securing the Grid with Multi-Day Storage



**ENERGY STORAGE**  
Global Conference  
Brussels, 14-16 October 2025

Cillian Totterdell  
Form Energy



# Form Energy at a glance

- Founded in 2017
- Developing, manufacturing, and commercializing a 100-hour, iron-air rechargeable battery in the United States
- Enabling a reliable, cost-effective, and stable electric grid
- Employing ~1,000 people
- Announced partnerships with leading utilities and entities on >14 GWh of projects
- Completed construction of ~500,000 ft<sup>2</sup> manufacturing facility in Weirton, WV



## OUR LEADERSHIP

Led by energy storage veterans with decades of cumulative experience and 100s of MWs of storage deployed



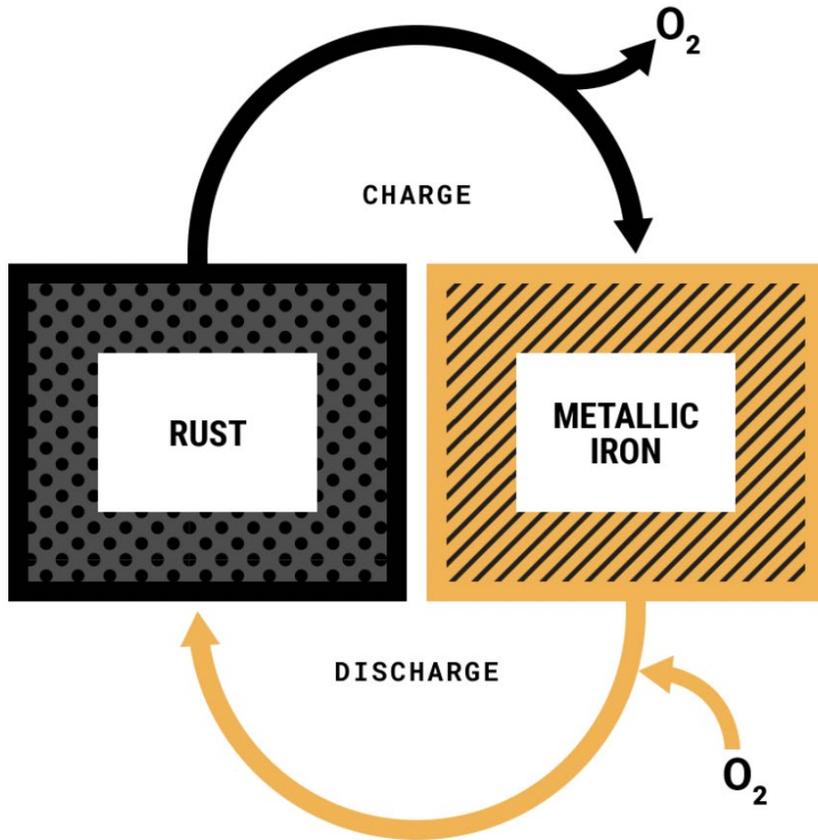
## OUR INVESTORS

\$1.2B+ in venture capital from long-term, impact-oriented investors



# Technology overview: Rechargeable iron-air batteries

## Reversible rusting



## Technology benefits



### COST

Lowest cost rechargeable battery chemistry, with a chemistry entitlement of €1.00/kWh



### SAFE

No thermal runaway (unlike li-ion)  
Non-flammable aqueous electrolyte



### SCALABLE

Iron is the most globally abundant metal, easily scalable to meet TW demand for storage



### DURABLE

Iron electrode durability proven through decades of life and 1000's of cycles (Fe-Ni)

# Form Factory 1: Commercial-Scale Manufacturing

Transforming Weirton Steel Land for Battery Manufacturing in West Virginia

- **Production Capacity:** 500 MW / 50 GWh annually by '28
- **Total Local Investment:** \$760 million
- **Selection Process:** year-long, 500 sites
- **Construction Start:** 2023
- **Production Start:** 2024
- **Jobs:** Minimum 750 full-time jobs
- **Weirton Benefits:** Local manufacturing know-how, strong natural infrastructure

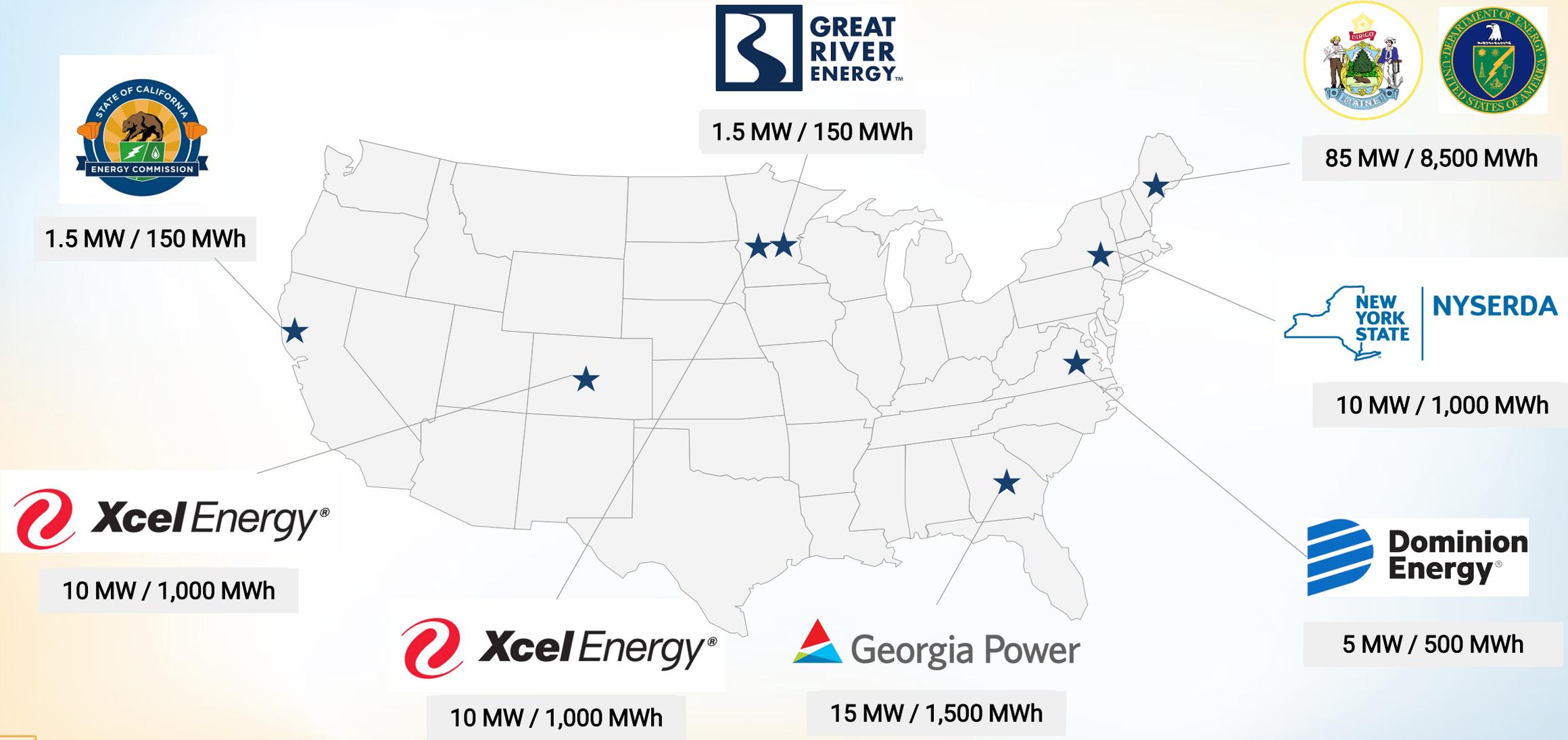


*Form Factory 1 site, June 2023*

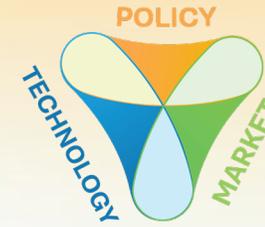


*Form Factory 1, July 2024 (first ~500k sqft)*

# Over 14 GWh of announced **deployments** across the United States



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Head of Unit

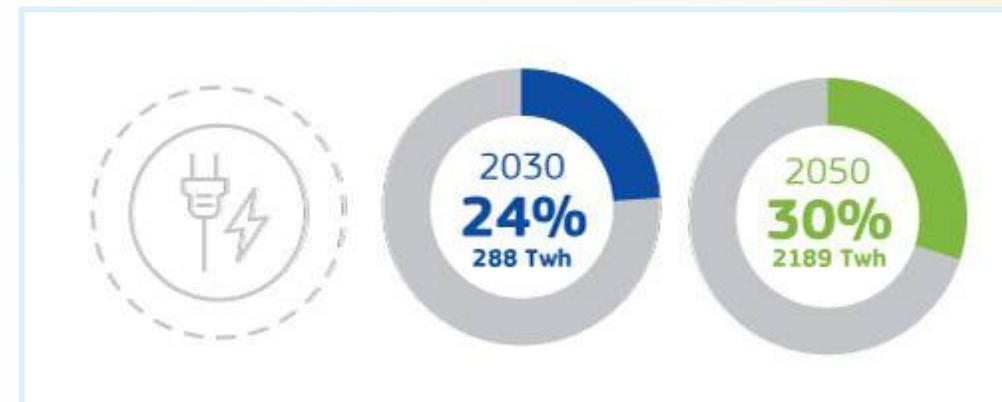
DG ENER, European Commission



# Role of energy storage (I)

## Outlook towards 2030 & 2050

- EU RES target: 42.5% by 2030, with aspiration of 45%.
- Renewables set to represent 69% electricity consumption by 2030.
- Flexibility needs projected to reach 24% of electricity demand in 2030 & 30% in 2050.
- Estimated 200 GW energy storage needed by 2030 and 600 GW by 2050 at EU-level.



Source: EC, JRC Flexibility requirements and the role of storage in future European power systems, 2023



Source: EASE.

→ Clear role for energy storage in meeting flexibility needs & supporting the decarbonisation of Europe's energy system towards 2030, 2040 and 2050.

# Role of energy storage (II)

## Long-duration energy storage

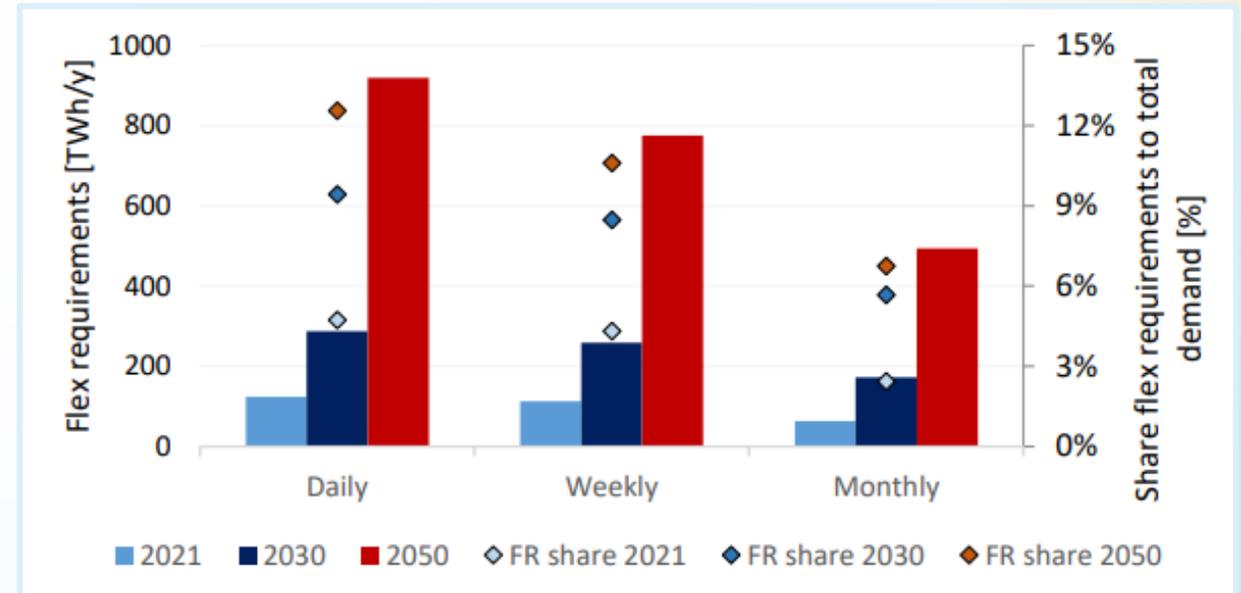
- Flexibility needed on different timescales

- Daily
- Weekly
- Monthly
- Seasonal

→ Long-duration energy storage

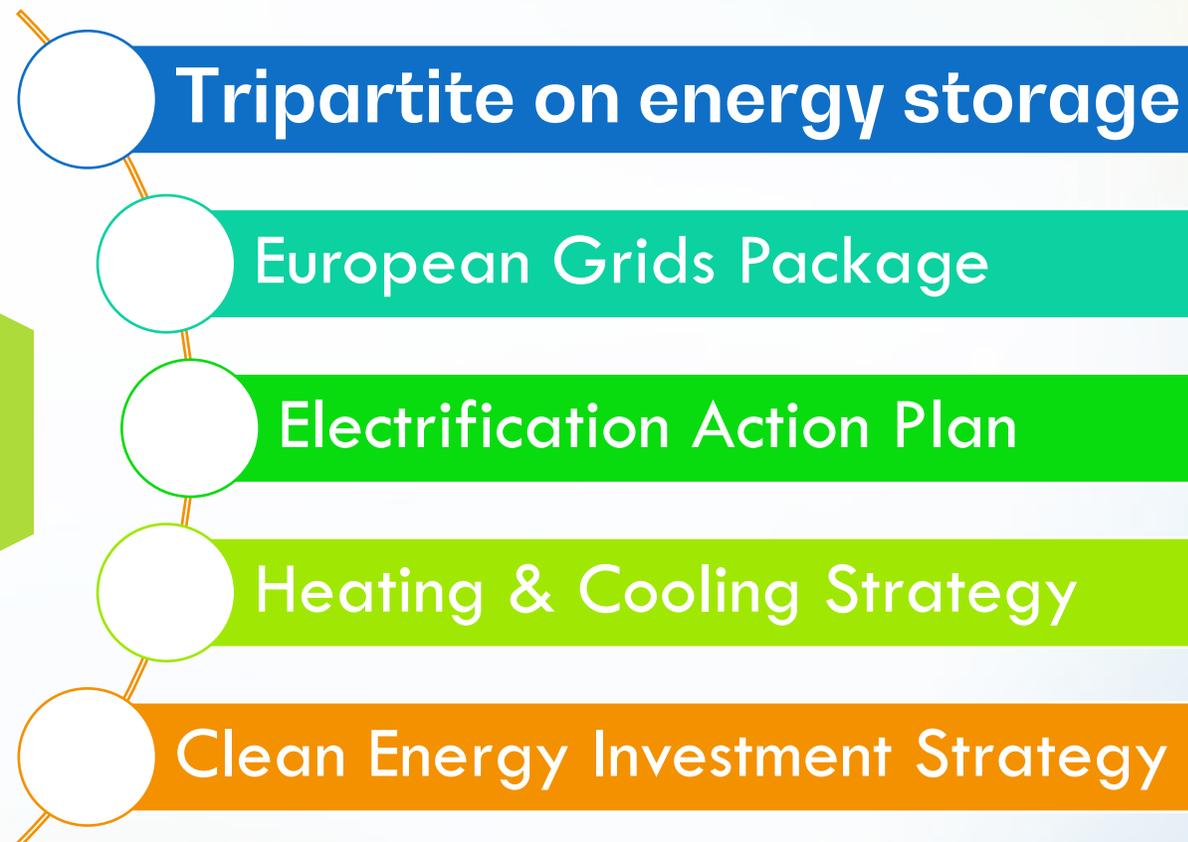
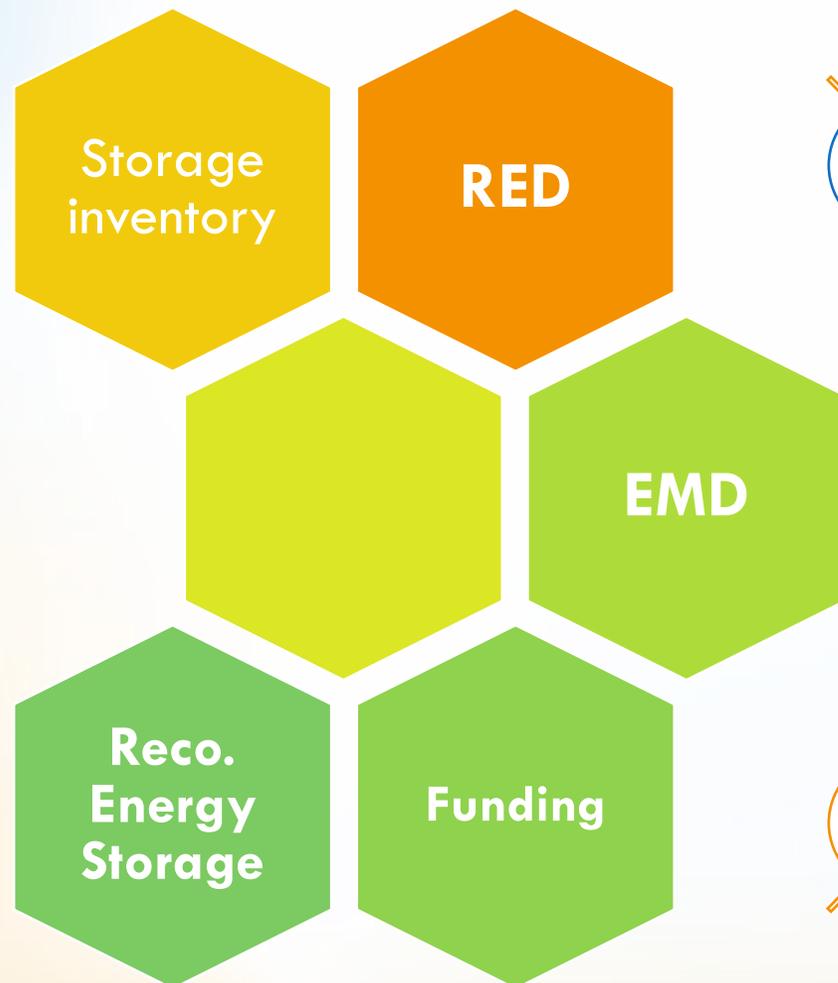
- Increase in flexibility needs on a relative basis is the **highest on a monthly timescale** with 173 TWh.

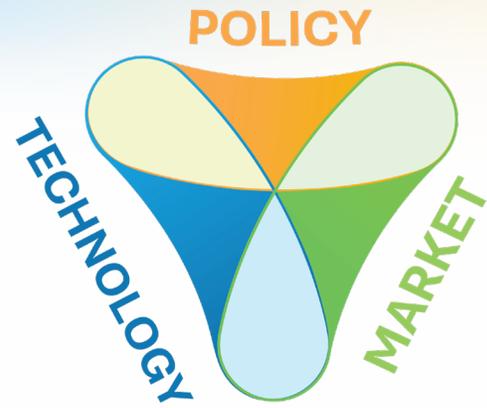
- LDES could avoid between **35% and 88%** of the renewable energy curtailment.



Source: EC, JRC Flexibility requirements and the role of storage in future European power systems, 2023

# Further work at EU level- not starting from scratch





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# THANK YOU!





LDES: An opportunity for Europe's Grids

The Energy Dome Case

# Who I Am

## **Mike Vasconcelos Tocchetti**

*Head of Business Development, Europe, Energy Dome*

~10 years experienced cleantech professional with a track record in project development, business strategy, and energy infrastructure across Europe and the US:

Previous experiences:

- 2 years | Business Development Director, *Terna Plus - North America*
- 5+ years | Lead Business Developer, *Ørsted - Europe and North America*
- 2 years | Civil Engineer, **Ramboll - Denmark**

Education:

- MSc in Civil Engineering, *Danmarks Tekniske Universitet (DTU) - Copenhagen (DK)*



# Setting The Scene

## The European Paradox

Decarbonisation is Europe's opportunity to build a future that is both *sustainable* and *energy independent*

Europe leads in **renewables**, but lags in productivity and energy independence

**A cost-only approach is not suitable in the energy sector**, other criteria must be considered

EU energy transition **demands** reliable and affordable energy.

“Without productivity, we are less free to choose our destiny” M. Draghi, The Future of European Competitiveness

# What Sets Energy Dome Apart?

A Game-Changer in Long-Duration Energy Storage



## Cost Competitive

Offers highly competitive CAPEX versus alternative storage solutions, including Li-Ion and pumped hydro



## No Rare Materials

Eliminates reliance on scarce or ethically problematic materials like lithium.



## Industrial-Grade Reliability

CO<sub>2</sub> thermodynamic cycle proven at commercial scale; robust, repeatable, and ready.



## Systemic Innovation

Represents a foundational shift in how long-duration energy storage is conceived and delivered.



## Geo-Agnostic Deployment

Functions independent of terrain, deployable across diverse environments unlike pumped hydro.



## Proven s reliable supply chain

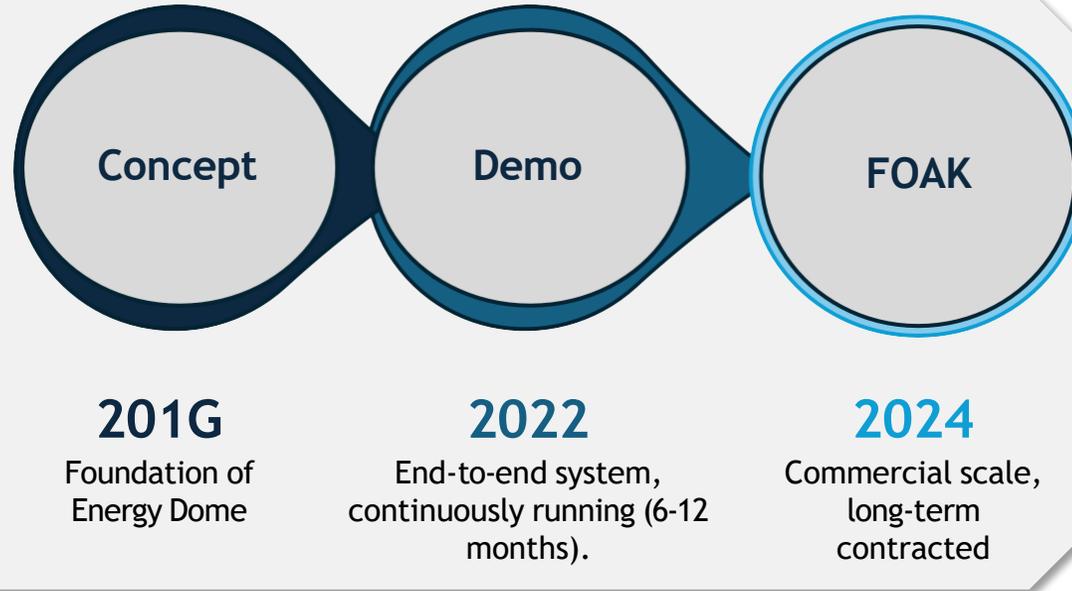
CO<sub>2</sub> Battery is based on off-the-shelf components

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# The Sardinian Project (Ottana)

From First-Of-A-Kind CO<sub>2</sub> Battery (Energy Dome) to global market expansion

A **First of a Kind (FOAK)** marked a breakthrough - it proved our technology and demonstrated that the risks had been successfully mitigated.



**Global Scale  
Deployment**

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# Decarbonization As An Opportunity



Mario Draghi : “Decarbonization must be a joint plan for competitiveness”

**Energy Dome = European technology,  
European supply chain, European Jobs.**

LDES is not a cost, it is an industrial policy tool to:

1. Unleash REN efficiency, existing and new
2. Incentivize manufacturing in Europe
3. Enhance grid security
4. Help system flexibility



Exhibit 1. Our FOAK CO2 Battery - Ottana, Sardinia  
(20MW/200MWh).

# Policy Gaps

## Why Is LDES Not Yet Scaling

Today's market design still values **short-term flexibility over true duration**. Without a remuneration mechanism that rewards sustained energy delivery, long-duration assets remain undervalued. **PPAs could help bridge this gap** by pricing the firmness of energy delivered (€/MWh). Meanwhile, **permitting frameworks remain largely lithium-centric**, slowing innovation in alternative storage technologies.

### What's Needed?



# Energy Sovereignty and Market Evolution

Decarbonize maintaining our energy security

Achieving energy sovereignty necessitates the integration of **European technologies**, **localized manufacturing capabilities**, and **coordinated public-private financing**.

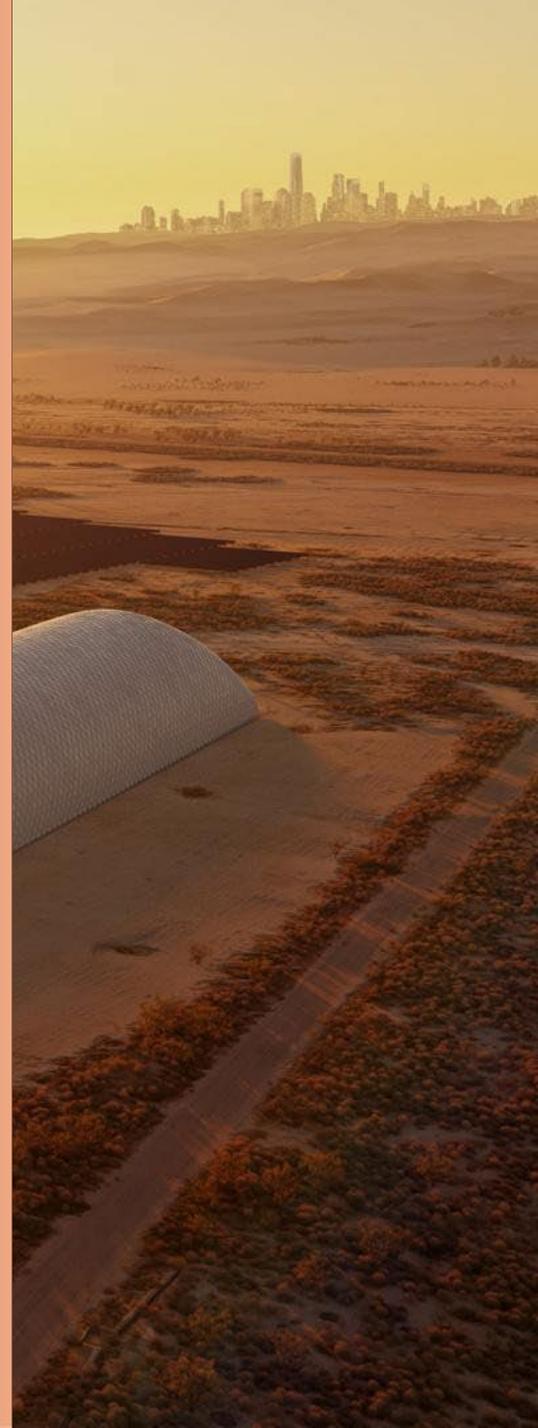
The Energy Dome CO<sub>2</sub> Battery represents a mature and validated LDES solution, ready for immediate deployment

**Decarbonization does not Require Deindustrialization. But without Sovereignty in Energy Storage, we surrender our Ability to Choose Our Own Energy Future**

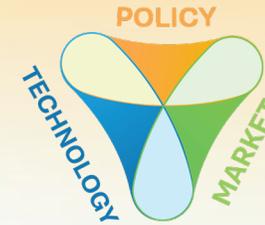
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**Thank you  
for your  
attention**



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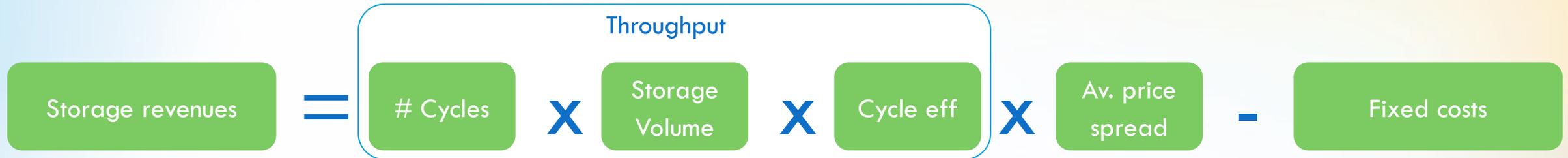
Marcel Eijgelaar

Principal Researcher  
Group R&D, DNV



# The competitive position of LDES

## Storage revenues from arbitrage



Main observation from the paper:

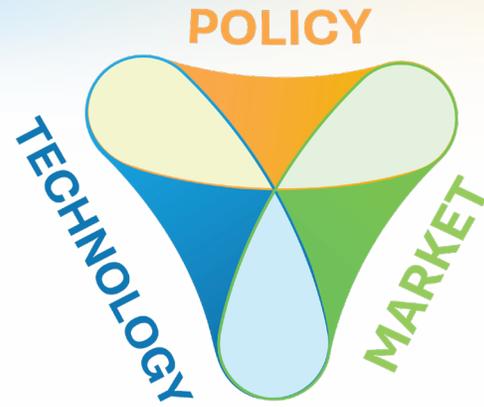
- The higher the volatility, the more short-duration storage
- The more short-duration storage, the more competition for long-duration storage

The paper optimizes the investments and dispatch of different storages, looking at the influence of:

- market price volatility (non marginal price based);
- the renewable generation mix;
- sector coupling (opportunity demand);
- the amount of storage;
- short duration acting as (expensive) long duration.

# General insights

- Volatility tends to favour short duration and efficient (Li- and Na- ion) battery storage
- 2h to 4h batteries will be dominant and might reach up to 20% of peak demand in North-Western Europe and 80% in solar dominated Southern Europe in 2035 (not counting ancillary and intraday markets)
- This storage will partly behave as long duration storage (because of competition batteries will not fully dispatch to avoid a negative price spreads)
- To gain a market share of 5% (in MW) in arbitrage, 24h duration storage requires more than 5 times lower cost per MWh than Li/Na-ion batteries.



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