How can electricity storage support the decarbonisation of the energy sector?

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Energy Community Panel Webinar on Energy Storage

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Introduction to EASE

Towards a cleaner Europe

Climate change and market will drive the business towards a greener energy system

Energy systems are moving to higher and higher renewable energy penetration

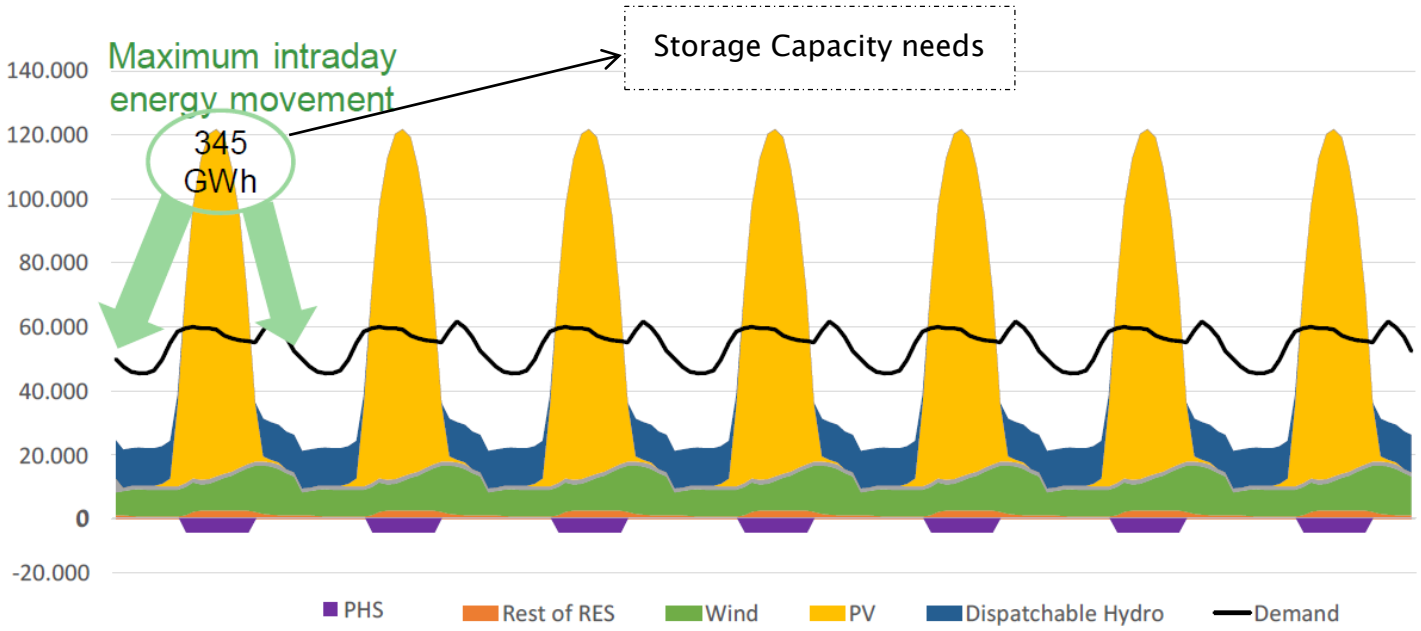
- E.g. the EU has a renewable energy target of at least 32% by 2030
- Climate neutral by 2050

But integrating Renewable Energy Sources in a cost-efficient way entails significant challenges!

Challenges of integrating Renewable Energy Sources

Why is energy storage required? Intra-day storage – The example of Spain in 2050

In 2050: Total demand – 470 TWh; Peak Demand – 70 GW



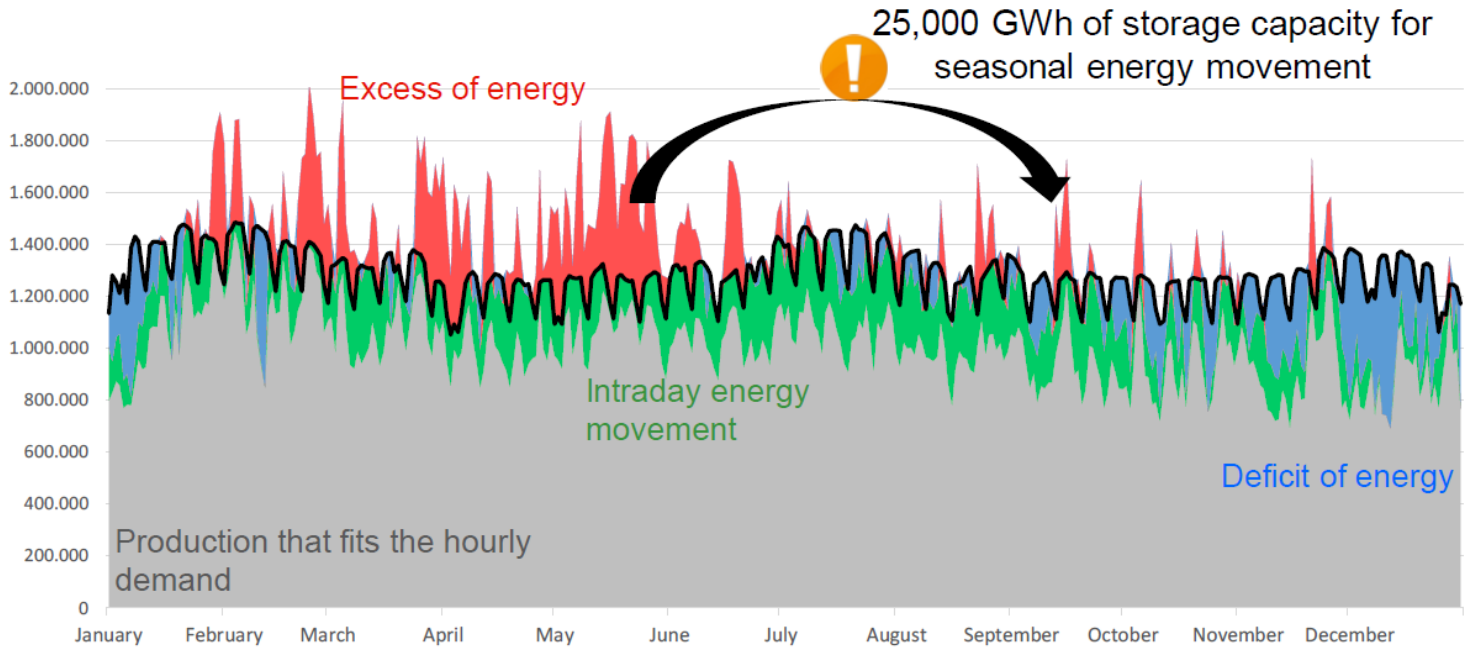
Source: Eurelectric

The higher the penetration of renewable energy, the higher the need for flexibility

ES technologies can store energy when production in excess and discharge when needed

Why do we need Energy Storage ?

Why is energy storage required? Seasonal needs – The example of Spain in 2050



Source: Eurelectric

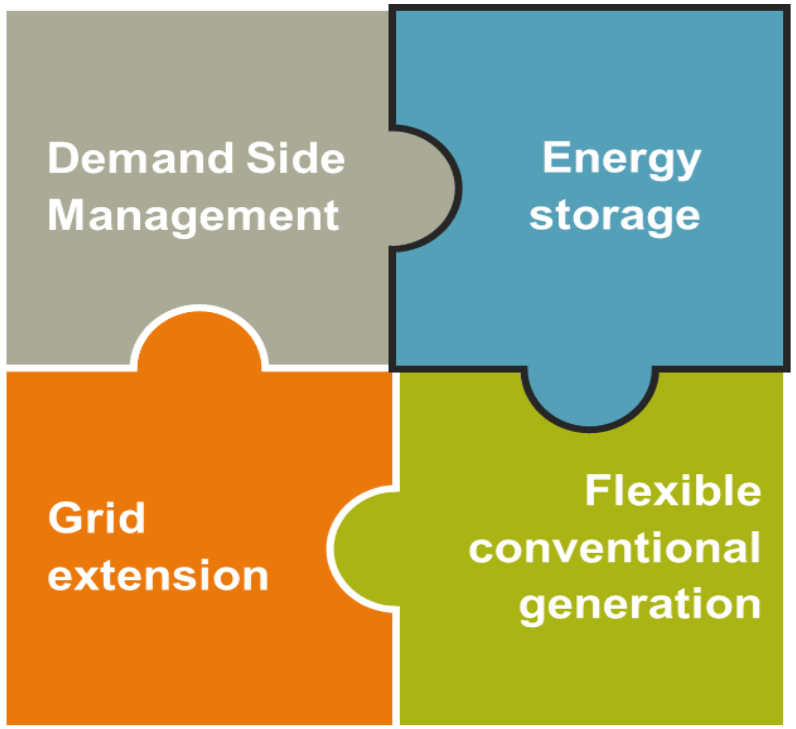
ES can provide seasonal storage – 72 times the capacity needed for intraday storage

Challenges of integrating Renewable Energy Sources

Why are batteries and storage key for flexibility?

To balance potential against user needs

Social acceptance becoming increasingly limited; big investments needed

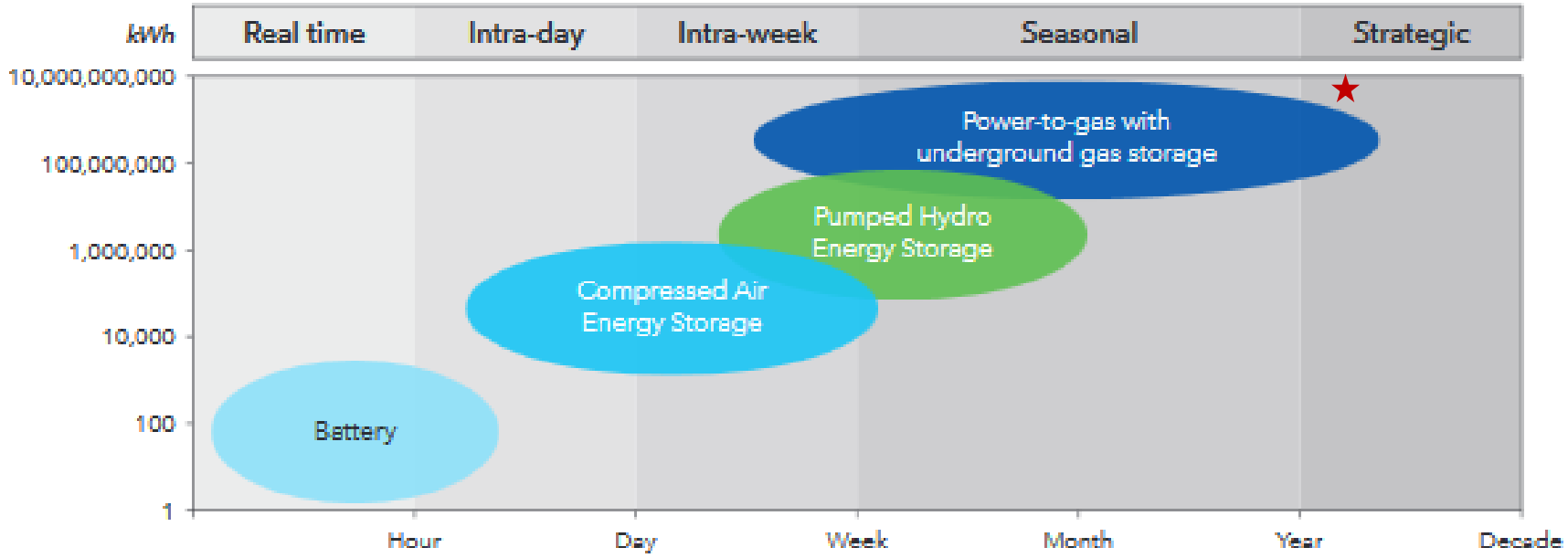


Many available technologies, value for host of different applications and locations.

Concerns about the environmental impacts and sustainability

Challenges of integrating Renewable Energy Sources

Short and long-term energy storage technologies



★ These are only four of many technologies

- Different energy technologies can be used for different timeframes
- Today other speakers will talk about Battery and PHS projects
  - They are two **of the key technologies for intra-day and seasonal flexibility…**
    - **… and only two of many!**

Challenges of integrating Renewable Energy Sources

Many Energy Storage Technologies on the Market and in R&D

Chemical

- Ammonia
- Drop-in Fuels
- Hydrogen
- Methanol
- Synthetic Fuels
- Synthetic Natural Gas

Electrochemical

Classic Batteries

- Lead Acid
- Li-Ion
- Li-Polymer
- Li-S
- Metal Air
- Na-Ion
- $Na-NiCl_2$
- Na-S
- Ni-Cd
- Ni-MH

Flow Batteries

- Vanadium Red-Ox
- Zn-Br
- Zn-Fe

Hybrid Supercapacitors

Electrical

- Supercapacitors
- Superconducting Magnetic ES (SMES)

Mechanical

- Adiabatic Compressed Air
- Diabatic Compressed Air
- Liquid Air Energy Storage
- Flywheels
- Pumped Hydro

Thermal

- Latent Heat Storage
- Sensible Heat Storage
- Thermochemical Storage

Many available technologies, value for host of different applications and locations…

Challenges of integrating Renewable Energy Sources

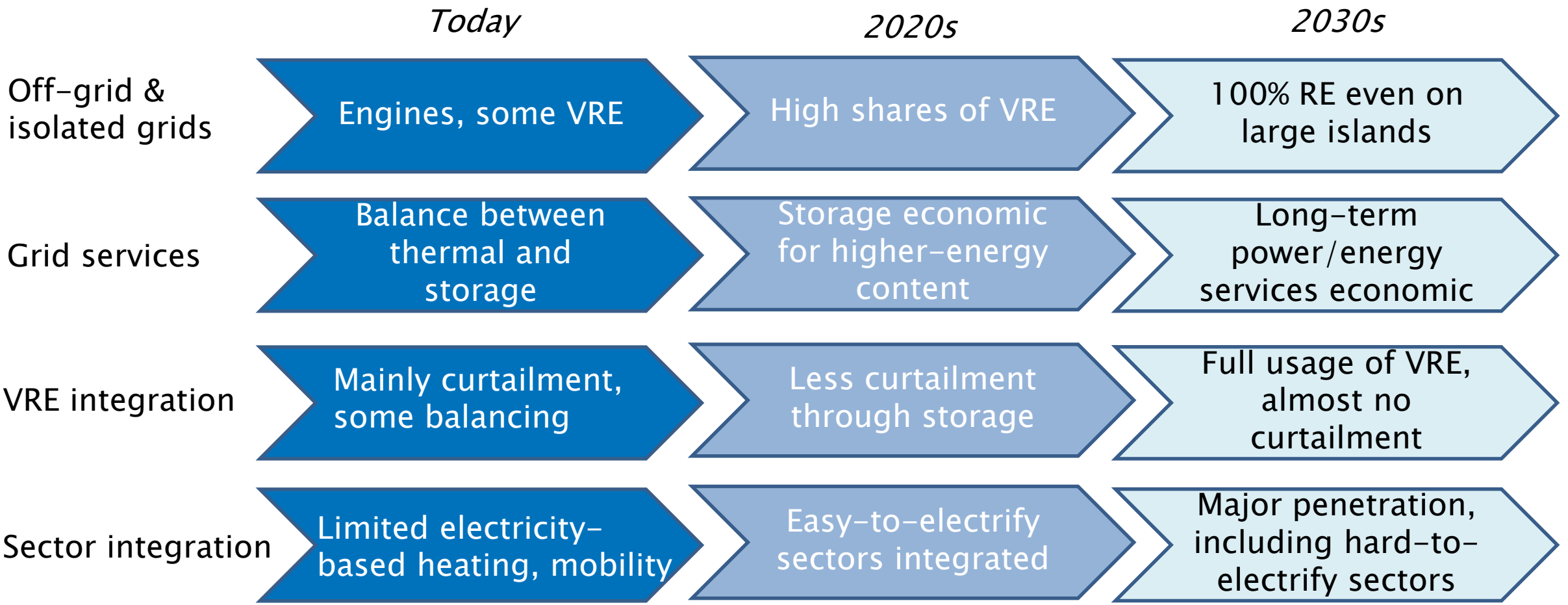
Energy Storage can provide many valuable services across the energy system

	Generation	Transmission	Distribution	Customer services
Conventional	Black start	Primary frequency control	Capacity support	End-user peak shaving
Conventional	Arbitrage	Secondary frequency control	Dynamic, local voltage control	Time-of-use energy cost management
Conventional	Support to conventional generation	Tertiary frequency control	Contingency grid support	Particular requirements in power quality
Renewable	Distributed Generation Flexibility	Improvement of the frequency stability of weak grids	Intentional islanding	Continuity of energy supply
Renewable	Capacity firming	Investment deferral	Reactive power compensation	Limitation of upstream disturbances
Renewable	Limitation of upstream disturbances	Participation to angular stability	Distribution power quality	Compensation of the reactive power
Renewable	Curtailment minimisation		Limitation of upstream disturbances	

But in the future…

The future of energy systems

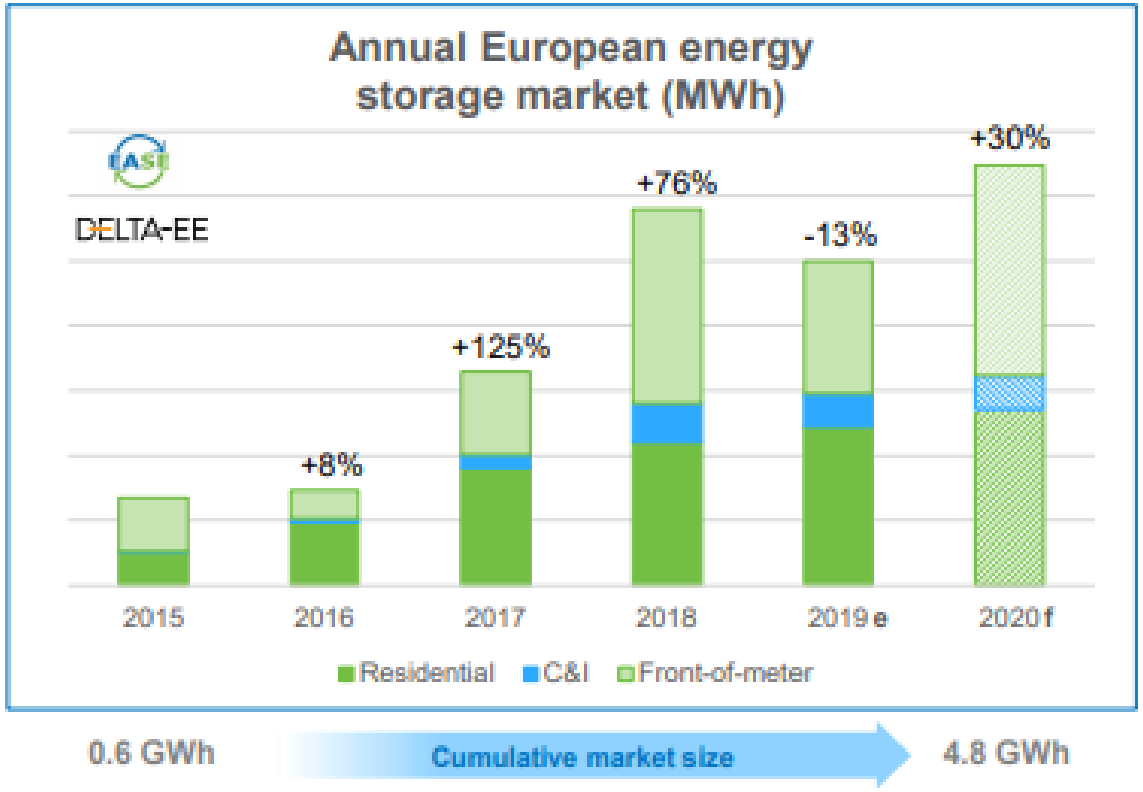
The landscape will be completely different – storage paramount



The future of energy systems

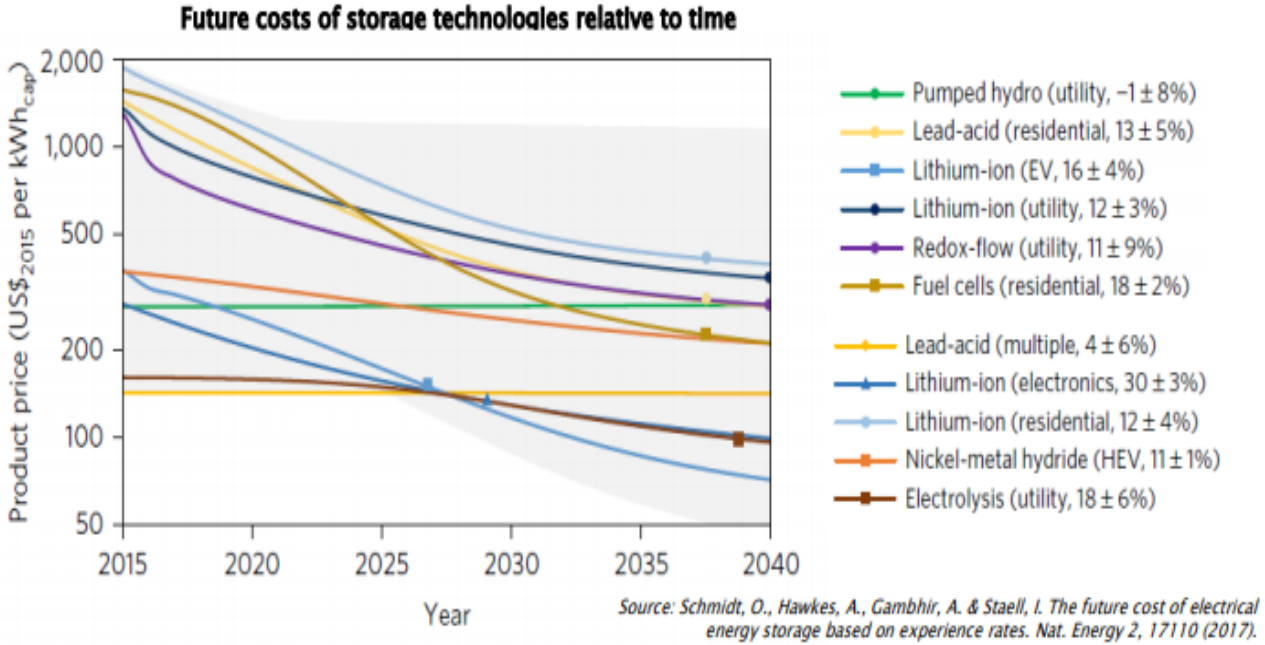
Higher uptake and lower costs for energy storage solutions

The market has been steadily growing…



Source: EMMES 4.0

And costs are steadily going down…



Source: Schmidt, O., Hawkes, A., Gambhir, A. & Staell, I. The future cost of electrical energy storage based on experience rates. Nat. Energy 2, 17110 (2017).

Covid-19 will of course impact the sector…

Real business cases for energy storage NOW

No longer the “new kid in the block”

A key message:

Renewable energy coupled with storage is already able to replace traditional plants, support RES, and increase profits

Real business cases for energy storage NOW

Example 1: Replacing a traditional power plant in Spain

PV + Wind: 1.7GW-plus

+

Energy Storage: 160MW

What 2 power plants decommissioned

Where: Spain

To replace: 1.3GW-plus

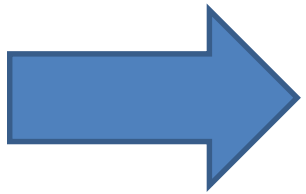
Source: Endesa – PV Magazine

Real business cases for energy storage NOW

Example 2: Kosovo coal power plant vs RES+ES plant

The government of Kosovo considered a new **450 MW coal power plant**

Kosovo has **massive lignite reserves** and a **growing energy demand**



The World Bank assessed whether such solution was the **least-cost electricity options** – and therefore whether it was worth financing

Real business cases for energy storage NOW

Example 2: Kosovo coal power plant vs RES+ES plant

The study looked into a **wide array of fossil fuels solutions**, such as:

- Construction of dual fuel power plant
- Installation of reciprocating engines using heavy fuel oil
- Construction of a new coal plant

VS

The study looked into a **wide array of renewable energy solutions**, such as:

- Biogas and biomass
- Hydropower
- Solar PV
- Wind power

Source: IEEFA

Real business cases for energy storage NOW

Example 2: Kosovo coal power plant vs RES+ES plant

Conclusion: when considering all externalities…

Cost Item	RE + Storage	Coal 450MW	Dual Fuel 450MW
CAPEX	€ 1,806M	€ 2,085M	€ 1,660M
Present value of total cost	€ 9,401M	€ 9,781M	€ 10,038M
Difference from least cost (%)	-	4.04%	6.78%

- Due to significant reductions in capital costs of solar PV, wind and storage technologies…

- **Renewable energy with energy storage leads to the least cost scenario**

Source: IEEFA

Real business cases for energy storage NOW

Example 2: Kosovo coal power plant vs RES+ES plant

The key messages:

New coal power plants are no longer the least-cost options, even in a country with enormous lignite reserves such as Kosovo

Renewable and energy storage are able to meet electricity supply needs securely and cost-effectively in countries with growing energy demand

The economics are clear, but legislation sometimes lags behind:
there is untapped potential…

How to foster energy storage business cases?

Appropriate legislation is paramount!

- Legislation must, among others:
  - ✓ Recognise energy storage as a key element of the energy system
  - ✓ Ensure technology-neutral policies
  - ✓ Follow, when possible, market-based principles for procurement of services
  - ✓ Allow monetisation of different services to build strong business cases
  - ✓ Encourage storage of RES

Conclusions

Energy storage a cost-effective enabler of the energy transition

- The energy transition entails significant challenges
- Energy storage **can and shall play a key role** in addressing them
- Energy Storage:
  - ✓ Enable high integration of renewable energy
  - ✓ Brings benefits to the energy system
  - ✓ Enables replacement of traditional power plants
  - ✓ Allows for the most cost-effective solutions

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