Underground Energy Storage: the Industry Perspective

07 November 2019

European Workshop on
Underground Energy Storage

Patrick Clerens

EASE Secretary General

EASE members

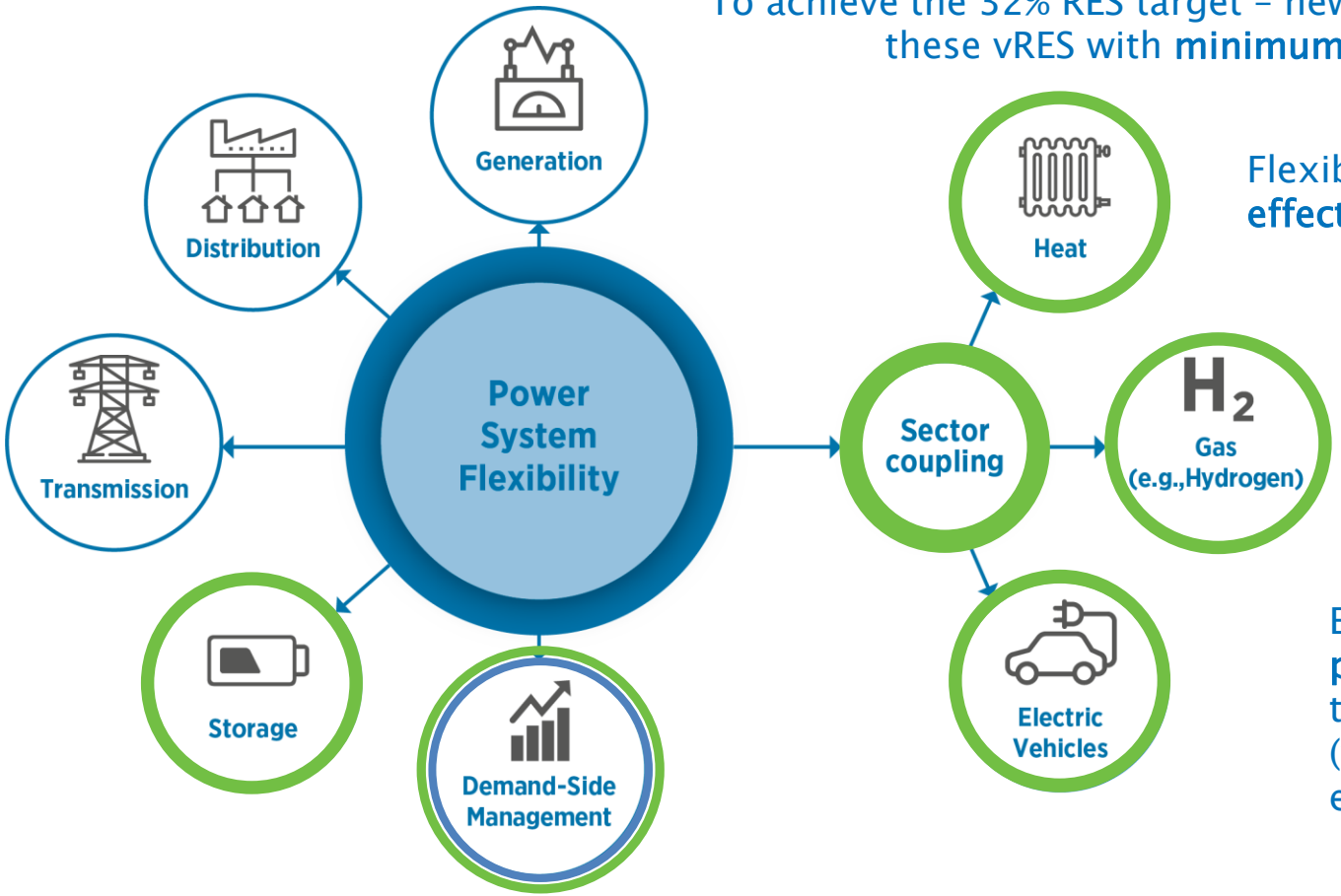
Activities and Services

EASE members have significant **expertise across all major storage technologies and applications**.

This allows us to **generate new ideas and policy recommendations** that are essential to build a regulatory framework that is supportive of storage

Why we need Energy Storage

Underground energy storage plays a key role in the future power system



To achieve the 32% RES target – new flexibility sources have to be deployed to integrate these vRES with **minimum curtailment and at optimised system cost**

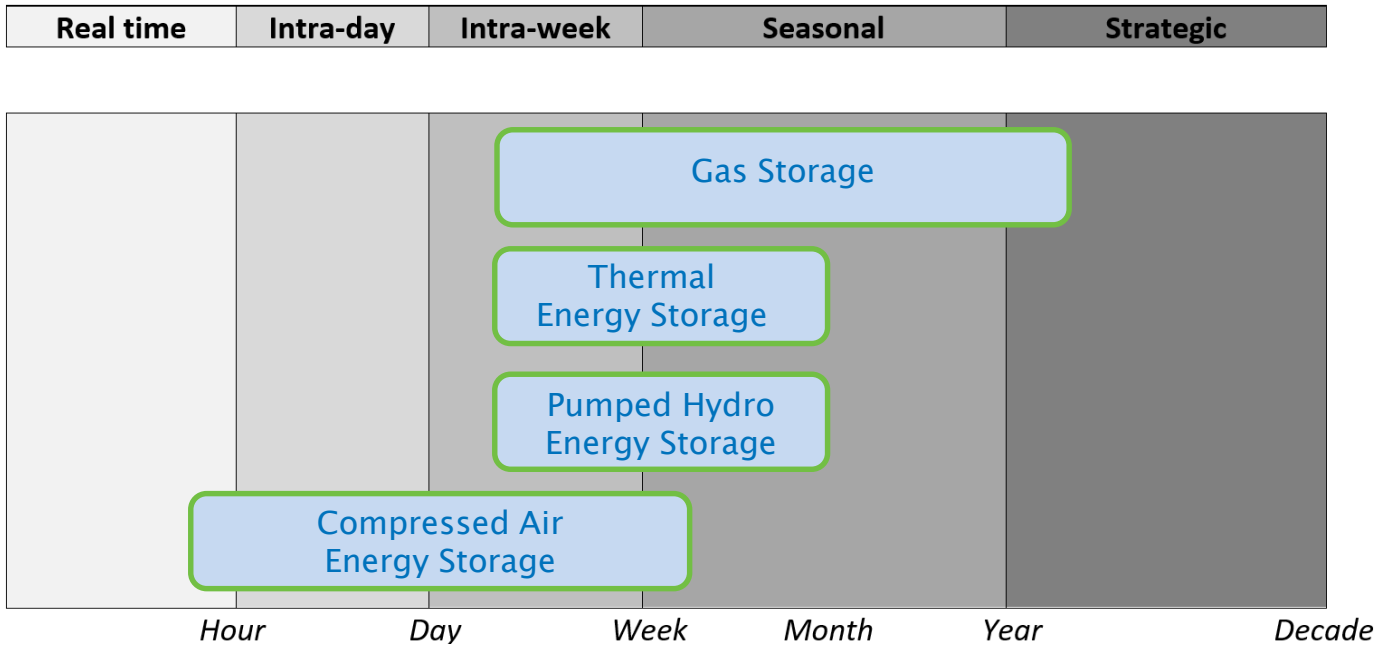
Flexibility plays a crucial role in ensuring **secure and cost-effective operation of the network**

Energy storage – provide flexibility to the system at **various time-scales**, from seconds and hours to weeks and months

Energy storage – offer highly **reliable, predictable, and accurate flexibility** services totally **independently from external factors** (weather, time or season, consumer behaviour, etc.)

Technologies and Applications

Both short and long-term energy storage technologies are needed



- Different energy technologies can be used for different timeframes
- Bulk energy storage technologies can provide long term/seasonal balancing. But further cost declines needed!
  - Underground energy storage could play a key role in the next few years
  - Currently unclear how these longer duration applications will be monetised

Inspiring pilot projects and industrial demonstrators

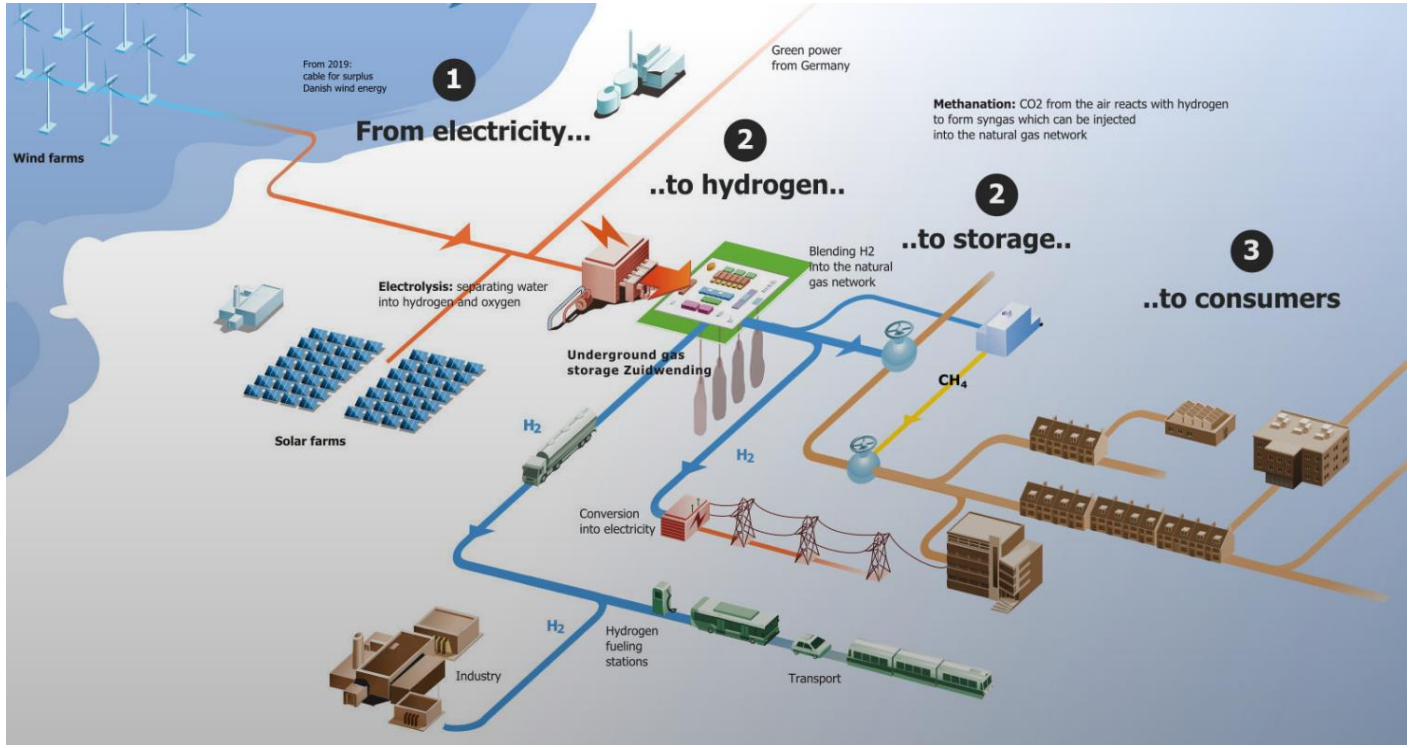
JOINT RESEARCH ON LARGE-SCALE SUBSURFACE ENERGY STORAGE

1. Joint Research On Large-scale Subsurface Energy Storage For Security Of Supply: it **assesses the value of hydrogen** and compressed air storage technologies in the current and future energy system, and will address key **technical and non-technical hurdles** that affect market implementation.
Focus on the Netherlands, funded by the Dutch government.

Consortium: TNO, EBN, Gasunie, Gasterra, NAM and Nouryon

Inspiring pilot projects and industrial demonstrators

TSO 2020



2. TSO 2020: exploits **synergies between power storage solutions and alternative transport infrastructure needs**. A power cable networks dispatches the electricity flows from the Cobracable PCI to a nearby major gas network facility. **Existing gas storage facilities and the national gas pipeline** network (power to gas) will be unlocked to absorb the H2. Local businesses will provide H2 distribution via road transport in NL and DE

Consortium: TenneT, T.U. Delft, Gasunies, **EASE**, Dutch Ministry of Infrastructure and Environment, Energy Valley, Green Planet, Energy Engineers

Inspiring pilot projects and industrial demonstrators

HEATSTORE

3. HEATSTORE: It focuses on **underground thermal energy storage** technologies to:

- ✓ lower the costs
- ✓ reduce risks
- ✓ improve the performance of high temperature (~25°C to ~90°C)
- ✓ optimise heat network demand side management (DSM).

6 demonstration projects and 8 case studies in 8 European countries. More than 20 companies involved

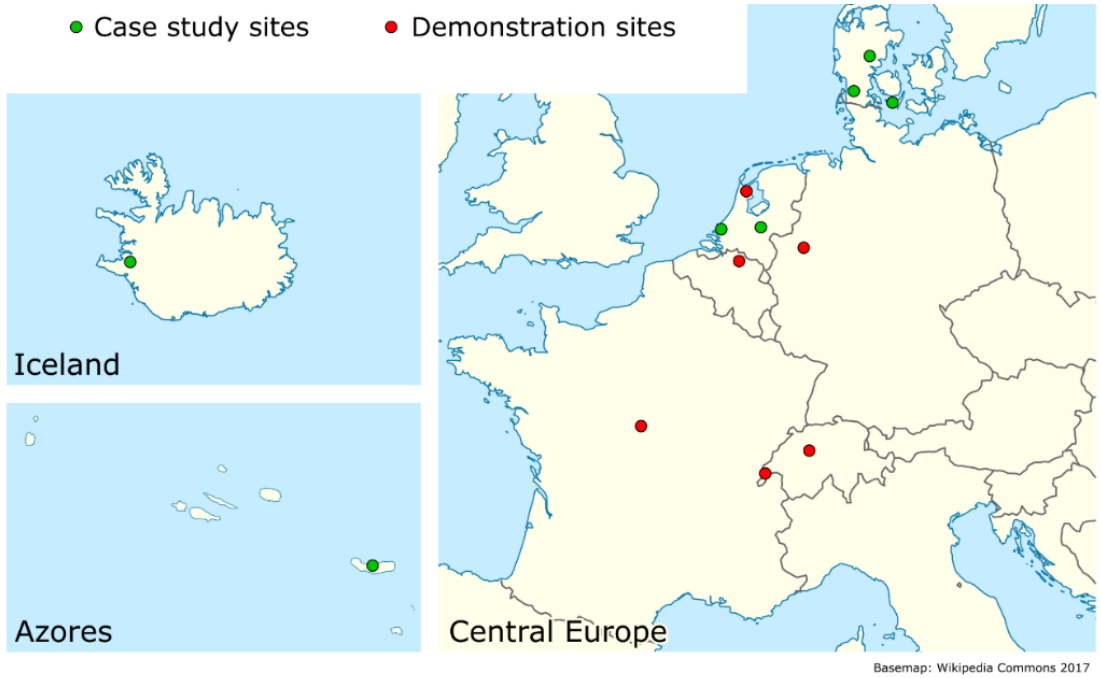
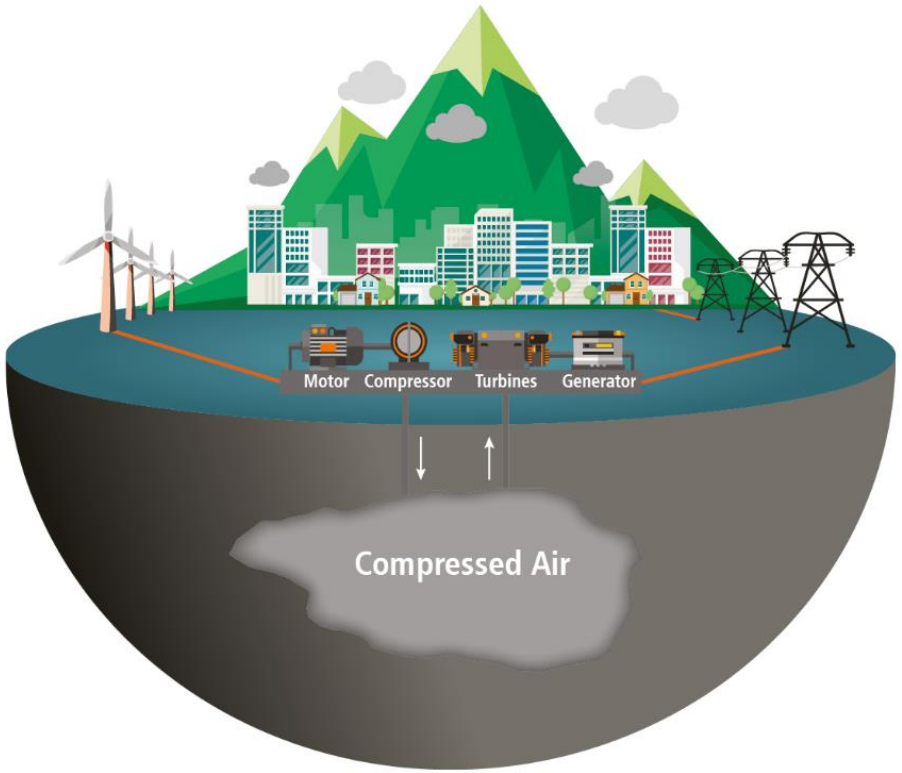


Figure 1. Overview of demonstration sites and case study locations in HEATSTORE

Example: Middenmeer (northern NL) – Storage of **heat in summer and use in winter** to allow the doublets to keep running at constant load. For agriculture businesses.

Inspiring pilot projects and industrial demonstrators

ZUIDWENDING



Developed by Corre Energy

4. CAES ZUIDWENDING PROJECT: Same area of TSO 2020, it will implement a new design that will allow green hydrogen to fully replace methane, providing a **100% renewable-CAES** solution

Generation capacity: approximately 300 MW

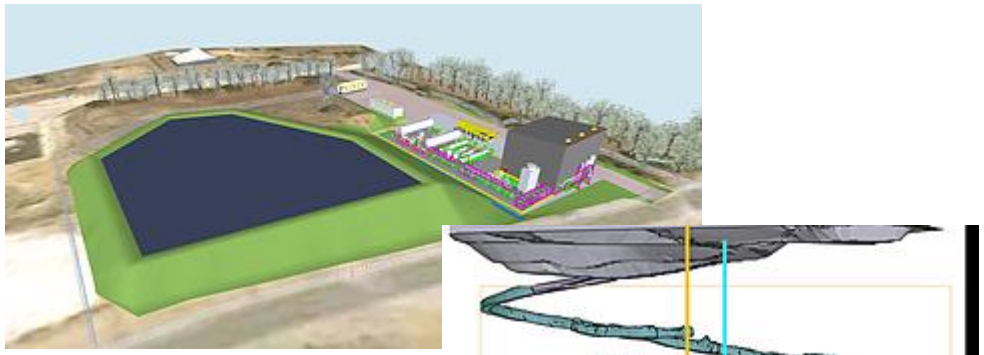
Daily storage/delivery capacity: approximately 3-4 GWh

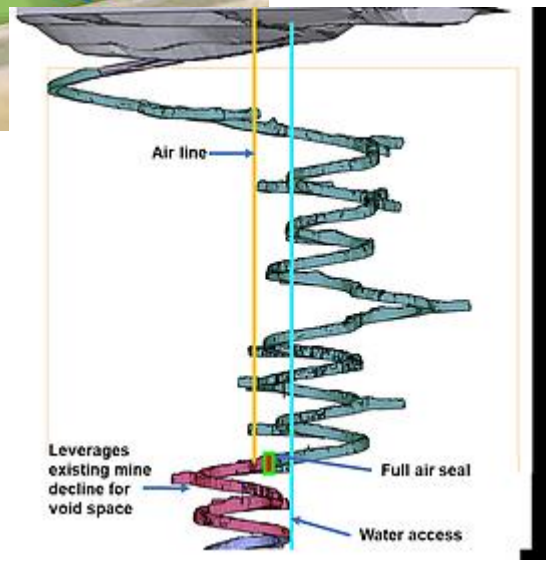
Scheduled for commissioning: 2024-25.

And there are inspiring projects also outside Europe…

Inspiring pilot projects and industrial demonstrators

ANGAS project





Developed by Hydrostor with Terramin's support

5. ANGAS A-CAES: Advanced Compressed Air Energy Storage.

It will provide: synchronous inertia, load shifting, frequency regulation, and support grid security and reliability, for approximately 5 MW

Repurpose of existing underground mining infrastructure, benefiting both the electricity grid in and the **local community**

Important **lessons for Just Energy Transition**

Scheduled for commissioning: 2020

Expected market developments and drivers

What will the future hold for the sector

Hard to predict. Some of the trends which some of EASE members expect to see in some EU member states:

- **Buildup of wind and solar capacity,** in particular offshore ⟶ Higher need for weekly, monthly, seasonal flexibility
- **Dependence on natural gas in the energy mix will** decrease; risk of stranded assets?
- **Increase in Hydrogen** production; re-purposing of the gas infrastructure?

Energy storage will play more and more a key role for both intra-day and seasonal storage

Need for more research for underground energy storage

We have heard the researchers' perspective in the previous presentation.

This is supported by the EASE recommendations for the medium and long term period

Need for more research for underground energy storage

Medium-term perspective

Within the next 5 years:

- Identify all **possible market models/use cases** able to guarantee the economic feasibility of energy storage
- **Assess how markets could be improved** in order to allow the full deployment of energy storage. Joint effort between the EU Member State necessary
- Study **system integration**, focusing on how gas, electricity, heat, and other infrastructures (e.g. refuelling infrastructure) can be combined and complemented with storage of gas, electricity, heat, and/or fuels
- Investigate **new designs for energy storage and hybrid technologies** and analyse requirements for optimal integration.

Cost and manufacturing capacity

Long-term perspective

Within the next 10 years:

- Support **new large-scale demonstration** projects based on the experience gained
- Continue **evaluation of new ideas** and continuously **check R&D status against application requirements**
- **Support communication and interaction of different storage assets** in the grid for system services and load shifting

Do you want to know more?

Source: EASE EERA Storage Technology Development Roadmap 2017 HR

Which barriers is underground energy storage facing?

Several overarching issues

1. A level playing field

A level playing field is paramount for the energy transition

*Possible action: Ensure Energy Storage facilities are **able to participate in different markets** on a level playing field with other flexibility providers (cf. Clean Energy Packge)*

2. Taxation

Ensure that the structure of electricity grid fees reflects the costs that each user induces on the grid

*Possible action: When Energy Storage facilities provide services that have value in terms of increasing the efficient operation of the grid and decreasing the costs of the grid, these facilities should **not be penalised with unfair cost requirements.***

Double taxation as consumption (once when stored, once when consumed) must be abolished

Which barriers is underground energy storage facing?

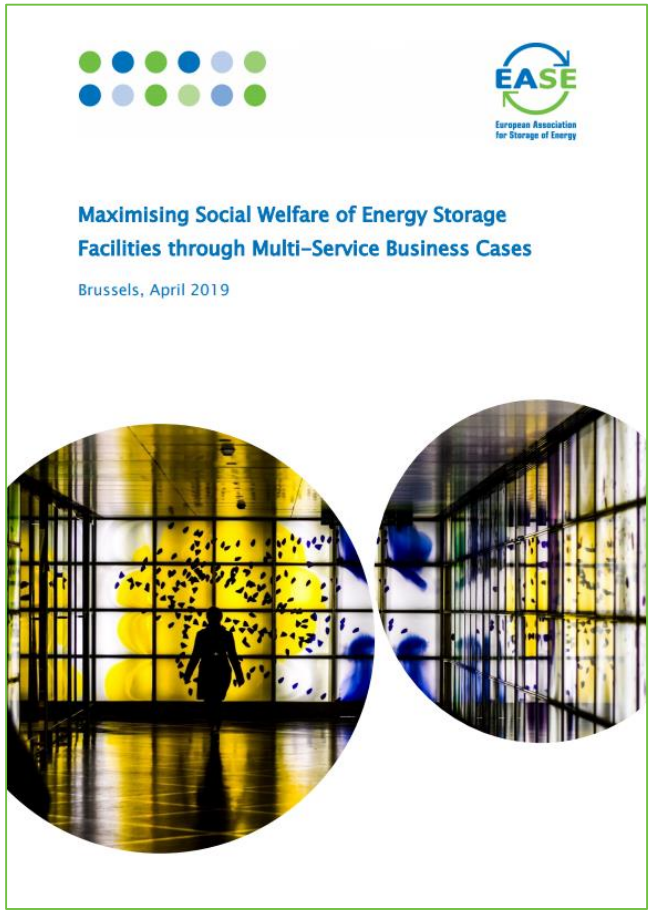
Several overarching issues

3. Revenue stacking

Revenue stacking allows a storage facility to provide various services to various stakeholders (generators, consumers, network operators) and 'stack' multiple revenue streams. This is not explicitly allowed in some Member States' legislation

Possible action: the EU regulatory framework should ***enable revenue stacking,*** *and ensure that the added-value of* ***longer duration storage is monetised***

Do you want to know more?



Maximising Social Welfare of Energy Storage Facilities through Multi-Service Business Cases

Which barriers is underground energy storage facing?

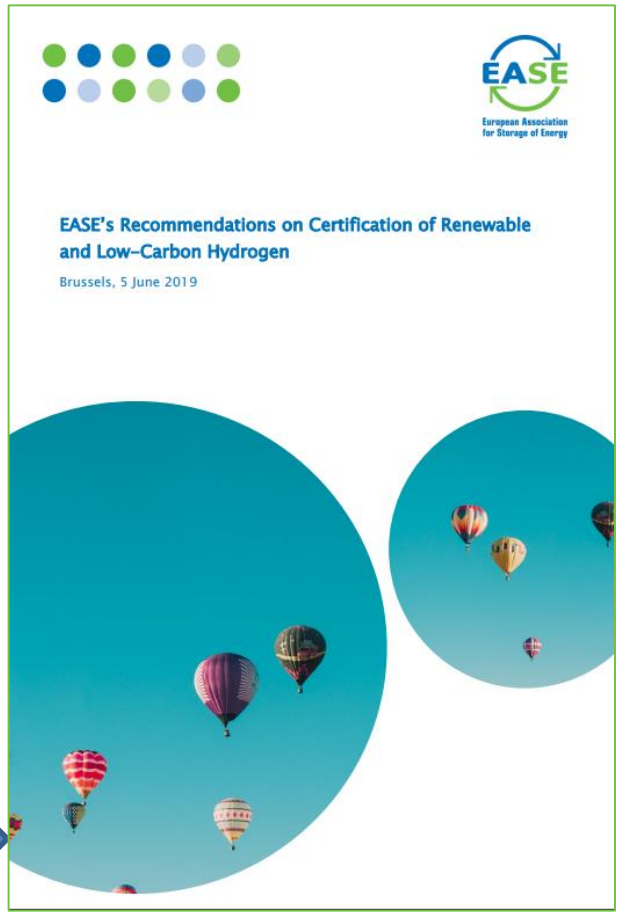
Several overarching issues

4. Certification of renwable gases produced through Power-to-Gas

High-carbon gases should be replaced by renewable and low-carbon gases

*Possible action: develop harmonised **definitions, a Guarantees of Origin, a registry**; remove **administrative barriers** and ensure a **level playing field***

Do you want to know more?



EASE's Recommendations on Certification of Renewable and Low-Carbon Hydrogen

Which barriers is underground energy storage facing?

Several overarching issues

5. Hydrogen imports

The EU should not decarbonise its energy system by increasing emissions elsewhere. Hydrogen imports should be subjected to the same requirements and thresholds for certification that are applied in the EU

*Possible action: **a new system**, revising existing arrangements regarding hydrogen imports, is necessary; a **strong EU Emissions Trading Scheme***

6. Deployment of hydrogen infrastructures

It is important to take into account the evolution of the demand in the long run

*Possible action: a **stronger oversight by ACER and NRAs**, new requirement for joint grid planning/joint market activities*

EASE – European Association for Storage of Energy
Avenue Adolphe Lacomblé 59/8
BE – 1030 Brussels
Tel: +32 2 743 29 82 | Fax: +32 2 743 29 90
@EASE_ES
info@ease-storage.eu
www.ease-storage.eu