Hydrogen for Long-Duration Energy Storage

18 August 2019
Hydrogen Energy Network Meeting

Patrick Clerens
EASE Secretary General
Introduction to EASE
Why we need energy storage

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.).
Why we need energy storage...on daily timeframe

The role of intra-day storage – The example of Spain in 2050

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

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

The global yearly production capacity of batteries in 2016 = 28 GWh. In 2020 expected to be 174 GWh
Why we need energy storage...on seasonal timeframe

The example of Spain in 2050

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

Source: Eurelectric
Technologies and applications

Energy storage applications: different capacity, different timeframes

Source: PwC, 2015, following Sterner et al. 2014
Technologies and applications

Energy storage applications: different capacity, different timeframes

- Different storage technologies have different capacity
- Different energy technologies can be used for different timeframes
- Bulk energy storage technologies can provide long term/seasonal balancing. Energy storage can and will play a key role in the next years

➢ Although still currently unclear how these longer duration applications will be monetised
Technologies and applications

Technologies that bring costs down: high-temperature electrolyser

• Levelised Cost of Hydrogen (LCOH) generation from high-temperature electrolyzers are expected to be lower than from water electrolysis thanks to high electrical efficiency (~30%)

• Usual operating temperature: 650–800°C

• Usual operating pressure: 1 bar
  ✓ 30 bars under development, so more efficiency expected

• For bigger units (~ 3 t/d): LCOH ~ 2 €/kgH2
Technologies and applications

Approaches that bring costs down: scale-up through sectoral integration

Hydrogen allows for the interconnection/integration of energy consuming sectors: industry, heating and cooling, transport with the power producing sector.

Source: Clean Energy Wire
Hydrogen and industry

Context and recommendations

Hydrogen–based chemical production can significantly reduce process emissions

- Promote the uptake of renewable and low-carbon hydrogen generated through water electrolysis in energy-intensive industries.
- For the refining case, clarify the methodology to qualify as a REFUNOBIO in a way which will not hinder the development of Power-to-gas.
- Increase RD&D funding for hydrogen projects aimed at decreasing production costs and further develop the associated processes.
Hydrogen and mobility

**Context and recommendations**

To decarbonise the transport sector, Hydrogen fuel cells are an **excellent substitute for fossil fuels**

- Provide further support for the deployment of hydrogen refuelling stations
- Revise the AFI Directive to include a compulsory target on hydrogen refuelling infrastructure
Hydrogen and the gas system

Context and recommendations

Hydrogen has the potential to replace natural gas as an energy carrier and substitute several uses of gas

- Support the efforts to assess the maximum blending levels of hydrogen in national and local natural gas grids as well as the impact of hydrogen on end user appliances
- Support efforts to assess the re-use of existing natural gas infrastructure
- Support efforts to assess the presence of unnecessary legal/administrative barriers
- Simplify licensing requirements and authority approvals
- Promote non-discriminatory tariffs
Hydrogen and the electricity system

Context and recommendations

By reducing curtailment, PtG can enable a higher intake of renewable electricity into the energy system while reducing costs.

- Ensure that the structure of electricity grid fees reflects the costs that each user induces on the grid. When Power-to-Gas facilities provide flexibility services that have value in terms of increasing the efficient operation of the grid, these facilities should not be penalised.

- Ensure Power-to-Gas facilities are able to participate in different markets on a level playing field with other flexibility providers.
Hydrogen – overarching issues

Deployment of a hydrogen infrastructure

It is important to take into account the evolution of the gas demand in the long run when assessing the investment decision on gas infrastructure, in order to ensure its economic efficiency/viability and to avoid stranded assets.

- A stronger oversight by ACER and NRAs may be necessary: the increasing importance of links between gas and electricity infrastructure should be reflected in regulation.
Hydrogen – overarching issues

Revenue stacking

It is paramount to maximise social welfare by utilising all available technologies as much as possible. In the multi-service business case approach, multiple stakeholders are together involved in the ownership, development, management, and/or operation of an energy storage facility.

- The EU regulatory framework should enable revenue stacking to allow for market-based development of energy storage.
Hydrogen – overarching issues

Hydrogen imports

The EU should not decarbonise its energy system by increasing emissions elsewhere.

- It is paramount to maximise social welfare by utilising all available technologies as much as possible
- Implement a strong EU Emissions Trading Scheme
- A new system, revising existing arrangements regarding hydrogen imports, may be necessary
- Define, implement, and support an effective Guarantees of Origin scheme for low-carbon and renewable hydrogen (more in the next slide)
Hydrogen – overarching issues

Definition of renewable gases and other gases

- **Need** **clarify the classification and regulatory framework** for power-to-gas facilities.

- **Definition**: develop a harmonised definition for renewable and/or low-carbon hydrogen based on a transparent methodology in order to avoid fragmentation of the market

- **Guarantees of Origin**: develop a mutual recognition of Guarantee of Origins to facilitate cross border trade

- **Registry**: launch an EU-wide certification system and align it with national registries in a timely manner

- **Administrative barriers**: minimise administrative barriers to the certification of renewable and/or low-carbon hydrogen while also ensuring a robust certification system

- **Level playing field**: ensure fair and effective competition between technologies and energy carriers and between imported H₂ and H₂ produced in the EU
Need for more research for 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 hydrogen, electricity, heat, and/or fuels

- Investigate new designs for energy storage and hybrid technologies and analyse requirements for optimal integration.
Need for more research for energy storage
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

Source: EASE EERA Storage Technology Development Roadmap 2017 HR
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