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Hydrogen Power —
What is needed to make it a reality?

The role of hydrogen power generation in a decarbonised energy system

In 2050, most of Europe's power supply will come from the wind and the sun. At the same time, with electricity provided to a very large extent by variable supply, the need for flexible power plants to balance out deviations in supply and demand will considerably increase.

In a system with very low amounts of dispatchable power generation, hydrogen can be used as an economically viable long-term energy storage solution.

Dispatchable power plants, such as power plants using climate-neutral hydrogen, will complement variable renewables and ensure that electricity supply matches demand at all times. This is especially important in prolonged periods of low renewable output or when low output is coupled to prolonged demand peaks.

Hydrogen-Readiness of the technology

New gas power plants can already be designed and built to operate with a considerable share of hydrogen and can be upgraded to a higher share whenever more hydrogen becomes available.

While existing power plants are optimised for natural gas, most can already handle a certain share of hydrogen blended into natural gas and can be upgraded for more.

The capability of gas power plants to switch to hydrogen ensures that both existing and new plants are not locked into using one specific type of fuel (today, natural gas) – that is, it avoids "carbon lock-in".

EUGINE – European Engine Power Plants Association

Lyoner Str. 18
60528 Frankfurt
Phone: + 49 69 6603 1309
Email: ralf.wezel@eugine.eu
www.eugine.eu

EUTurbines – European Association of Gas and Steam Turbine Manufacturers

Boulevard A. Reyers 80
1030 Brussels
Phone: + 32 2 706 8211
Email: ralf.wezel@euturbines.eu
www.euturbines.eu

Helping the transition towards a decarbonised and integrated energy system

An increasing number of countries need to take investment decisions for flexible and future-proof power plants today, especially to achieve a quick coal phase-out. Flexible hydrogen power plants are an optimal solution to complement variable renewables and to replace more polluting plants. Nevertheless, the needed quantities of pure hydrogen and hydrogen blends will not be immediately available everywhere.

To account for the uncertainty around clean hydrogen availability, technology providers have defined different H2-readiness levels depending on the future share of hydrogen and the cost of the technical adaptations needed to reach that desired share.

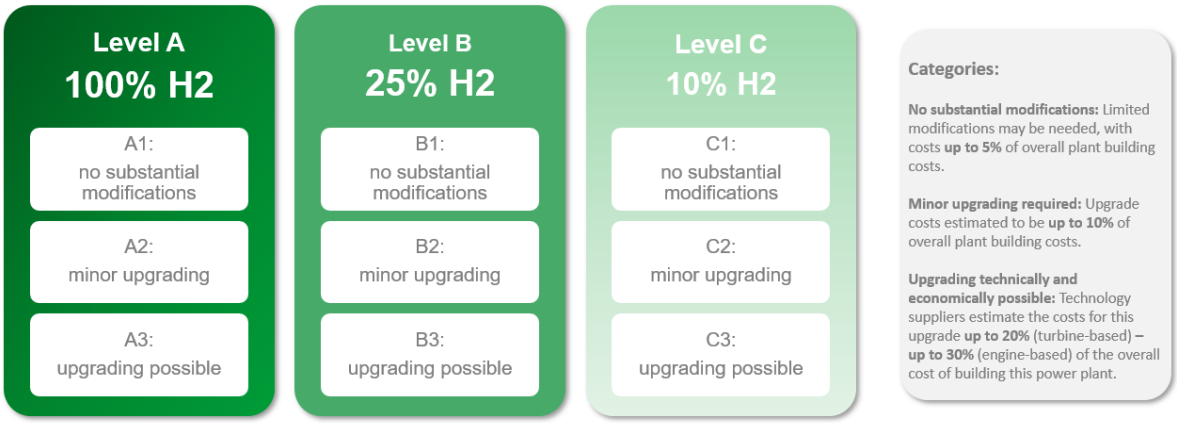

Figure 1 - EUGINE - EUTurbines Common H2-Ready Definition

This definition aims at providing certainty to investors and guidelines to policy makers. It acts as a bridge between today and tomorrow.

Building tomorrow's integrated energy system today

Hydrogen power plants will deliver dispatchable, climate-neutral electricity and heat in times of prolonged, low wind and solar output. No other technology can provide comparable carbon-neutral long-term balancing and flexibility services.

Hydrogen plants can also operate as flexible combined heat-and-power (CHP) plants, additionally supplying climate-neutral heat to district heating networks.

Thus, hydrogen power generation is not an "inefficient alternative" to the direct use of renewable electricity, but the most reliable renewable solution when the direct use of wind and solar is not possible.

An energy system that recognises the role of hydrogen power generation will need to look not only at the marginal cost of the energy produced, but also at the stability and security that flexible, renewable hydrogen power plants can bring to the system overall.

In addition, there needs to be a coordinated approach to the decarbonisation of the electricity and gas supply – hydrogen power plants will only be able to deliver clean electricity when sufficient clean hydrogen is available.

Our policy recommendations

To facilitate the transition and avoid the risk of stranded assets, “hydrogen-readiness” should be defined in legislation as “the capacity to run on a given share of hydrogen and/or to be retrofitted with limited efforts once hydrogen or higher shares of hydrogen become available”.

Making hydrogen power generation happen will however need more than technological readiness — it also needs a policy framework ensuring that the **power sector has access to adequate quantities of hydrogen** and that allows for a **business model making hydrogen power attractive** for investors and power plant operators.

The energy system of tomorrow is being build today. If we want to build a system that is truly decarbonised and secure, the power sector needs to be regarded as a priority for the use of hydrogen, especially in infrastructure planning.

More specifically, for investments in future-proof technology to be made in a timely manner, the following requirements need to be met:

- **An integrated infrastructure planning that includes technology providers**
    - Integrated regional and national plans including all energy networks (electricity, gas, hydrogen and heat) will ensure that investments are future-proof and avoid costly new investments whenever infrastructure can be repurposed. Power plant operators and technology providers should be included in the planning process at both distribution (DSO) and transmission (TSO) level.
    - Blending hydrogen into the existing gas networks is a step that can be considered to develop a hydrogen market. While this does not mean that the same level of blending should be required in all parts of the grid, common gas quality standards should integrate the different chemical and physical properties of methane and hydrogen.
    - The new gas market rules should provide hydrogen-readiness definitions for different gas customer segments, facilitating a coordinated approach between supply and demand side and the parallel development of technological solutions.

- **Power plants’ access to hydrogen networks**
    - Hydrogen power plants and hydrogen-ready power plants must be allowed to connect to repurposed and new hydrogen transport infrastructure (including the so-called “hydrogen backbone”) as soon as possible to facilitate their switch to climate-neutral gases.
    - Regulated Third Party Access rights (TPA) and regulated tariffs should be introduced as soon as possible for hydrogen networks, based on the currently existing model for methane gas networks.
    - Independent energy market regulators should be entrusted with overseeing the development of competitive markets and the avoidance of monopolistic market outcomes.

- **Predictable hydrogen market developments**
    - Restricting hydrogen access and markets to “hard-to-decarbonise” sectors will hamper the security of clean electricity supply, probably leading to market fragmentation, higher prices, and a globally lower uptake of hydrogen.
    - A binding EU-wide GHG intensity reduction target for gas supplied through regulated networks, in addition to a renewable gas target at European and national level, would be the simplest and most effective way to accelerate the development of a renewable hydrogen market.
    - EU-wide minimum hydrogen blending levels and rules – leaving the flexibility to Member States to adapt those levels for the domestic network – would provide certainty to investors while still allowing for national and regional differences in gas quality.

- **Business models valuing flexible, dispatchable and decarbonised power**
    - Hydrogen power plants should be able to recover their costs, as otherwise there will be no investments, neither in new plants nor in retrofitting existing plants. Both support mechanisms and markets should value the availability on-demand of decarbonised energy sources and the reliability they provide to the system.
    - Long-term contracts for difference for power plants, covering the price gap between natural gas and hydrogen, could be an important mechanism to support investments in hydrogen-ready power plants.
    - The value of hydrogen power plants is not only defined by the amount of electricity generated, but by ensuring sufficient dispatchable capacity. With a limited number of operating hours, the provision of flexible capacity and balancing solutions needs to be remunerated.

About EUGINE and EUTurbines:

EUGINE is the voice of Europe’s engine power plant industry. Our members are the leading European manufacturers of engine power plants and their key components. Engine power plants are a flexible, efficient, reliable and sustainable technology, helping to ensure security of electricity supply and providing (renewable) electricity and heat. For more information, please see www.eugine.eu.

EUTurbines is the only association of European gas and steam turbine manufacturers. Its members are Ansaldo Energia, Baker Hughes, Doosan Skoda Power, GE Power, MAN Energy Solutions, Mitsubishi Power Europe, Siemens Energy and Solar Turbines. EUTurbines advocates an economic and legislative environment for European turbine manufacturers to develop and grow R&I and manufacturing in Europe and promotes the role of turbine-based power generation in a sustainable, decarbonised European and global energy mix. For more information, please see www.euturbines.eu.