



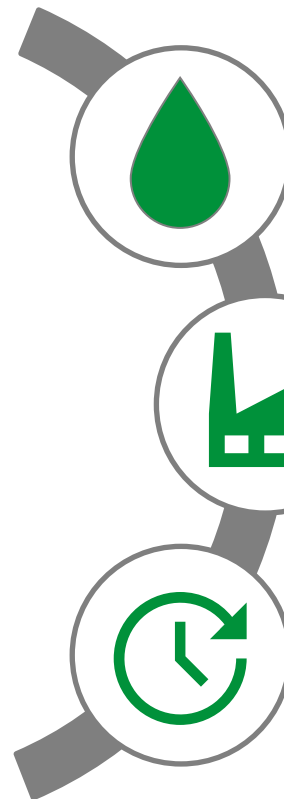
Hydrogen-Ready Turbine Based Power Plants

September 2021

Why H₂-Readiness for gas power plants?



Defining technology requirements for tomorrow's needs



REPLACING NATURAL GAS

Fossil gas needs to be replaced – hydrogen is one of the main alternatives

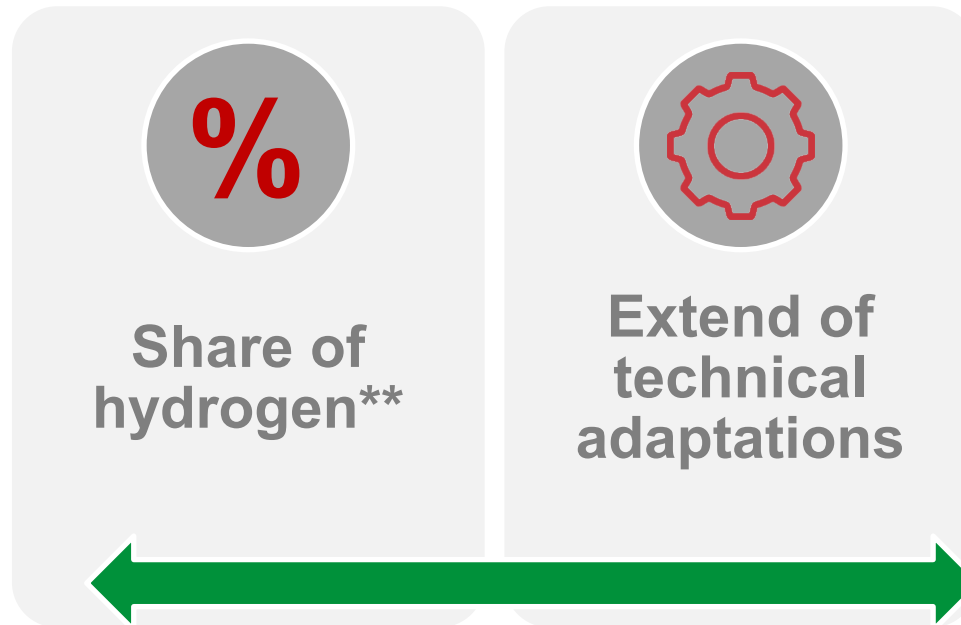
CLIMATE-NEUTRAL ELECTRICITY & HEAT

With hydrogen, turbine power plants can generate carbon-neutral electricity and heat

FUTURE-PROOF POWER PLANTS

Due to a lack of other options, turbine power plants today operate with natural gas, but will be technically ready to switch to hydrogen once it becomes available

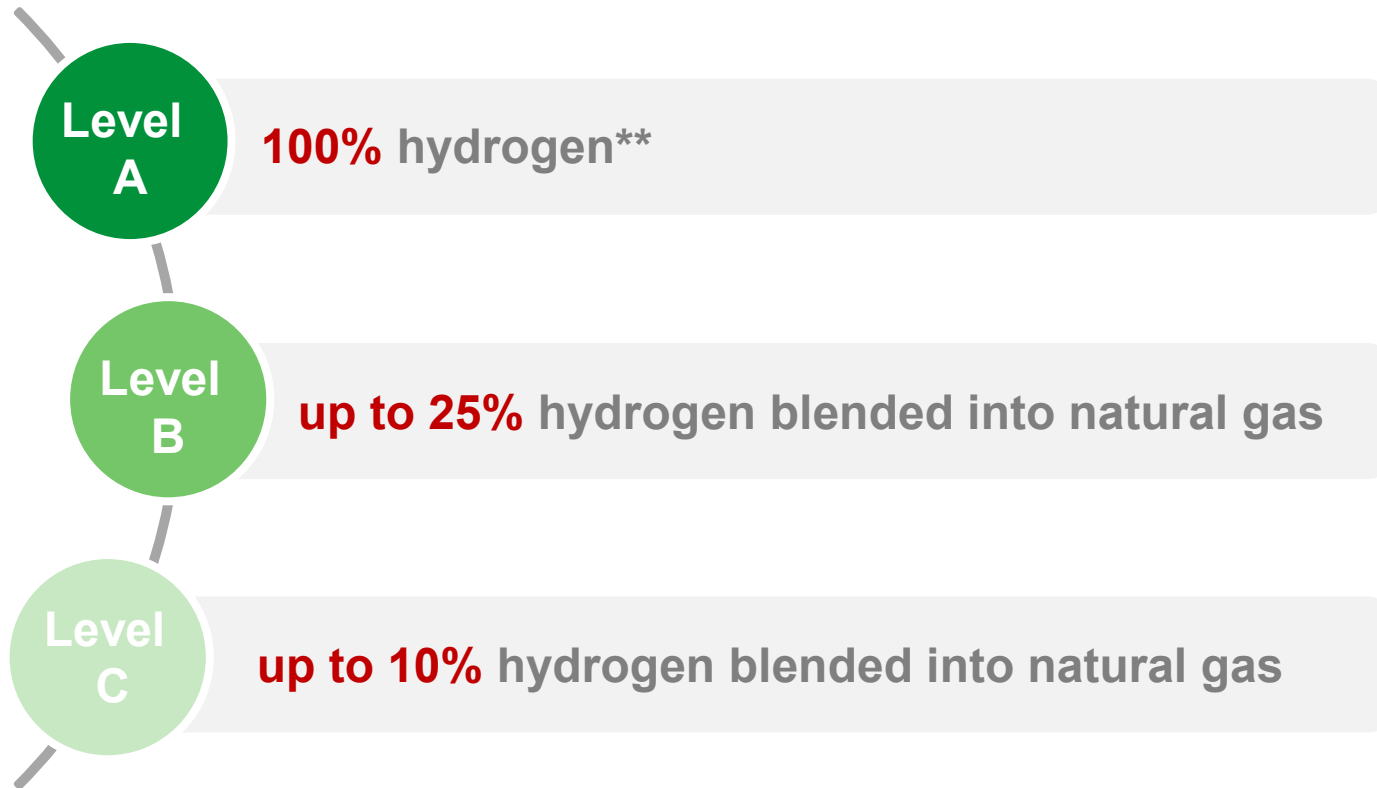
H2-readiness of **new*** gas power plants:



** New power plants with requests for quotation after the publication date of this definition. These definitions may not apply to existing gas power plants. Existing gas power plant owners should check with their technology supplier to determine applicability of these ratings to their sites.*

*** % figures relating to the volume share of hydrogen blended into natural gas.*

H2-Readiness Level Related to Shares of Hydrogen*



* % figures relating to the volume share of hydrogen blended into natural gas.

** This is a non-technical wording. As there are often fractions of other gases in the pipeline system, the technically more correct term would be hydrogen content >95%.

Technical adaptations*

Category 1: No substantial modifications

No substantial modification of the power plant's hardware is necessary to reach the relevant H₂-readiness level. However, the plant may require adaptations in operation, service & maintenance, operating procedures, software etc. Modifications are estimated by the technology supplier to remain **up to 5%** of the overall costs of building a new power plant**. Also, there may be modifications necessary in the gas supply outside the plant.

Category 2: Minor upgrading necessary

The plant is technically suitable and retrofittable to operate with the hydrogen share of the category. Certain modifications of the hardware, software, etc. will be required before being able to operate. Many of the upgrading efforts can be done as part of planned regular inspection and maintenance activities. The technology suppliers estimate the costs for this upgrade **up to 10%** of the overall cost of building a new power plant**.

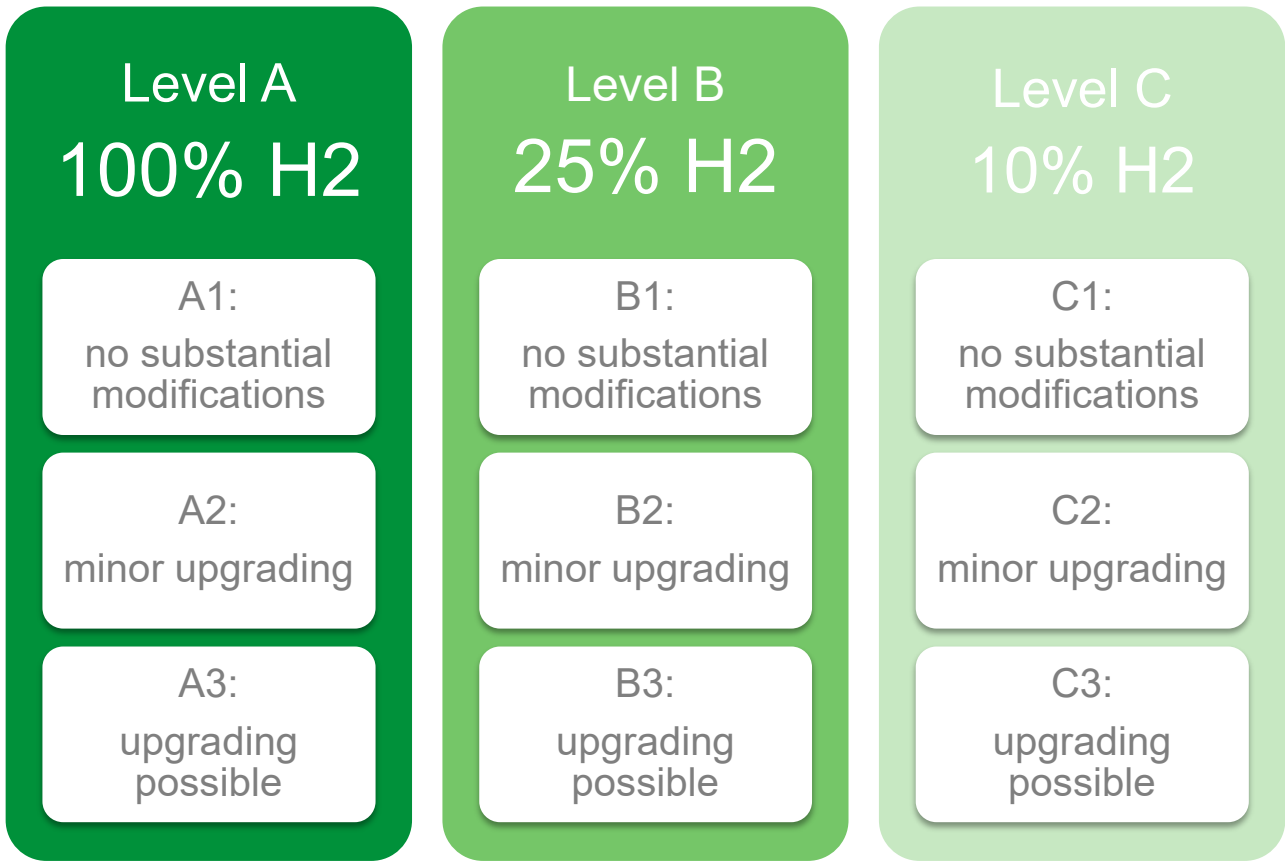
Category 3: Upgrading technically and economically possible

The plant is technically suitable and retrofittable to operate with the hydrogen share of the category. Certain modifications of the hardware, software, etc. will be required before being able to practically operate with the mentioned hydrogen level. The technology suppliers estimate the costs for this upgrade **up to 20%** of the overall cost of building this power plant**.

** For cost shares in the identified categories, it is assumed that the basic plant layout and design already provides for necessary space requirements in connection with the upgrade. Furthermore, it is assumed that the stable supply with the defined gas composition is ensured outside the plant (no mixing equipment is included as part of the modifications). It is also assumed that the requirements of the current industrial emissions legislation apply and, as a consequence, no additional NO_x reduction system will be needed.*

*** Costs relating to the inflation-adjusted costs of building a state-of-the-art simple cycle gas power plant without the need for additional exhaust aftertreatment solutions. Subject to review when significant parameters change.*

H2-readiness definition for new gas power plants



Categories:

1: No substantial modifications necessary
Limited modifications may be needed with costs **up to 5%** of overall plant building costs

2: Minor upgrading required
Upgrade costs estimated to be **up to 10%** of overall plant building costs

3: Upgrading technically and economically possible
Technically suitable, with upgrade costs estimated to be **up to 20%** of overall plant building costs

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