

European
Engine
Power
Plants
Association



Engine power plants getting ready for
climate-neutrality

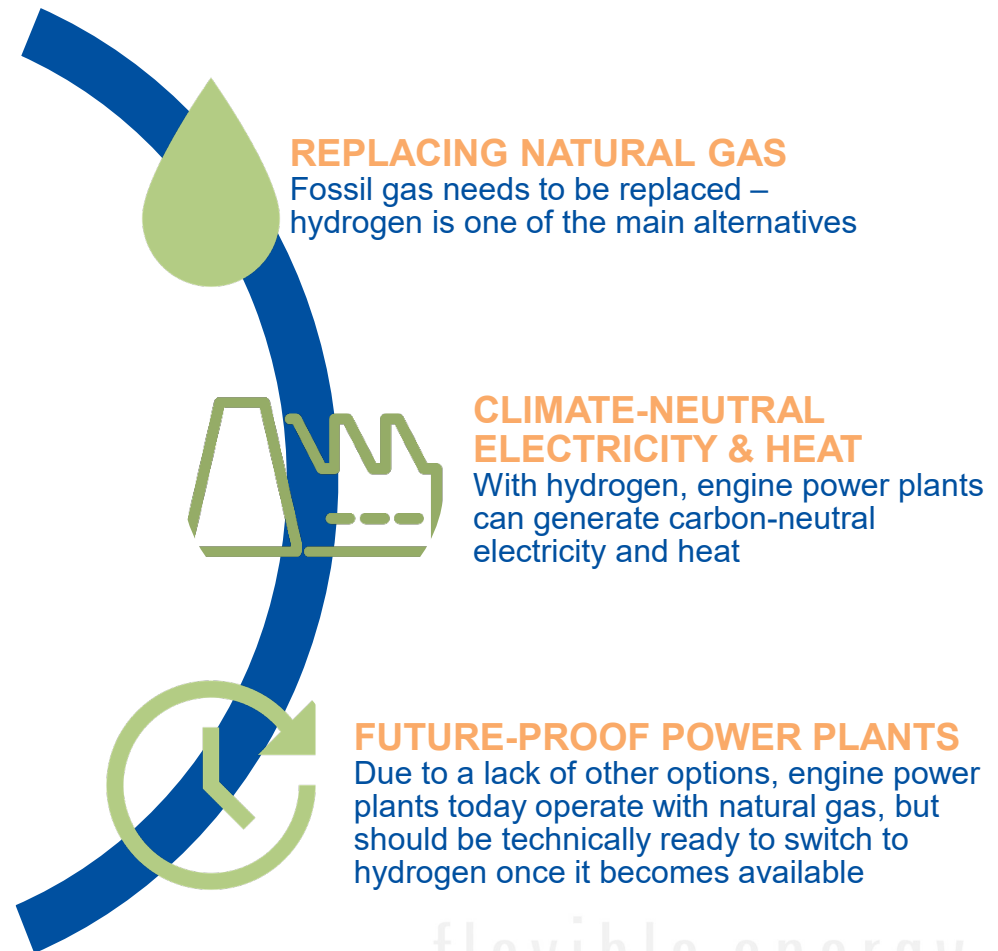


fast
responsive
environmentally sound
efficient
reliable
flexible energy

Why H2-Readiness for Gas Power Plants?



Defining technology requirements for tomorrow's needs



flexible energy



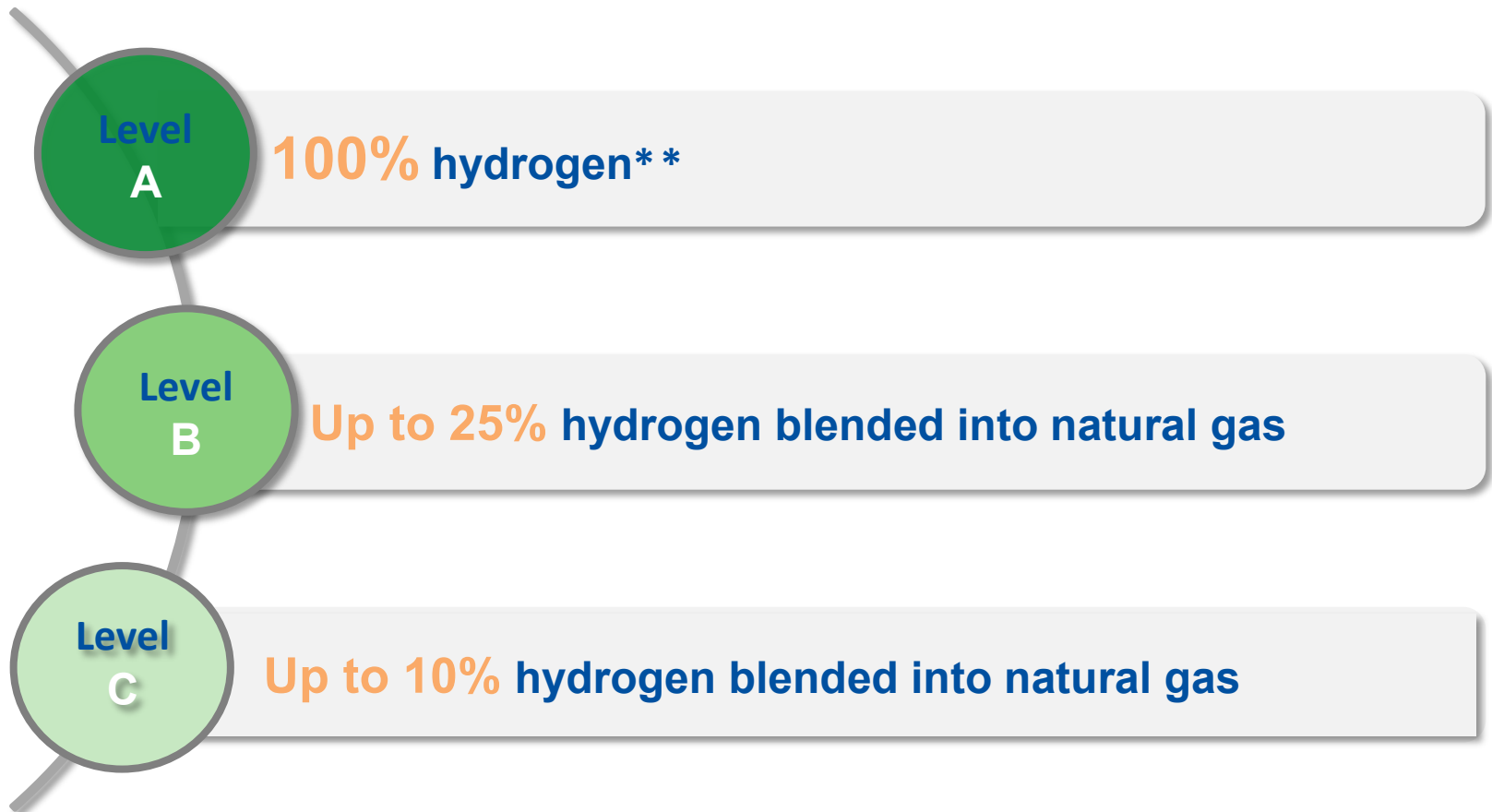
An H2-Ready Definition that is fit for purpose

The EUGINE H2-Ready definition distinguishes categories by:

- **Percentage Share^{*} of Hydrogen**
- **Technical Adaptions** needed to switch to the desired H2 level

* Percentages relating to the expected volume share of hydrogen blended into natural gas

H2-Readiness Level Related to Shares of Hydrogen*



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

** Non-technical wording has been used for the sake of clarity. Due to the presence of fractions of other gases in the pipeline system, the technical share of hydrogen content would rather be >95%

Technical Adaptations

Category 1:
No substantial
modifications

Technology suppliers estimate the costs of minor adaptations to be **up to 5%** of the overall costs of building a new power plant*

Category 2:
Minor upgrading
necessary

Technology suppliers estimate the costs for the minor upgrading efforts **up to 10%** of the overall cost of building a new power plant*

Category 3:
Upgrading technically
and economically
possible

Technology suppliers estimate the costs for this upgrade **up to 30%** of the overall cost of building this power plant*

* Costs relating to the inflation-adjusted costs of building the original plant. Subject to review when significant parameters change.

H2-Readiness of NEW Gas Power Plants



Level A
100% H2

A1:
no substantial
modifications

A2:
minor upgrading

A3:
upgrading
possible

Level B
25% H2

B1:
no substantial
modifications

B2:
minor upgrading

B3:
upgrading
possible

Level C
10% H2

C1:
no substantial
modifications

C2:
minor upgrading

C3:
upgrading
possible

Categories:

1: No substantial modifications necessary
Limited modifications may be needed with costs **of 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 possible
Technically suitable, with upgrade costs estimated to be **up to 30%** of overall plant building costs



H2-Readiness of EXISTING Plants

- Most existing power plants can handle a certain share of hydrogen without modifications
- Plants were built according to unique agreed specifications
- H2-readiness concerns the whole plant – not only the engine
- Adaptions can often be done during regular inspection and maintenance activities
- Requires case-by-case approach



**EUGINE H2-Checklist
for EXISTING plants**



H2-Readiness Checklist Elements



Checklist for EXISTING Plants



Gas / Fuel System (from the handover point of the gas grid to the injection into the engine)

Component	To be evaluated	25% H2-blend	~100% H2
Gas metering	Does the metering concept need to be reviewed? (depending on the gas supplier)		
Piping & sealings	Is the security and tightness of components in gas flow regulating handling components sufficient? Are diameter and material of piping adequate?		
Purging	Is the purging of the system possible?		
Valves & sealings	Is the security and tightness of components in gas flow regulating handling components sufficient?		
	Are diameter and material of piping adequate?		
	Are additional pressure relieve valves necessary?		

Engine-related

Component	To be evaluated	25% H2-blend	~100% H2
Fuel-mixing	Do changes of density, pressure and transient load make adaptations necessary?		
Dosing system	Materials used		
Core engine unit	Pre-ignition & ignition system, cylinder heads, pistons, crankcase ventilation and on engine gas pipes		
Combustion monitoring	Are adaptations of the software necessary?		
Intercooler system	Materials, sizing, flame arrestors		
Turbo charger	Suitability for rated power and transient load		

Cooling System

Component	To be evaluated	25% H2-blend	~100% H2
High temperature & low temperature water cooling	Are adaptations due to changes in heat balance and different water temperature necessary?		

Oil System

Component	To be evaluated	25% H2-blend	~100% H2
Lube oil system	Suitability of the oil used		

Exhaust Gas System

Component	To be evaluated	25% H2-blend	~100% H2
Exhaust system	Are adaptations caused by different dewpoint necessary?		
	Is the pressure resistance appropriate?		
Exhaust duct	Ventilation concept and need for additional safety valve/dilution		
Aftertreatment system / SCR	Functionality with regard to temperature change		

Safety System of the Plant

Component	To be evaluated	25% H2-blend	~100% H2
Gas safety concept	Is a review and adaptation necessary?		
Plant ventilation system	Does the ventilation design need to be adapted (additional sensors & different components)?		
Fire, gas & heat alarm systems	Review and adaptation regarding potential H2 leakages necessary		
H2 concentration detection	Is the measurement of critical H2 concentration in atmosphere & detection of H2 for lower explosion limits ensured?		
Access control	Foresee additional access restrictions to machine room caused by potential leakages		
Civil works	Are adaptations necessary?		





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