

The purpose of this checklist is to provide interested parties with an overview of the potential impact of switching an existing engine power plant, built for the use with natural gas, to hydrogen. The switch could be either toward pure hydrogen or to a blend of natural gas and a certain share of hydrogen.

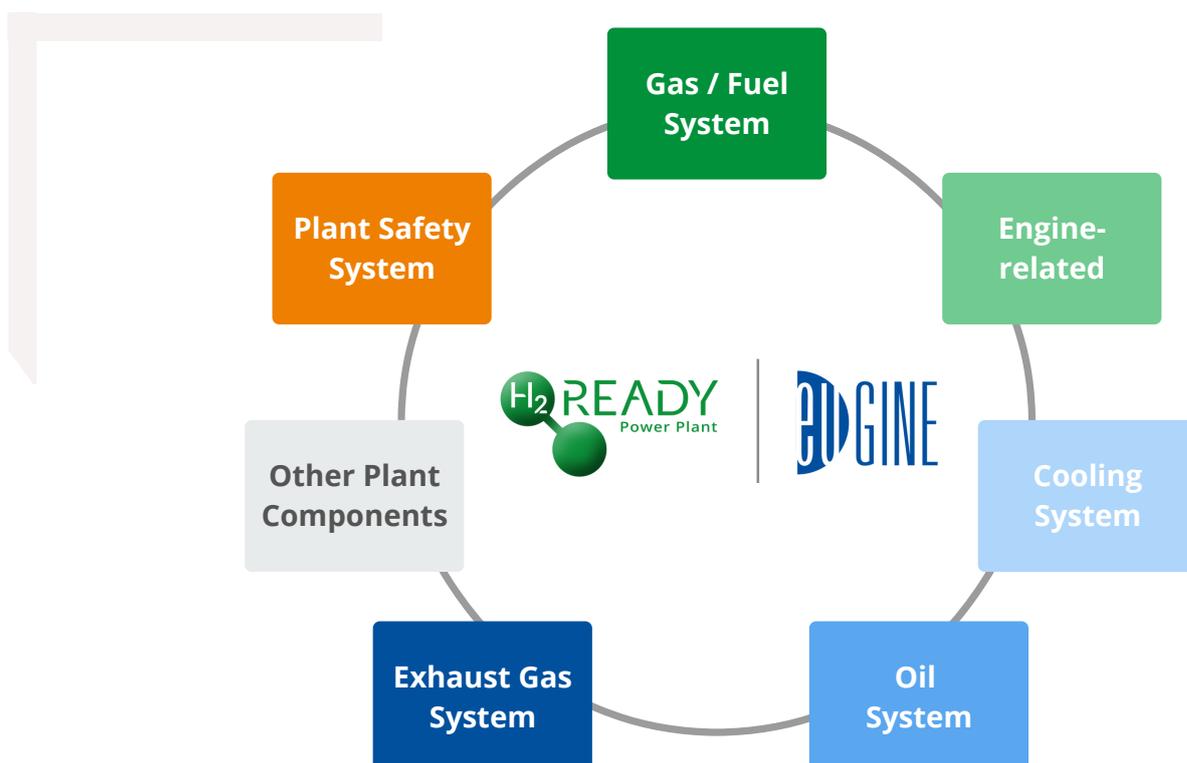
The evaluation for each individual engine power plant has to take place on a case-by-case approach, as the plants have been built based on a unique set of specifications agreed between operator and technology provider.

The components listed here are those elements of an engine power plant that must be considered when foreseeing a switch of a gas engine power plant from the use of natural gas to a mix of 25% (volume) hydrogen blended to natural gas or an operation with close to 100% hydrogen.

The list is to be seen as a basis for discussions between plant owners and technology suppliers. Parts of the specific power plant to be considered may already be compliant without modifications, while other parts might need to be modified.

The table presented in this document gives an indication of how likely it will be that certain components of a plant built for the use of natural gas will need to be adapted to make it ready for the use with hydrogen.

When it is indicated that adaptations are needed, these can often be simple and cheap –that is, a high number of modification areas does not automatically indicate a costly upgrade. Many of the modifications can be done during planned inspection and maintenance activities, which are scheduled to upgrade or exchange components at regular intervals.



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?		

Other Components of the Plant

Component	To be evaluated	25% H2-blend	~100% H2
Electric systems / low voltage & medium voltage	Are additional security measures in case of H2 leakages for the operation of the LV and MV panels necessary?		
Controls	Are changes in plant operation necessary?		
Documentation of installation & maintenance Operational guidelines & manuals	Rework installation, maintenance and operation guidelines to include H2-related operation & safety aspects		
Hand tools, electric & mechanical tools, gas measuring & analysis devices	Suitability of all tools to changed ATEX conditions		



probably no adaptation required



probably minor adaptations required



probably adaptation required



adaptations required

Responsibility of the gas supplier

Adaptation of the gas reduction / compressor station to the volume increase caused by hydrogen