KAWASAKI GAS TURBINE EUROPE GMBH

Gas Turbines Ready For Future Requirements

Hydrogen Energy Supply Chain for Decarbonization

KAWASAKI HYDROGEN ROAD

Development of Innovative Hydrogen Technologies
for Future Hydrogen Society

AHK Energiegeschäftsreise Frankreich
27th November 2024

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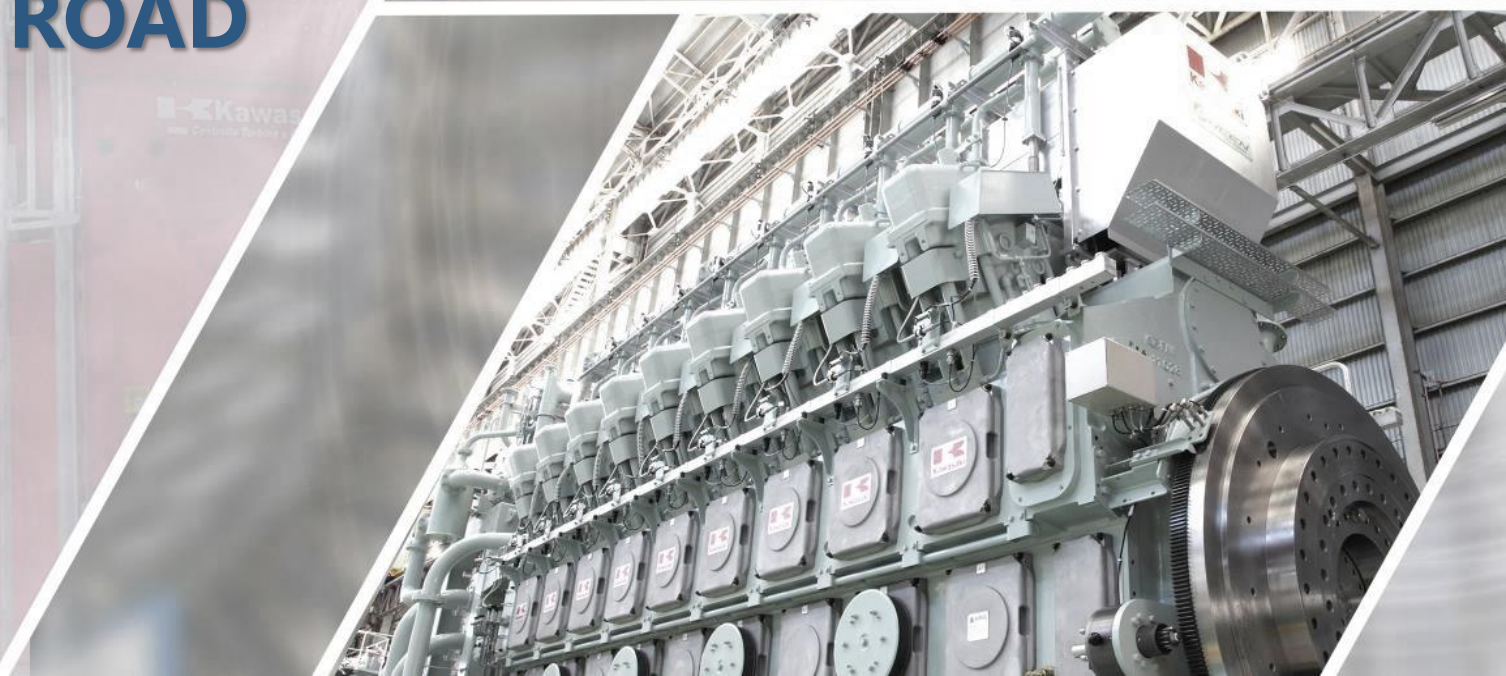
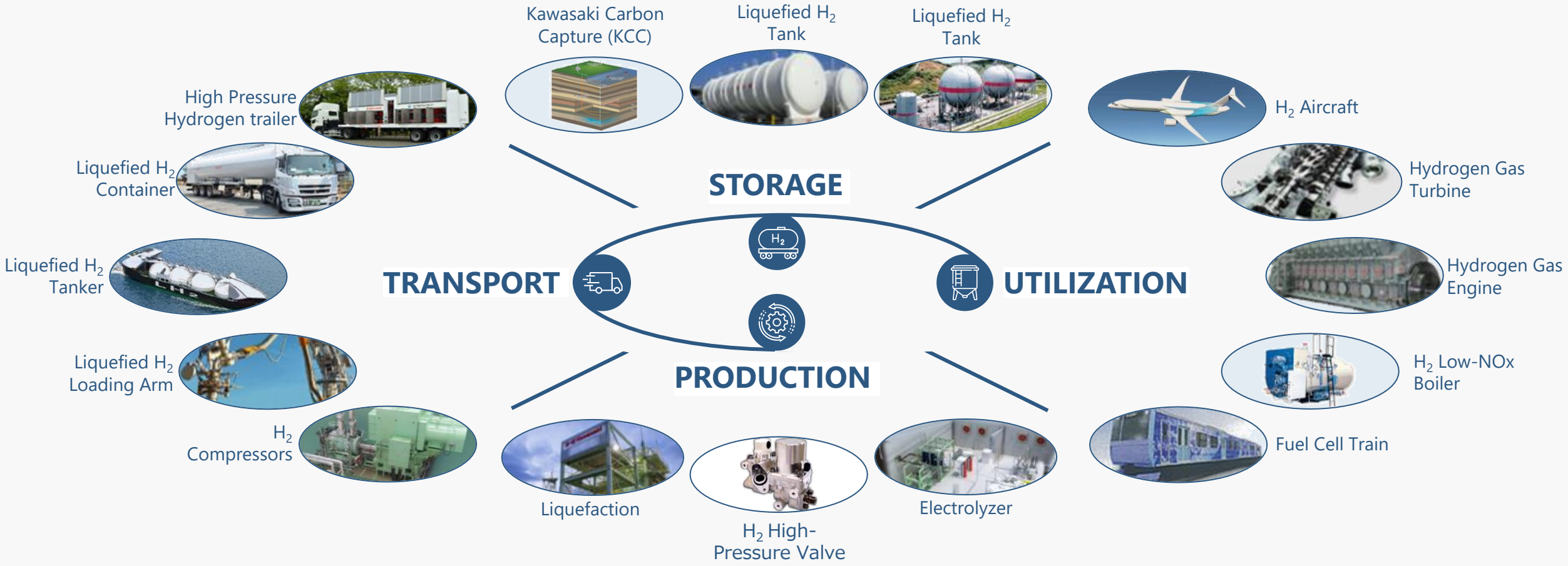
Kawasaki

AHK Deutsch-Französische Industrie- und Handelskammer
Chambre Franco-Allemande de Commerce et d'Industrie



HYDROGEN ROAD OF KAWASAKI HEAVY INDUSTRIES (KHI)

PRODUCT DEVELOPMENT WITH CORPORATE TECHNOLOGY SYNERGY



KAWASAKI GAS TURBINE EUROPE

PRODUCTS

Gas Turbine Generator Sets

GPB17D	GPB50D	GPB80D	GPB180D	GPB300D
1,800 kWel	4,700 kWel	7,800 kWel	18,500 kWel	34,300 kWel
η = 28.1 %	η = 32.6 %	η = 33.6 %	η = 34.3 %	η = 40.3 %

Gas Engines

KG12	KG18	KG18-V	KG18-T
5,200 kWel	7,800 kWel	7,800 kWel	7,800 kWel
η = 49.0 %	η = 49.0 %	η = 49.5 %	η = 51.0 %

@ ISO-conditions

SERVICES

ENGINEERING
Preliminary Engineering
Detailed Engineering

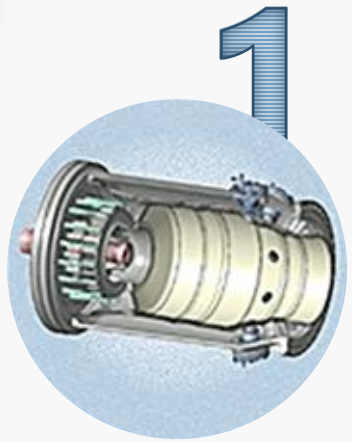
IMPLEMENTATION
Project Planning
Customized Packaging
Erection Commissioning

MAINTENANCE
Scheduled Maintenance
Trouble Shooting
Spare Parts, Consumables
General Overhaul
Remote Monitoring

HYDROGEN
Preliminary engineering
Detailed engineering
Retrofit

HYDROGEN TECHNOLOGY FOR GAS TURBINES (KHI)

OVERVIEW OF AVAILABLE TECHNOLOGIES



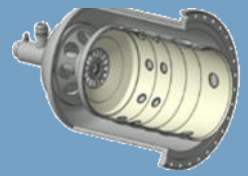
Combustor Configuration:	**H2 DLE**	**H2 Diffusion**	**H2 DLE MMX**
NO_x Reduction	"Dry"	"Wet" Water/Steam	"Dry"
H_2 Content	0 … 30 vol%	0 … 100 vol%	50% … 100 vol%
Technology Status	Demonstration at Akashi Works	Applied to KOBE Demonstration Plant	Applied to KOBE Demonstration Plant
	2014	2018	2020

WORLD'S FIRST H_2-POWER PLANT AT KOBE PORT

Interchangeable Combustor Equipment on the Gas Turbine Set

Tests & Demonstration
2018-2020

Diffusion Flame Combustor

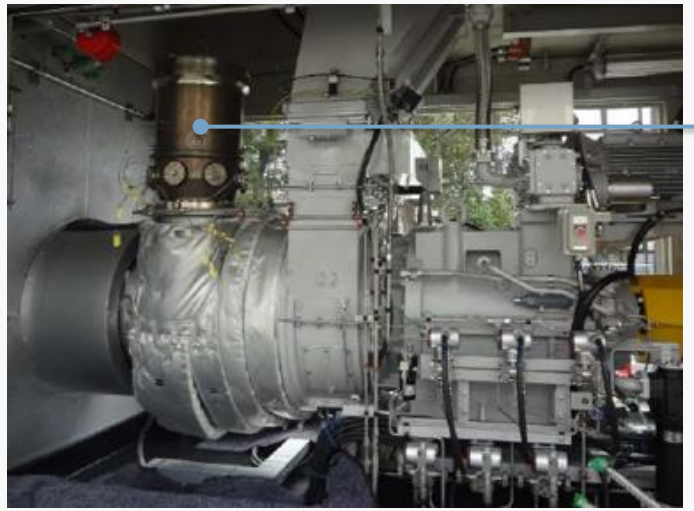


Best Choice for Mixture

Highest Fuel Flexibility

Water/Steam Injection

Tests & Demonstration
2020-2022



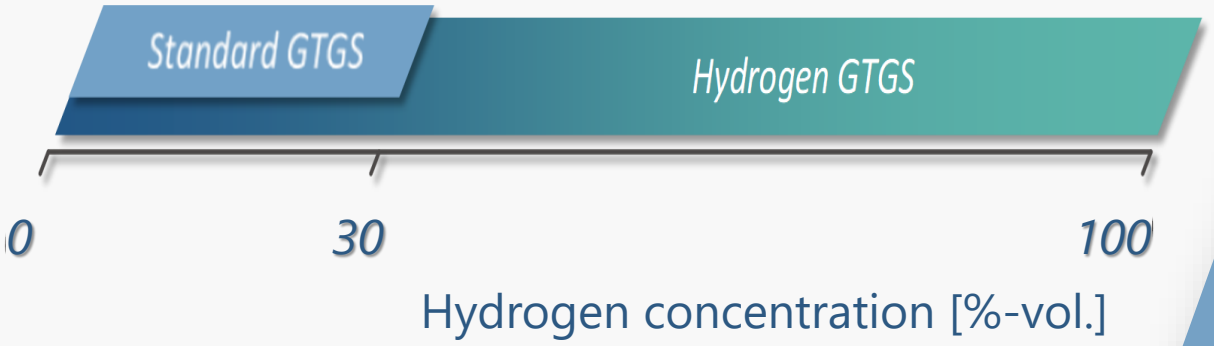
Micro-Mix (MMX) DLE Combustor

Up to 100% H_2-DLE

Technological Breakthrough

Dry Combustion

GAS TURBINE GENERATOR SET (GTGS)



GTGS types divided into two general categories

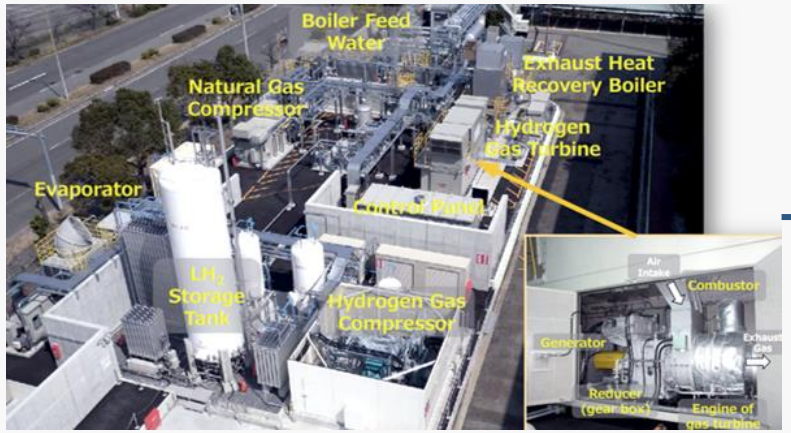
- Standard GTGS for applications with ≤ 30 %-Vol. H2
- Hydrogen GTGS for applications with ≤ 100 %-Vol. H2

All new GTGS are Standard type.

Standard GTGS can be upgraded to Hydrogen GTGS.

Depending on site requirements additional fuel gas equipment might be necessary.

FIRST REFERENCES



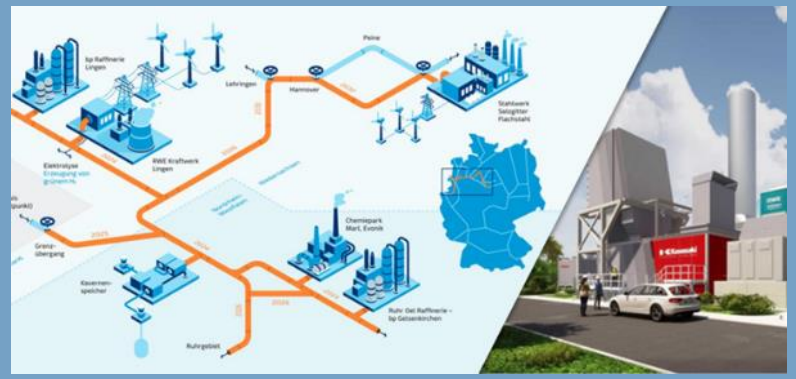
World's First 100% H2-CHP Plant at Kobe Port in 2018

Retrofit from diffusion to Micromix 2020

GPB17D-H2 CPChem (Tessenderlo, Belgium)

Installation in 2021

Retrofit for hydrogen in October 2023



Joint undertaking of RWE & Kawasaki
(planned commissioning end of 2026)

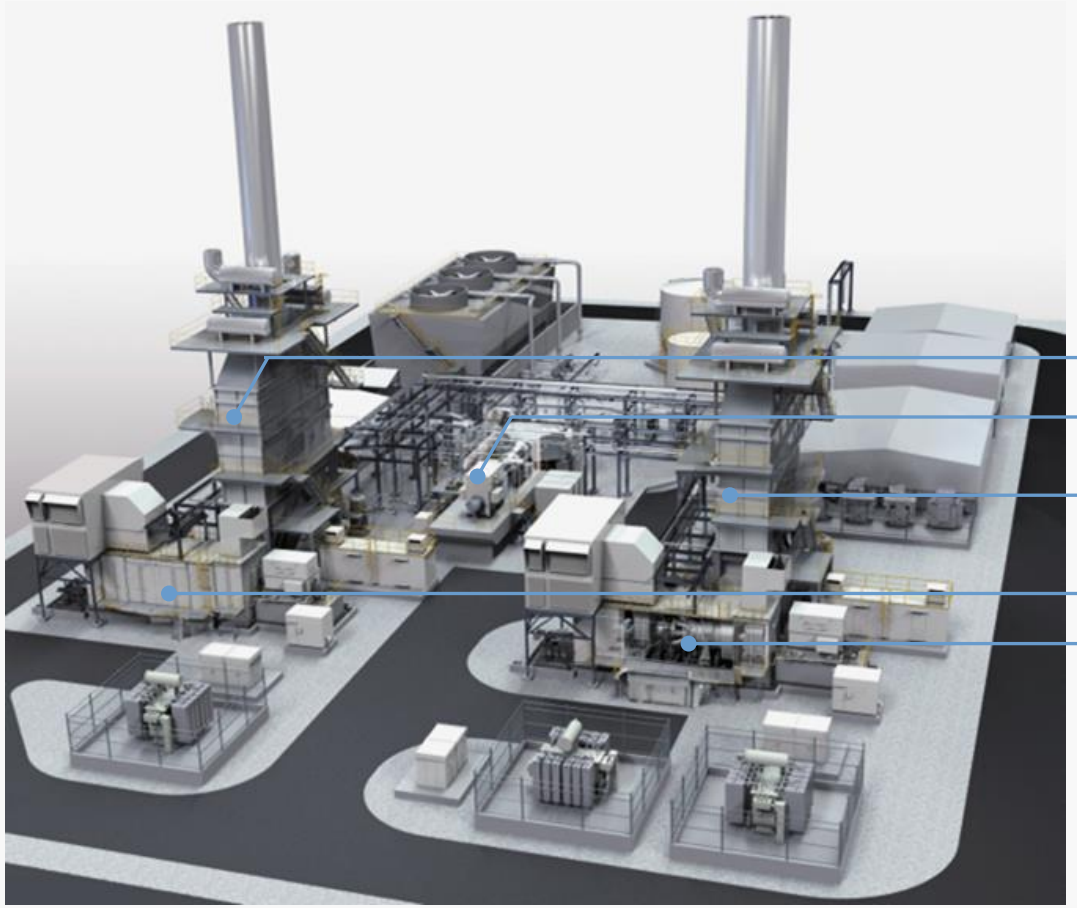
World's First 100% H2 industrial size GTGS

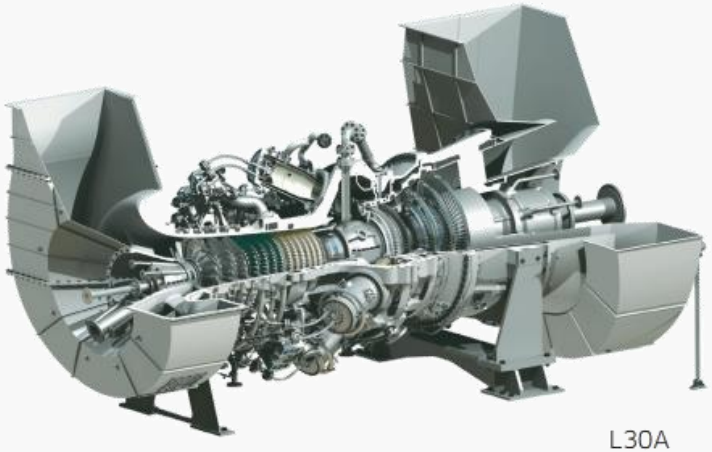
From 2026 onwards 34 MW plant could reconvert green hydrogen to power

Power generation Output:
34,000 kW
Mixed combustion (20%-50% hydrogen)

Hydrogen power generation plant for Seibu Oil Co., Ltd.
(started operations in August 2021)

H_2-READY 100 MW COMBINED CYCLE POWER PLANT





L30A

Combined Cycle Configuration*	1 on 1	2 on 1	2 on 1 (Reheat)
Electric Output in [MWe]	44.7	89.9	101.5
Heat Rate in [kJ/kWh]	6,650	6,620	6,520
Electrical Efficiency [%]	54.1	54.4	55.2
Number of Gas Turbine(s)	1	2	2
Bottoming Cycle Type	2PNRH	2PNRH	3PRH

* Standard conditions for NG, 100% H2 capability

Thanks for your Attention!

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