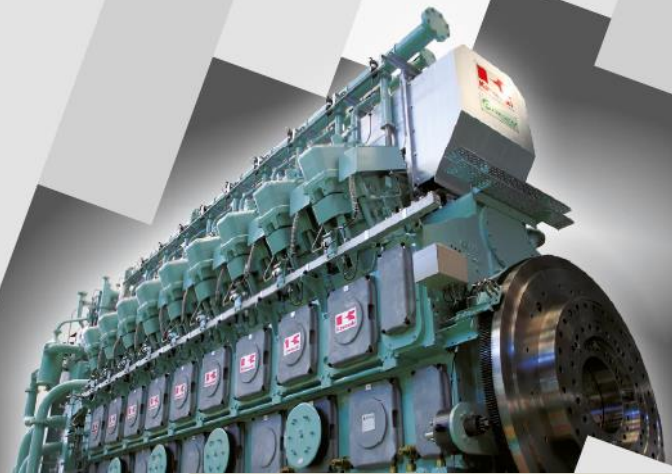
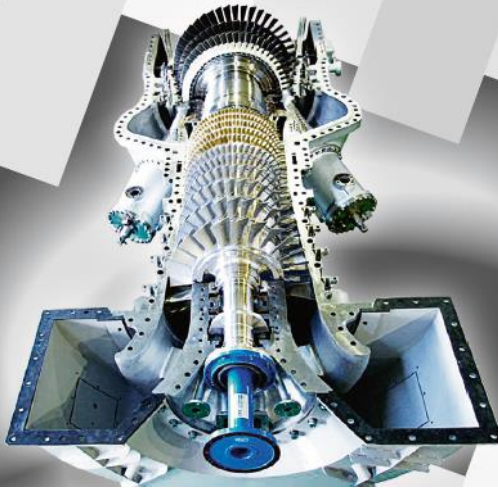


Two Specialists

No Compromise



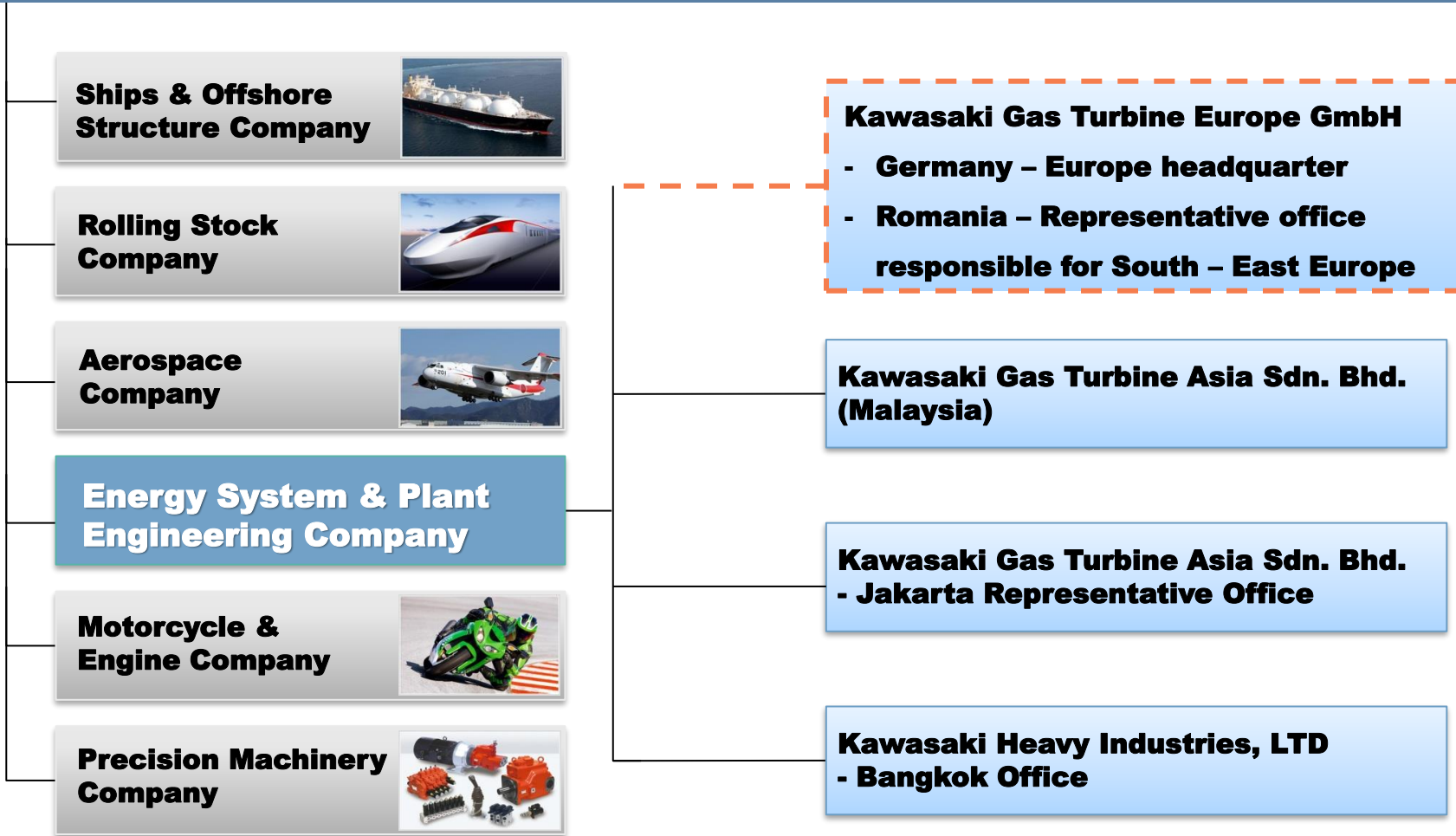
KAWASAKI Gas Turbine Europe GmbH

Energynomics – 15th September 2022

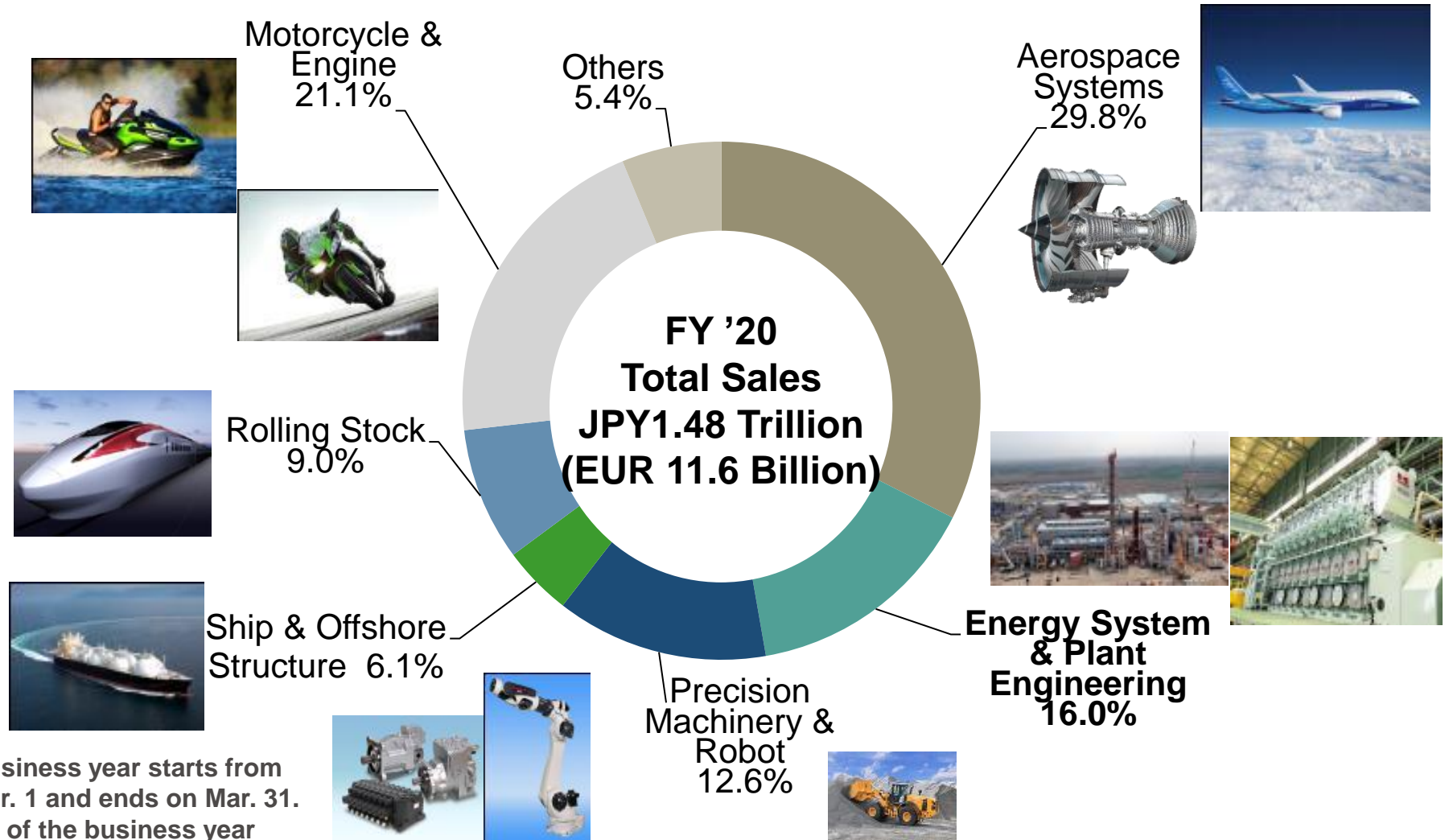
 **Kawasaki**
Powering your potential

Kawasaki Heavy Industries – Sections

Kawasaki Heavy Industries, Ltd.



Kawasaki Heavy Industries – Sections



Business year starts from
Apr. 1 and ends on Mar. 31.
As of the business year
ending Mar. 31 2021.

Kawasaki Gas Turbine Europe (KGE) – History

1975 License Agreement with Deutz AG

- *Deutz, Cologne starts the Sales and Service of the M1A Gas Turbine*
- *MWM Diesel & Gastechnik, Mannheim takes over the business from Deutz*

1998 Establishment of KAWASAKI Gas Turbine Europe GmbH

- *Headquarter for the entire European Market*
- *Sales, Packaging and Service of Gas Turbine Generator Sets*
- *10 Employees*

2003 Expansion of Production Facilities

- *Relocation to Bad Homburg (close to Frankfurt City)*
- *Establishment of the Production Site and Service Centre Europe*
- *Start of in-house packaging of GPB17D*
- *25 Employees*

2013 Introduction of the Gas Engines into the product portfolio

- *Start of Promotion and Sales of KG-12/V and KG-18/V*
- *40 Employees*

2018 Establishment of Romanian Office in Bucharest

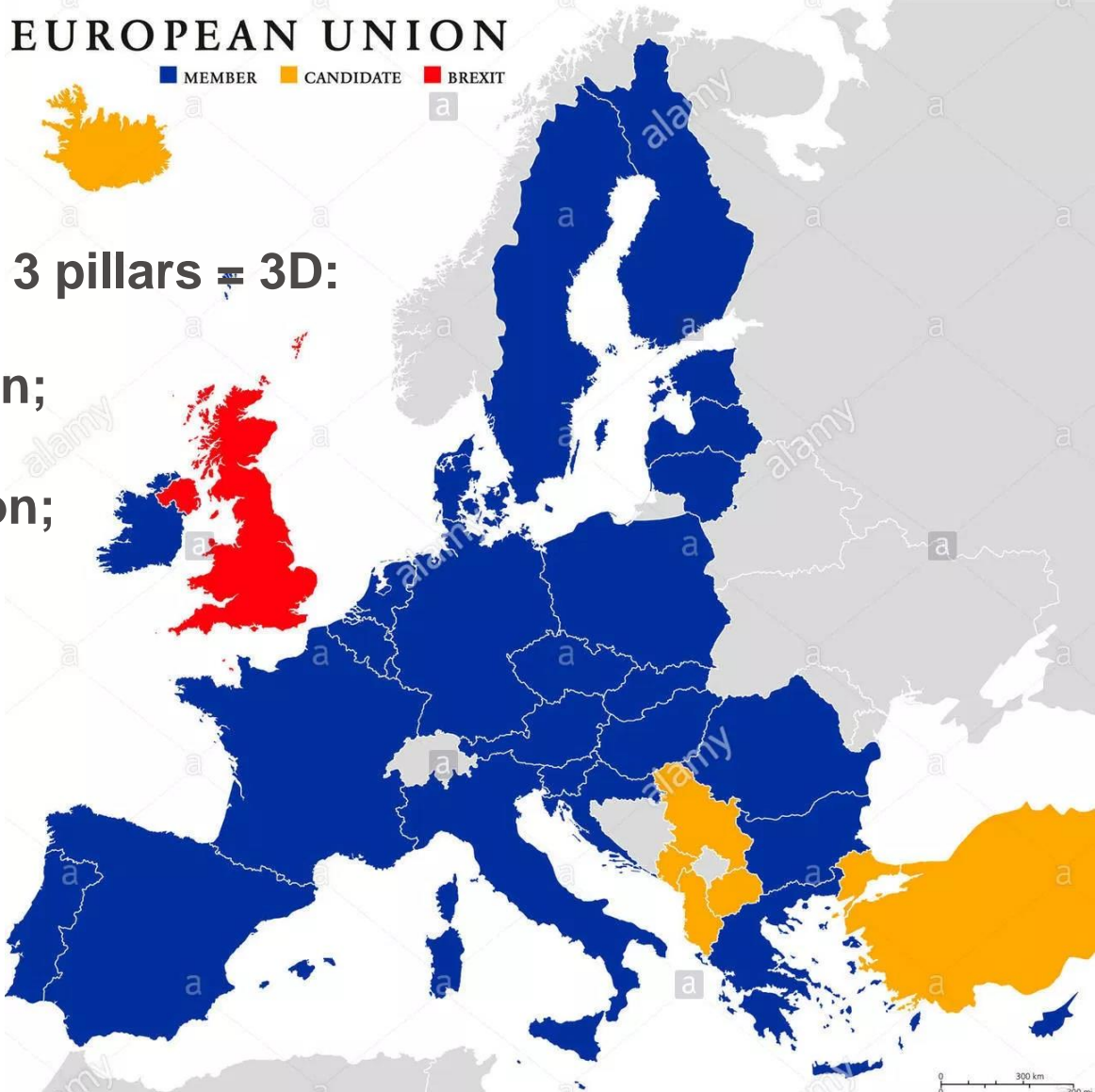
- *Promotion & Sales Activities started, responsible for South-East Europe*
- *Currently: 67 Employees*



European Union - Energy Approach based on 3D

EUROPEAN UNION

MEMBER CANDIDATE BREXIT



Energy approach based on 3 pillars = 3D:

- 1st D = Decarbonization;
- 2nd D = Decentralization;
- 3rd D = Digitalization;

Kawasaki Products & Services

Kawasaki Gas Turbine Europe



Products



Services

Gas Turbines

Gas Engines

Engineering

Implementation

Maintenance

M1A-17D
1,816 kWel
 $\eta = 28.1 \%$

KG12
5,200 kWel
 $\eta = 49 \%$

Concept Engineering

Project Planning

**Spare Parts
Consumables**

M5A-01D
4,720 kWel
 $\eta = 32.6 \%$

KG18
7,800 kWel
 $\eta = 49.0 \%$

Detailed Engineering

Customized Packaging

Full Maintenance

M7A-03D
7,810 kWel
 $\eta = 33.6 \%$

KG18-V
7,800 kWel
 $\eta = 49.5 \%$

**Erection
Commissioning**

Remote Monitoring

L20A-01D
18,500 kWel
 $\eta = 34.3 \%$

KG18-T
7,800 kWel
 $\eta = 51 \%$

Other Services

L30A-01D
34,300 kWel
 $\eta = 40.3 \%$

Gas Turbine Generator Sets – Main Features

Main Features



· **High Exhaust Temperature** >500°C

· **Less amount of Low Temperature Heat**

· **Low Level Sound Enclosures**

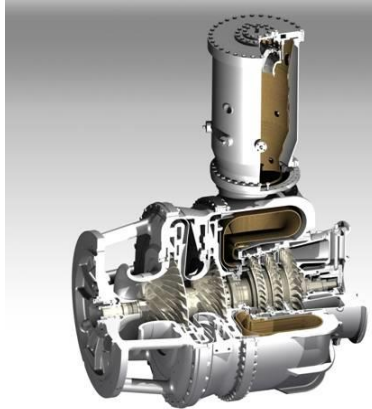
· **Low Exhaust Gas Emissions**

· **Less Interfaces**

· **Long Maintenance Intervals**

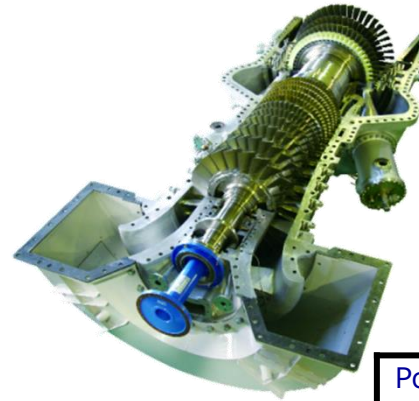
Kawasaki Gas Turbine Engine Models

M1A-17D



Power Output [kWe]	1,816
Ele. Efficiency [%]	28.1
Sat. steam 8 barg [t/h]	5
Exhaust Gas Temperature [°C]	522
NO _x @ O ₂ = 15% [ppm]	< 9
CO @ O ₂ = 15% [ppm]	50

M7A-03D



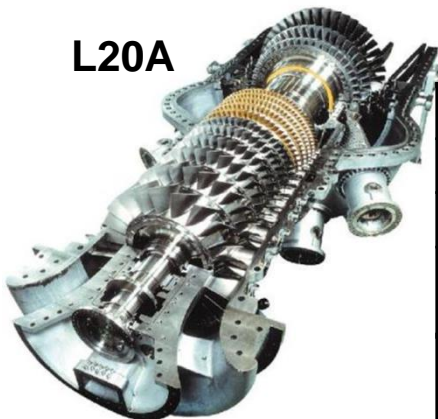
Power Output [kWe]	7,810
Ele. Efficiency [%]	33.6
Sat. steam 8 barg [t/h]	16.4
Exhaust Gas Temperature [°C]	523
NO _x @ O ₂ = 15% [ppm]	< 9
CO @ O ₂ = 15% [ppm]	10

M5A-01D



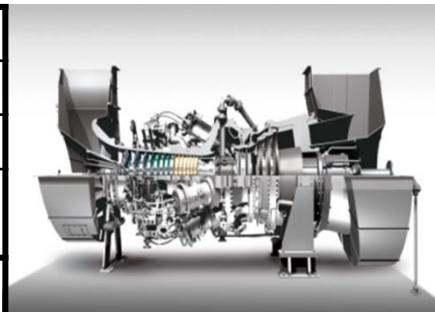
Power Output [kWe]	4,720
Ele. Efficiency [%]	32.6
Sat. steam 8 barg [t/h]	11
Exhaust Gas Temperature [°C]	511
NO _x @ O ₂ = 15% [ppm]	15
CO @ O ₂ = 15% [ppm]	15

L20A



Power Output [kWe]	18,500
Ele. Efficiency [%]	34.3
Sat. steam 8 barg [t/h]	37
Exhaust Gas Temperature [°C]	542
NO _x @ O ₂ = 15% [ppm]	15
CO @ O ₂ = 15% [ppm]	25

L30A



Power Output [kWe]	34,380
Ele. Efficiency [%]	40.3
Sat. steam 8 barg [t/h]	55
Exhaust Gas Temperature [°C]	502
NO _x @ O ₂ = 15% [ppm]	15 / 9
CO @ O ₂ = 15% [ppm]	25

Gas Engine Generator Sets – Main Features

Main Features



· **Highest Electrical Efficiency 51%**

· **Excellent Partial Load Performance**

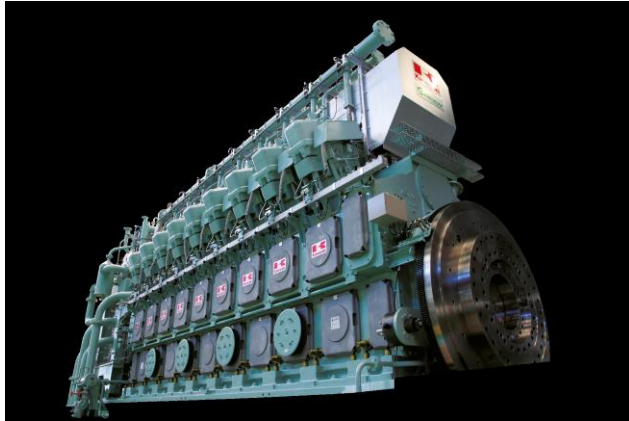
· **Wide Continuous Operating Range**

· **Less Impact by Ambient Conditions**

· **Quick Start-Up** (In 5 minutes to 100% Load)

Kawasaki Gas Engine Models

KG 18V



KG 12



KG 18T

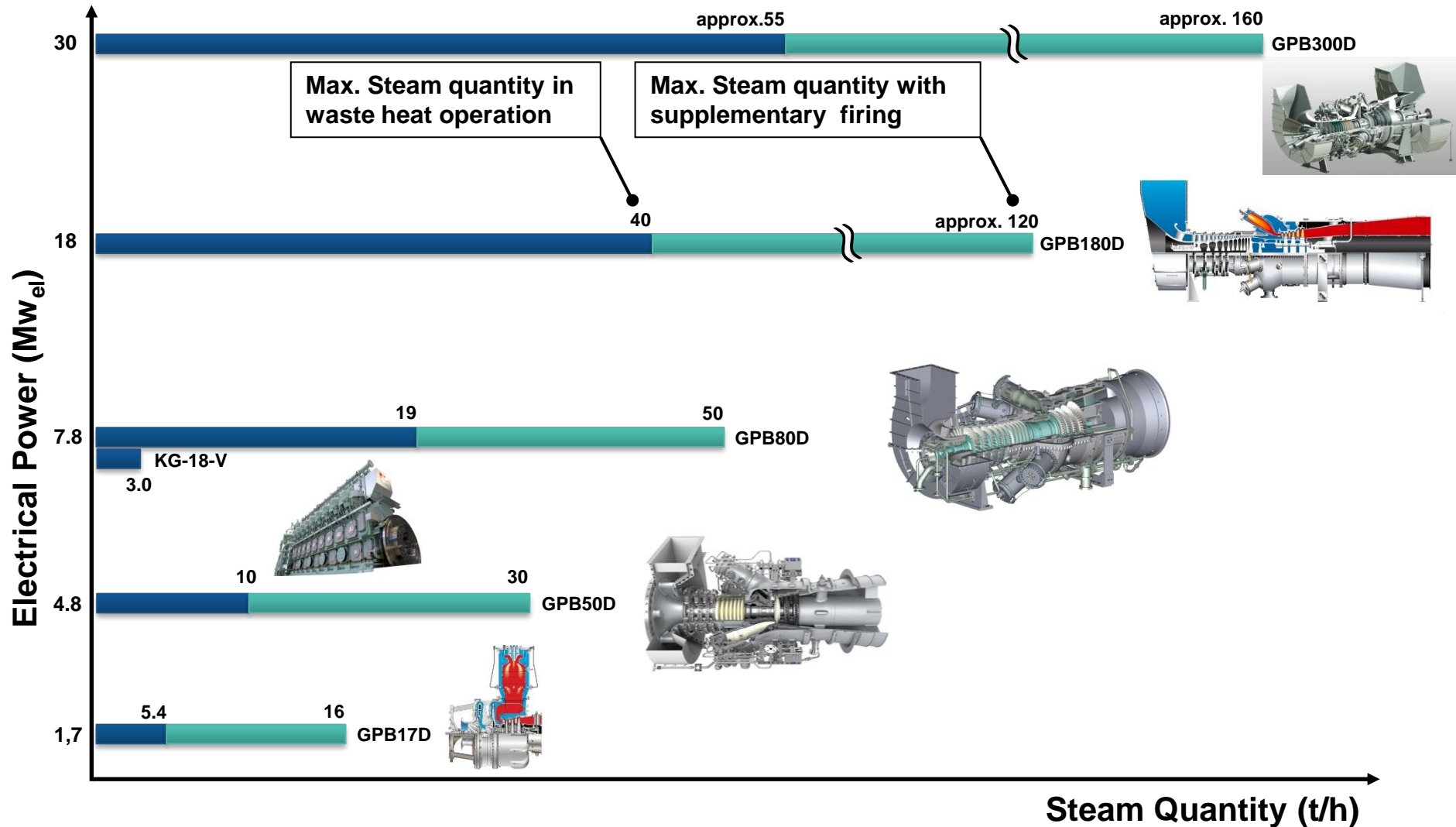


Power Output [kWe]	7,800
Ele. Efficiency [%]	49.5
Total Engine Heat [kWth]	5,000
Exhaust Gas Temperature [°C]	320
NOx @ O ₂ = 0% [ppm]	200
CO @ O ₂ = 0% [ppm]	50
Methane number	> 65

Power Output [kWe]	5,200
Ele. Efficiency [%]	49
Total Engine Heat [kWth]	3,000
Exhaust Gas Temperature [°C]	320
NOx @ O ₂ = 0% [ppm]	200
CO @ O ₂ = 0% [ppm]	50
Methane number	> 65

Power Output [kWe]	7,800
Ele. Efficiency [%]	51
Total Engine Heat [kWth]	3,500
Exhaust Gas Temperature [°C]	285
NOx @ O ₂ = 0% [ppm]	250
CO @ O ₂ = 0% [ppm]	50
Methane number	> 65

Performances in CHP



KGE market – request of electricity and steam / hot water / chilled water

Typical applications:

Pulp and paper



Medicines / cosmetics



Refinery / Chemistry



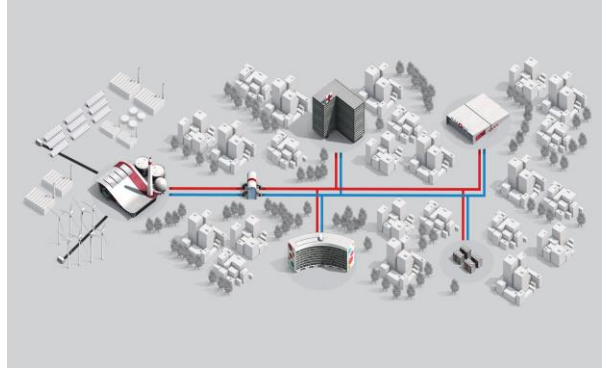
Food and Beverage



Automotive / Tires



District Heating



Universities
Hotels

Hospitals
Airports

GPB80 + GPB180 example of installation EDP (P)

Project background

- Build up new and full flexible power plant based on Kawasaki GPB80 and GPB180 each with Bypass Stack, Supplementary Firing and Draft Fan.

Challenges

- Maritime climate

Project key data

- Commissioning: December 2009
- Output (electrical): 7,290 kW @ 15 °C
18,000 kW @ 15 °C
- Efficiency_(Electrical, terminal, LHV): GPB80: 32.7 %
GPB180: 32.8 %



Joetsu Green Power Project for Nihon Techno / J



Model	KG-18-V
Unit Output	7,800kW
No. of Unit	14
Total Output	109.2MW

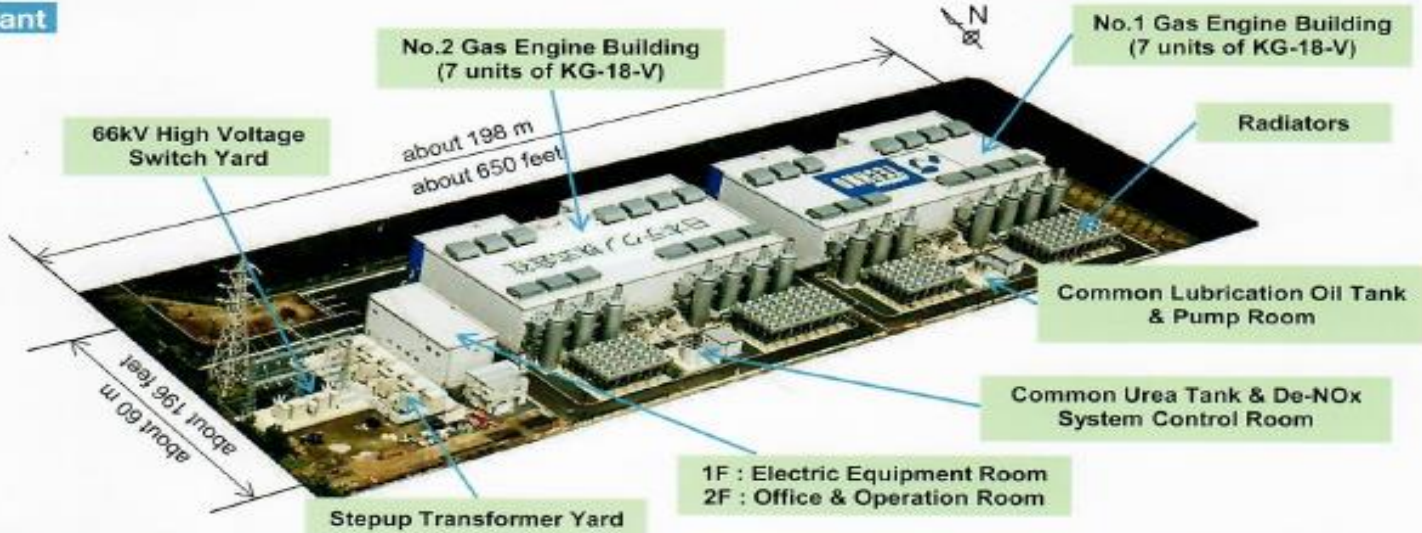


110MW Nihon Techno Sodegaura Green Power (JPN)

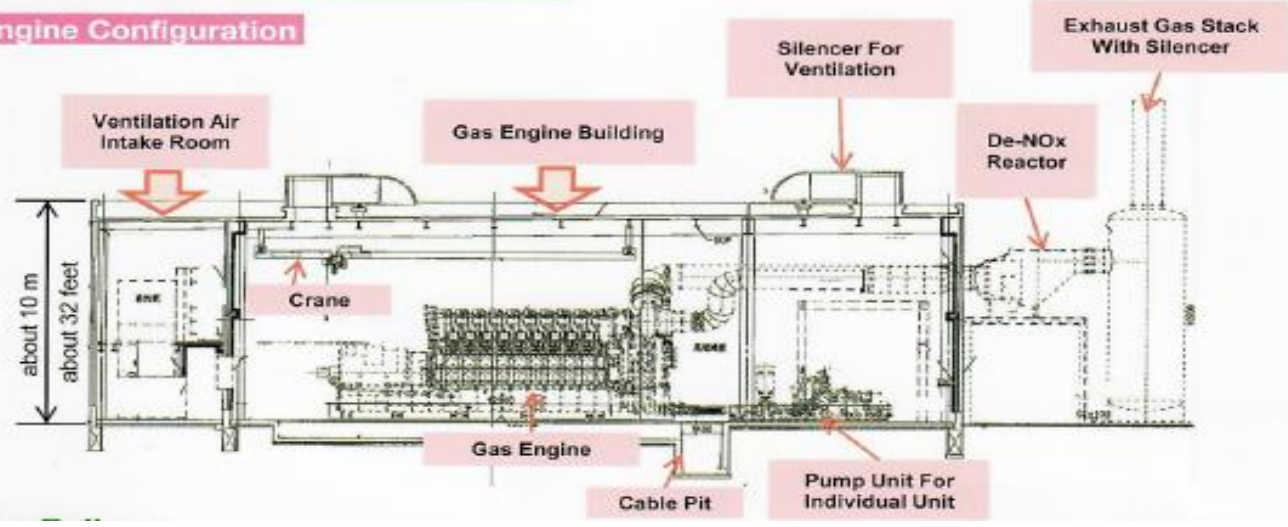
Plant outline

< Total site area : 12,430.24 m² (3.07acre) >

Plant



Each Engine Configuration



Working as one for the good of the planet!

Highly Focusing on Environmental Protection
and Energy Savings

- **Reduction of emissions**
 - ❖ Global warming gas CO₂
 - ❖ Harmful gas NO_x, SO_x
- **Energy Saving**

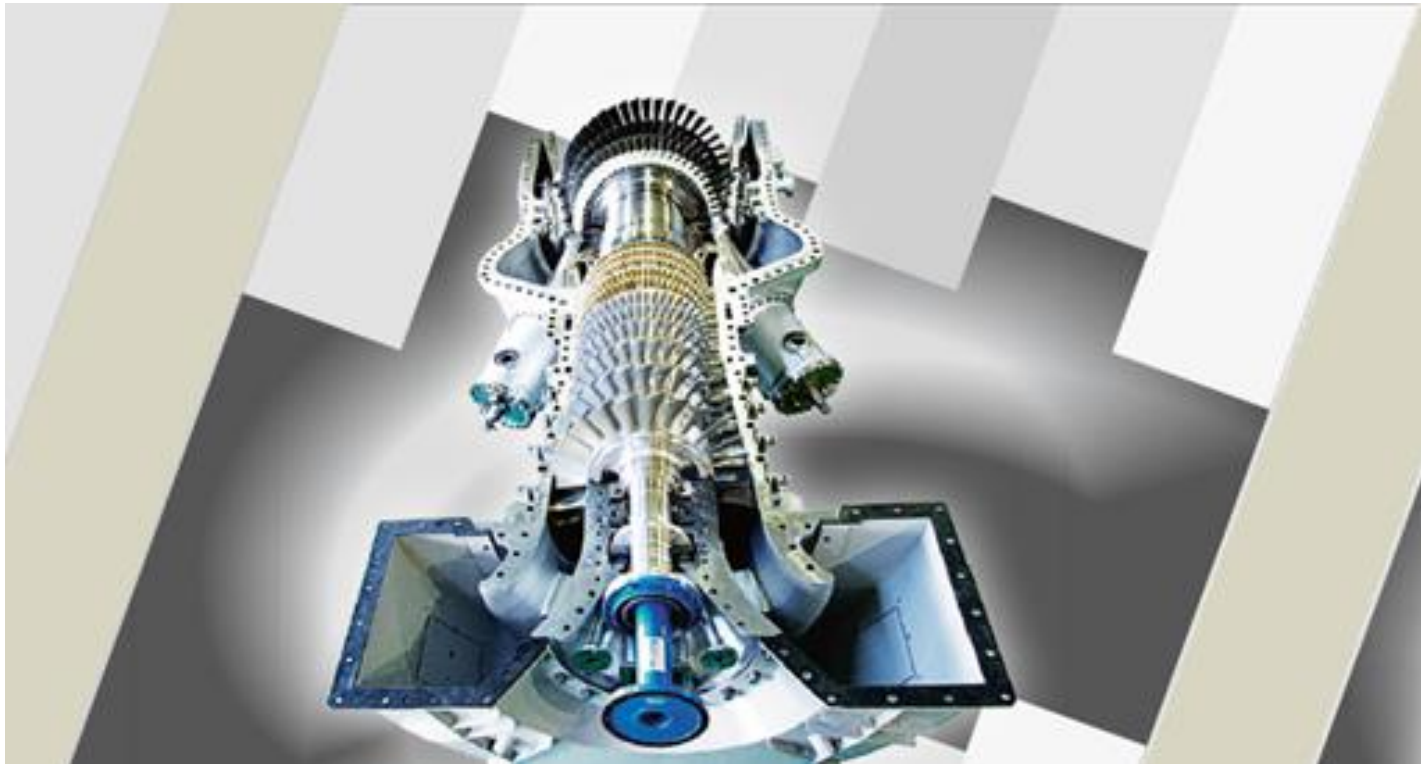
Hydrogen – future fuel for
energy production

Distributed Generator System

- **Provide highly efficient energy use**
- **Flexible and reliable**
to complement unstable renewable energy

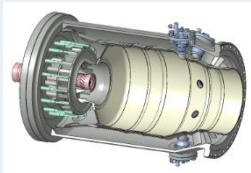
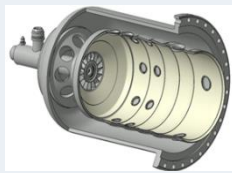
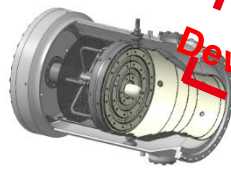
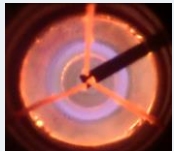


H2 – future fuel as alternative to classic fuel

Kawasaki Heavy Industries Hydrogen Road Map



H2 – future fuel as alternative to classic fuel

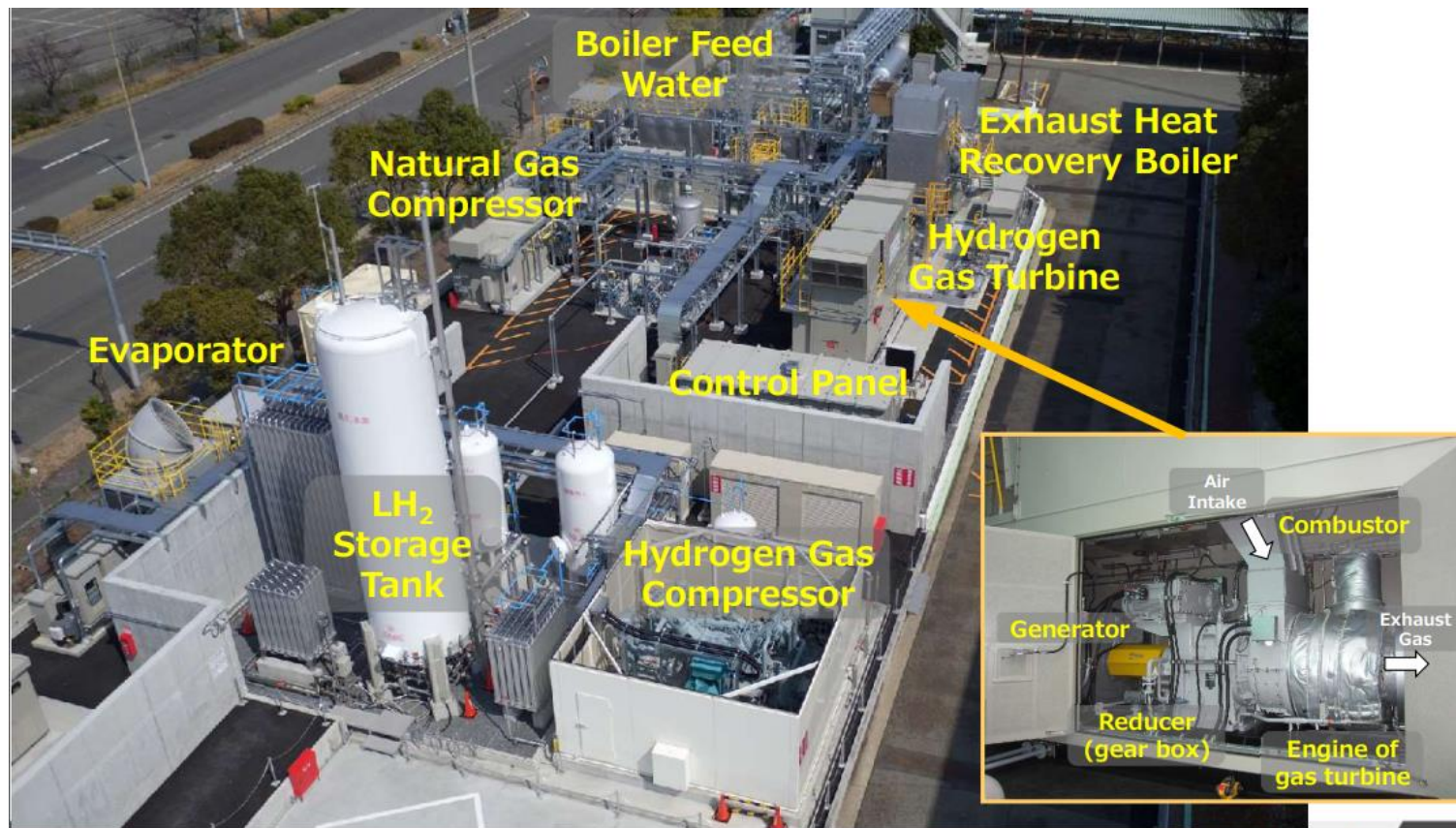
Overview of Combustor Developments

Combustor Configuration	DLE Combustor for Natural Gas	Diffusion Flame Combustor	DLE Micro-Mix Combustor
NOx Reduction	“Dry”	“Wet” Water/Steam	“Dry”
			 Latest Development
H2 Content	0-30vol%	0-100vol%	50-100vol%
Status	Final Combustor Test, 2021 	Final Combustor Test, 2016 Applied to KOBE Demonstration Plant, 2018 	Final Combustor Test, 2018 Applied to KOBE Demonstration Plant, 2020 

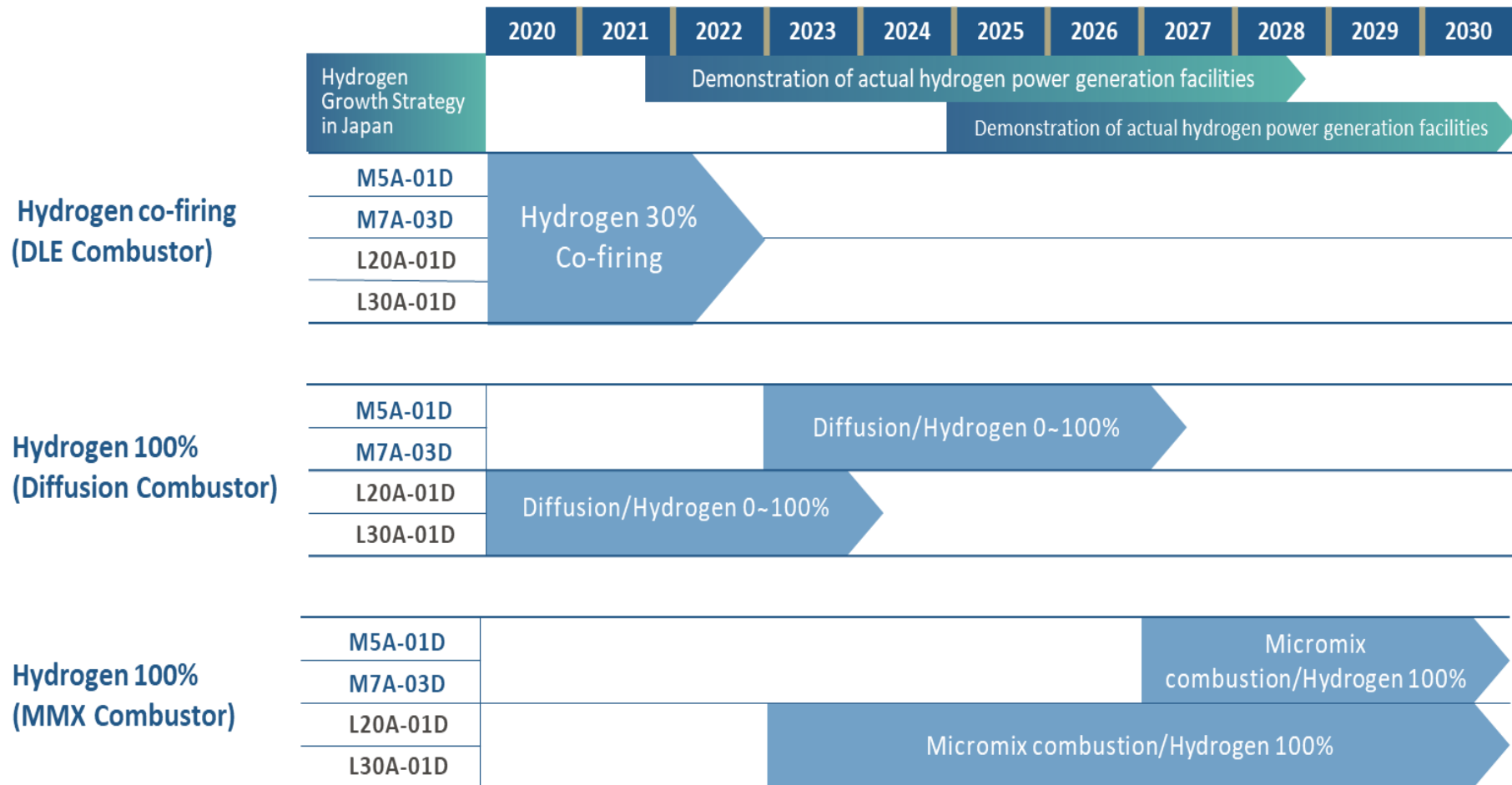
Main Difference between NG & H2 Gas Turbines is the Combustor

H2 – future fuel as alternative to classic fuel

World's First 100% H2-CHP Plant at Kobe Harbor



H2 – future fuel as alternative to classic fuel



H2 – future fuel as alternative to classic fuel

RWE and **Kawasaki** plan to build one of the world's first 100% hydrogen-capable gas turbines on industrial scale in Lingen, Germany



The project is one of the first worldwide to use a gas turbine to convert 100% hydrogen into electricity on an industrial scale. The plant, with an output of 34 megawatts (MW), could become operational in mid-2024

Hydrogen road of Kawasaki Heavy Industries

H2 – future fuel as alternative to classic fuel



Hydrogen gas engine



Fertilizer plant



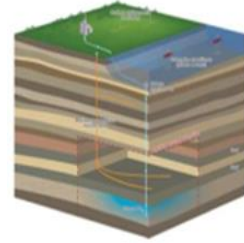
Electrolyzer



Liquefaction



Liquefied H2 Tank



KCC

Produce

Storage

Realization of Products with Corporate Technology Synergy

Use

Transport



H2 Compressors



Hydrogen Gas Turbine



Liquefied H2 Loading Arm



High Pressure Hydrogen trailer



H2 Low-NOx Boiler



Fuel cell train



High-Pressure H2 valve

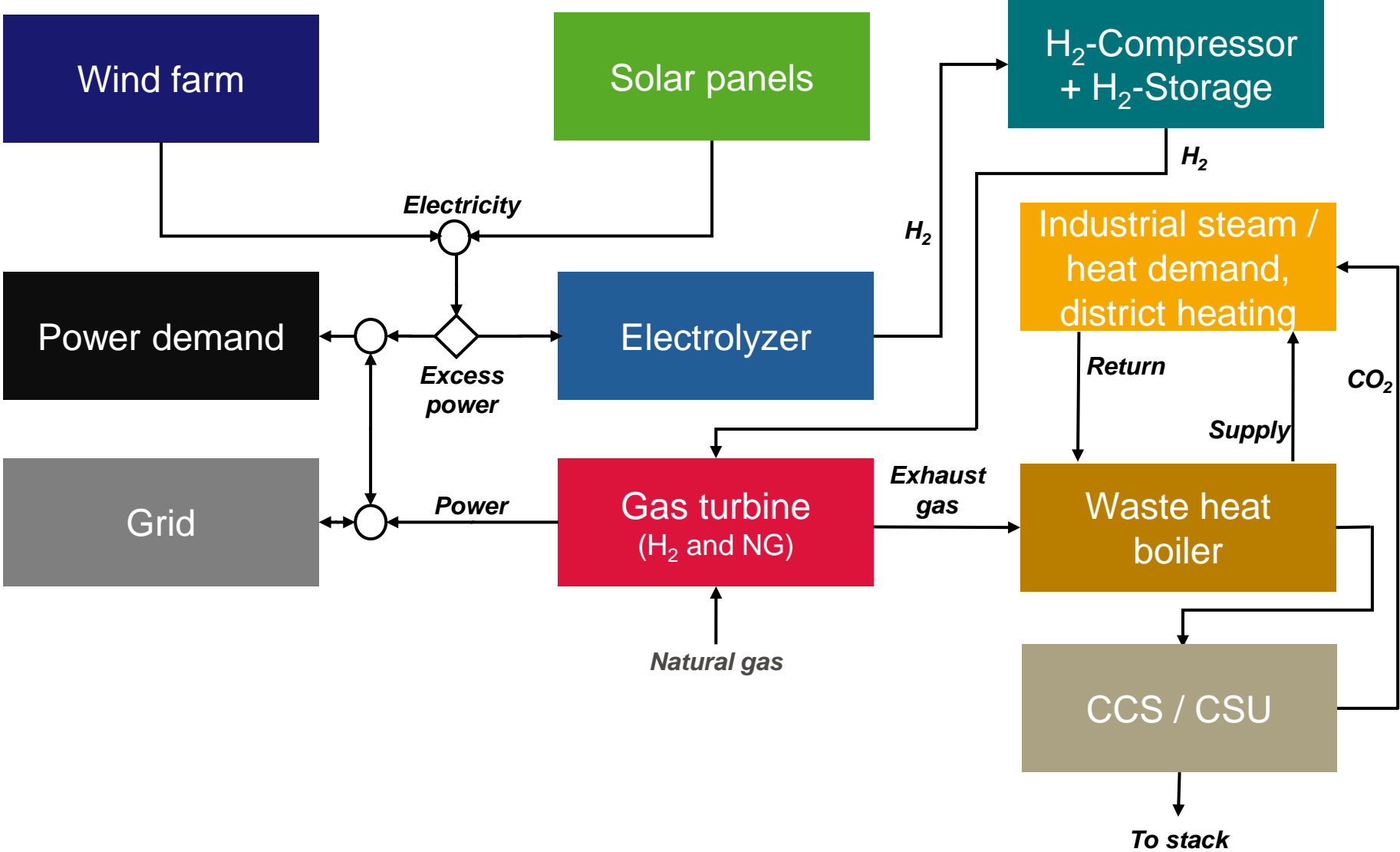


Liquefied H2 Container



Liquefied H2 Tanker

Future Cogeneration Plants



**If you are facing an actual energy project,
or a real challenge, and require support
from our side, don't hesitate to reach out of
us!**

We provide green and efficient solutions!

**Our energy solutions will bring your
project one day closer to reality.**

Kawasaki will pursue "manufacturing that makes the Earth smile."

“Global Kawasaki”