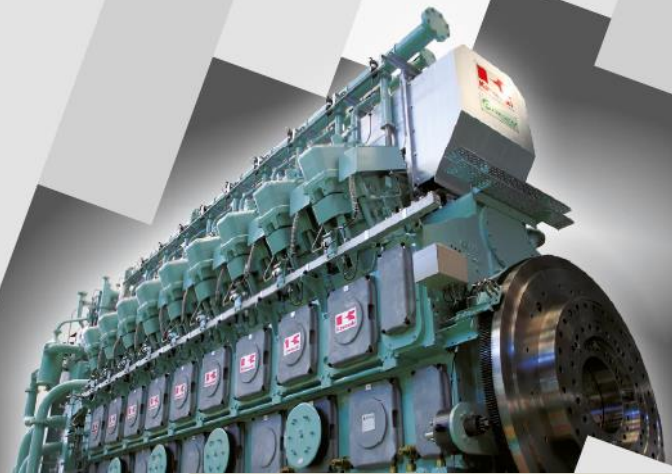
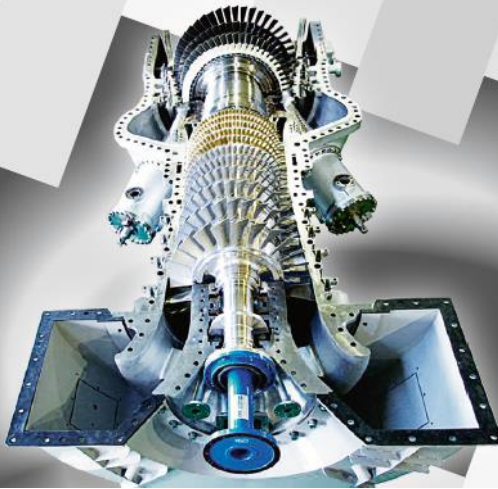


# Two Specialists

## No Compromise



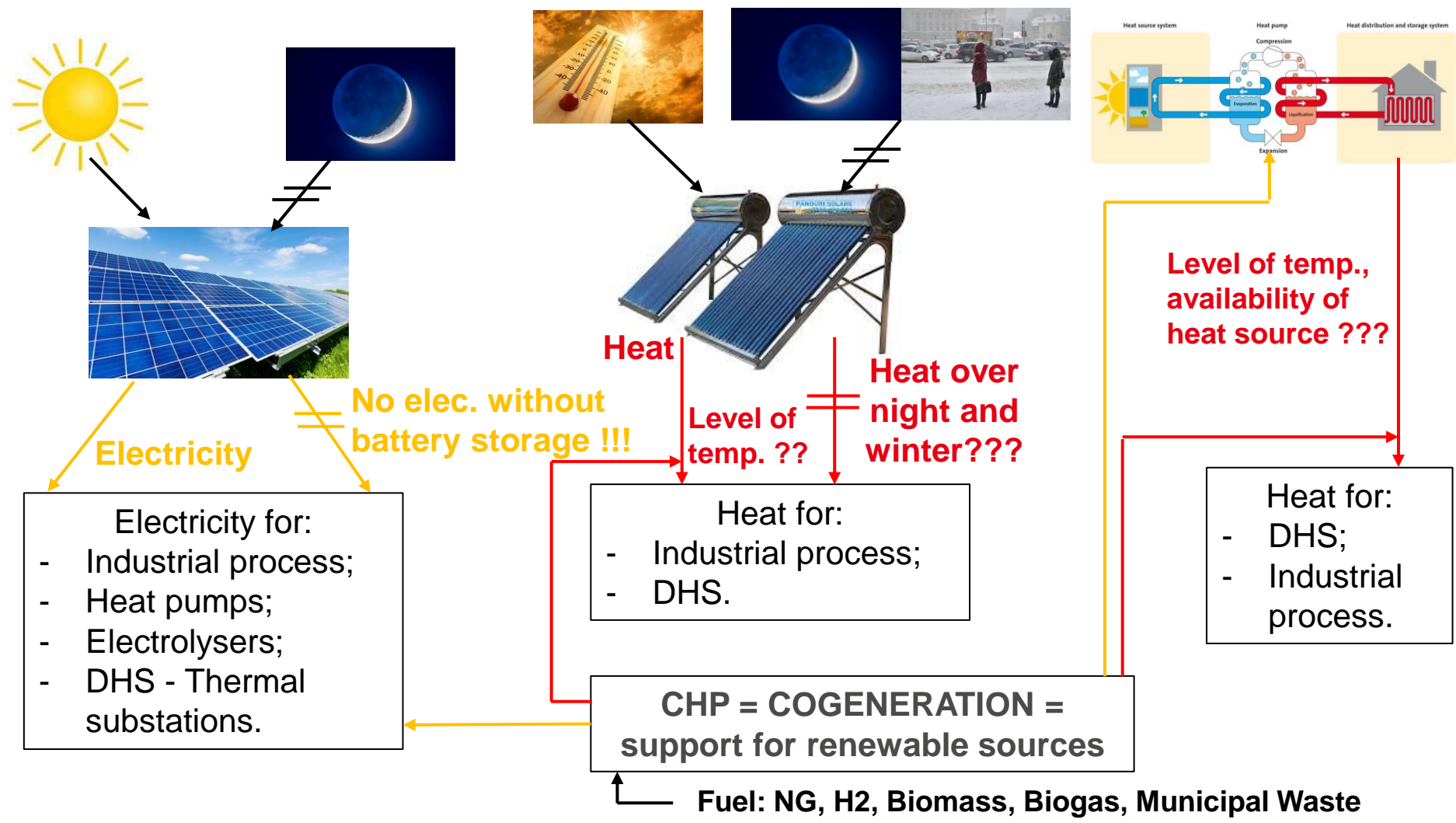
## **KAWASAKI Gas Turbine Europe GmbH**

**Energynomics – 11<sup>th</sup> May 2023**

 **Kawasaki**  
Powering your potential

# Cogeneration solution = energy efficiency solution = support for renewable energy sources

## Renewable sources ≠ Energy efficiency solutions



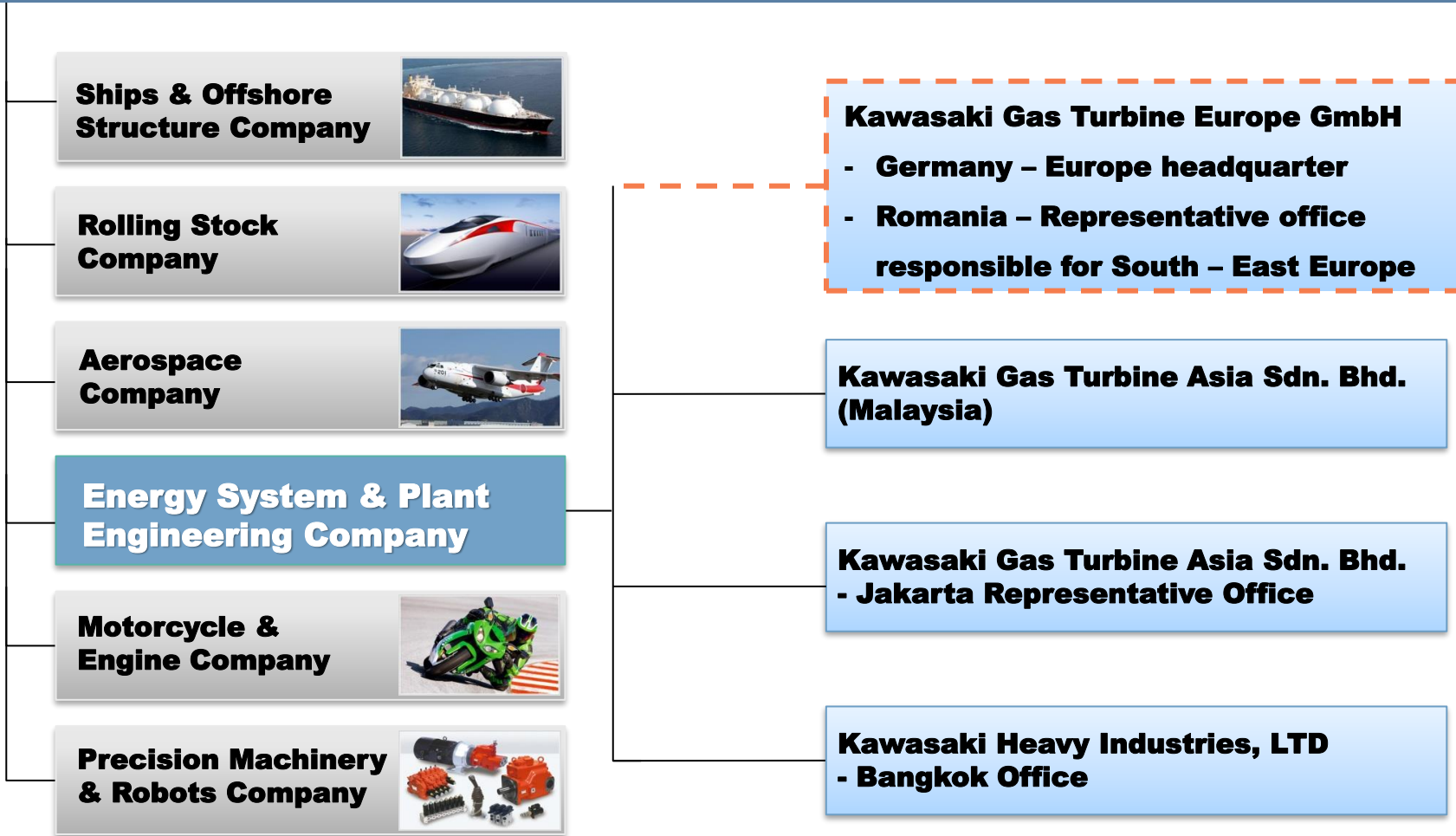
# European Union - Energy Approach based on 4D

## Energy approach based on 4 pillars = 4D:

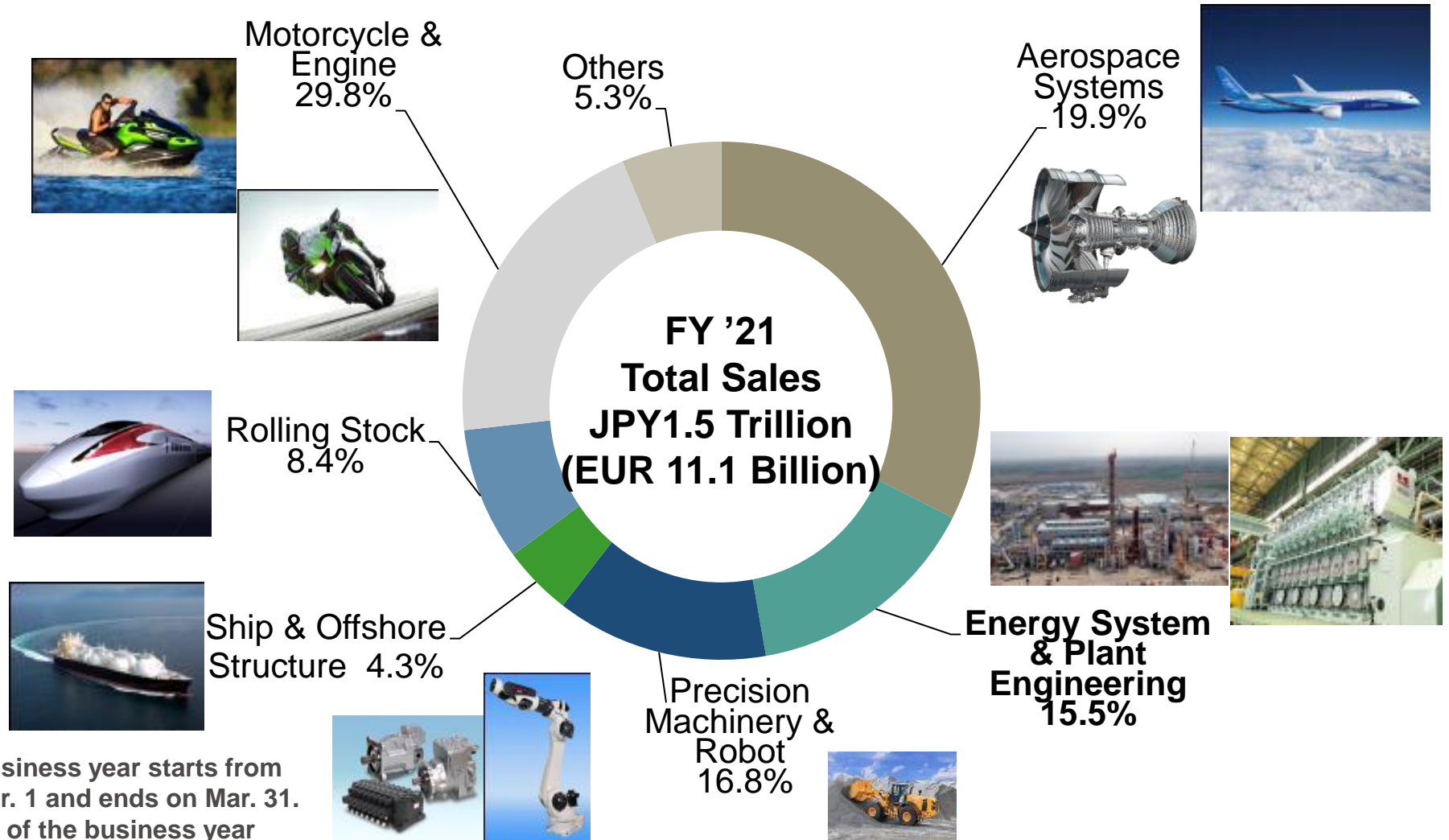
- **1<sup>st</sup> D = Decarbonization;**
- **2<sup>nd</sup> D = Decentralization;**
- **3<sup>rd</sup> D = Digitalization;**
- **4<sup>th</sup> D = Distributed energy generation**

# Kawasaki Heavy Industries – Sections

## Kawasaki Heavy Industries, Ltd.



# Kawasaki Heavy Industries – Sections



## Working as one for the good of the planet!

Highly Focusing on Environmental Protection  
and Energy Savings

- **Reduction of emissions**
  - ❖ Global warming gas CO<sub>2</sub>
  - ❖ Harmful gas NO<sub>x</sub>, SO<sub>x</sub>
- **Energy Saving**

Hydrogen – future fuel for  
energy production

**Distributed Generator System**

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



# 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  
 $\eta = 34.3 \%$

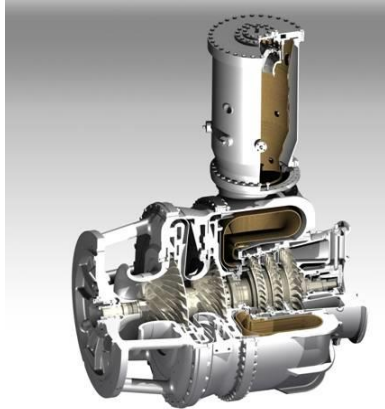
**KG18-T**  
7,800 kWel  
 $\eta = 51 \%$

**Other Services**

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

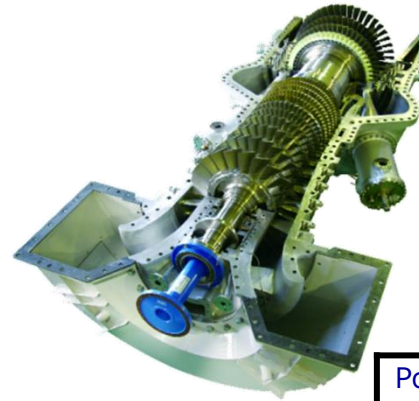
# Kawasaki Gas Turbine Engine Models

**M1A-17D**



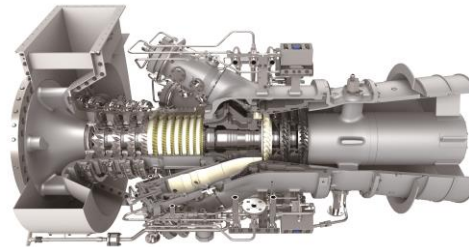
Power Output [kWe]	1,816
Ele. Efficiency [%]	28.1
Sat. steam 8 barg [t/h]	5
Heat recovered [kWth]	3,646
NO <sub>x</sub> @ O <sub>2</sub> = 15% [ppm]	< 9
CO @ O <sub>2</sub> = 15% [ppm]	50

**M7A-03D**



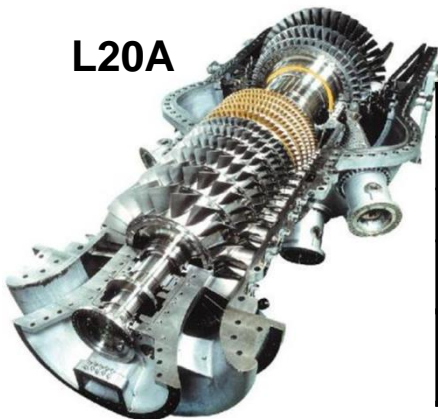
Power Output [kWe]	7,810
Ele. Efficiency [%]	33.6
Sat. steam 8 barg [t/h]	16.4
Heat recovered [kWth]	12,471
NO <sub>x</sub> @ O <sub>2</sub> = 15% [ppm]	< 9
CO @ O <sub>2</sub> = 15% [ppm]	10

**M5A-01D**



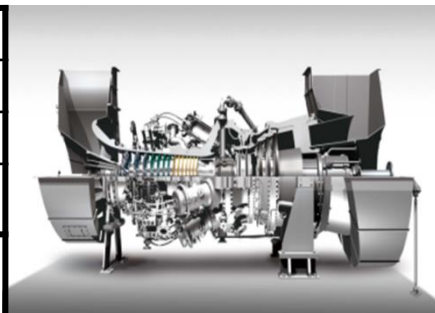
Power Output [kWe]	4,720
Ele. Efficiency [%]	32.6
Sat. steam 8 barg [t/h]	11
Heat recovered [kWth]	7,723
NO <sub>x</sub> @ O <sub>2</sub> = 15% [ppm]	15
CO @ O <sub>2</sub> = 15% [ppm]	15

**L20A**



Power Output [kWe]	18,500
Ele. Efficiency [%]	34.3
Sat. steam 8 barg [t/h]	37
Heat recovered [kWth]	28,550
NO <sub>x</sub> @ O <sub>2</sub> = 15% [ppm]	15
CO @ O <sub>2</sub> = 15% [ppm]	25

**L30A**



Power Output [kWe]	34,380
Ele. Efficiency [%]	40.3
Sat. steam 8 barg [t/h]	55
Heat recovered [kWth]	7,723
NO <sub>x</sub> @ O <sub>2</sub> = 15% [ppm]	15 / 9
CO @ O <sub>2</sub> = 15% [ppm]	25

Parameters for ISO conditions



# Kawasaki Gas Engine Models

## KG 18V



## KG 12



## KG 18T



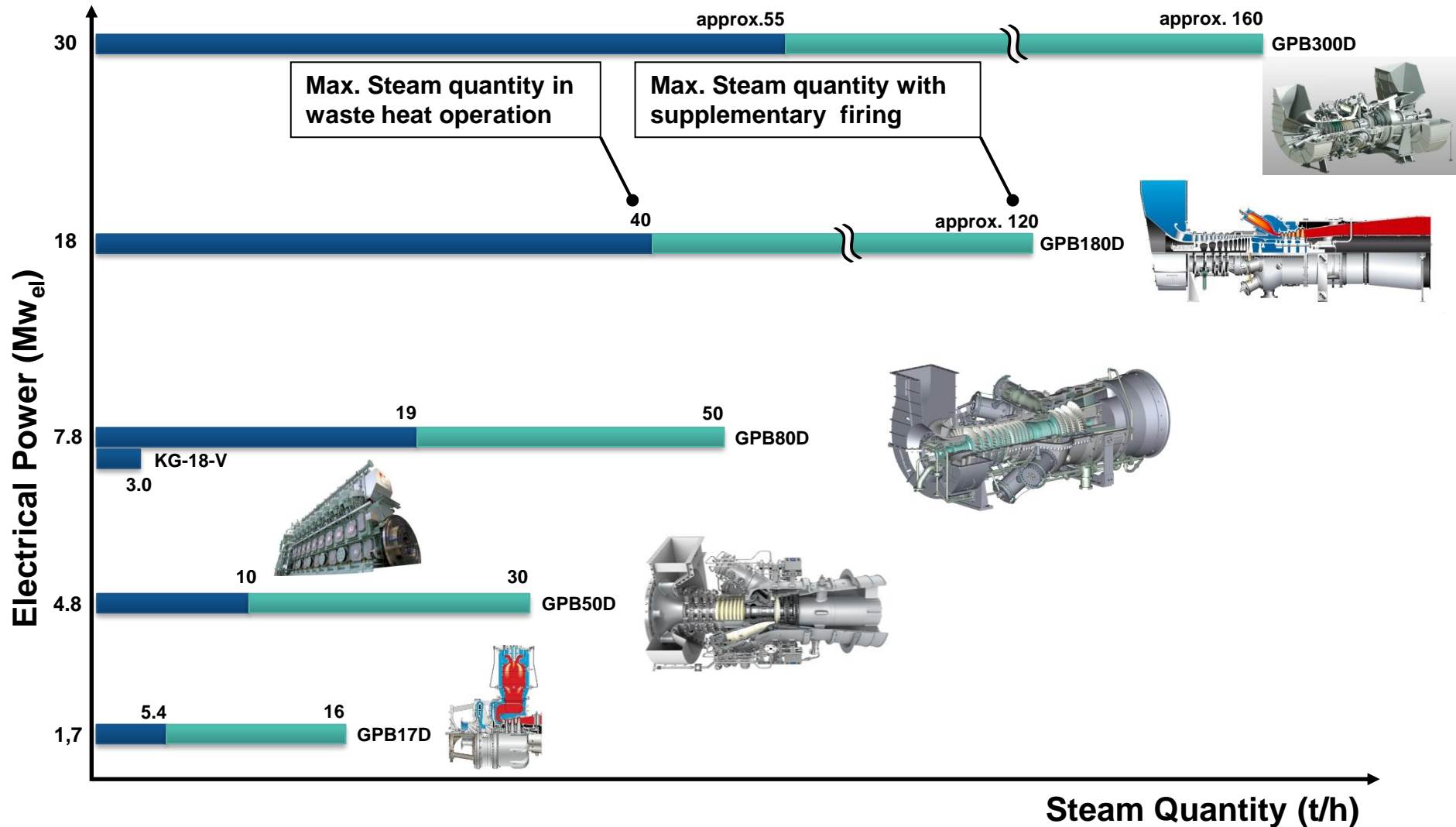
Power Output [kWe]	7,800
Ele. Efficiency [%]	49.5
Heat recovered [kWth]	5,000
Exhaust Gas Temperature [°C]	320
NOx @ O <sub>2</sub> = 0% [ppm]	200
CO @ O <sub>2</sub> = 0% [ppm]	50
Methane number	> 65

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

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

Parameters for ISO conditions

# Performances in CHP



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

## Typical applications:

Pulp and paper



Medicines / cosmetics



Refinery / Chemistry



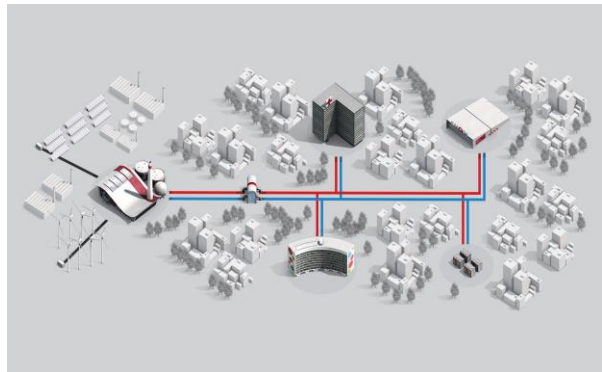
Food and Beverage



Automotive / Tires



District Heating



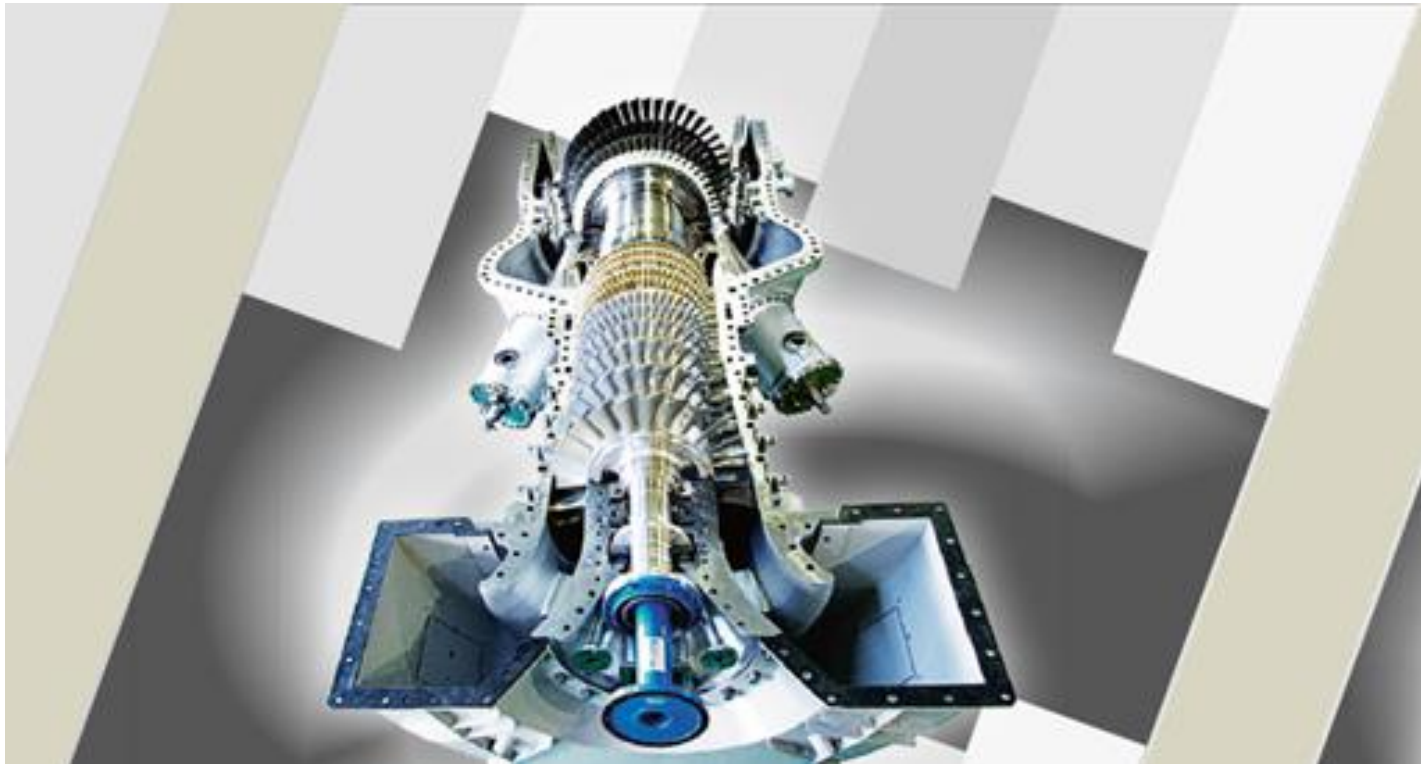
Universities  
Hotels

Hospitals  
Airports



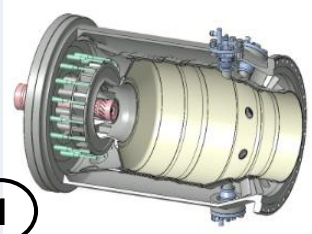
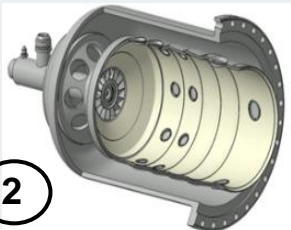
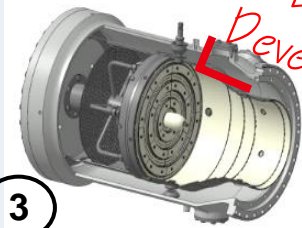
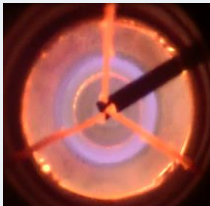


# H2 – future fuel as alternative to classic fuel

## Kawasaki Heavy Industries Hydrogen Road Map



# Developments for Hydrogen Gas Turbines @ KHI

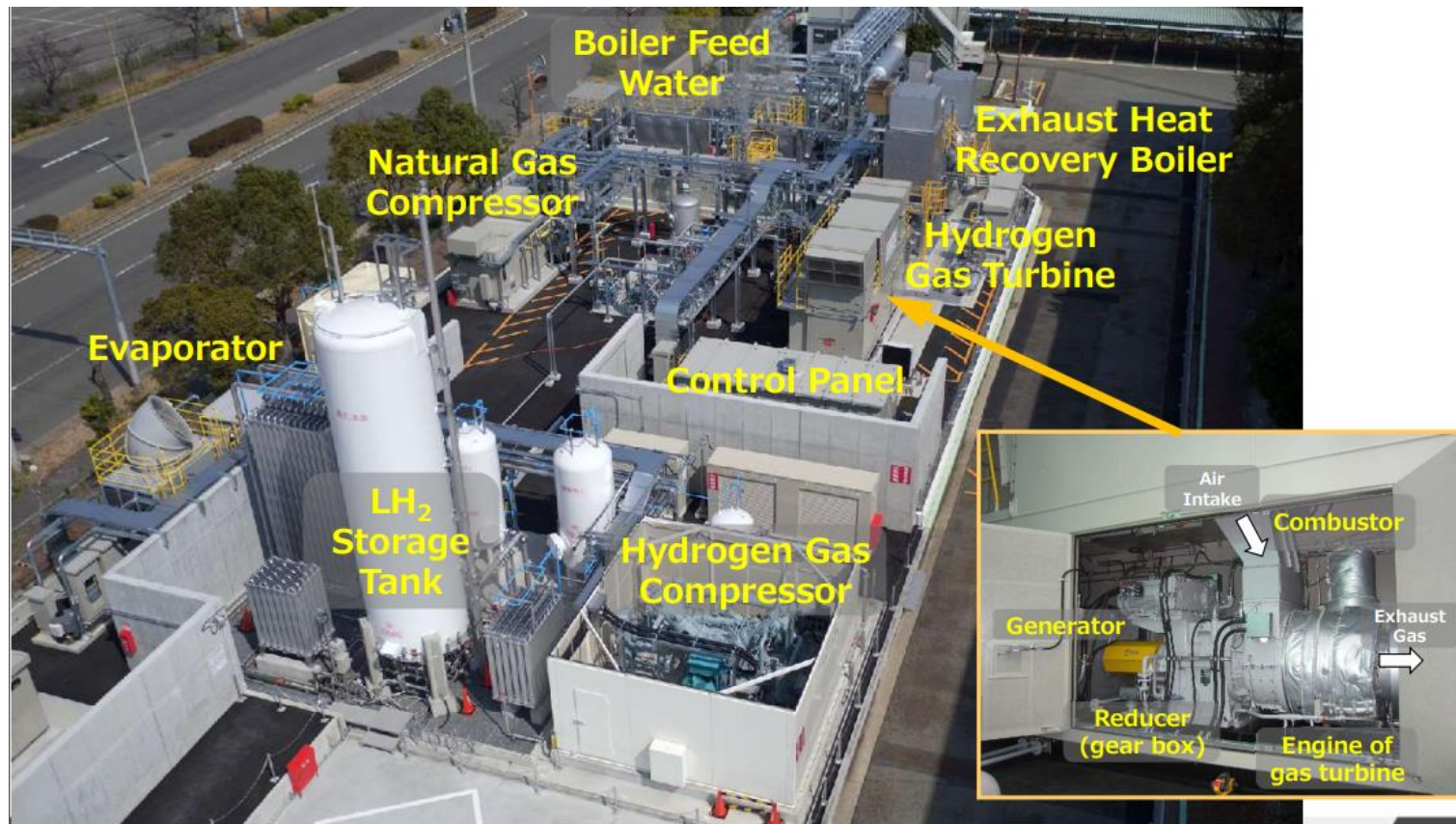
## Overview of Combustor Developments

Combustor Configuration	DLE Combustor for Natural Gas	Diffusion Flame Combustor	DLE Micro-Mix Combustor
NOx Reduction	“Dry”	“Wet” Water/Steam	“Dry”
	 <p>①</p>	 <p>②</p>	 <p>③</p> <p><i>Latest Development</i></p>
H2 Content	0-30vol%	0-100vol%	50-100vol%
Status	<p>Final Combustor Test, 2021</p> 	<p>Final Combustor Test, 2016 Applied to KOBE Demonstration Plant,</p> 	<p>Final Combustor Test, 2018 Applied to KOBE Demonstration Plant,</p> 



# H2 – future fuel as alternative to classic fuel

## World's First 100% H<sub>2</sub>-CHP Plant at Kobe Harbor



# H2 – future fuel as alternative to classic fuel

**INNOVATIONSPREIS  
DER DEUTSCHEN  
GASWIRTSCHAFT**

## Press Release

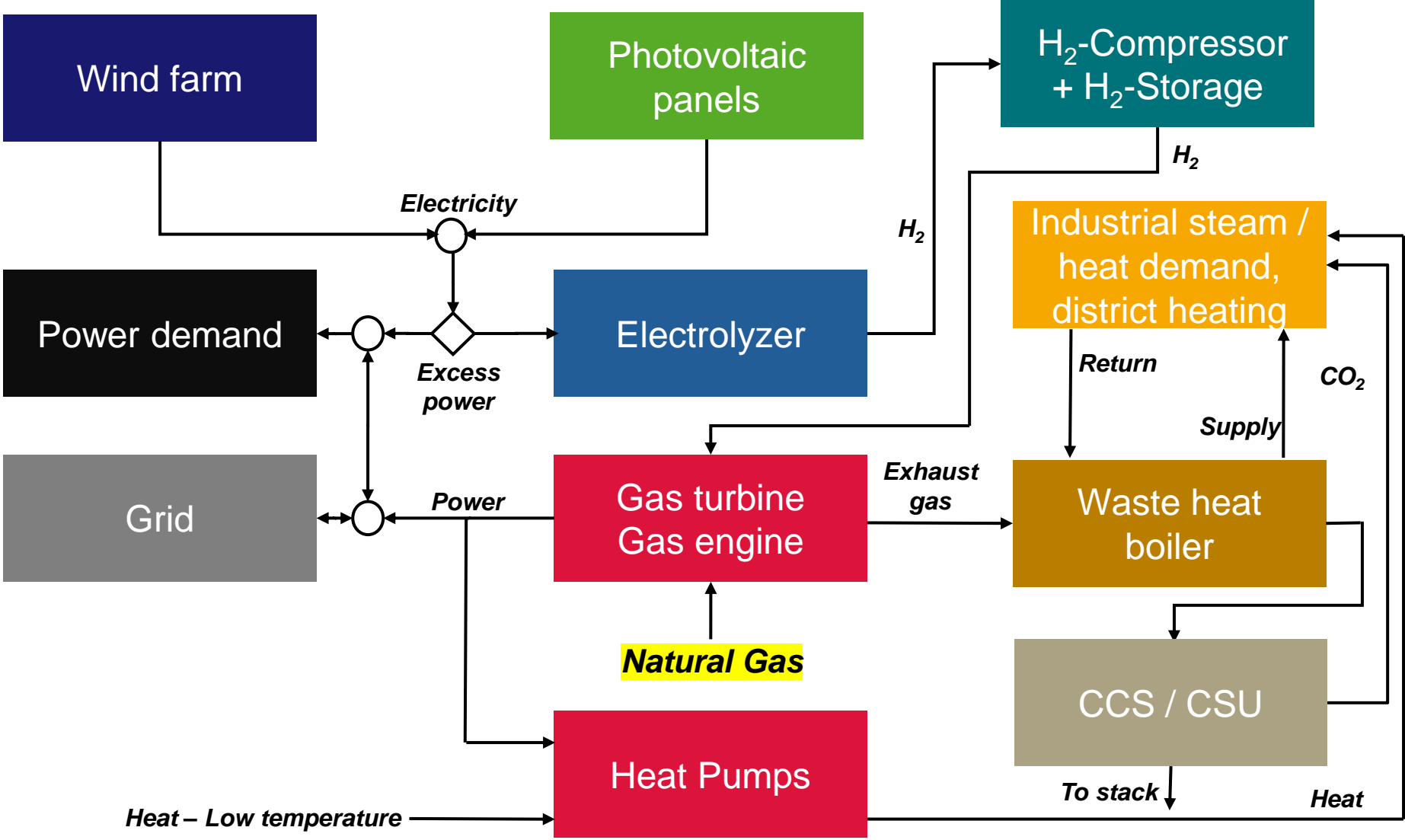
### **Innovation Award: Gas industry honors forward-looking energy projects**

- Four projects were honored in the categories of application-oriented research, sustainable generation, intelligent infrastructure and efficient application technology.
- Jury chairman Prof. Behrendt: "The winning projects demonstrate innovative ideas, have the courage to change and show that the gas industry is actively working on solutions for tomorrow."
- ENERGY-HUB Wilhelmshaven honored as a gamechanger

Berlin, October 12, 2022 - Under the patronage of the Federal Minister of Education and Research, Bettina Stark-Watzinger, the Innovation Award of the German Gas Industry was presented today for the 22nd time. The award is sponsored by the three industry associations BDEW, DVGW and Zukunft Gas, as well as the competence partner ASUE. Wintershall Dea supports the Innovation Award as a partner.

**Kawasaki Gas Turbine Europe GmbH wins the INNOVATION AWARD OF THE GERMAN GAS INDUSTRY 2022 with its DLE H2 Micro-Mix Burner**  
**Kawasaki Gas Turbine Europe GmbH has won the Innovation Award of the German gas industry in the category "Efficient Application Technology".**

# Future – Hybrid Plants



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

# “Global Kawasaki”