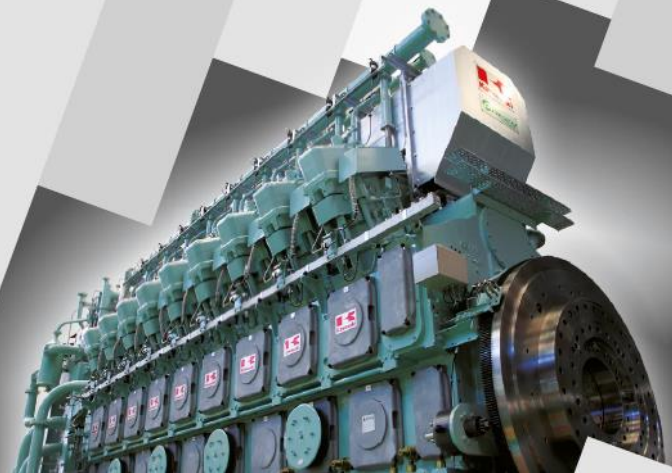
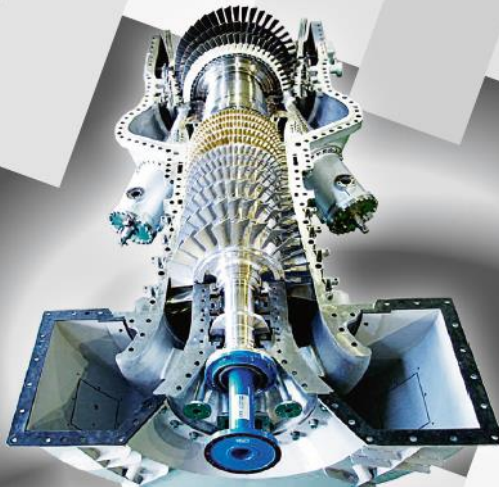


# Two Specialists

## No Compromise



## KAWASAKI Gas Turbine Europe GmbH

**Energynomics – 12<sup>th</sup> November 2020,  
“UTILITIES” conference**

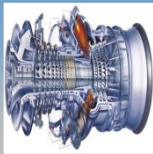
 **Kawasaki**  
Powering your potential

# Agenda



**1**

**Kawasaki Heavy Industries (KHI)**



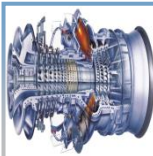
**2**

**Kawasaki Gas Turbine Europe (KGE)**



**3**

**Utilities market – KGE / KHI Products & Services**



**4**

**Developments for Hydrogen Gas Turbines @ KHI**

# Kawasaki Heavy Industries – Sections

## Kawasaki Heavy Industries, Ltd.

**Ships & Offshore  
Structure Company**



**Rolling Stock  
Company**



**Aerospace  
Company**



**Energy System & Plant  
Engineering Company**

**Motorcycle &  
Engine Company**



**Precision Machinery  
Company**



**Kawasaki Gas Turbine Europe GmbH**

- Germany – Europe headquarter
- Romania – Representative office responsible for South – East Europe

**Kawasaki Gas Turbine Asia Sdn. Bhd.  
(Malaysia)**

**Kawasaki Gas Turbine Asia Sdn. Bhd.  
- Jakarta Representative Office**

**Kawasaki Heavy Industries, LTD  
- Bangkok Office**

# 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*



# Utilities market – KGE / KHI solutions

## Main utilities

- **Electricity + Steam / Hot Water (cogeneration)**
  - Gas Turbine Generator Sets;
  - Gas engines;
  - CCPP;
  
- **Electricity only**
  - Gas engines;
  - CCPP;
  
- **Water – Wastewater Treatment Plant**
  - MAG Turbo Blower;
  - Gas Turbine Generator Sets



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

## Typical applications:

### Pulp and paper



### Medicines / cosmetics



### Refinery / Chemistry



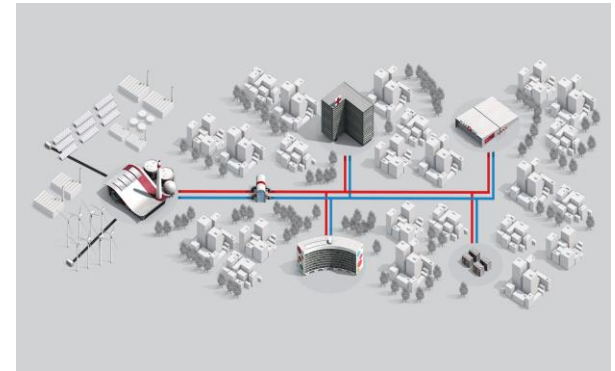
### Food and Beverage



### Automotive / Tires



### District Heating



Universities

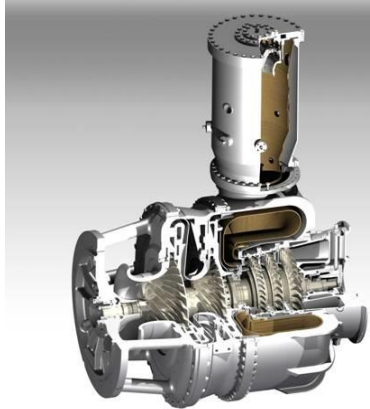
Hospitals

Hotels

Airports

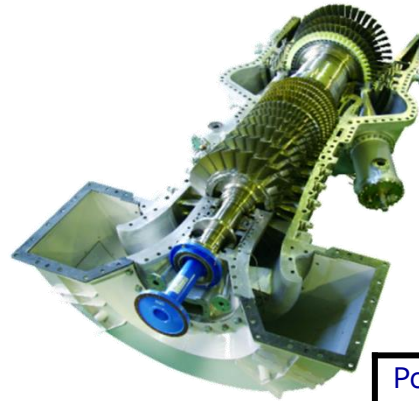
# Kawasaki Gas Turbine Generator Sets

**M1A-17D**



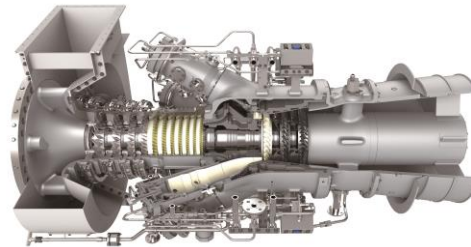
Power Output [kWe]	1,816
Ele. Efficiency [%]	28.1
Sat. steam 8 barg [t/h]	5
Exhaust Gas Temperature [°C]	522
NO <sub>x</sub> @ O <sub>2</sub> = 15% [ppm]	< 9
CO @ O <sub>2</sub> = 15% [ppm]	50

**M7A-03D**



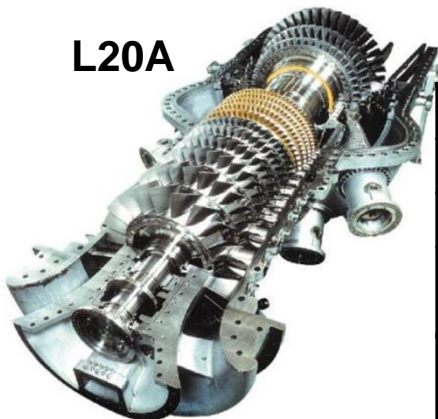
Power Output [kWe]	7,810
Ele. Efficiency [%]	33.6
Sat. steam 8 barg [t/h]	16.4
Exhaust Gas Temperature [°C]	523
NO <sub>x</sub> @ O <sub>2</sub> = 15% [ppm]	< 9
CO @ O <sub>2</sub> = 15% [ppm]	10

**M5A-01D**



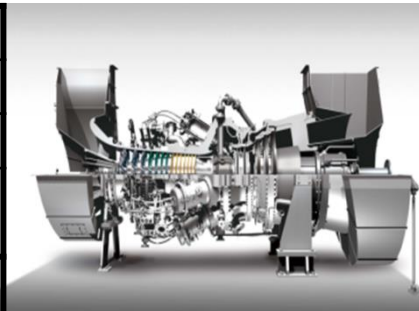
Power Output [kWe]	4,720
Ele. Efficiency [%]	32.6
Sat. steam 8 barg [t/h]	11
Exhaust Gas Temperature [°C]	511
NO <sub>x</sub> @ O <sub>2</sub> = 15% [ppm]	15
CO @ O <sub>2</sub> = 15% [ppm]	15

**L20A**



Power Output [kWe]	18,500
Ele. Efficiency [%]	34.3
Sat. steam 8 barg [t/h]	37
Exhaust Gas Temperature [°C]	542
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
Exhaust Gas Temperature [°C]	502
NO <sub>x</sub> @ O <sub>2</sub> = 15% [ppm]	15 / 9
CO @ O <sub>2</sub> = 15% [ppm]	25

# Kawasaki Gas Engine Models

**KG 18V**



**KG 12V**



**KG 18T**



Power Output [kWe]	7,800
Ele. Efficiency [%]	49.5
Exhaust Heat [kWth]	4,000
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 [%]	49.5
Exhaust Heat [kWth]	2,700
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
Exhaust Heat [kWth]	
Exhaust Gas Temperature [°C]	
NOx @ O <sub>2</sub> = 0% [ppm]	250
CO @ O <sub>2</sub> = 0% [ppm]	
Methane number	> 65



# KHI - first in-house-developed 107 MW class CCPP

**17<sup>th</sup> September, 2020 — KHI Ltd. announced the completion for Kashima South Joint Power Corporation (Kamisu City, Ibaraki Prefecture) of 107 MW CCPP.**



**The plant include a cogeneration facility supplying electricity and steam according to demand from surrounding factories.**

# Joetsu Green Power Project for Nihon Techno / J



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



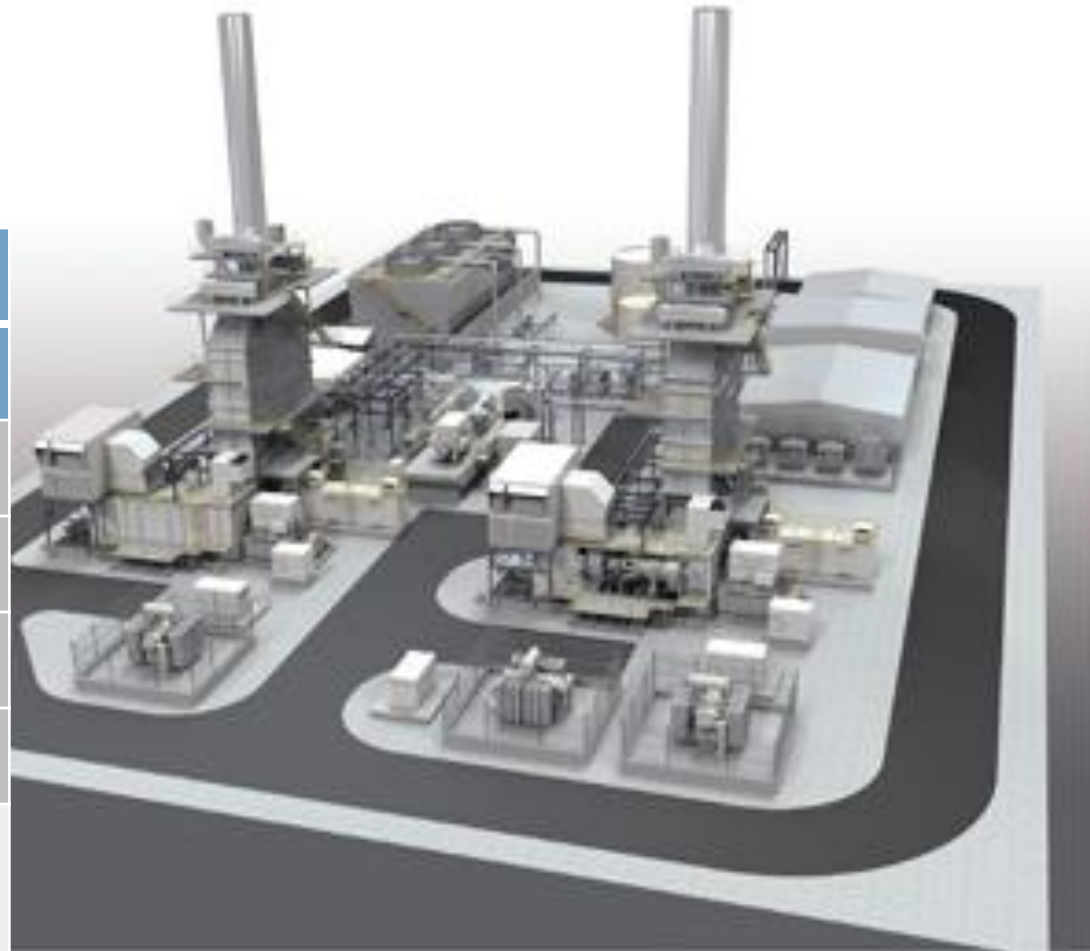
# 100 MW CCPP (standard solution)

**Combined Cycle Performance Data  
(Reference)**

	1 on 1	2 on 1	2 on 1 (Reheat)
CC Electric Output [MW]	44.7	89.9	101.5
CC Heat Rate [kJ/kW-hr]	6,650	6,620	6,520
CC Electrical Efficiency [%]	54.1	54.4	55.2
Number of Gas Turbines	1	2	2

**Condition:**

Inlet Air Temperature: 15 deg-C  
Atmospheric Pressure: 101.3 kPa  
Fuel Type: Natural Gas (100% CH<sub>4</sub>)  
LHV of Fuel: 35.9 MJ/Nm<sup>3</sup>





# KHI MAG Turbo blower

Blowers in aeration process consume approx. 60% of electricity in wastewater treatment plants (WWTP).

**KHI propose the latest and ultra-modern aeration system, which enables enormous energy saving.**

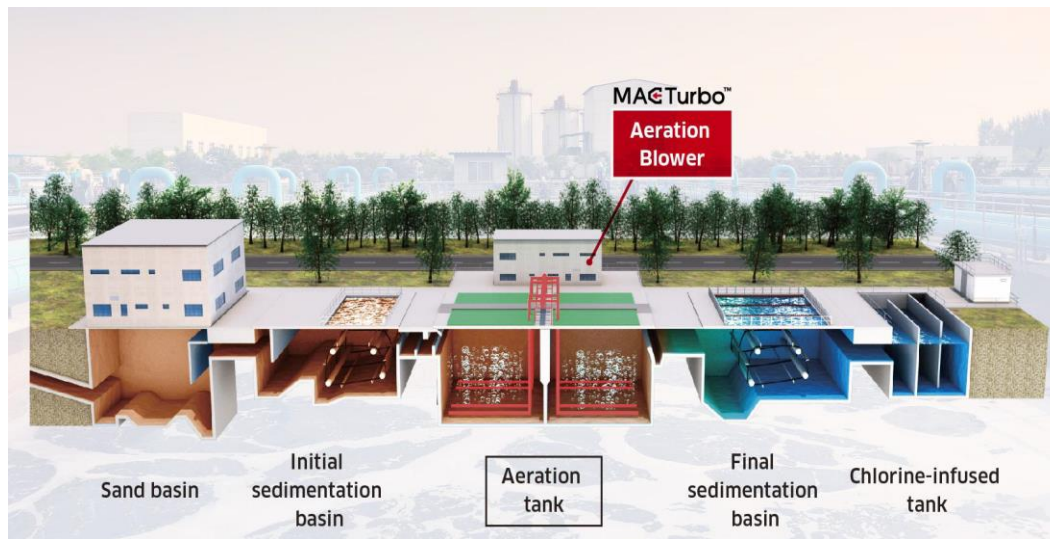


**The key to the enormous energy saving is “Mega MAG Turbo”, the large output aeration blower empowered by magnetic bearing system with world No.1 energy efficiency.**

MAC Turbo™	
High Speed driven Single stage type Turbo Blower with Magnetic Bearing	
Bearing	Magnetic Bearing developed by Kawasaki
Lube. Oil	NOT Necessary
Speed Increasing	Frequency Inverter
Driver	High Speed PM (Permanent Magnet) Motor
Capacity Control	Dual Control (Inlet Guide Vane+Variable Speed)

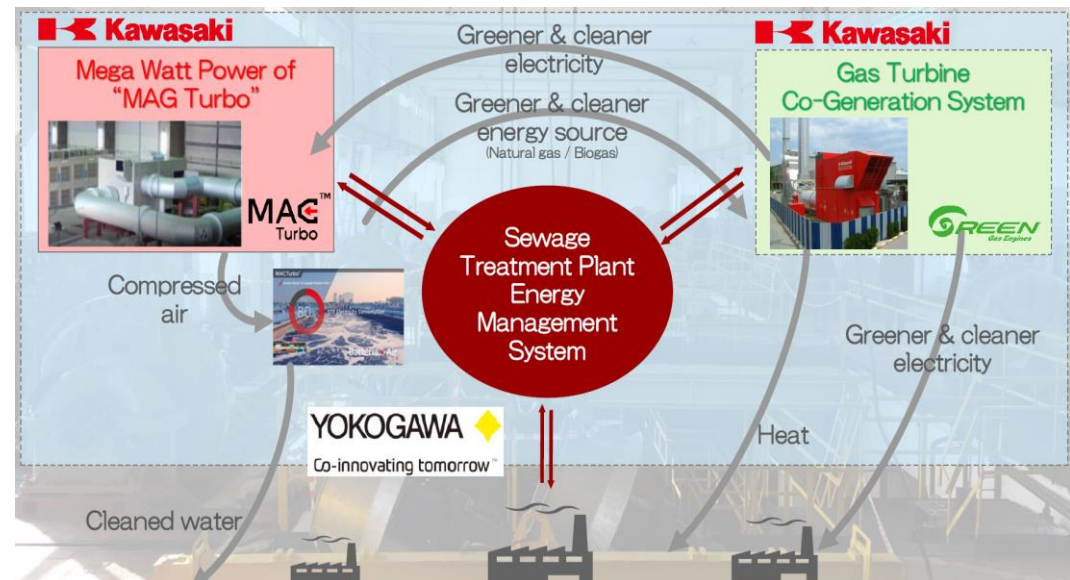


# KHI / KGE – transformation of Waste Water Treatment Plant in Waste Water Energy Center



Wastewater treatment plant can be converted into **"wastewater energy center"**

**A successful cooperation between Kawasaki - Yokogawa**





# Kawasaki Hydrogen Road Map

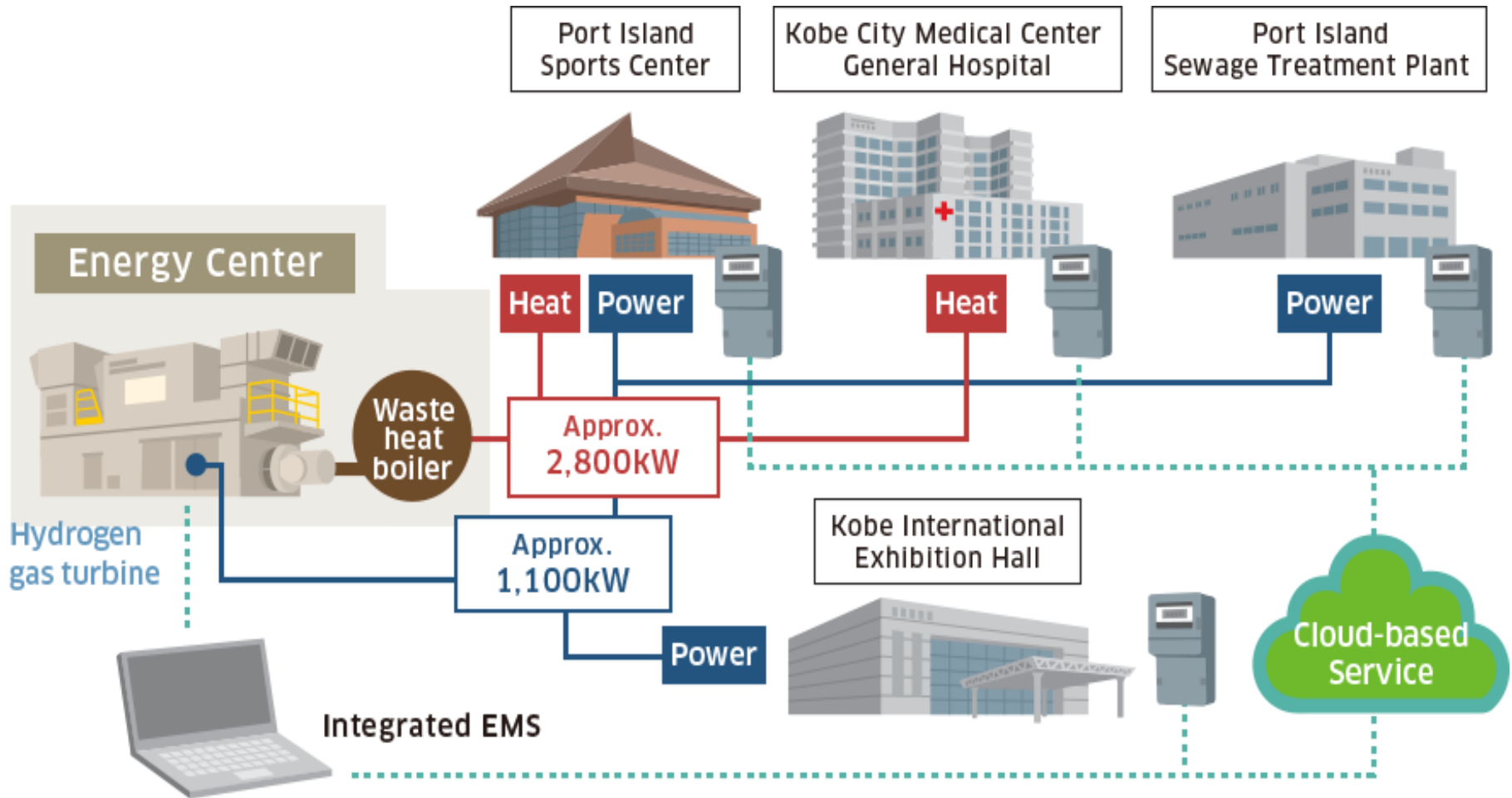
## KOBE city



**Development of Smart Community Technology by Utilization of Cogeneration System with Hydrogen Gas Turbine**

# Kawasaki Hydrogen Road Map

The first attempt in the world to supply electric power and heat generated from hydrogen gas turbine to an actual urban area





# Kawasaki Hydrogen Road Map

**Gas Turbine CHP Plant using  
100% Hydrogen as a fuel**

**Power Generation: 1.7 MWe**



## Partners:

- Obayashi
- Kawasaki
- Kobe City
- KEPCO
- Iwatani
- Osaka University

**Supported by NEDO**



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

# “Global Kawasaki”