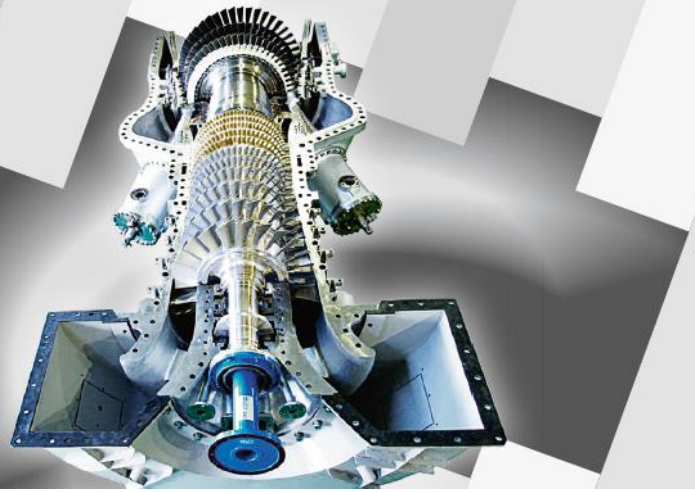
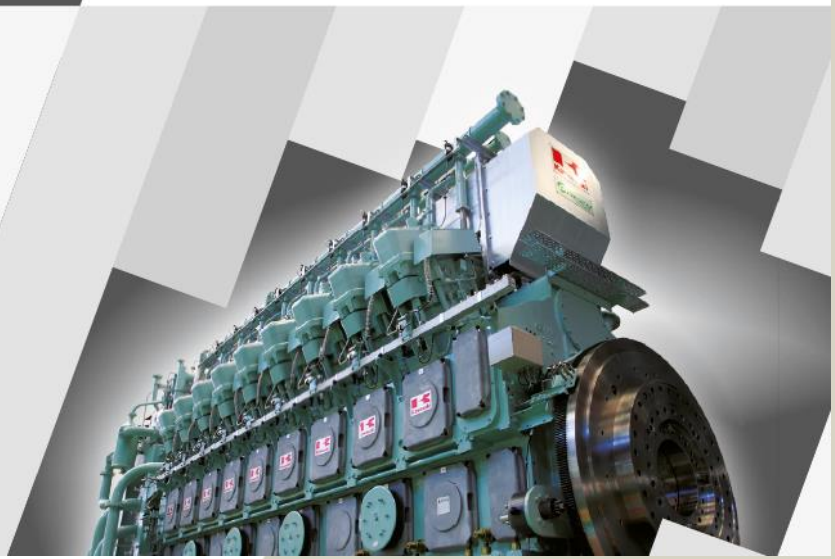
Two Specialists

No Compromise





KAWASAKI Gas Turbine Europe GmbH

CHP and Combined Cycle-Plants

General Company Presentation

Kawasaki
Powering your potential

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**

Planning of cogeneration power plants

Potential clients of cogeneration

- **Industry**

Pulp and paper

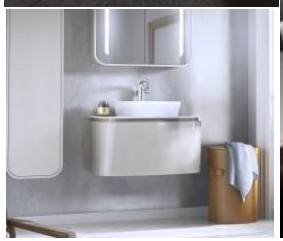
Medicines and cosmetics

Refinery / Chemistry

Food and beverages industry

Automotive and tyres

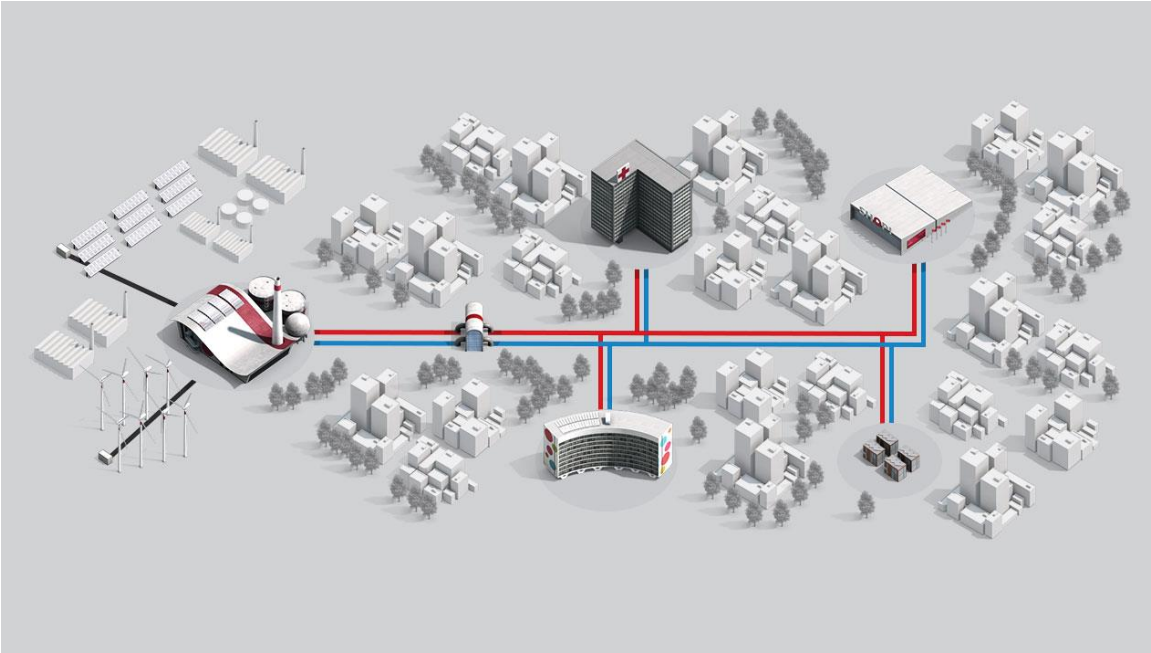
Ceramics



Planning of cogeneration power plants

Potential clients of cogeneration

- **District Heating**



- **Services with own small cogeneration unit:**

Universitary campus **Hospitals** **Hotels** **Airports**

Kawasaki Products & Services

Kawasaki Gas Turbine Europe · Kawasaki Heavy Industries

Products

Gas Turbines	Gas Engines
M1A-17D 1,816 kWel η = 28.1 %	**KG12** 5,200 kWel η = 49.0 %
M5A-01D 4,720 kWel η = 32.6 %	**KG12-V** 5,200 kWel η = 49.5 %
M7A-03D 7,810 kWel η = 33.6 %	**KG18** 7,800 kWel η = 49.0 %
L20A-01D 18,500 kWel η = 34.3 %	**KG18-V** 7,800 kWel η = 49.5 %
L30A-01D 34,300 kWel η = 40.3 %	

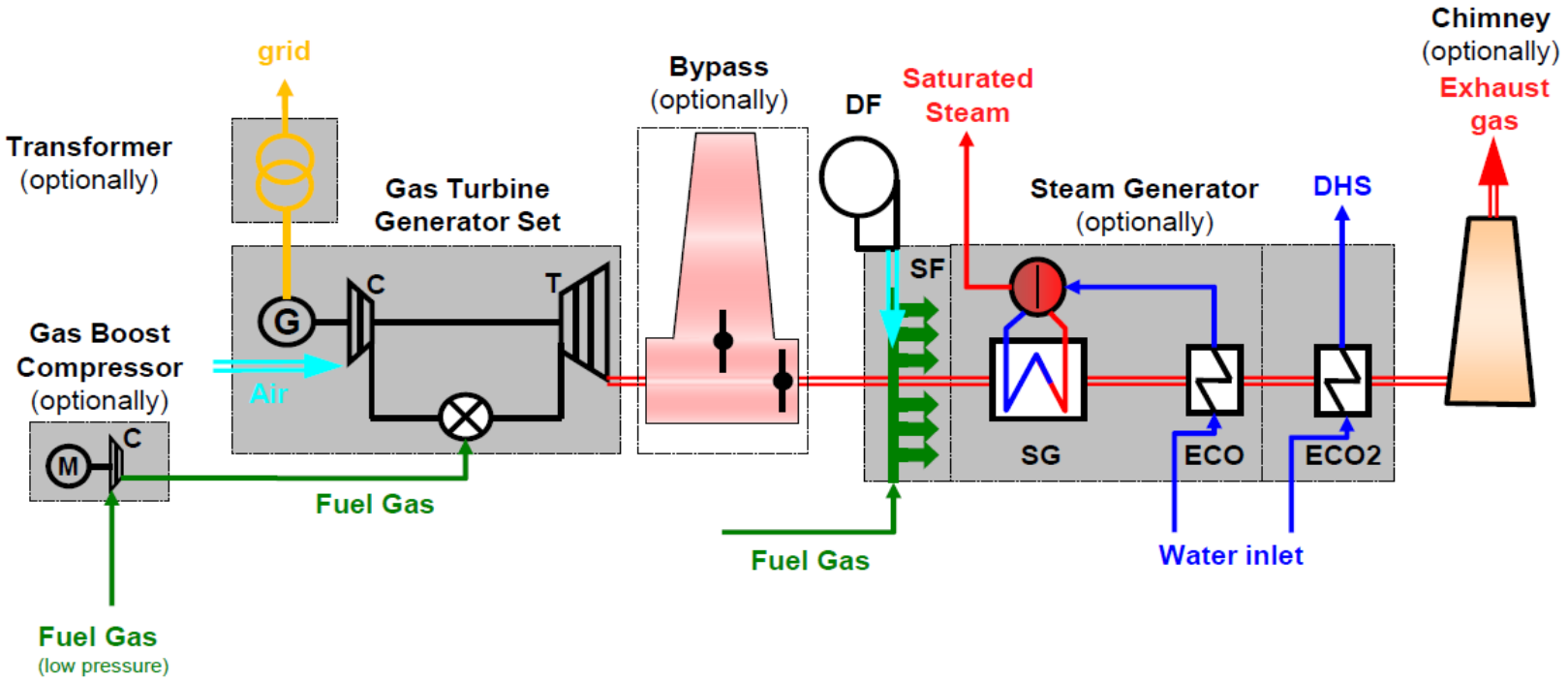
Services

Engineering	Implementation	Maintenance
Concept Engineering	Project Planning	Spare Parts Comsumables
Detailed Engineering	Customized Packaging	Full Maintenance
	Erection Commissioning	Remote Monitoring

Other Services

Low-interest loans
(i.e. governmental loans)

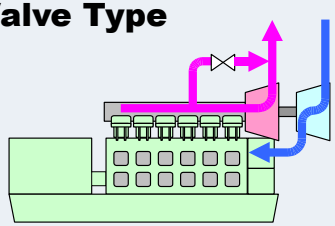
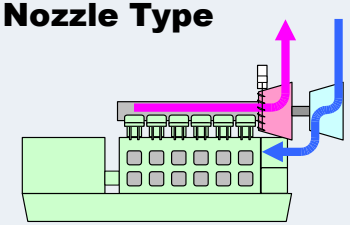
Kawasaki Gas Turbine Europe (KGE) – Scope of Supply



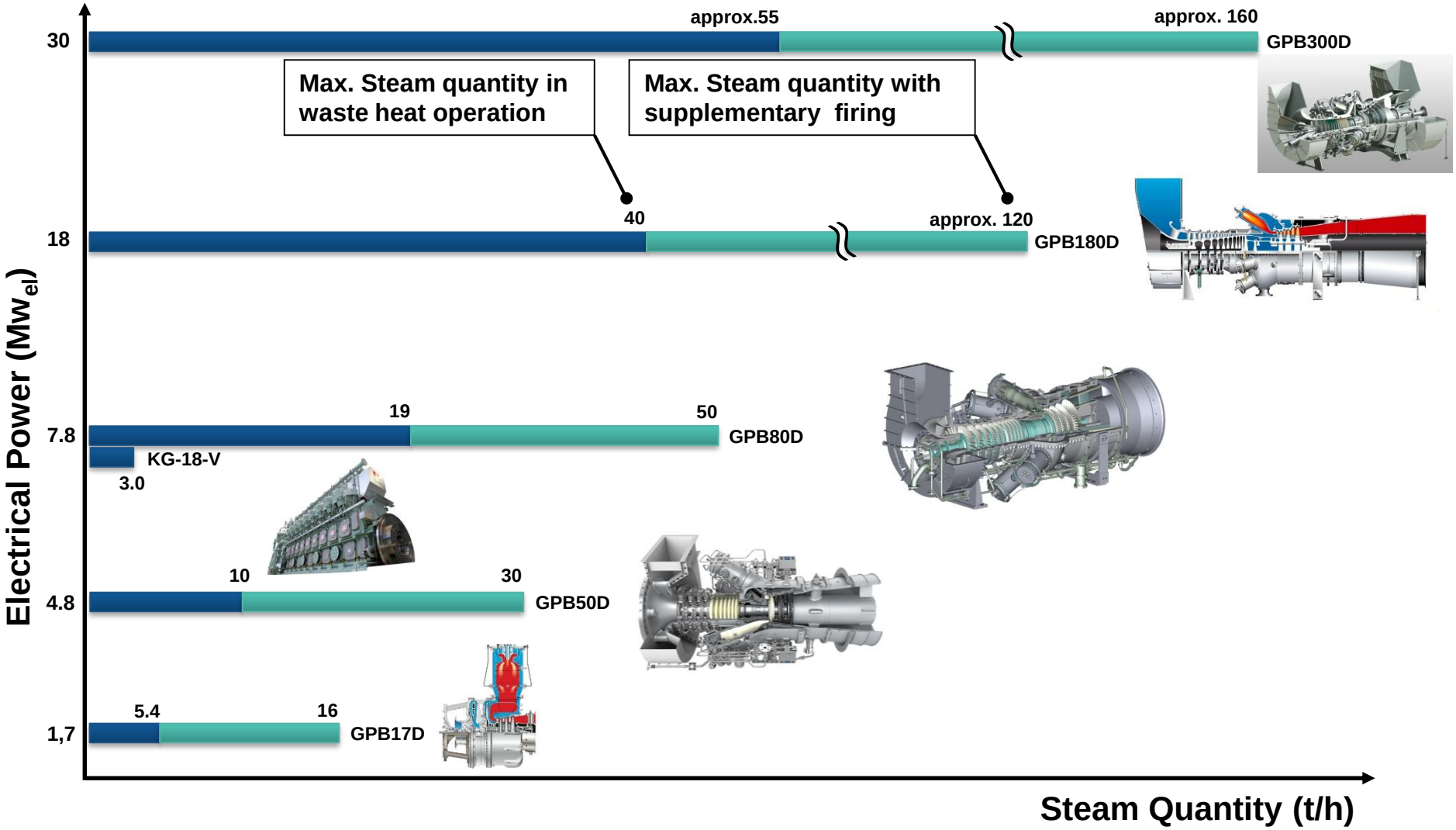
Kawasaki
Powering your potential

Kawasaki Gas Engine Models

High Efficiency and Environmental Performance

Model		KG-12	KG-18	KG-12-V	KG-18-V
Cylinder Bore x Stroke(mm)		300 x 480			
Output (kW)	50Hz/ 750rpm	5,200	7,800	5,200	7,800
	60Hz/ 720rpm	5,000	7,500	5,000	7,500
Heat Rate(kJ//kWh)		7,346 (6,963 BTU / kWh)		7,273 (6,893 BTU / kWh)	
Electrical Efficiency (%)		49.0		49.5	
NOx(ppm)[O2=0%]		200 or Less(at O2=0%)【 57 or Less(at O2=15%) Equivalent 】			
Operating Range		30~100% Load			
Turbocharger Control System		By-Pass Valve Type 		Variable Nozzle Type 	

Performances in CHP



GPB80 example of installation / AGFA (B)

Project background

- Supplementation of steam generation by one GTGS, boilers with supplementary firing

Challenges

- Limited space
- Low noise level for all aggregates
- Combustion air cooler
- Electrical cabinets separate
- Extended scope of supply:
  - Gas Boost Compressor
  - Water tube boiler with ECO2
  - Supplementary firing up to 40 t/h
  - Stainless steel chimney

Project key data

- Commissioning: 08/2011
- Output (electrical, at 11° C): 7,480 kW
- Efficiency$_{\text{(Electrical, terminal, LHV)}}$: 34.4 %

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)

Gas Engine Features

49.5% Electrical Efficiency - The World Best Performance

Achieved excellent electrical efficiency by optimized design of combustion chambers and individual cylinder control

Environmental Friendly

NOx emission : Less than 200 ppm (@O_2 = 0%)

High Partial Load Performance and Wide Continuous Operating Range

Operating range is 30% ~ 100% / Keep high efficiency at partial load

*suitable for peak operation

Quick Start Up

Within 10 minutes to 100% load from start order

*suitable for peak operation

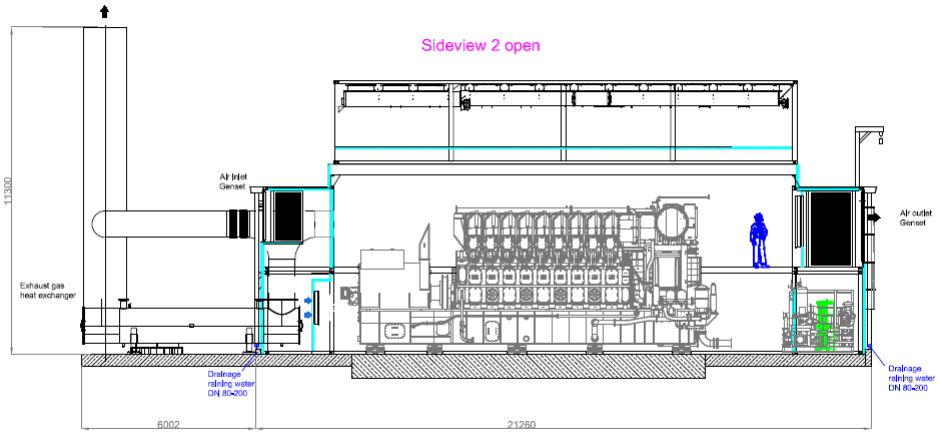
Less Impact by Ambient Conditions

Stable output in hot climates / at high altitude

Construction Period: December 19, 2011 - August 15, 2012

Gas Engine – Container Stack Solution

Under Development

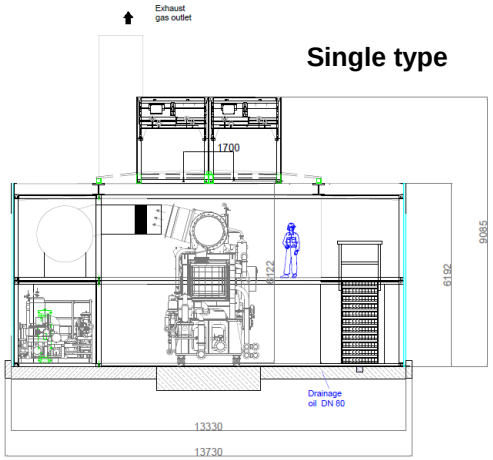


Easy installation

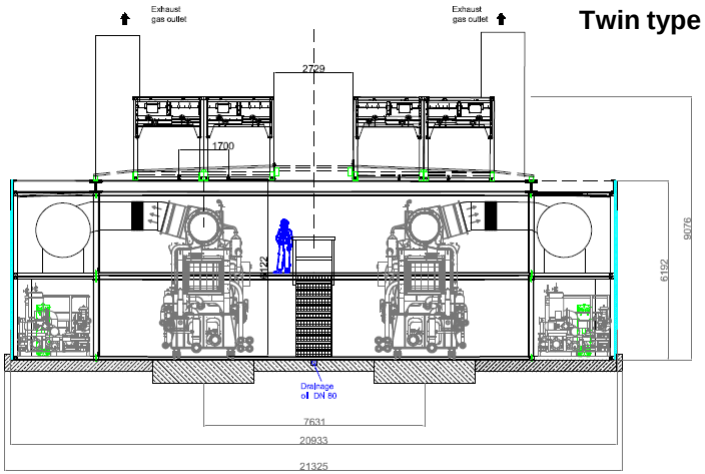
Less Civil work

Shorter site work

Single type



Twin type

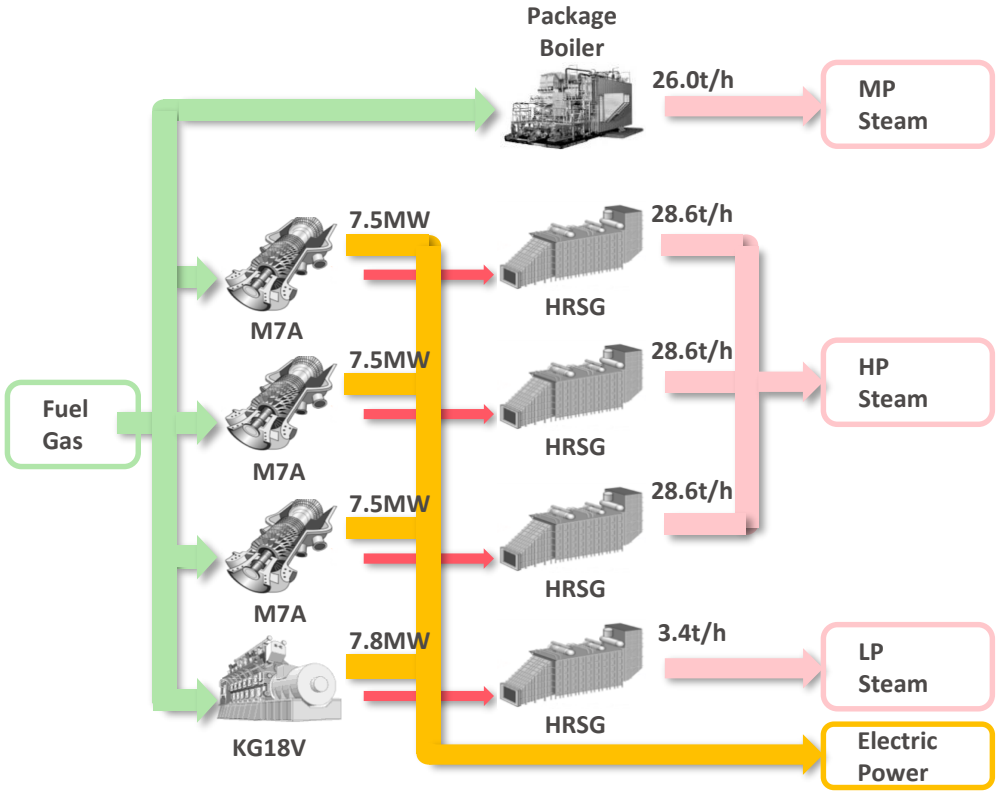


Kawasaki Powering your potential

Hybrid CHP for Chemical Industries (JPN)

Example of installation
GPB80 GT and KG-18 GGE, Japan

CHP Package	GPB80D ＋Gas Engine
Output	M7A（7.5MW）x 3 units KG-18-V（7.8MW）x 1 unit 26t/h Package Boiler



LP : Low Pressure
MP : Medium Pressure

Kawasaki Powering your potential

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”

Kawasaki
Powering your potential