

High Efficient CHP System

Environmentally Friendly & Energy Saving



KAWASAKI Gas Turbine Europe GmbH
CHP System/Gas Turbine & Gas Engine

 **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**



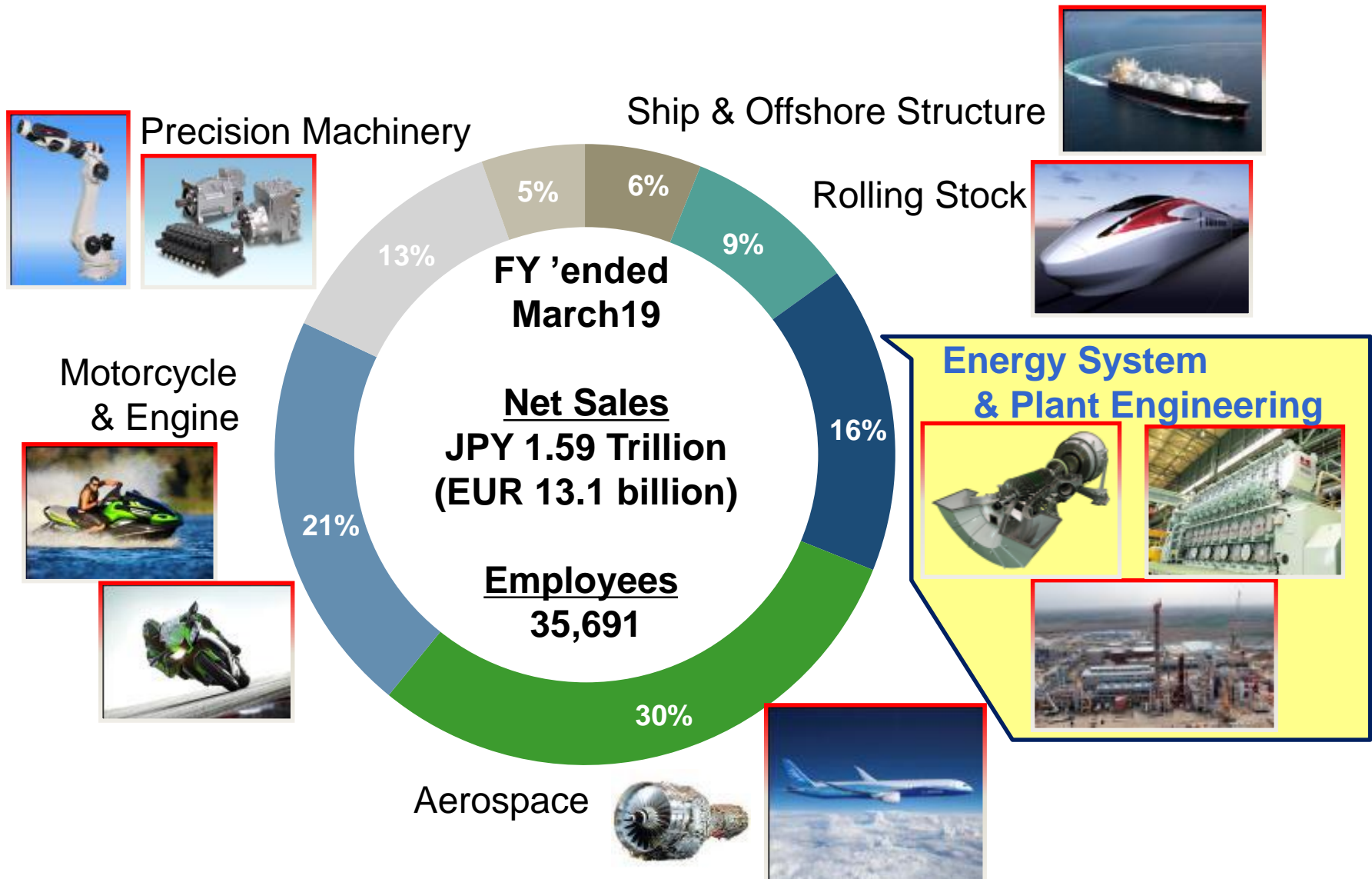
**Kawasaki Gas Turbine Europe GmbH
(Germany)**

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

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

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

Kawasaki Heavy Industries – Product Segment Overview



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*

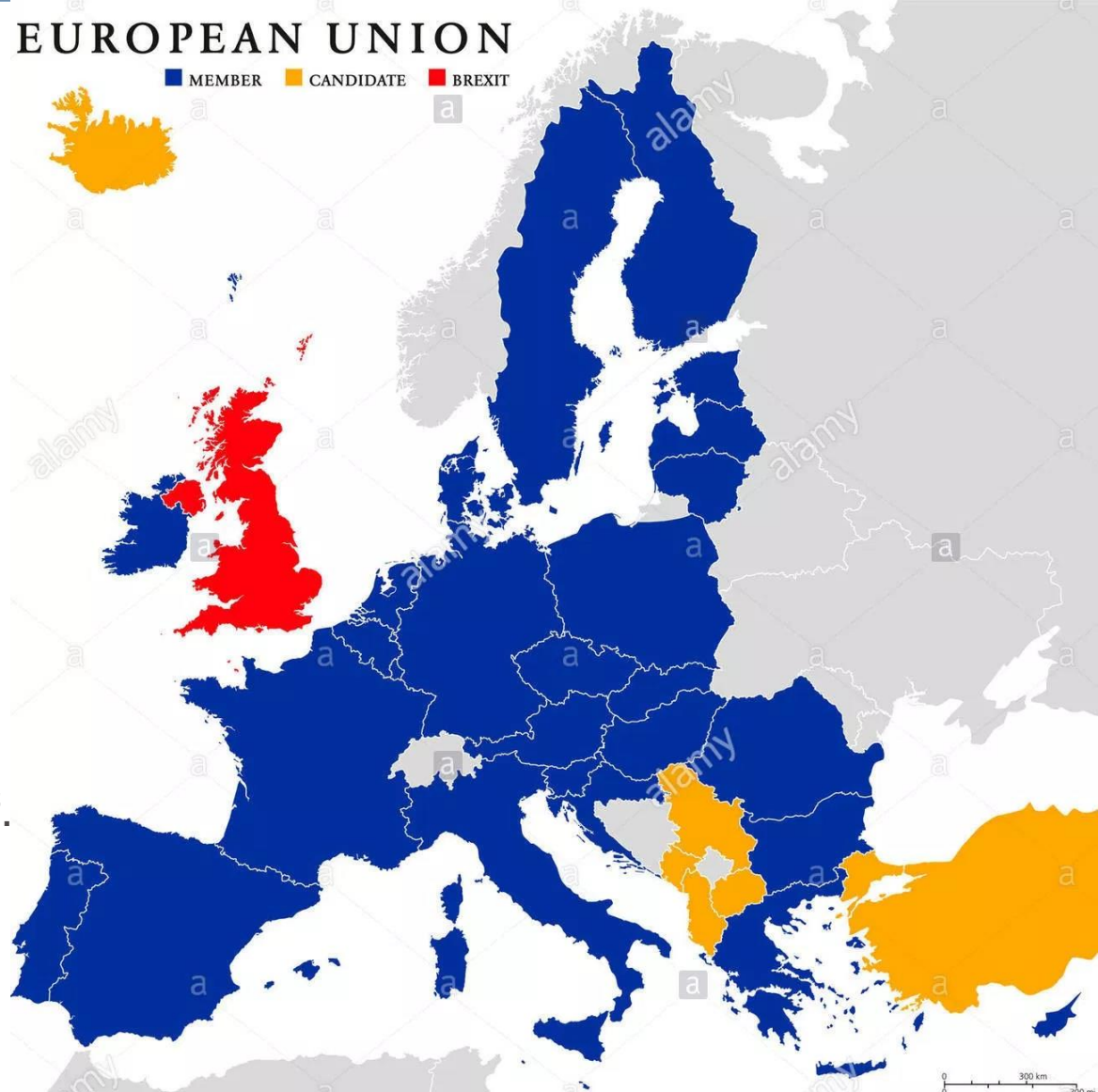
2018 Establishment of Romanian Office in Bucharest

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



European Union context for KGE business

- EU-ETS – reduction of CO₂ emissions;
- 2015 Paris Agreement – greenhouses gas emissions reduction 2020 – 2030, limit global warming to no more than 2 deg. C;
- EU Directive 27/2012 – Energy Efficiency
- Decision 1442/2017 – En. Eff. levels and Emiss. Levels associated with BAT;



Kawasaki's challenge

**How can Kawasaki,
Japanese/German company,
contribute to
such European
environmental policy ?**

EUROPEAN UNION

MEMBER CANDIDATE BREXIT



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**



- **Renewable energy**



Distributed Generator System

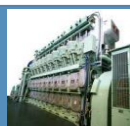
- **Provide highly efficient energy use**
 - **Flexible and reliable**
- to complement unstable renewable energy**

Kawasaki Products & Services

Kawasaki Gas Turbine Europe · Kawasaki Heavy Industries



Products



Services

Gas Turbines

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

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

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

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

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

Gas Engines

KG12
5,200 kWel
 $\eta = 49.0 \%$

KG12-V
5,200 kWel
 $\eta = 49.5 \%$

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

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

Engineering

Concept Engineering

Detailed Engineering

Implementation

Project Planning

Customized Packaging

Erection Commissioning

Maintenance

Spare Parts Consumables

Full Maintenance

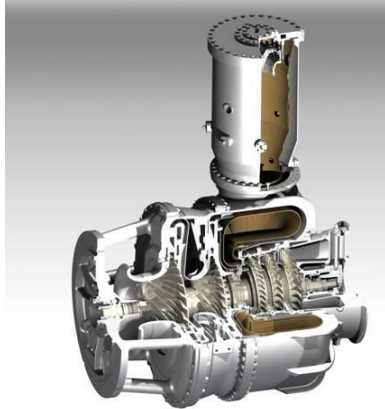
Remote Monitoring

Other Services

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

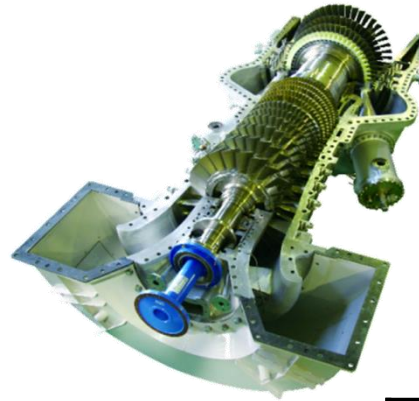
Kawasaki Gas Turbine Engine Models

M1A-17D



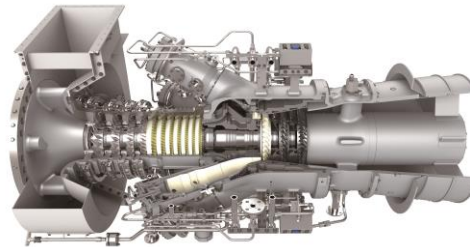
	M1A-17D
Electric Output[kWe]	1,816
Ele. Efficiency[%]	28.1
Exhaust Gas Temperature[degC]	522

M7A-03D



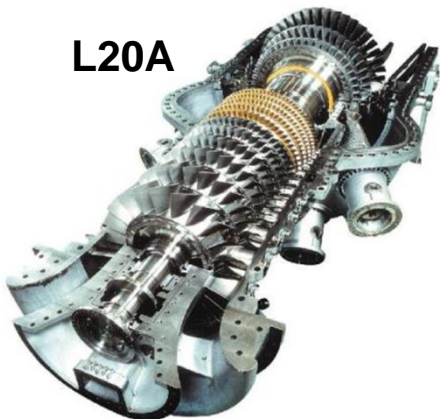
	M7A-03D
Electric Output[kWe]	7,810
Ele. Efficiency[%]	33.6
Exhaust Gas Temperature[degC]	523

M5A-01D



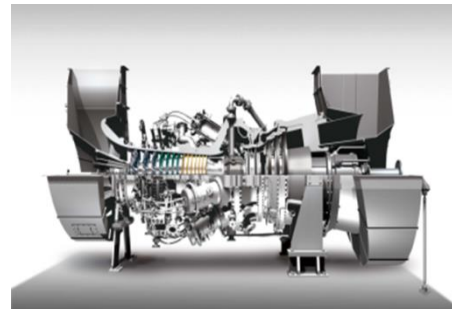
	M5A-01D
Electric Output[kWe]	4,720
Ele. Efficiency[%]	32.6
Exhaust Gas Temperature[degC]	511

L20A



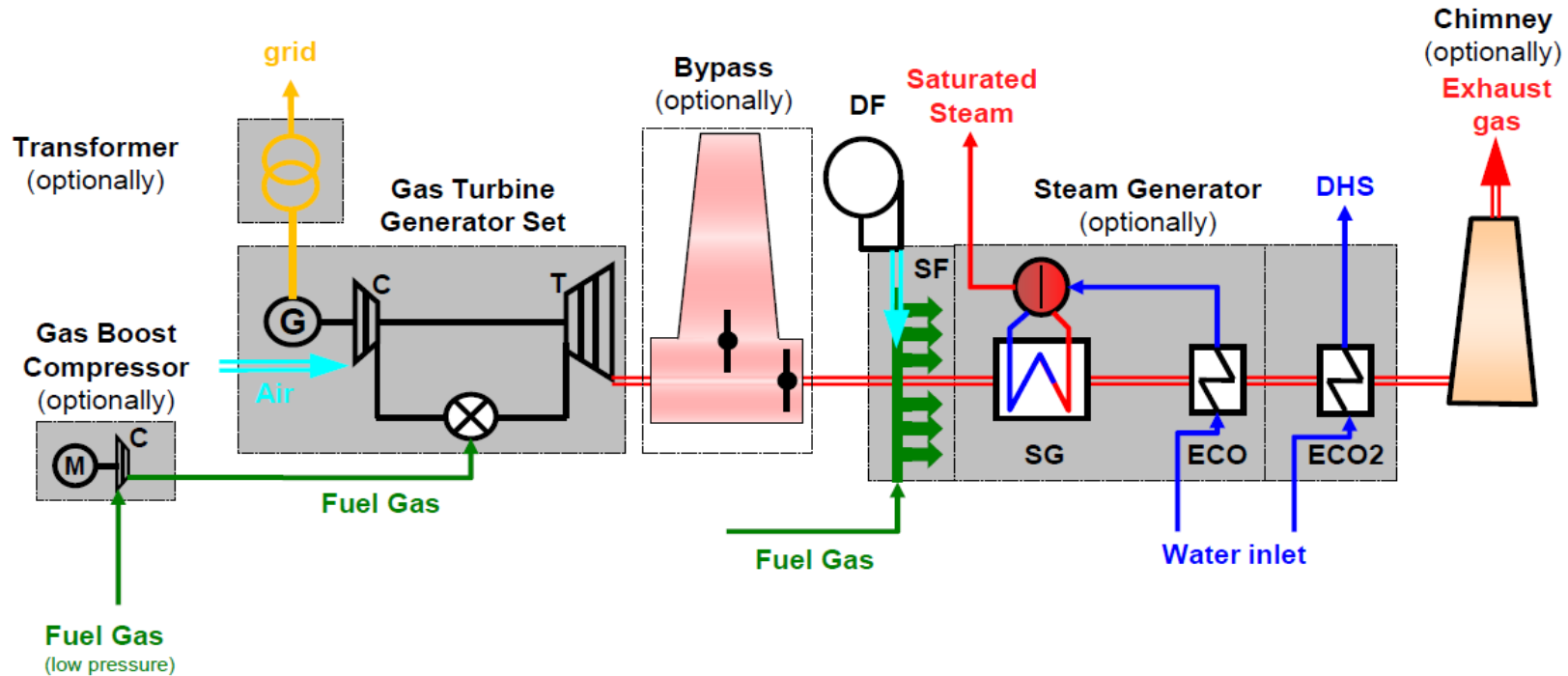
	L20A
Electric Output[kWe]	18,500
Ele. Efficiency[%]	34.3
Exhaust Gas Temperature[degC]	542

L30A



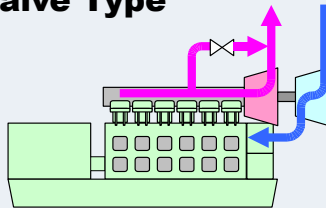
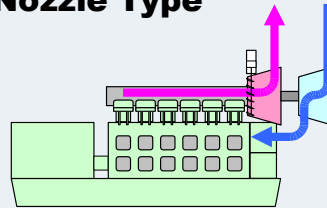
	L30A
Electric Output[kWe]	34,380
Ele. Efficiency[%]	40.3
Exhaust Gas Temperature[degC]	502

Kawasaki Gas Turbine Europe (KGE) – Scope of Supply

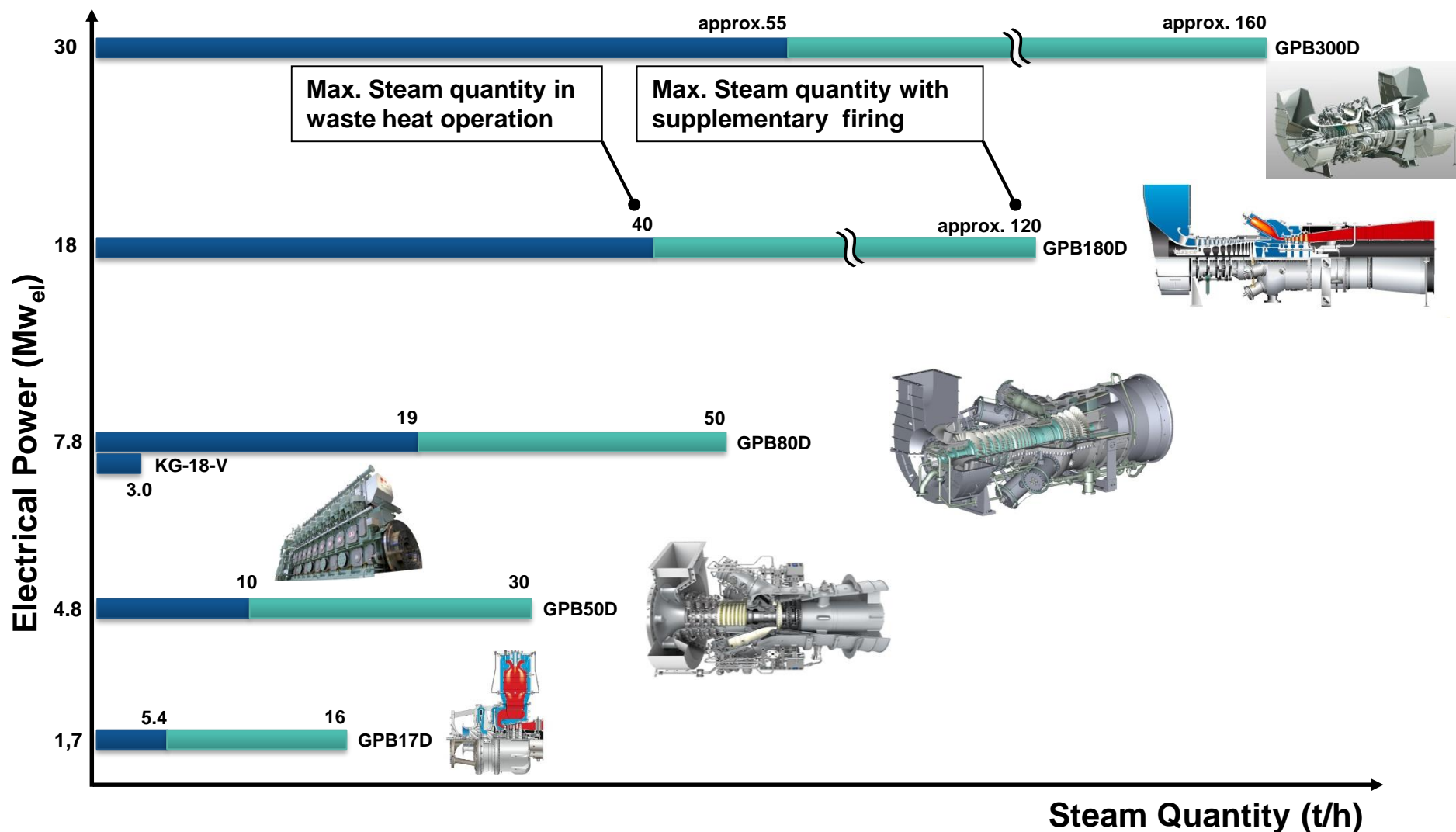


Kawasaki Gas Engine Models

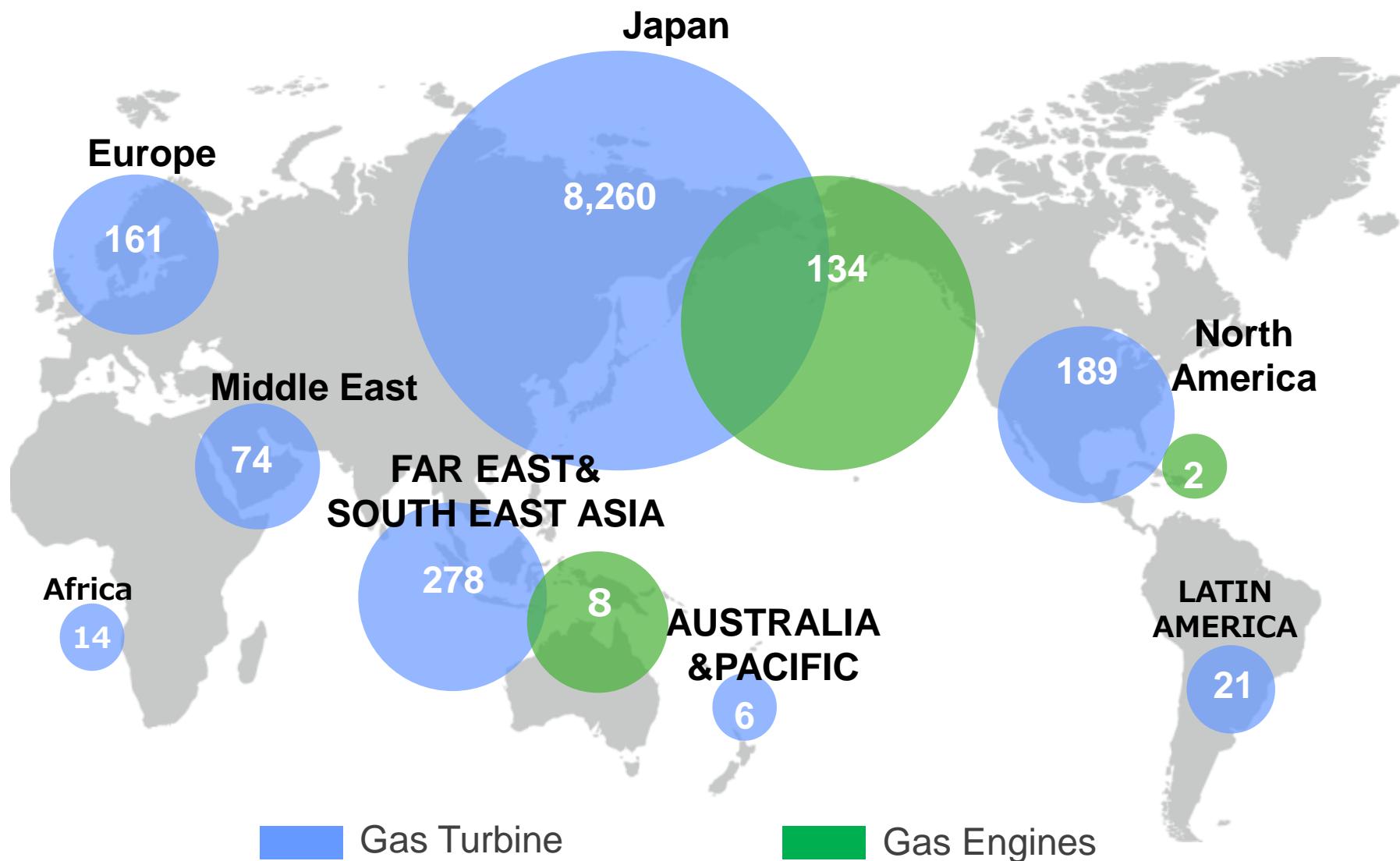
High Efficiency and Environmental Performance

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



Installations Records (as of 04.2018)



※ Far East Russia is included in Europe.

GPB17 example of installation /P Kelco Großenbrode (D)

Project background

- Supplementation to existing conventional boilers with Steam turbine

Challenges

- Maritime climate
- First GPB17 with 9 ppm NOx-System in Europe
- Low sound level of 65dB(A) because of tourist region
- Extended scope of supply:
 - gas boost compressor
 - Re-cooling system

Project key data

- Commissioning: September 2014
- Output (electrical): 1,735 kW at 10° C
- Efficiency (Electrical, terminal, LHV): 26.7 %



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 _{(Electrical, terminal, LHV):} | 34.4 % |

Fuji Power Plant for Shizuokagas and Power Company /J



**Domestic
dispersed
power system**

**Model
KG-18-V**

**Unit Output
7,800kW**

**No. of Unit
2**

**Total Output
15.6MW**

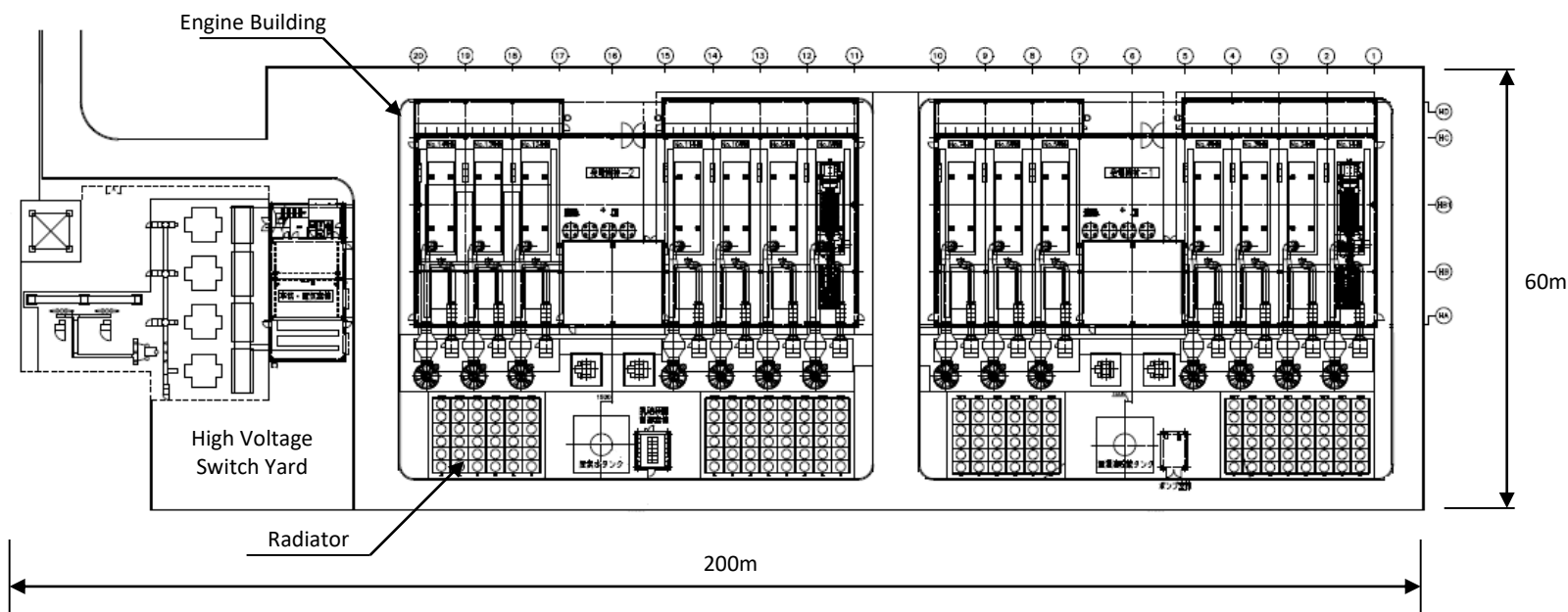
Joetsu Green Power Project for Nihon Techno / J



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

Joetsu Green Power Project for Nihon Techno / J

Model	KG-18-V
Output	7,800kW
Unit	14
Total Output	109.2MW
Operation Start	August 2012

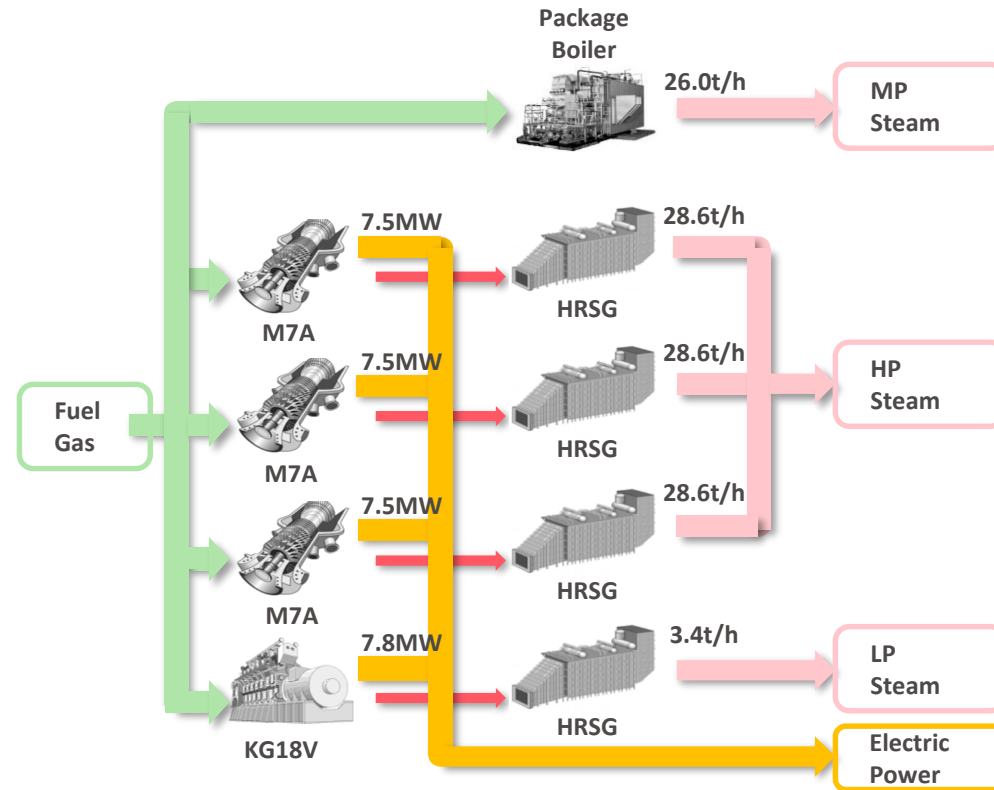


Hybrid CHP for Chemical Industries (JPN)

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

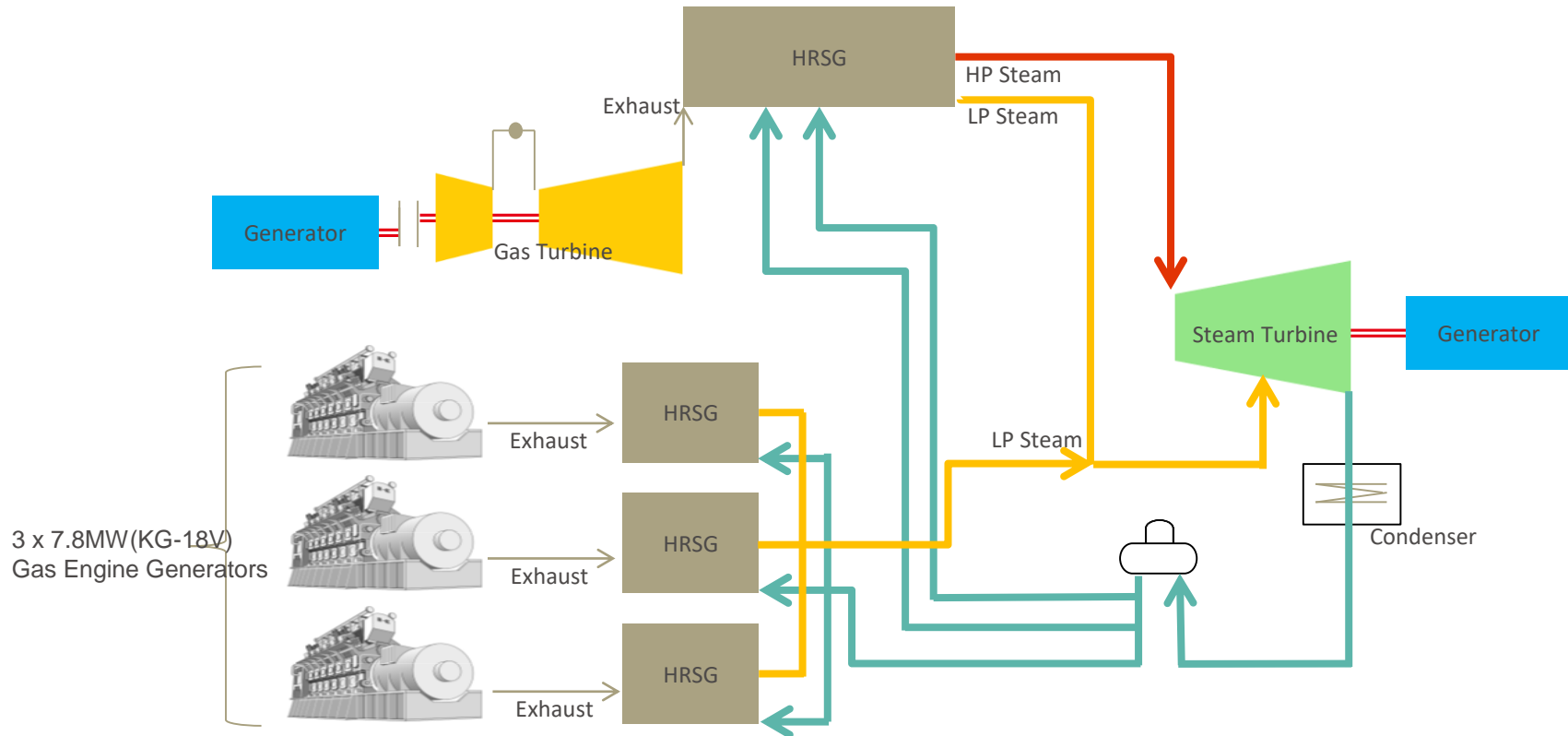


LP : Low Pressure
MP : Medium Pressure

Hybrid CHP for Industrial Park (THA)

Optimal Configuration for load alteration (Peak/Off-peak) By Hybrid Combined Cycle (Gas Turbine & Gas Engines + Steam Turbine)

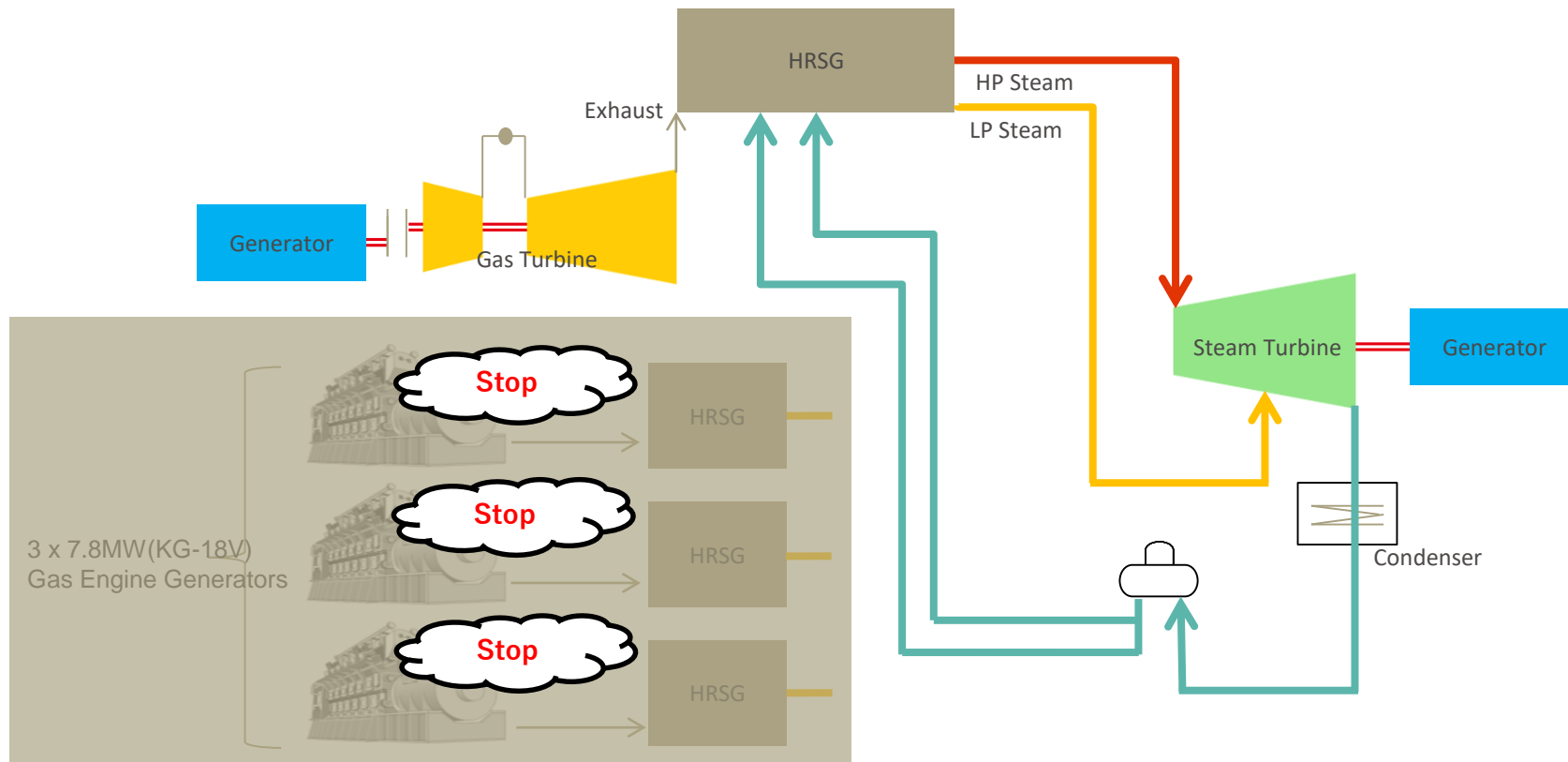
~Peak (Day) Time~



Hybrid CHP Reference for Industrial Park (THA)

Optimal Configuration for load alteration (Peak/Off-peak)
By Hybrid Combined Cycle (Gas Turbine & Gas Engines + Steam Turbine)

~Off-Peak (Night) Time~



Kawasaki Hydrogen Road Map

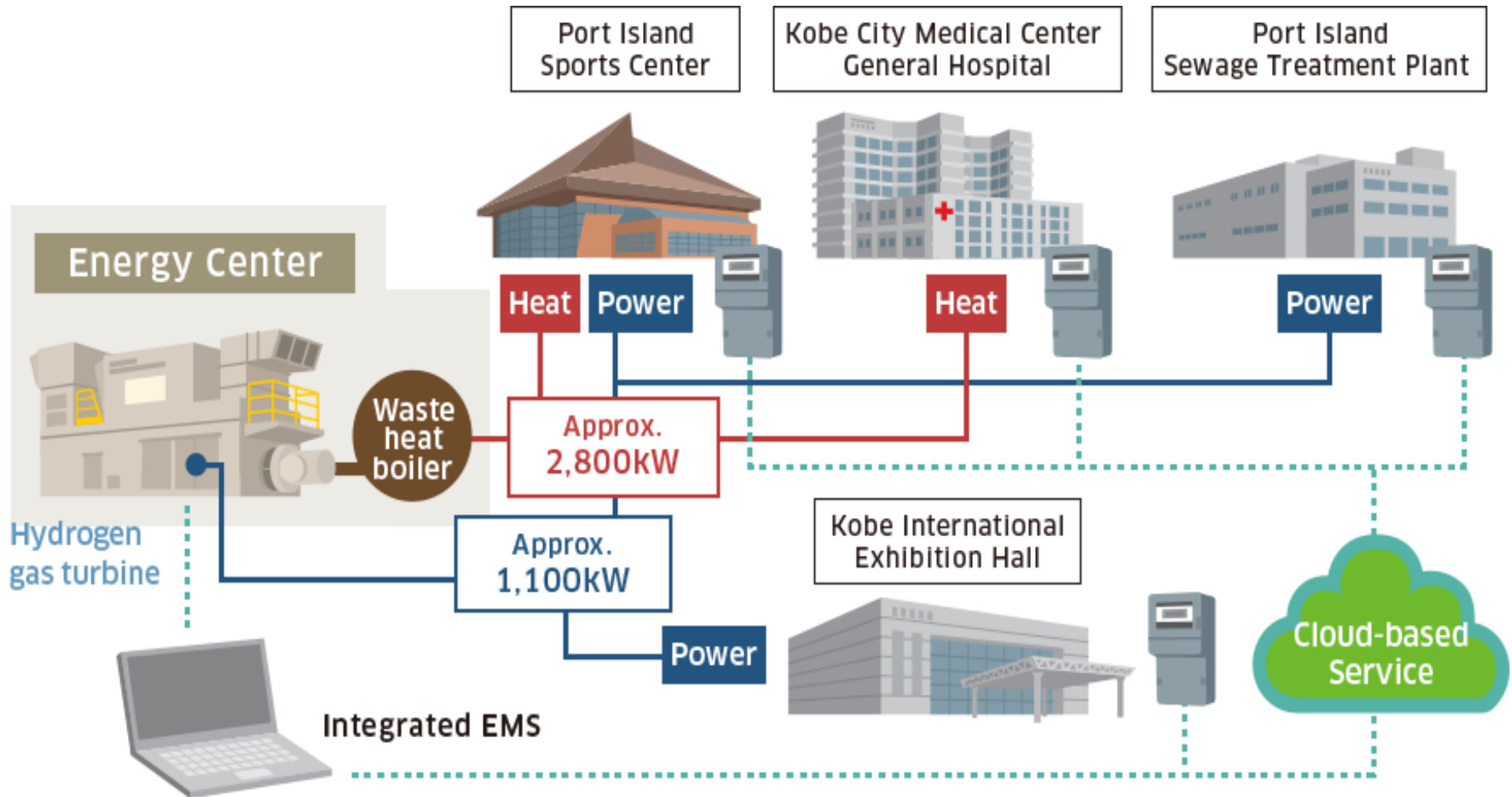
KOBE city



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”