KAWASAKI
Boiler and Absorption Chiller for Co-generation system

14 November, 2018

Kawasaki Thermal Engineering Co., Ltd.
Overseas Project Department

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Organization of Kawasaki

Kawasaki

- Ship & Offshore Structure
- Rolling Stock
- Aerospace System
- Energy System & Plant Engineering
- Motorcycle & Engine
- Precision Machinery & Robot





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Boiler

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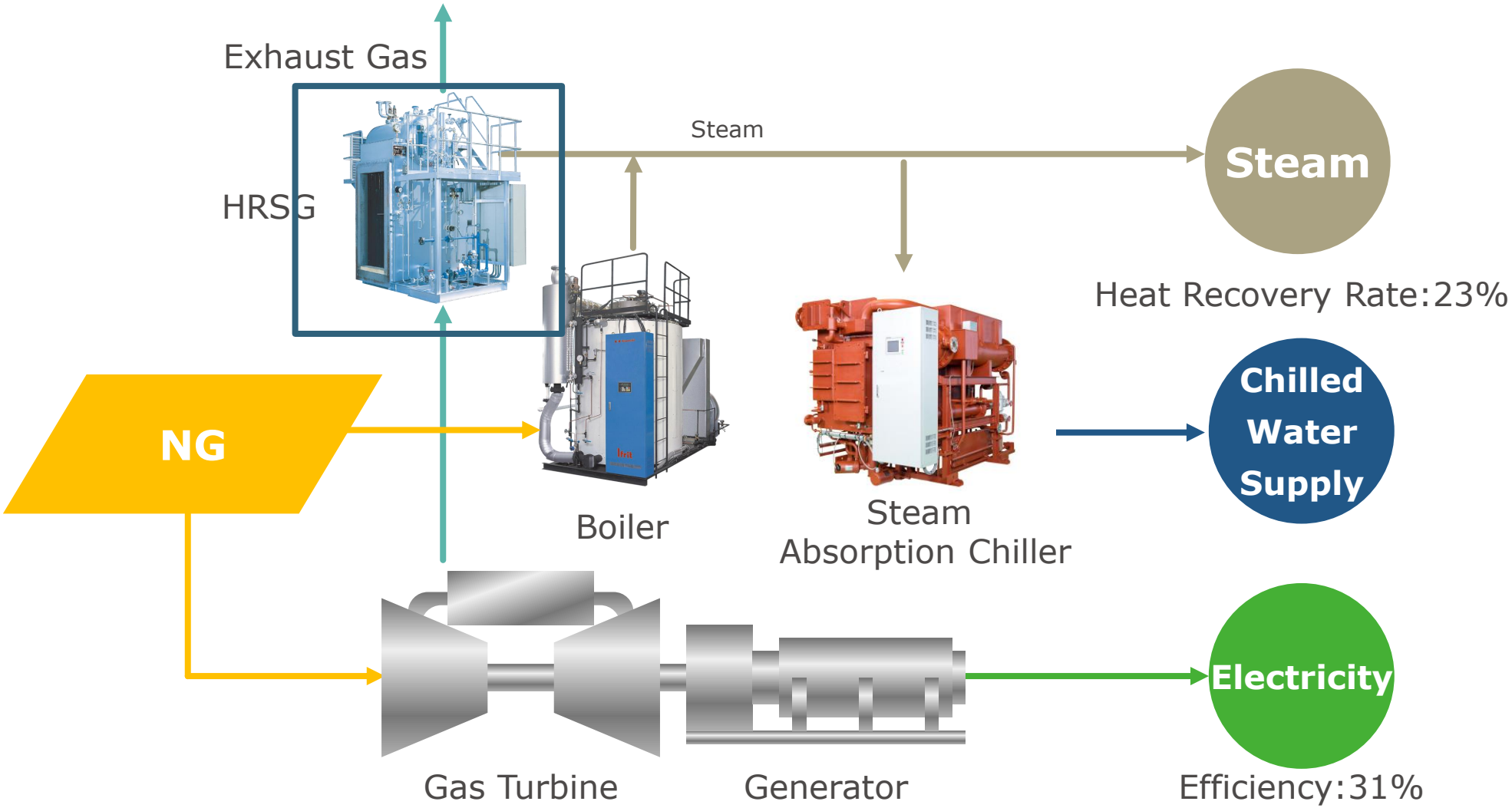
Gas Turbine Cogeneration System

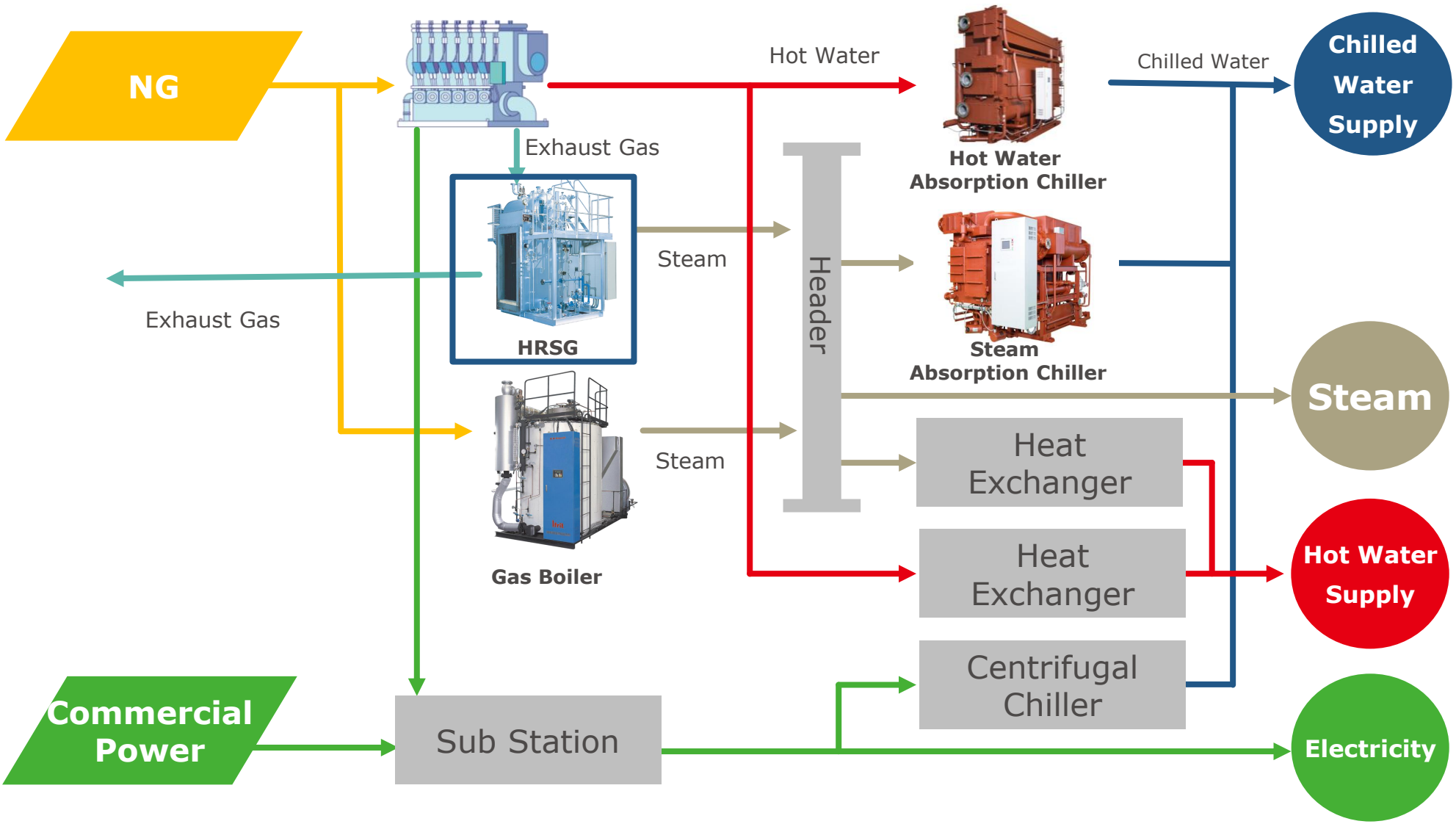


Heat Recovery Steam Generator (Water Tube Type)

Boiler planning (For example)

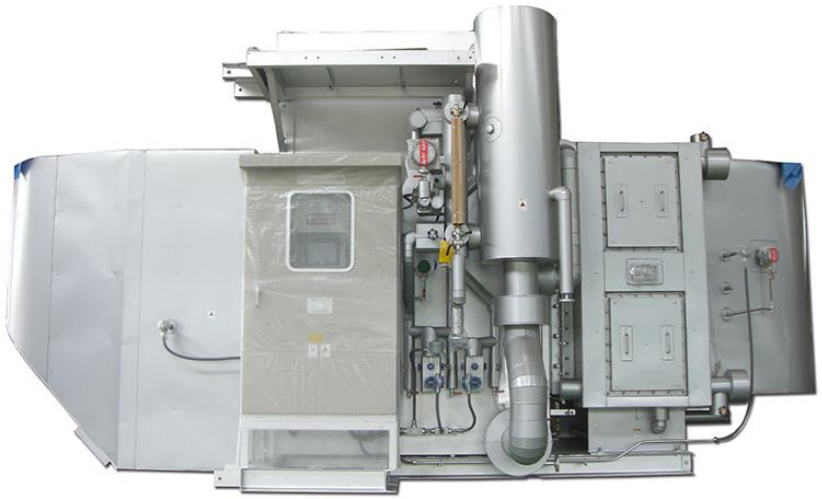
GT Model		GPB17D	GPB80D
Boiler Model		RGB-60GE	RGB-200GE
GT outlet exhaust gas amount	m^3_N/h	22,637	76,132
GT outlet exhaust gas temp.	Deg C	525	525
Drum pressure	MPaG	0.83	1.68
Feed water temp.	Deg C	60	60
Boiler inlet exhaust gas amount	m^3_N/h	22,637	76,132
Boiler inlet exhaust gas temp.	Deg C	525	525
Economizer outlet exhaust gas temp.	Deg C	114	123
Steam output	kg/h	5,150	16,900

Gas Engine Cogeneration System



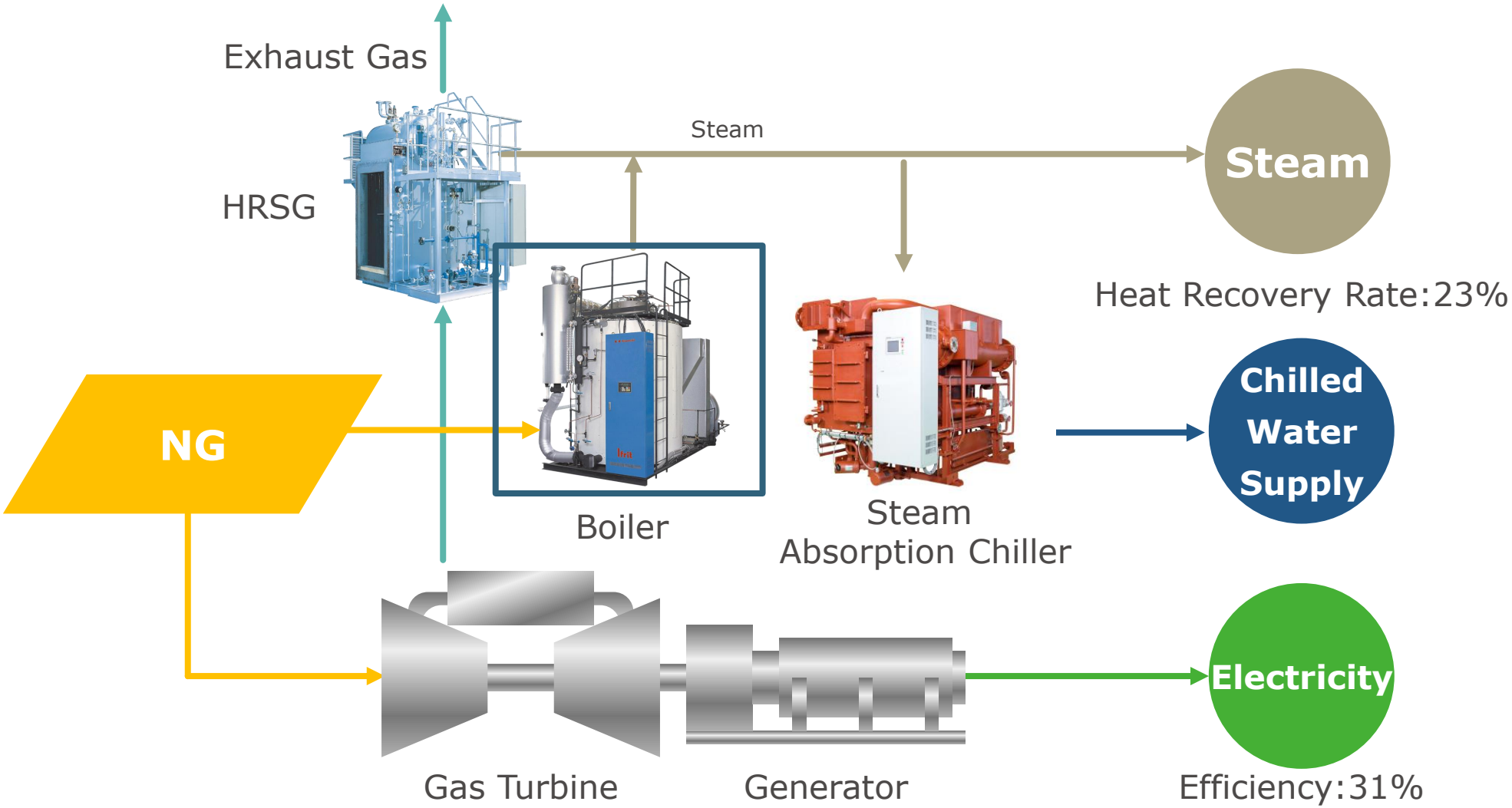
Heat Recovery Steam Generator (Once Through)

Boiler planning (For example)



- **GE model**
  KAWASAKI KG-18-V
- **Boiler model**
  RF-40GKE
- **Boiler inlet exhaust gas**
  35,800m^3_N/h at 320℃
- **Pressure**
  0.80MPa
- **Steam output**
  3,190kg/h at 60℃

Gas Turbine Cogeneration System



Once Through Boiler "IF Series"

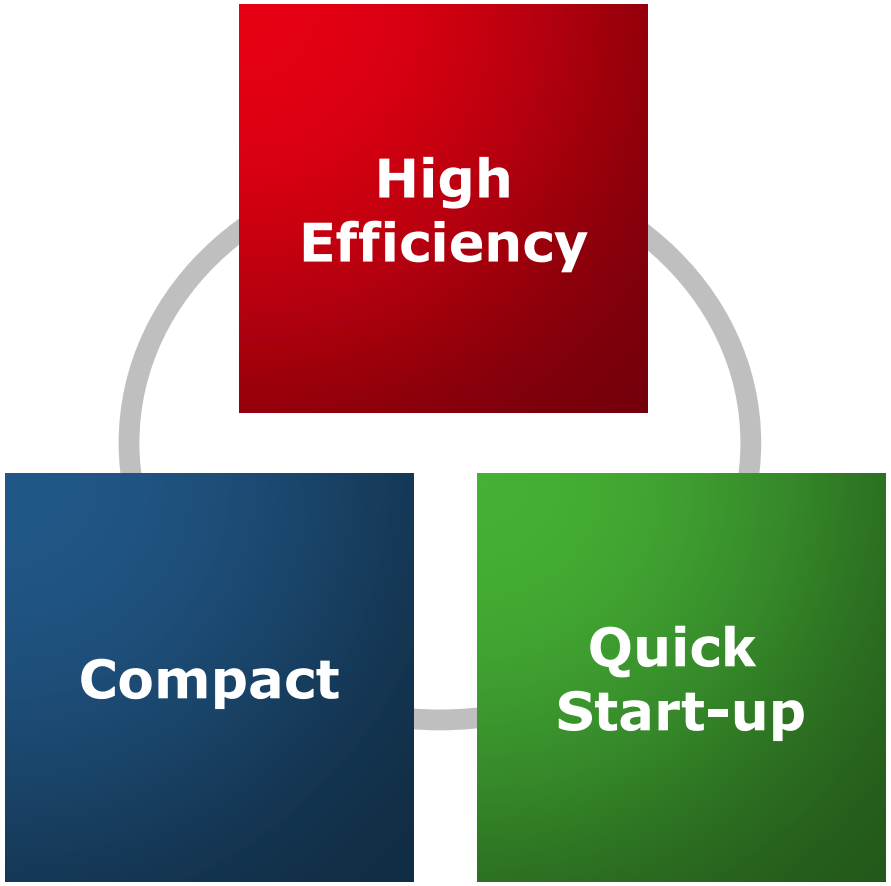
A Comparison of KTE's Line-up Boiler

		Water Tube	Fire Tube	Once-through (KF)	Once-through (IF)
Actual Evaporation	t/h	5	5	1.68×3	5
Weight	ton	12	11.5	2.4×3=7.2	7.8
Retained Water Volume	**L/t**	3,000	6,000	275×3 =825	**990**
Cold start Advantage	**Min**	40	40~60	10	**15**
Control	Combustion	Continuous		Intermittent (3 positions)	Continuous
	Water Feeding	Continuous		Intermittent (2 positions)	Continuous
Heating Surface Area		1,174	693	106×3=318	317
Max. Boiler Efficiency (%)		94	92	98	**98**
Dimension (m2)		25	12.6	2.5×3=7.5	7.3

Note) The boiler efficiency is indicated on the steam pressure of 0.49Mpa, the feed water temperature of 15 deg C and the room temperature of 35 deg C. The boiler efficiency shall have +/-3% allowance in concideration of the mesurement tolerance.

Summaries (1)

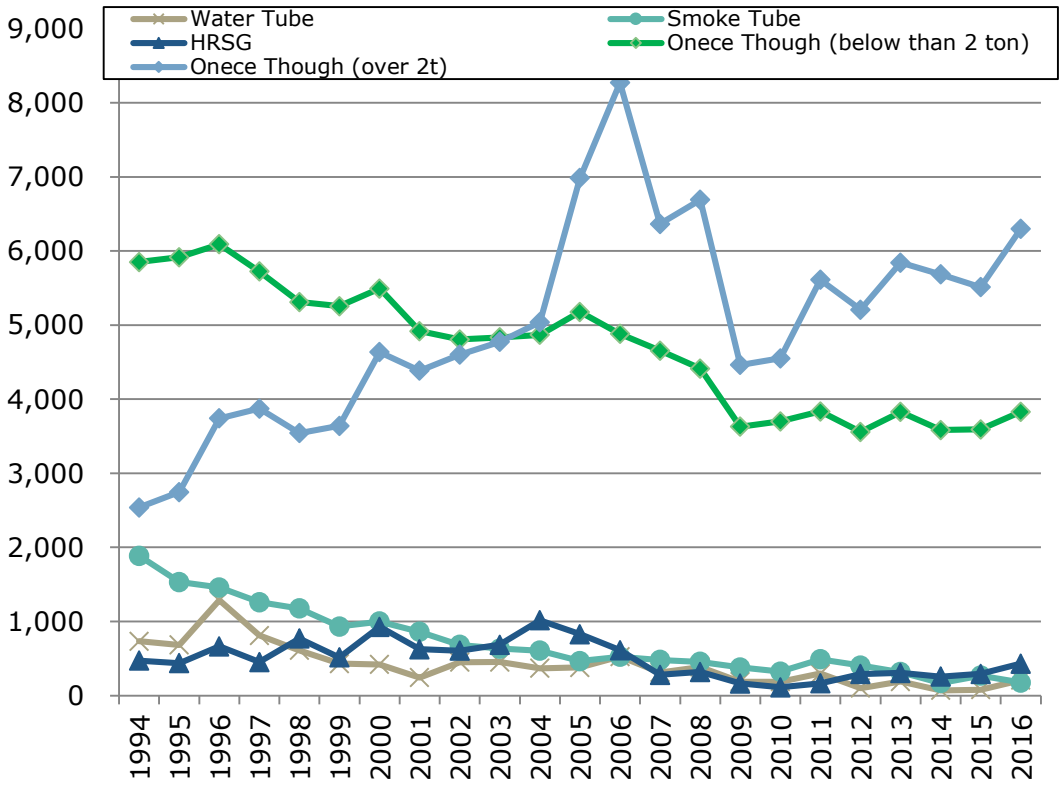
Why is Once-through Boiler popular in Japan?

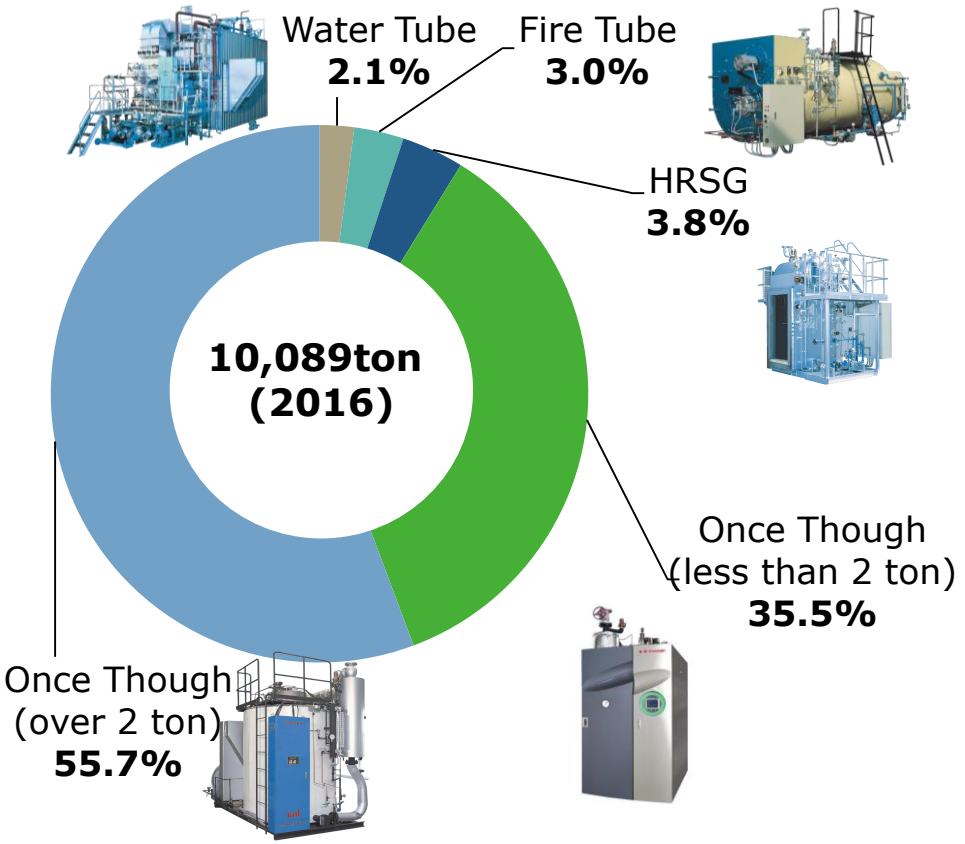


Once Through Boiler "IF Series"

1.Capacity	2.5 ~ 5 t/h	Big Once-through Boiler
2.Maximum Working Pressure	0.98 / 1.56 / 1.96/ 3.2 MPa	
3.License	Not required in Japan	
4.Efficiency	98% for Gas Fired, 95% for Oil Fired (with Economizer)	
5.Control	PI Control (with de-aeration device)	Pressure Fluctuation: ±0.01 MPa Range of combustion：30~100%(Oil) 17~100%(Gas)
6.Life Cycle	More than 15 years	De-aeration device, PI combustion
7.Steam Dryness	More than 99.5%	Equivalent Performance & High dryness
8.Option	☆Harmonized Multi-Control for more than 2 Boilers ☆100% Drain Recovery at high pressure	

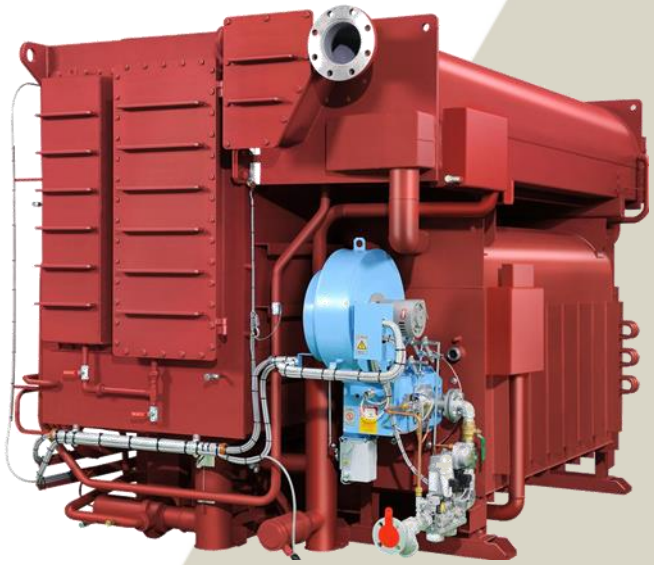
Boiler Market Trend in Japan





#Japan Boiler Association Market database

Absorption Chiller



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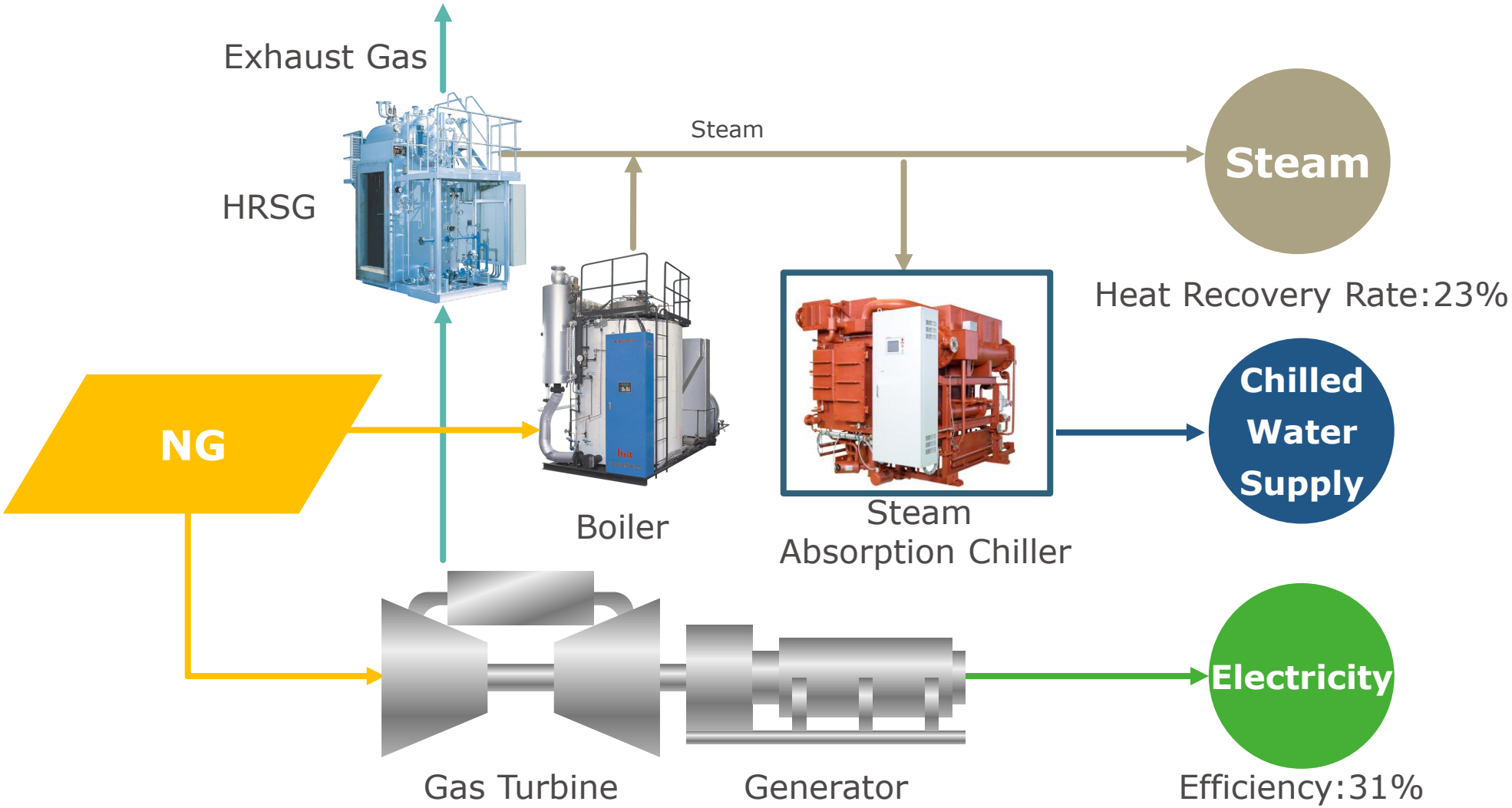
Gas Turbine Cogeneration System



Absorption Chiller “Efficio”

Kawasaki had developed the highest efficient absorption chiller in the world in 2013

COP	Direct Fired			Gene-Link Gas & Hot Water	Steam
	Gas	Diesel	Dual (Gas & Diesel)		
1.51	NZG	—	—	NZJ	—
1.43	NHG	—	—	NHJ	—
1.39	NUG	NUK	NUC	—	NES 3.8kg/h•RT
1.33	NEG	NEK	NEC	—	—

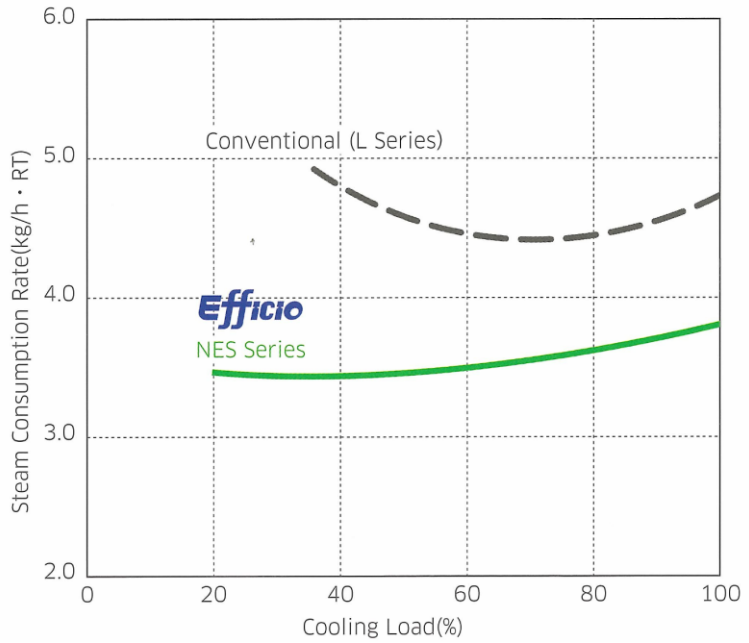
Note) COP is based on LHV

Efficio

Steam Absorption Chiller “Efficio”

The Efficio delivers high annual operational efficiency by adopting a parallel-flow, solution inverter control and larger absorbent solution storage tank. These features ensure excellent efficiency across the full range of load conditions, contributing to greater energy savings.

Partial Load Characteristics



Cooling water inlet temperature conditions are as specified by the JIS standards (32℃ at 100% load, 27℃ at 0% load, with the temperature varying proportionally at loads between 0% and 100%).

The Efficio employs below items
for highly efficient operation at partial load.

Parallel Flow

Parallel flow can be operated with high efficiency at partial load.

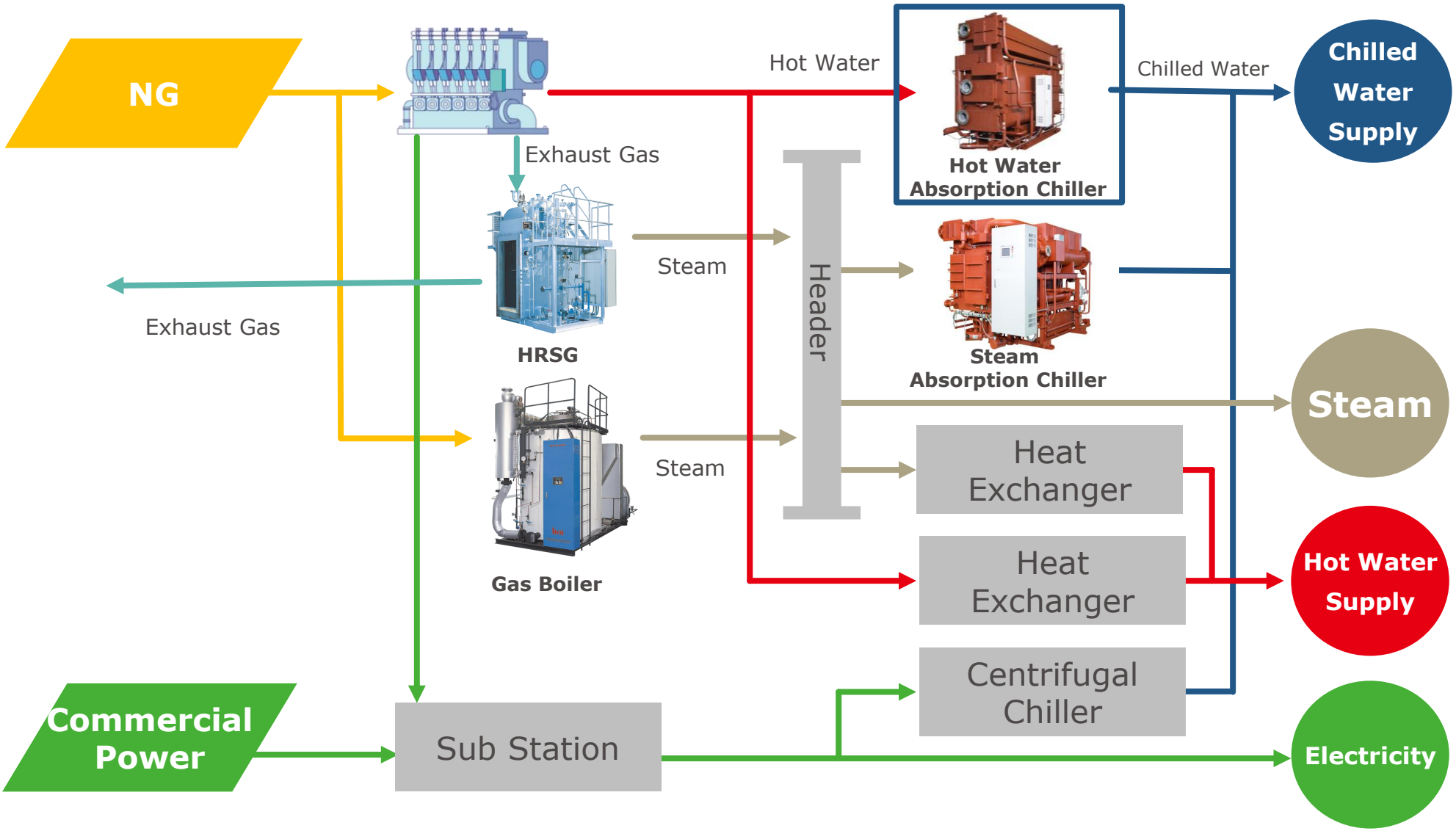
Solution Pump Inverter Control

Solution pump inverter control so that it can be operated with high efficiency at partial load.

Larger Absorbent Solution Storage Tank

The larger absorbent solution storage tank prevents the heat transfer tubes in the solution at low load. It can keep heat transfer area.

Gas Engine Cogeneration System



Hot Water Chiller “TSH Series”

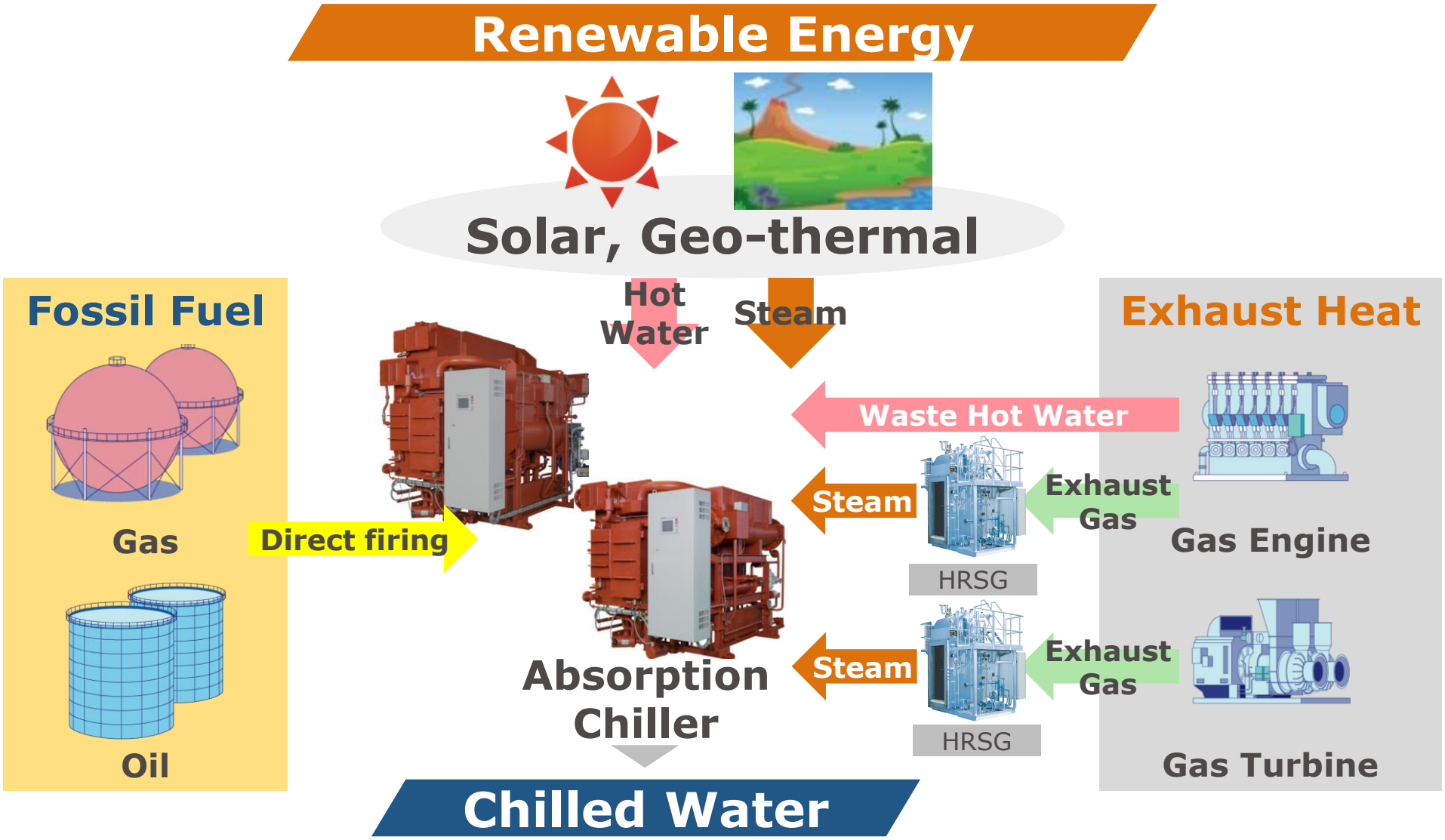
Efficiency

The highest efficiency
COP (based on JIS) = 0.80

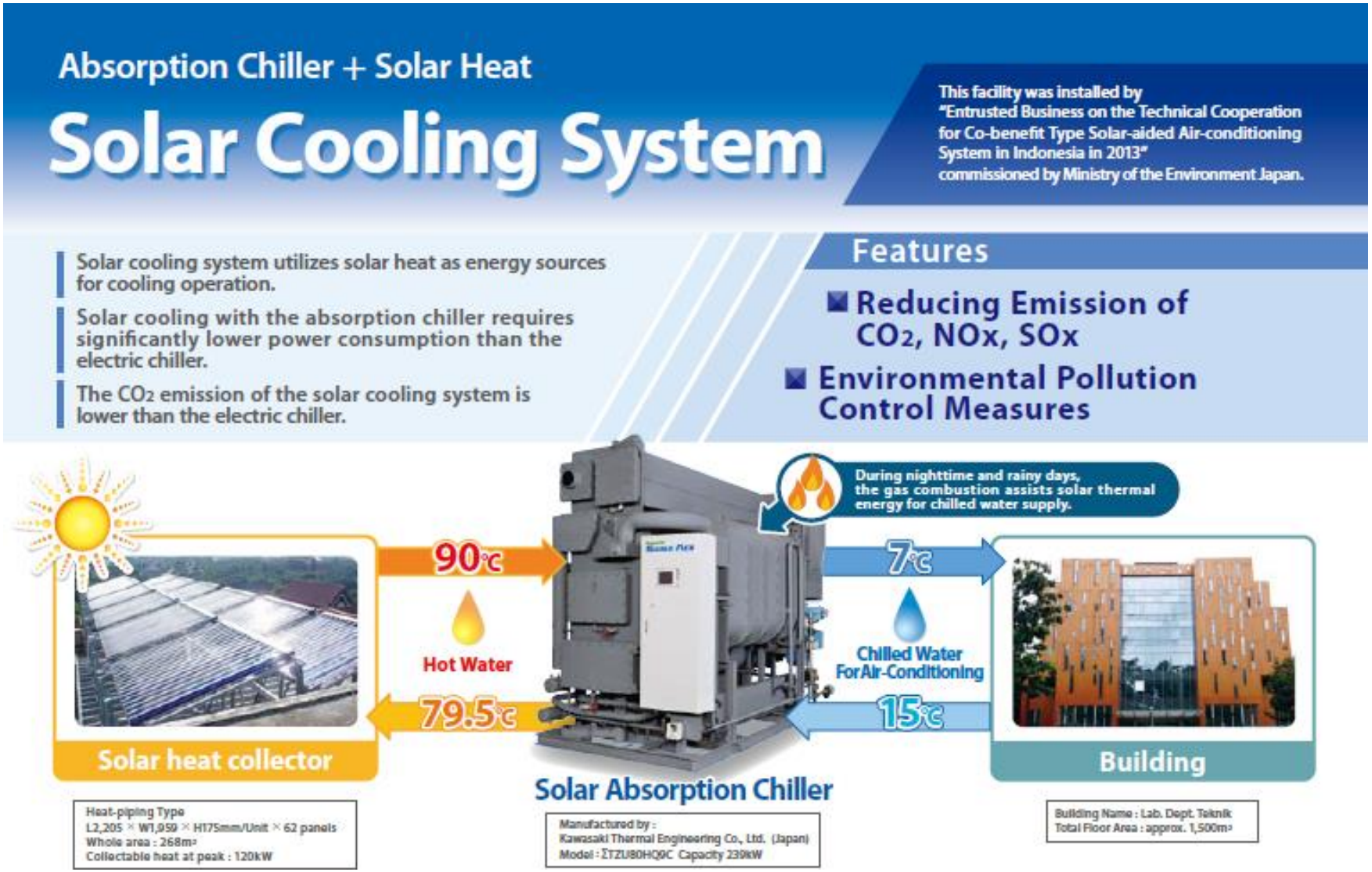
Structure

2-stage generation/condensation which structure has double generator and condenser(higher and lower pressure), it can be used to low temperature hot water (Min. 75’C).

Various energy sources can be utilized



Supply Record for Solar Cooling



Applying JCM Project in Indonesia

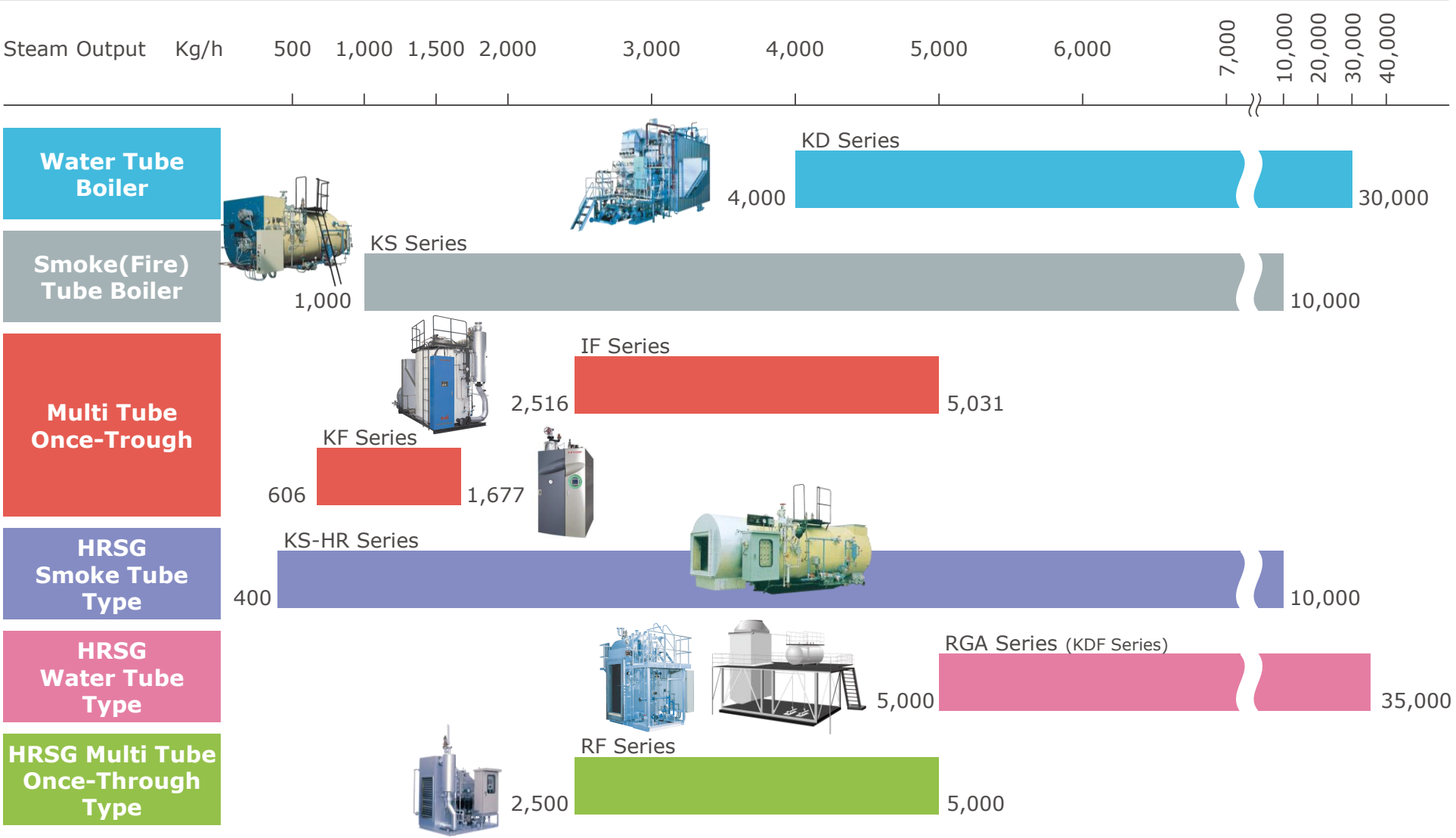
1) Chiller

1	Absorption chiller in Chemical Factory (2018) NES-630A / 1 unit

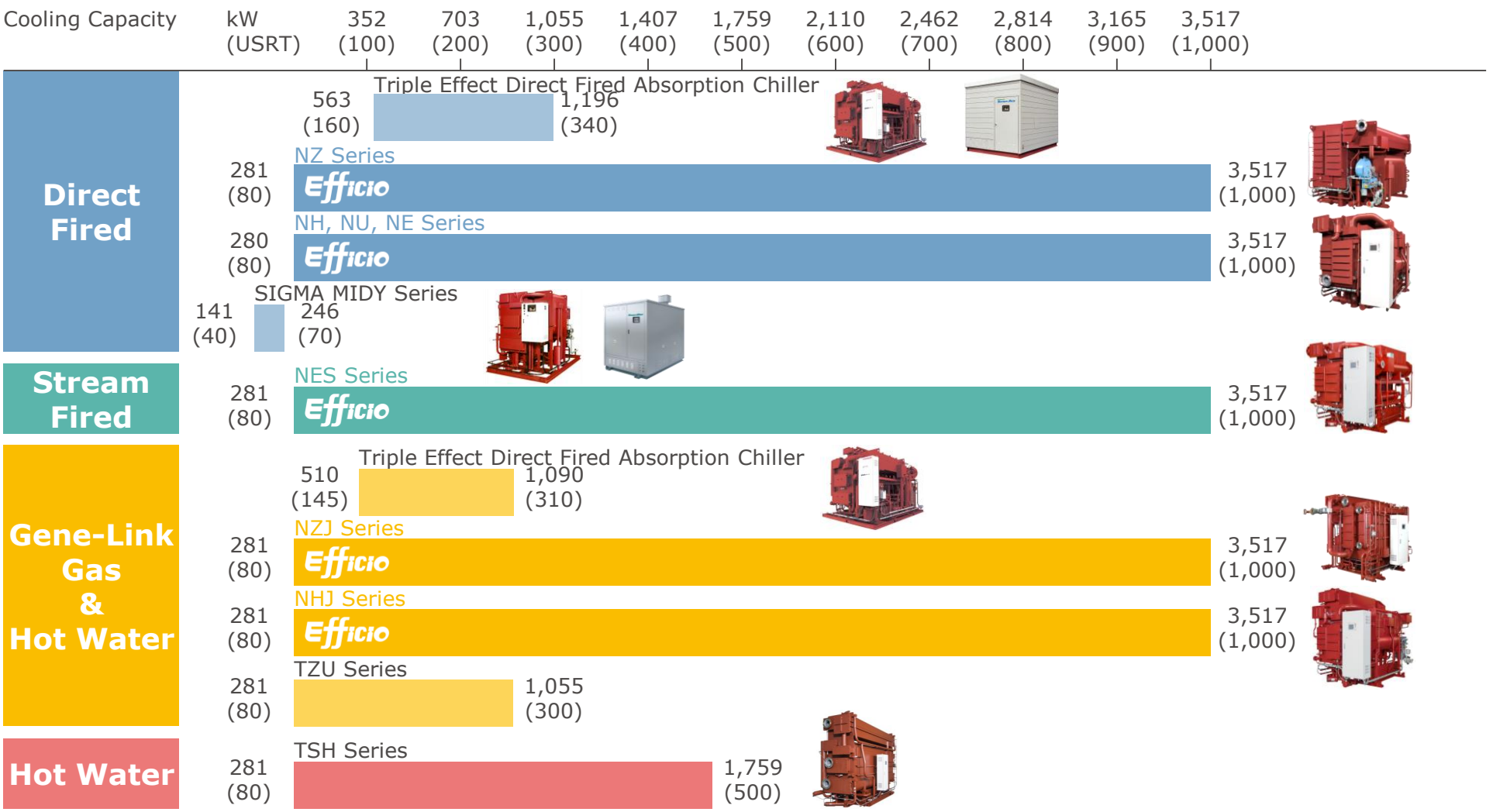
2) Boiler

1	High Efficiency Once-through boiler in Film Factory (2016) IF-4000 / 1 unit
2	High Efficiency Once-through boiler in Golf Ball Factory (2016) IF-3000 / 1 unit

Introduction of KTE Boilers Lineup



Line up of KTE Chillers



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