

CWC COGEN World Talks

Japan's CHP Outlook

5th. Sept. 2023



SHINJI, Takao Ph.D.

https://www.ace.or.jp/web/en/aboutus/aboutus_0010.html

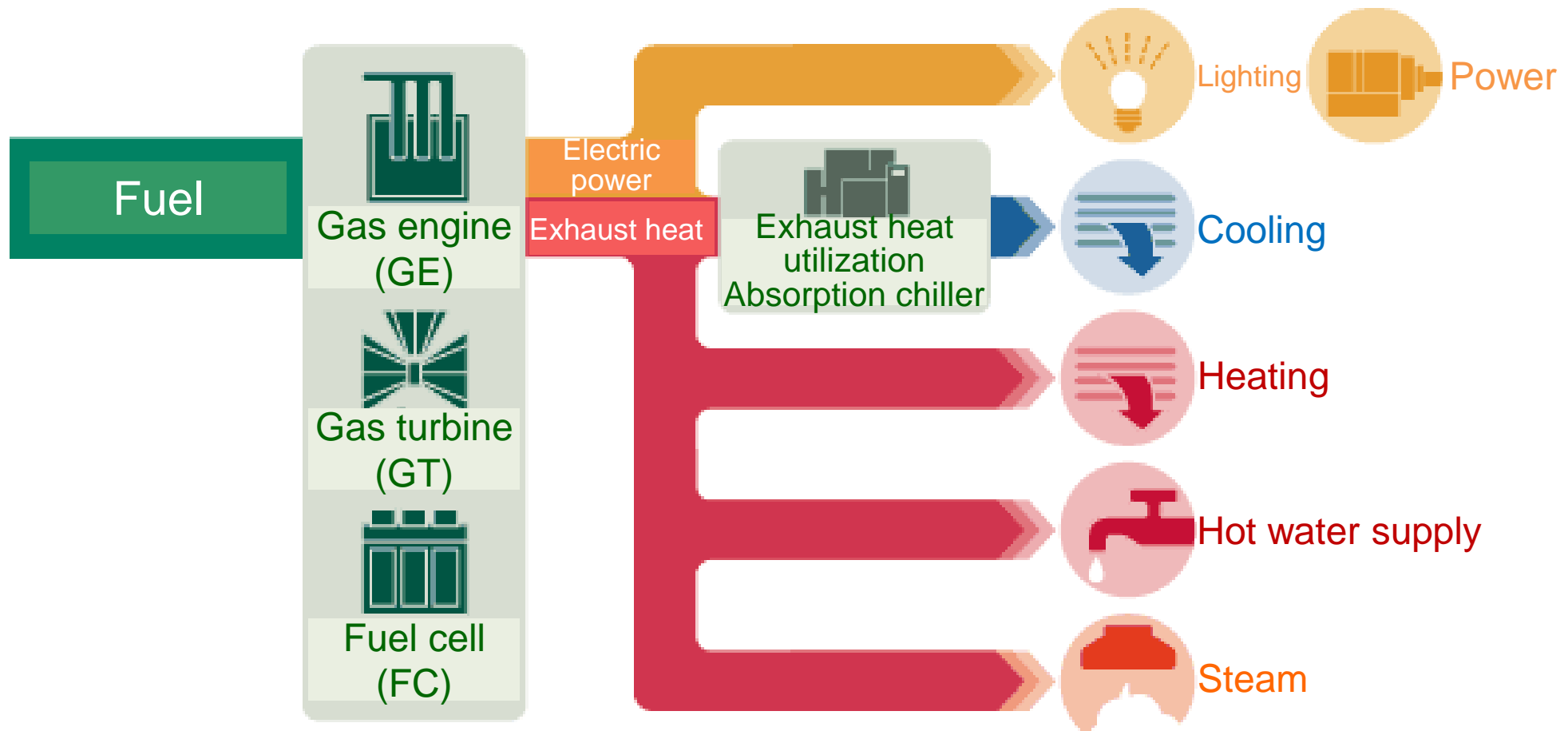
Advanced Cogeneration and Energy Utilization Center of Japan

Contents

- 1. Role of CHP**
- 2. Example Installations in Japan**
- 3. Value Proposition**
- 4. Role in Carbon Neutrality**
- 5. Micro-fuel Cell CHP Developments**

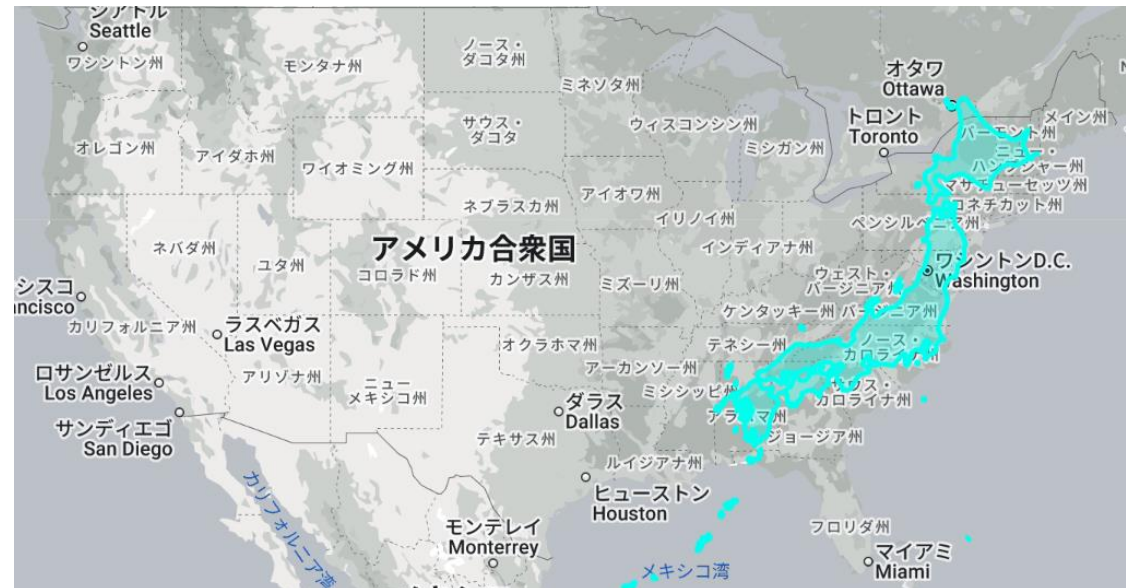
Energy saving by utilizing waste heat

❑ CHP systems achieve high efficiency by utilizing waste heat. In Japan, it is an important energy source for absorption chillers.



How big is Japan?

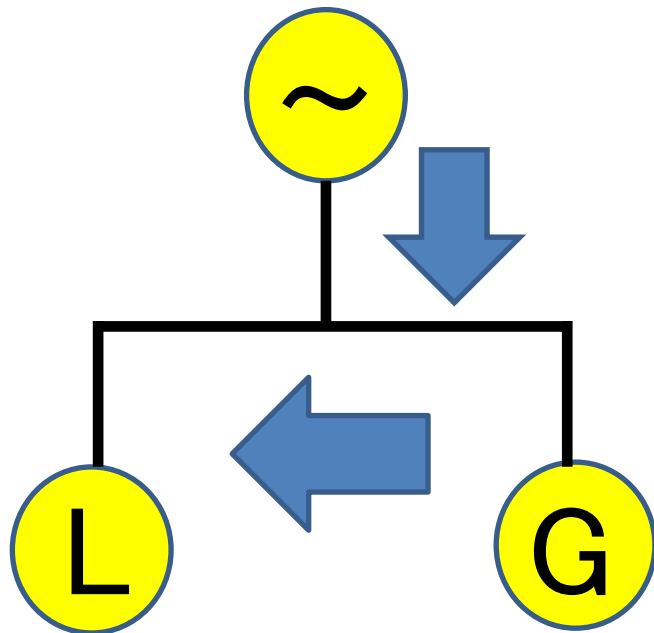
□ Japan's area, at 378 km², is slightly larger than Germany and a slightly smaller than California.



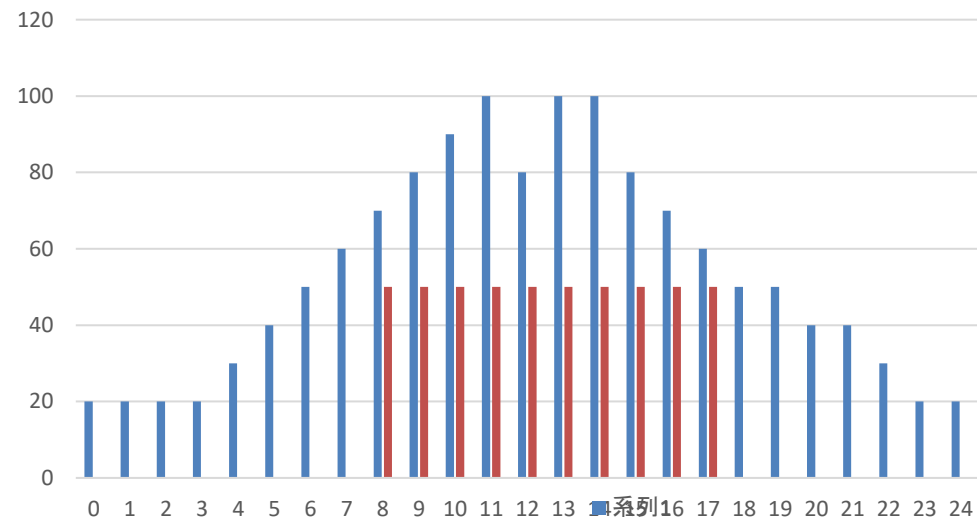
Without reverse power in almost all cases

- ❑ The electric power price is low
- ❑ Protection relays for grid interconnection with reverse power is rather complicated.

Output of CHP is controlled so that G is always smaller than L (based on receiving power).



CHP Typical Output Curve



1. Role of CHP

2. Installation of CHP in Japan

3. New values of CHP

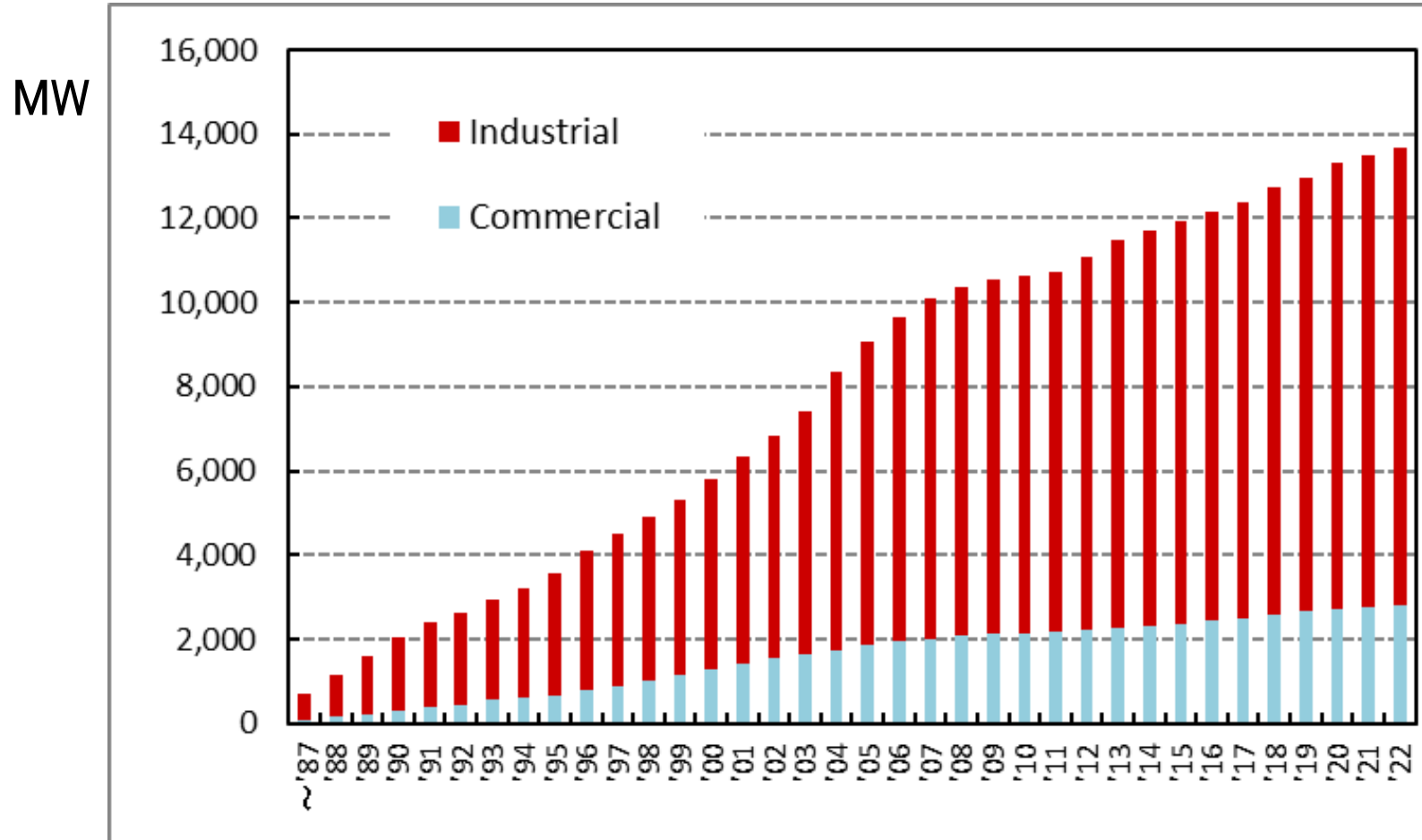
4. Role of CHP to achieve Carbon Neutrality

5. Development & introduction of micro fuel cell CHP

CHP Installations

Capacity: 80% industrial / 20% commercial

Accumulative Capacity (as the end of March 2023)

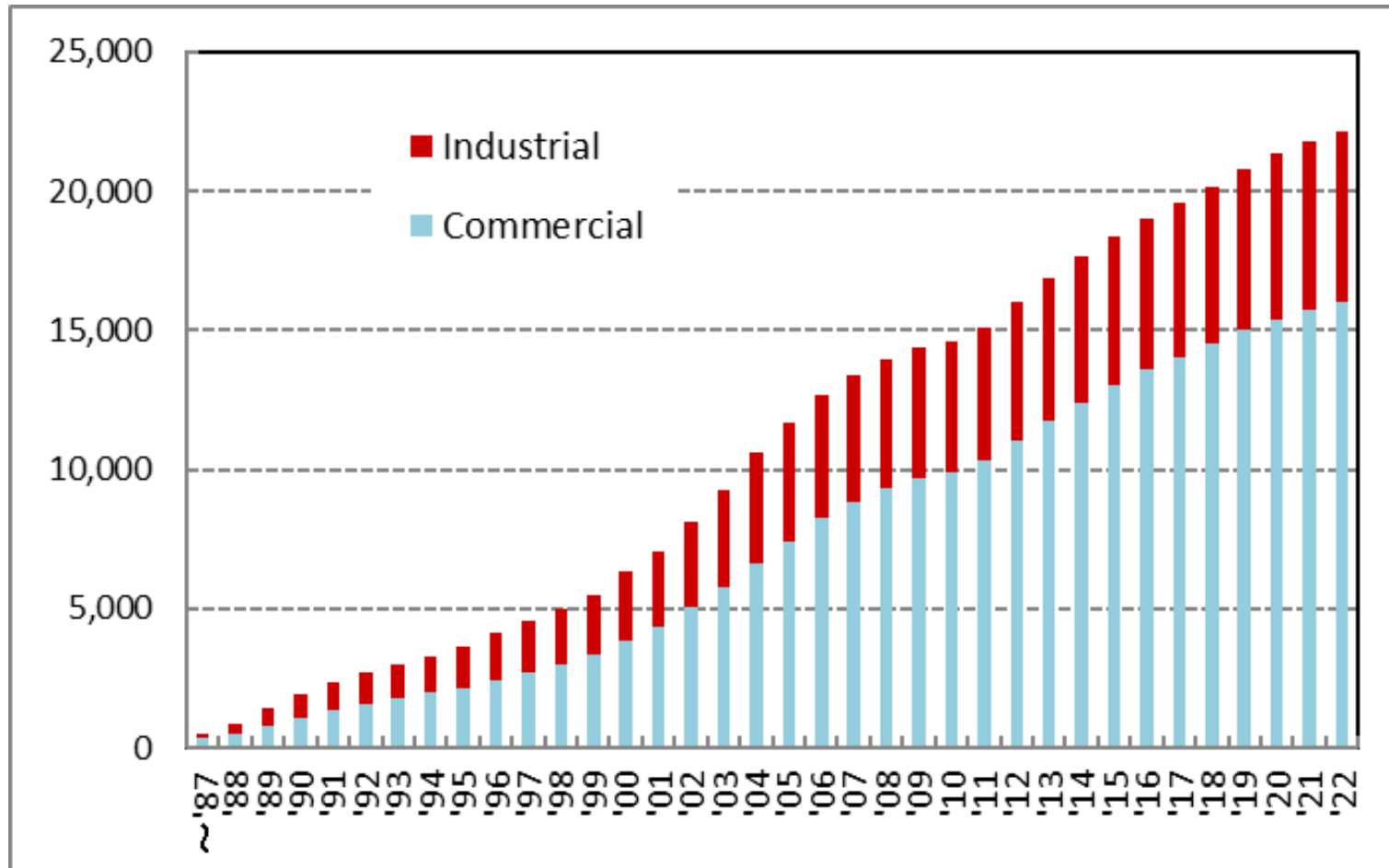


Source: ACEJ website

CHP Installations

❑ Total units: 30% industrial / 70% commercial

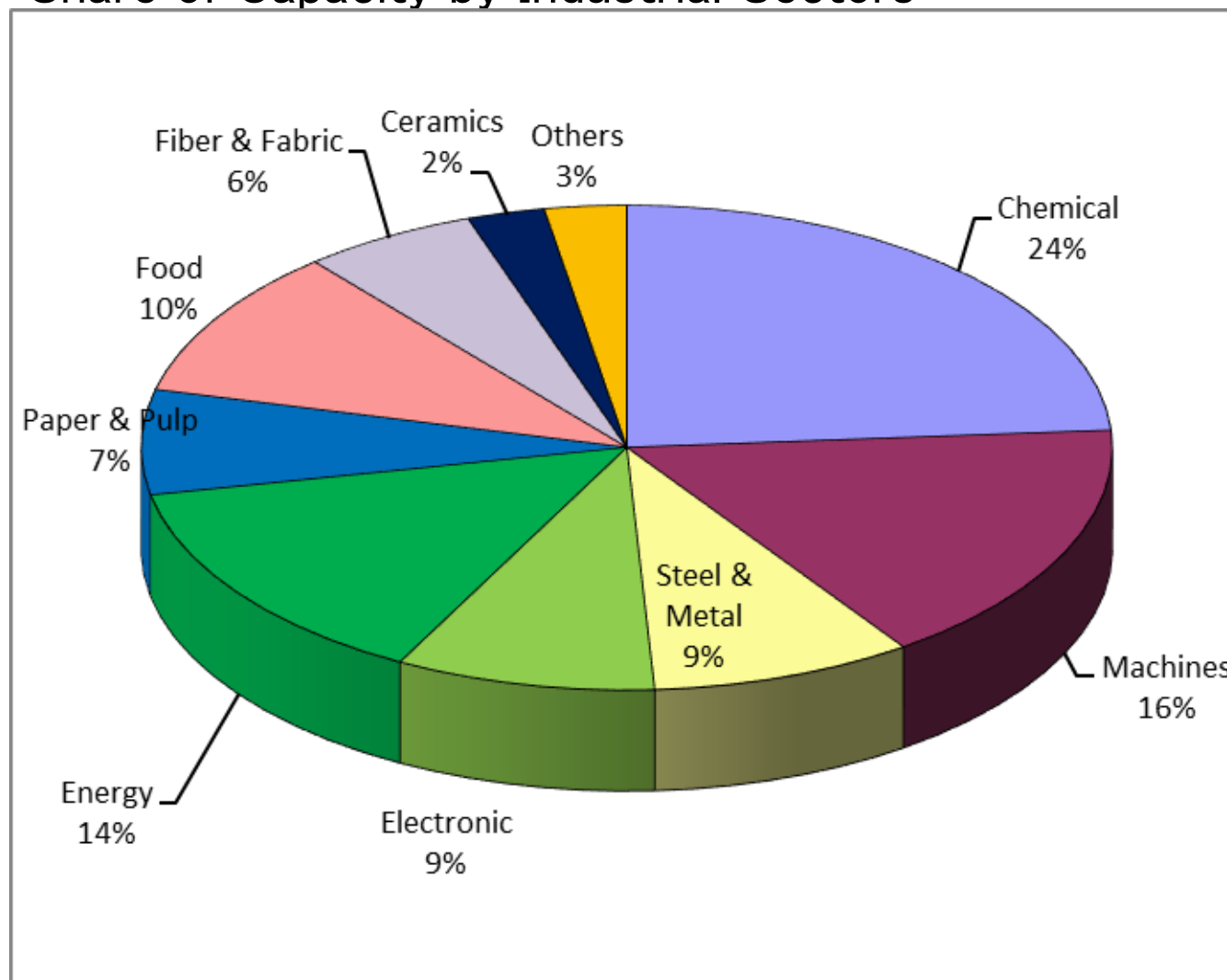
Accumulative Unit Number (as the end of March 2023)



Source: ACEJ website

Classification by Sector - Industrial

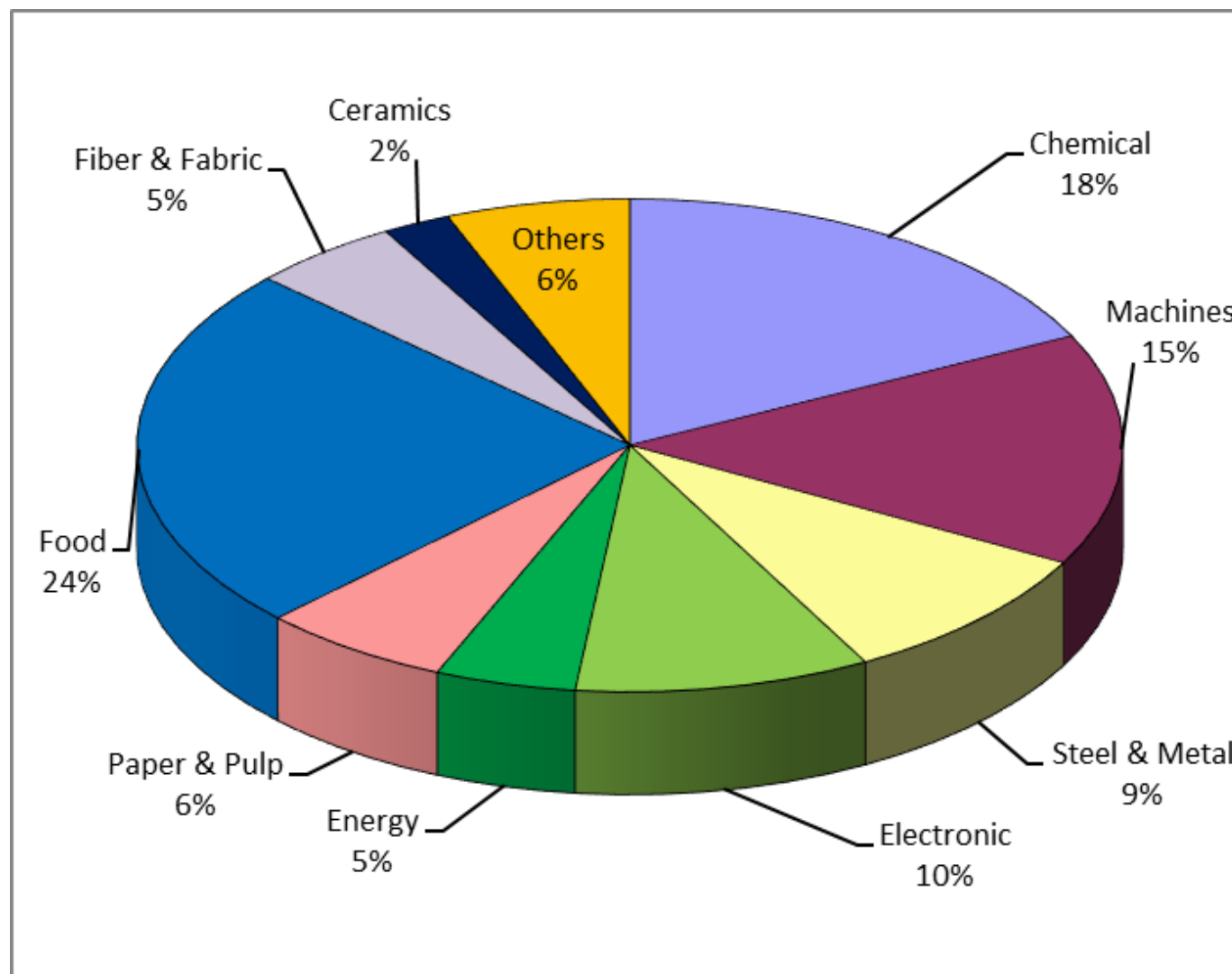
Share of Capacity by Industrial Sectors



Source: ACEJ website (https://www.ace.or.jp/web/field/field_0010.html)

Classification by Sector - Industrial

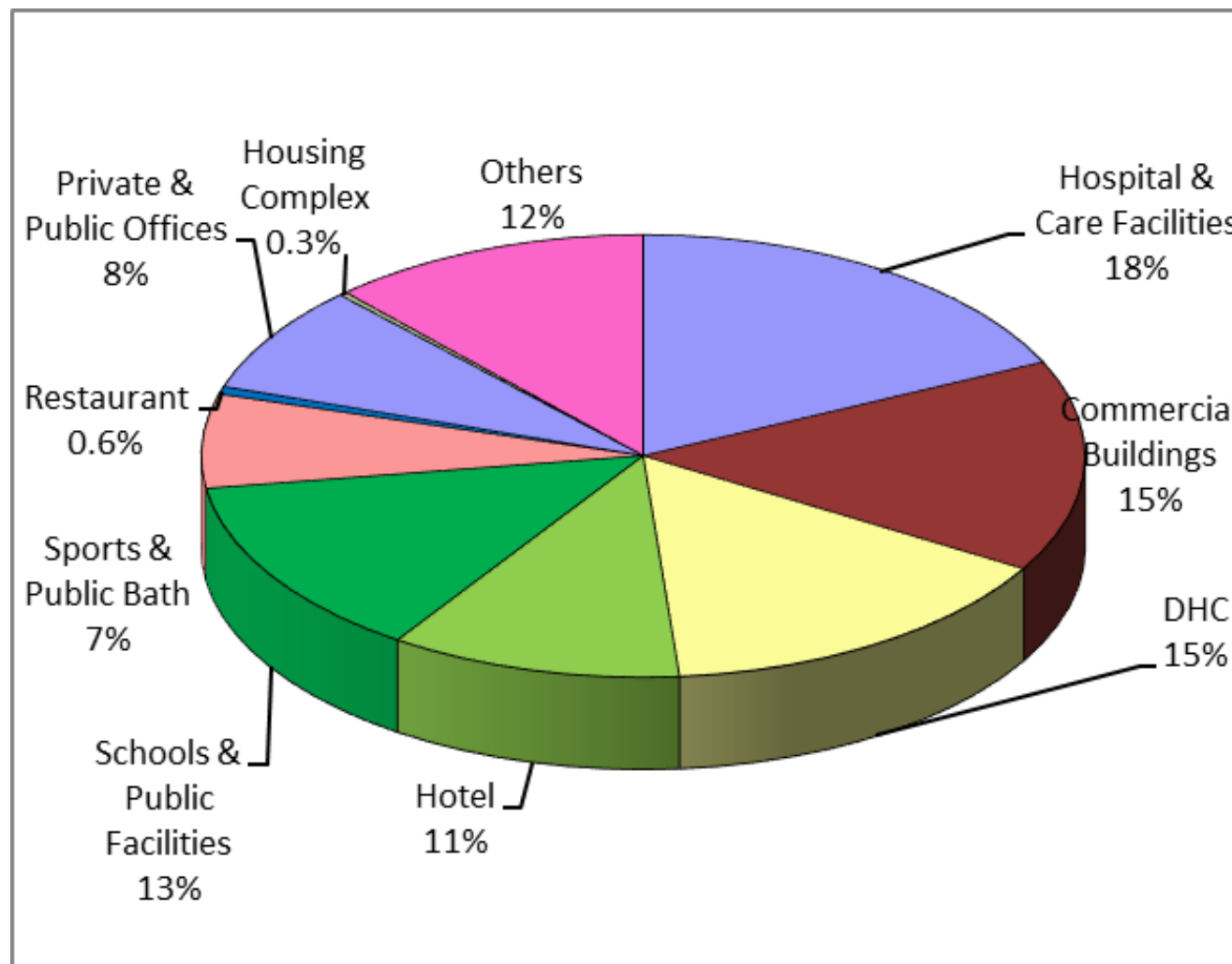
Share of units by Industrial Sectors



Source: ACEJ website (https://www.ace.or.jp/web/field/field_0010.html)

Classification by Sector - Commercial

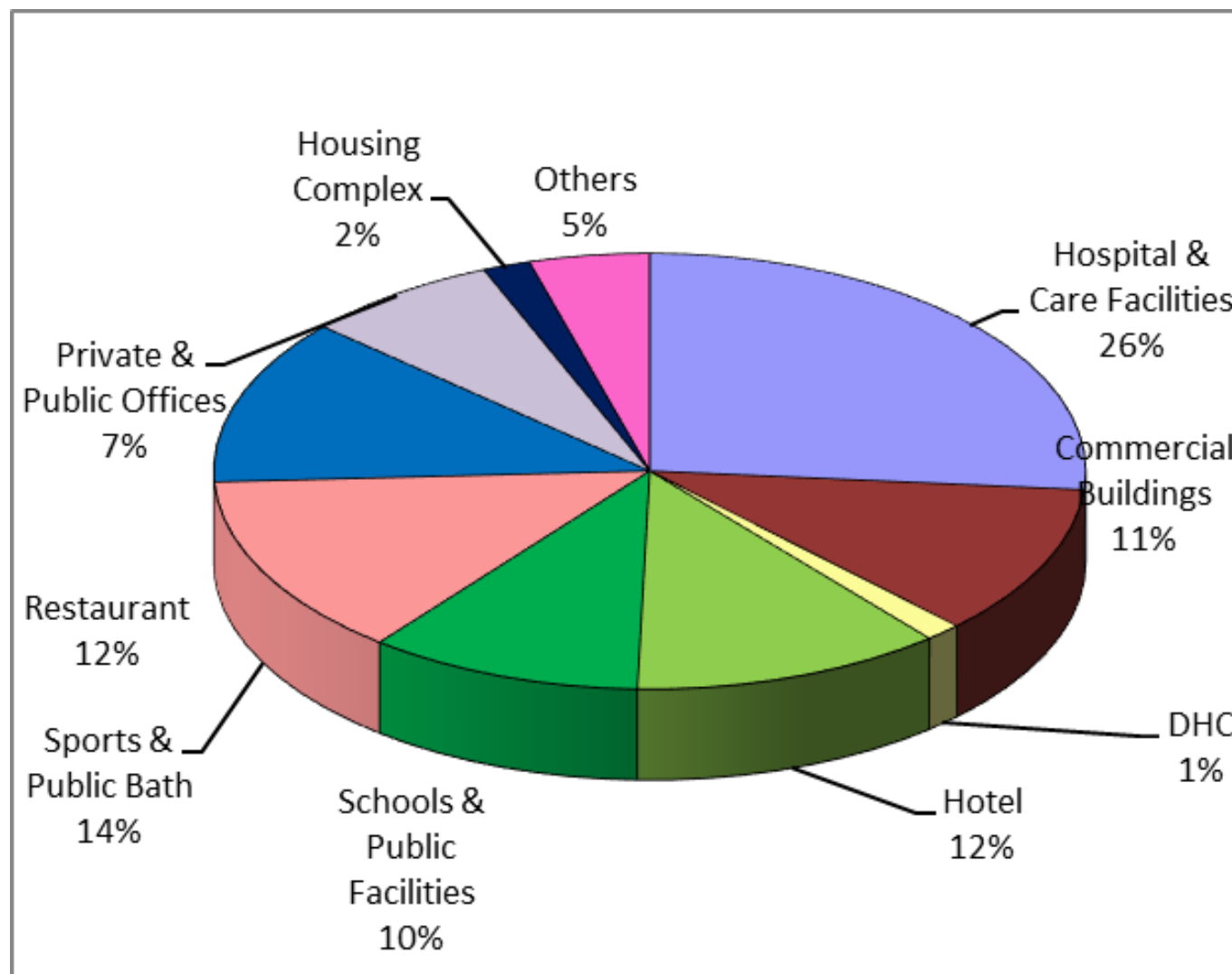
Share of Capacity by Commercial Sectors



Source: ACEJ website (https://www.ace.or.jp/web/field/field_0010.html)

Classification by Sector - Commercial

Share of units by Commercial Sectors



Source: ACEJ website (https://www.ace.or.jp/web/field/field_0010.html)

1. Role of CHP

2. Installation of CHP in Japan

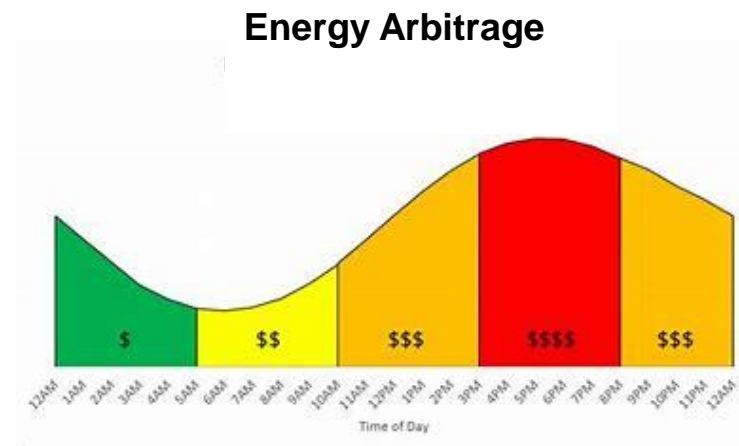
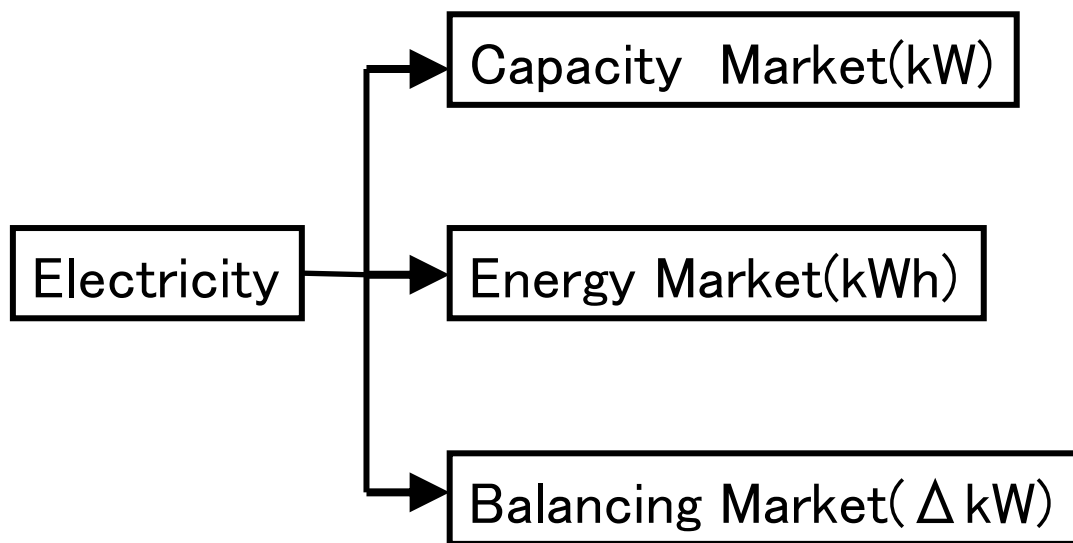
3. New values of CHP

4. Role of CHP to achieve Carbon Neutrality

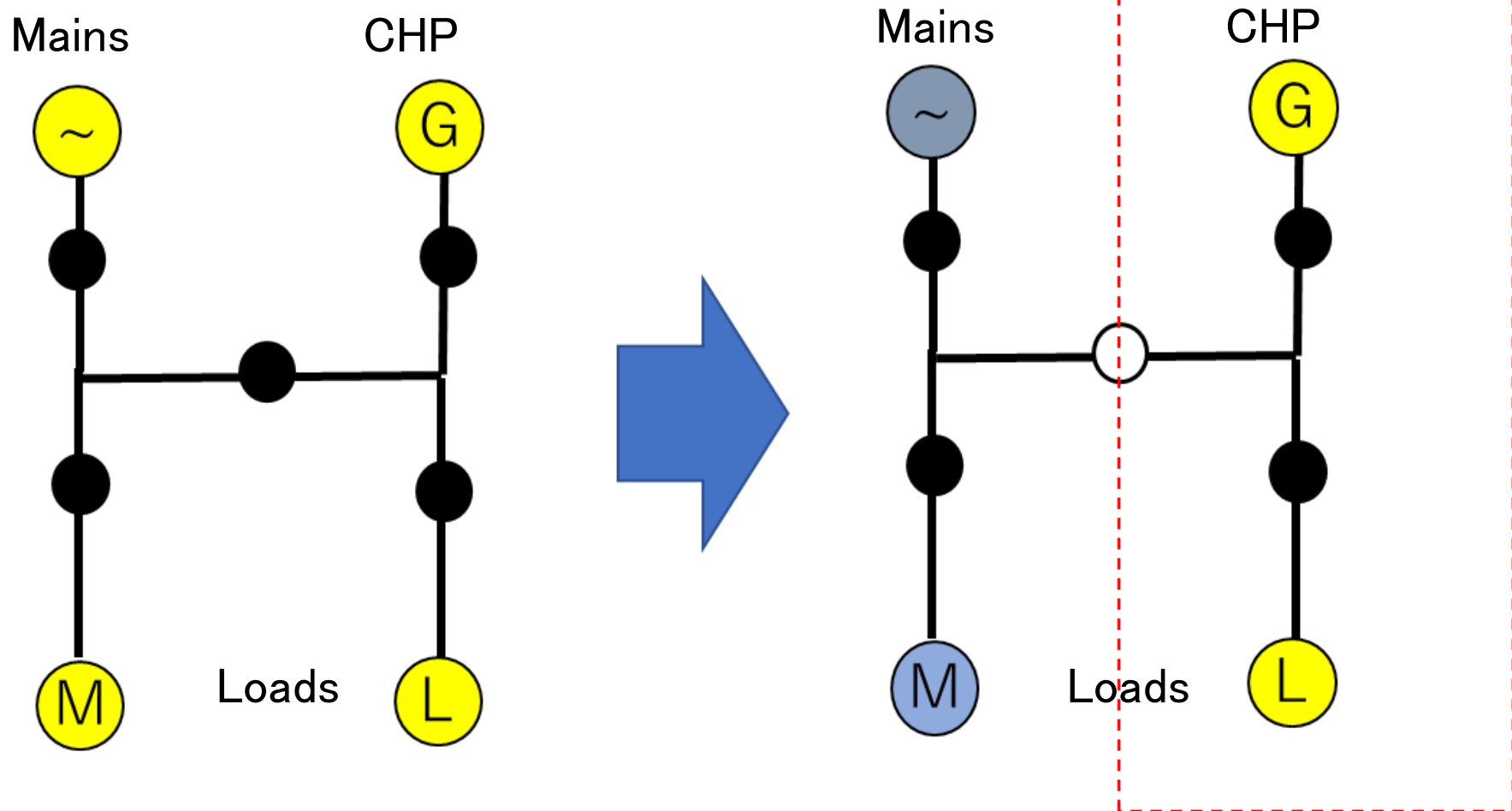
5. Development & introduction of micro fuel cell CHP

Energy Arbitrage

Energy arbitrage is a valuable tool for consumers looking to cut costs and reduce their environmental impact.



□ In an outage, CHP can supply power locally running as a stand-alone unit.



1. Role of CHP

2. Installation of CHP in Japan

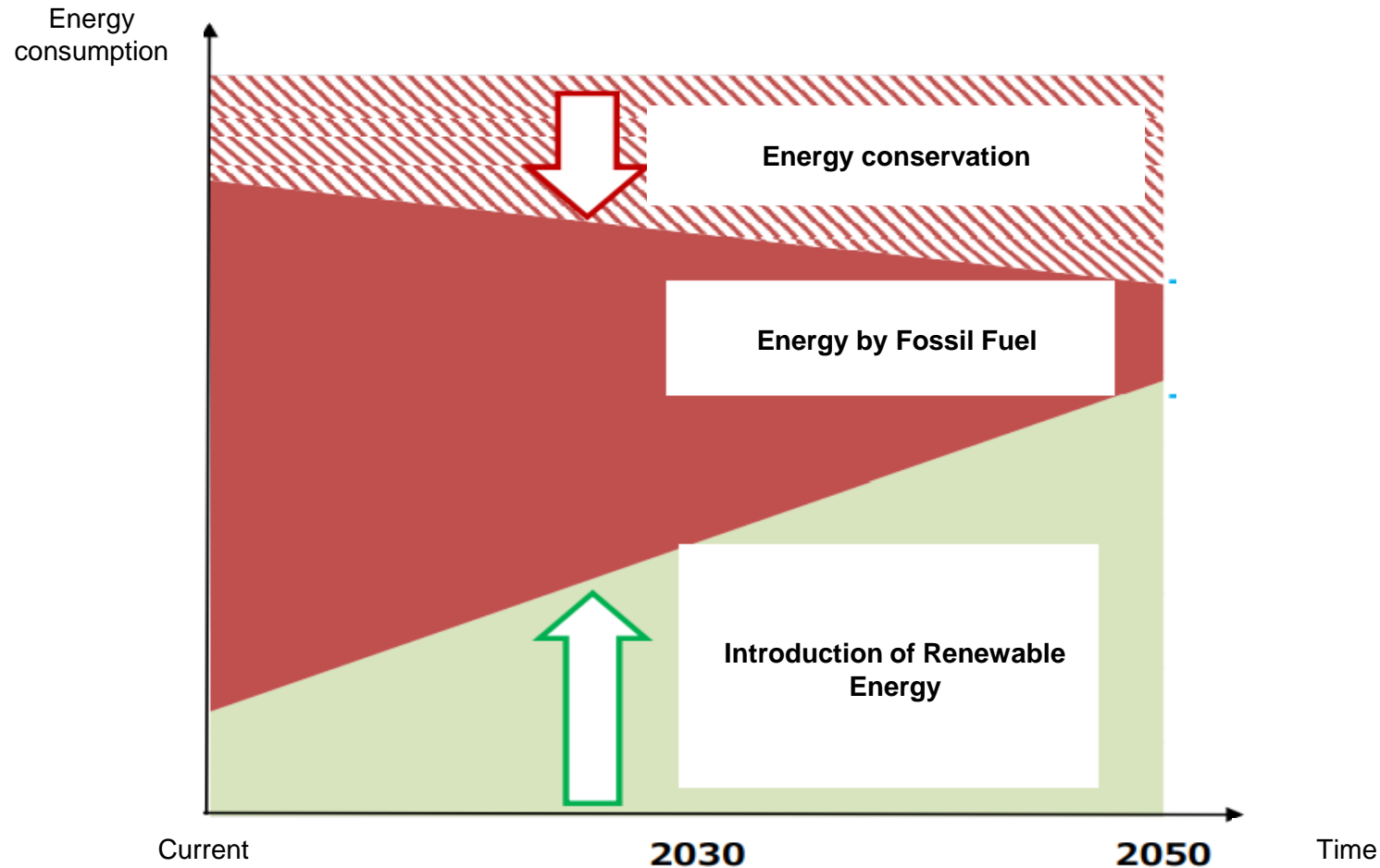
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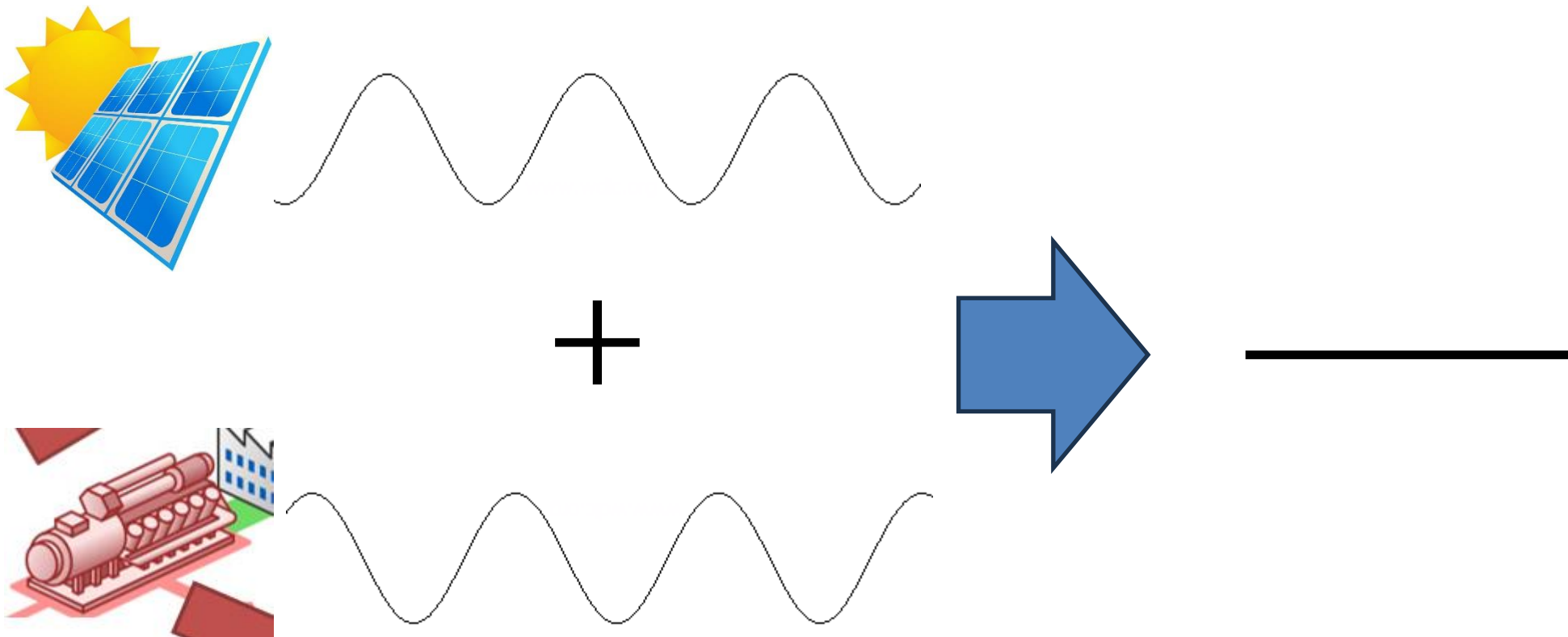
Energy Conservation

❑ CHP is essential part of energy conservation to achieve carbon neutrality.



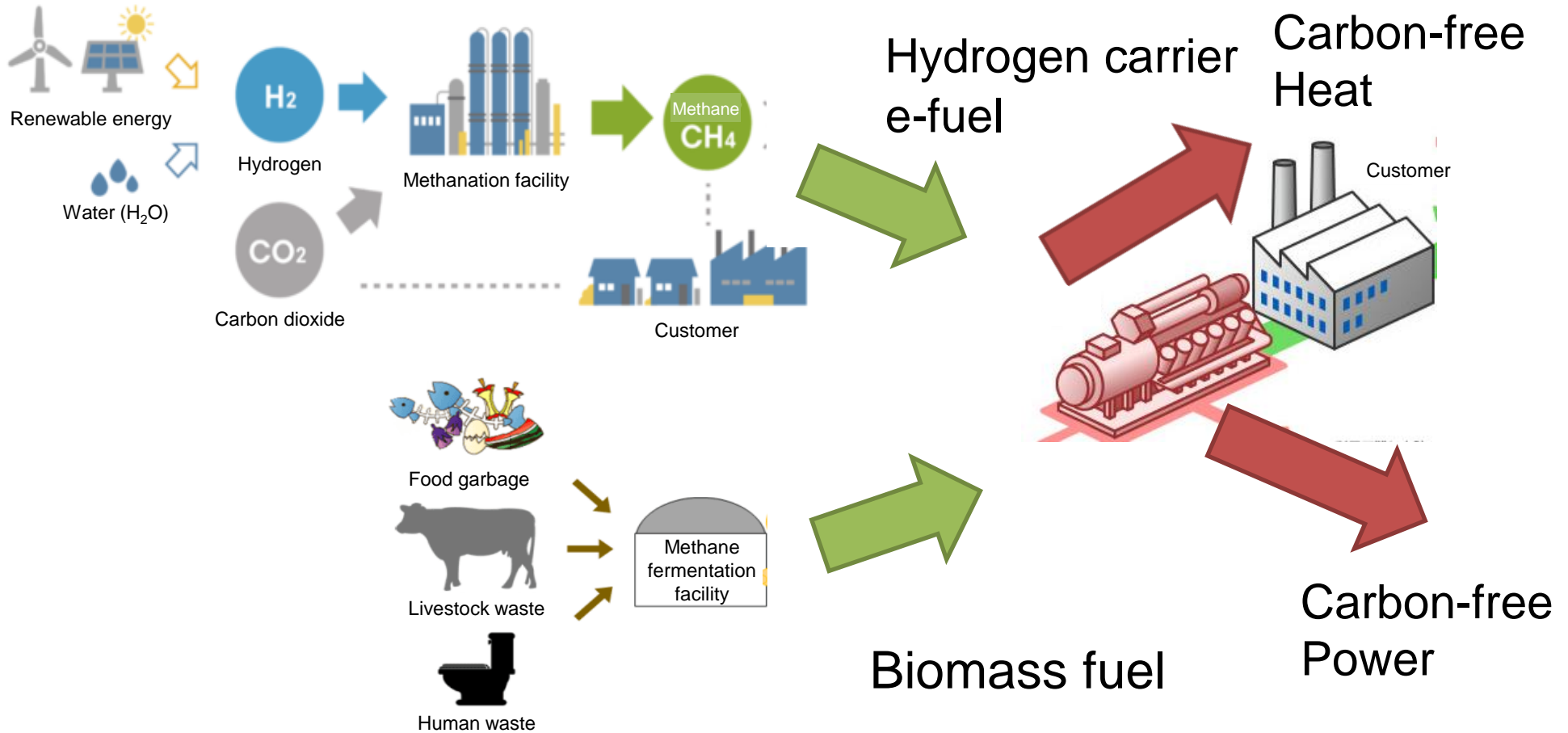
Coordination with Renewable Energy

❑ CHP can compensate for fluctuations in photovoltaic and wind power output. This supports greater renewable energy market penetration.



Adaptation to carbon-free fuels

❑ CHP can be adapted to run on carbon-free fuels such as hydrogen, ammonia, biomass, etc.



1. Role of CHP

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Enefarm at a glance

Specifications

Manufacturer	Panasonic		Aisin	Kyocera
Type	PEFC	PEFC	SOFC	SOFC
Electric Output	700W	700W	700W	400W
Electric Output (stand-alone)	500W	500W	700W	400W
Volume of Hot water tank	100L	370L	25L	20L
Electric Efficiency (LHV)	41%	40%	54~55%	50%
Heat recovery Efficiency (LHV)	57%	57%	32%	35%

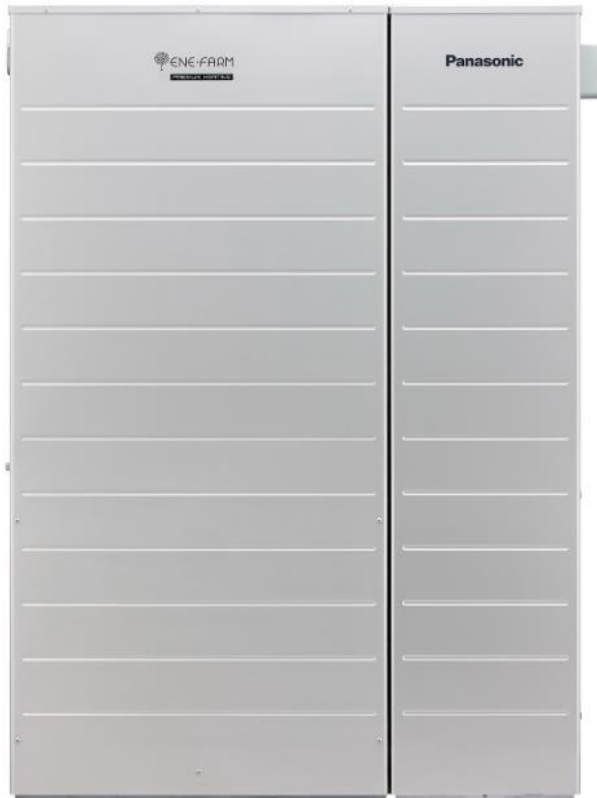
Number of installations

480,373(cumulative units as of 31st Mar.2023)

47,191 installations in FY2022

External Appearance

Panasonic
H=1,650mm



Panasonic
FC H=1,650mm
HWT H=1,860mm



External Appearance

Aisin
H=1,274mm



Kyocera
H=690mm



Recent Developments & Subsidies

Recent Developments

Internet Connection

Can collect weather forecasts to facilitate advance disconnection from the grid when a power disruption is predicted (in conjunction with renewables, etc.)

Electric Heat

The electric heater can provide hot water when gas is not available.

Control by Smartphone

Can be controlled and monitored remotely.

Increased efficiency $\eta 40\% \Rightarrow 41\%$ (Panasonic)
 $\eta 47\% \Rightarrow 50\%$ (Kyocera)

Downsizing 130L \Rightarrow 100L (Panasonic)

Reliability Improved by reducing the number of parts
by 45% - also reduces footprint by 20%(Kyocera)

Subsidies

150 thousand yen (approx. €1,000) per unit for a total of 30 billion yen (approx. €200 million) including subsidies for heat pumps

Example Cases of CHP Introduction

1. Industrial Case(Kiyohara Smart Energy Center)

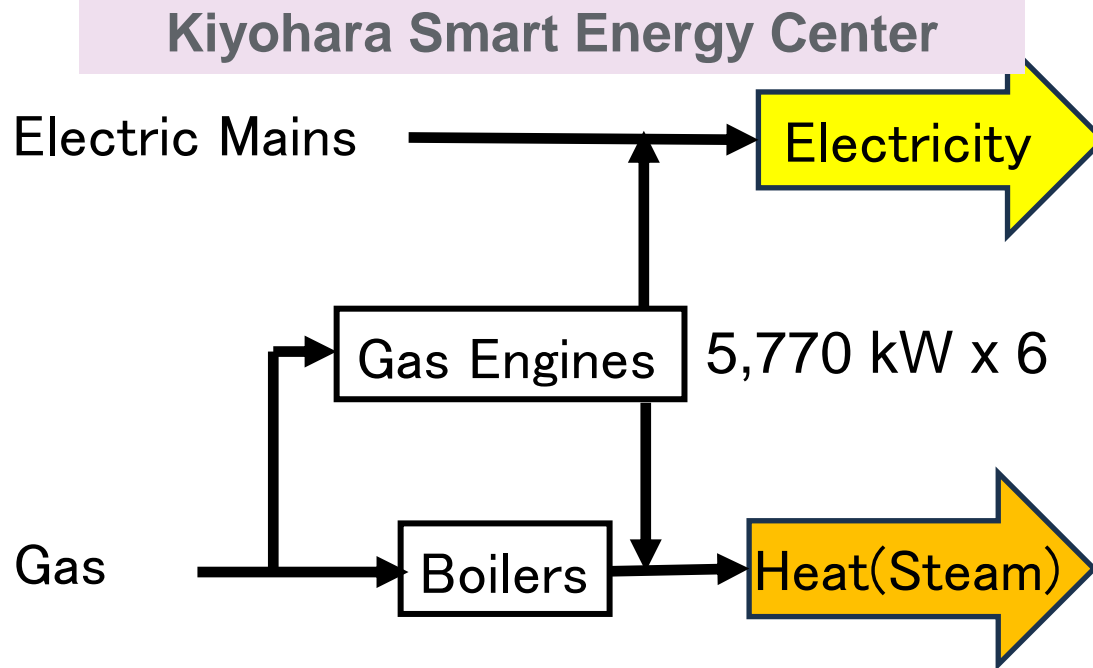
2. Commercial Case(46 Smart Energy Center)

Kiyohara Smart Energy Center

- 35 MW efficient CHP system provides electric power and heat to 7 businesses via private power lines and heat conduits.
- Energy and CO² is reduced by 20% compared with conventional system.
- Even during outages, the CHP system provides electric power and heat as a stand-alone unit.



Kiyohara Smart Energy Center



Facilities

Food Company

Factory A1

Factory A2

R&D Centre A

Optical Instrument Company

Factory B

Office B

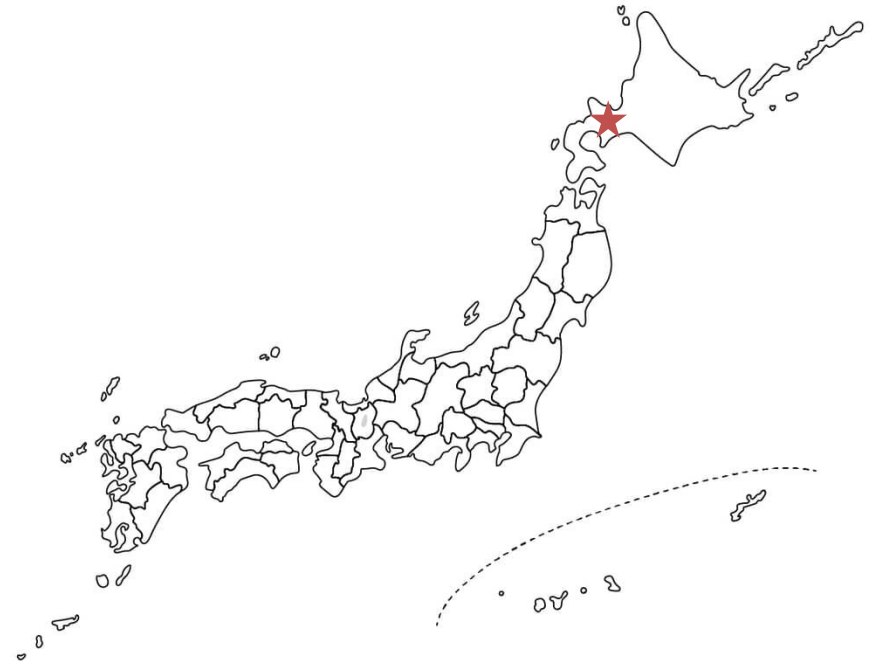
R&D Centre B

Pharmaceutical Company

Factory C

46 Smart Energy Center

- 630kW CHP system provides power and heat energy to entities via private power lines and heat conduits.
- Energy consumption is 24% lower than a conventional system.
- During outages, the CHP system can provide power and heat as a stand-alone unit.
- Waste heat is used for “road heating” to melt snow.
- CEMS (Community Energy Management System) encourages residents to change their consumption habits and utilize DR (Demand Response)
- Geothermal heat and solar heat are also utilized.



46 Smart Energy Center

