

# An Overview of Current Progress of Decarbonization in Japan



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# Agenda

## ➤ **Status Quo - What Characterizes Carbon Neutrality in Japan?**

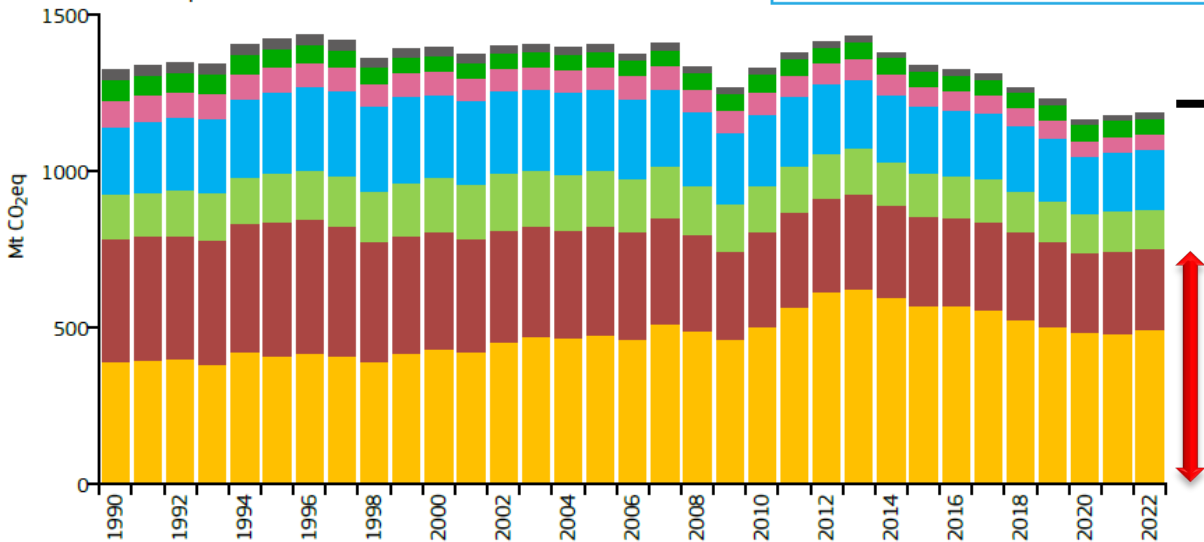
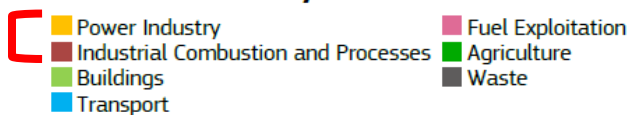
### **(Individual Issue)**

- **Electricity Supply Capability**
- **Avoided Emission: Energy Efficiency**
- **Sustainable Energy Options:**
  - **Solar Power Generation & Storage**
  - **Transformation & Recycle**
  - **CCUS**
  
- **Closing Remarks**

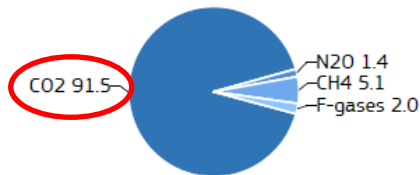
# Status Quo

## Japan

### GHG emissions by sector

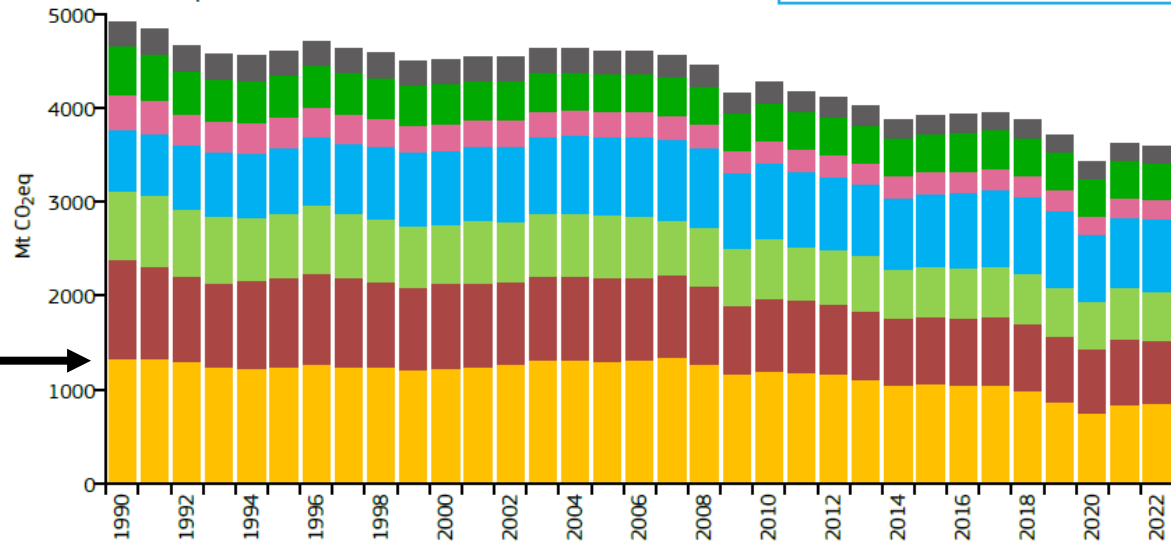
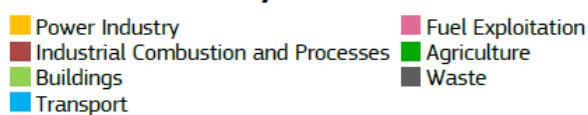


### GHG % in 2022

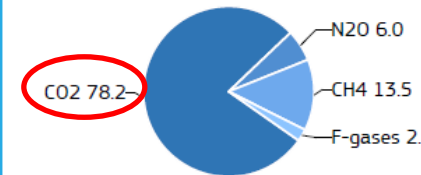


## EU27

### GHG emissions by sector



### GHG % in 2022



Year	GHG emissions Mt CO <sub>2</sub> eq/yr	GHG emissions per capita t CO <sub>2</sub> eq/cap/yr	GHG emissions per unit of GDP PPP t CO <sub>2</sub> eq/kUSD/yr	Population
2022	1182.770	9.410	0.227	125.697M
2015	1335.568	10.436	0.260	127.975M
2005	1402.608	10.929	0.287	128.336M
1990	1321.808	10.616	0.326	124.516M

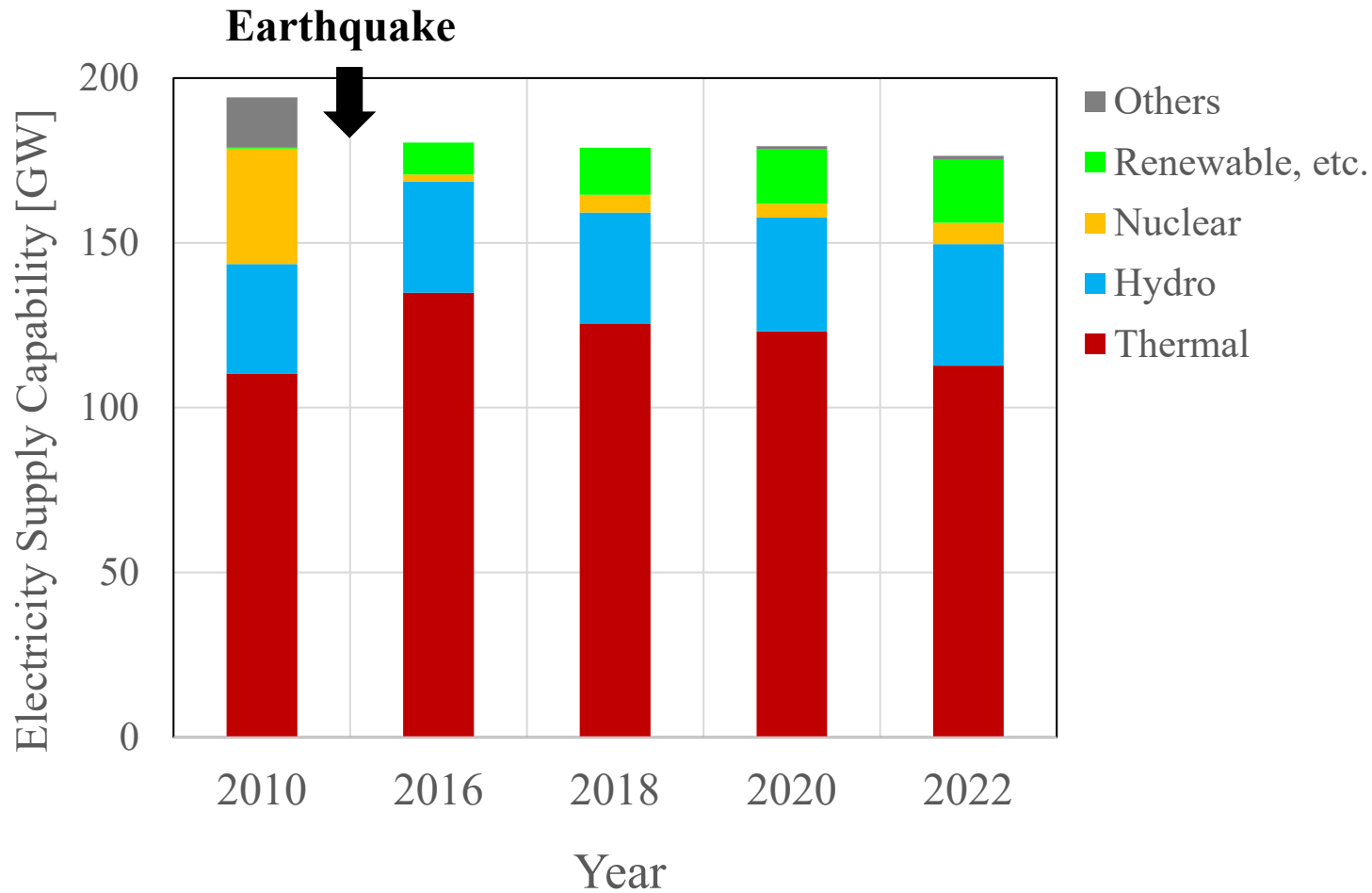
Year	GHG emissions Mt CO <sub>2</sub> eq/yr	GHG emissions per capita t CO <sub>2</sub> eq/cap/yr	GHG emissions per unit of GDP PPP t CO <sub>2</sub> eq/kUSD/yr	Population
2022	3587.796	8.087	0.175	443.641M
2015	3922.022	8.871	0.216	442.095M
2005	4597.105	10.564	0.282	435.163M
1990	4915.144	11.697	0.405	420.198M

(PPP: Purchasing Power Parity)

## Comparison of Trends in GHG emissions (Japan vs EU27)

Cited from "JRC SCIENCE FOR POLICY REPORT - GHG EMISSIONS OF ALL WORLD COUNTRIES 2023", EC.

# Electricity Supply



- The Number of Thermal Power Plants: Decreasing after 2016
- Nuclear Power: Shrinking after the Earthquake in Fukushima in March 2011
- Hydro Power: Slight Change
- Renewable: Gradually Increase  
(Note: not equal to the overall installed capacity, taking the instability of natural energy resources into account)

## Trends in Electricity Supply Capability in Japan

(Source) Aggregation of Electricity Supply Plans 2022, Organization for Cross-regional Coordination of Transmission Operators, Japan

# Avoided Emission

## DEFINITION:

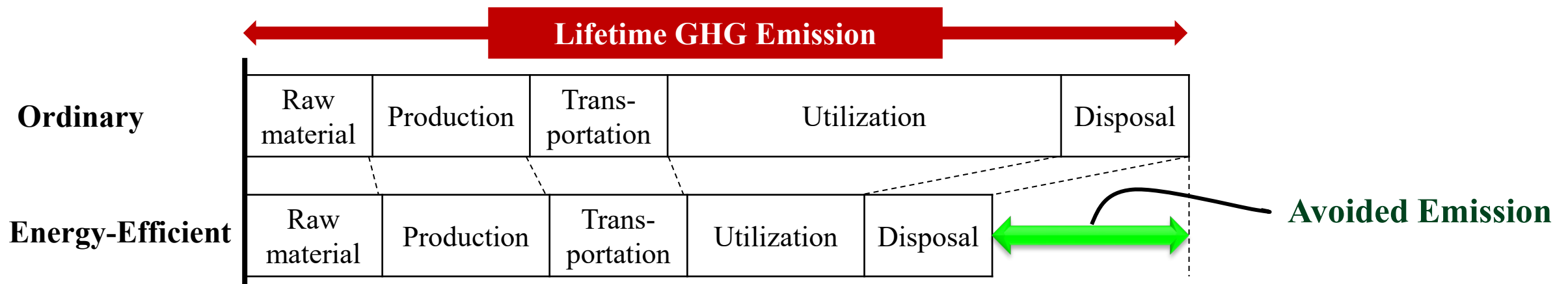
The difference between GHG emissions that occur or will occur (the "solution") and those that would have occurred without the solution (that of the reference scenario)

*(Source: Guidance on Avoided Emissions: Helping business drive innovations and scale solutions toward Net Zero, World Business Council for Sustainable Development)*

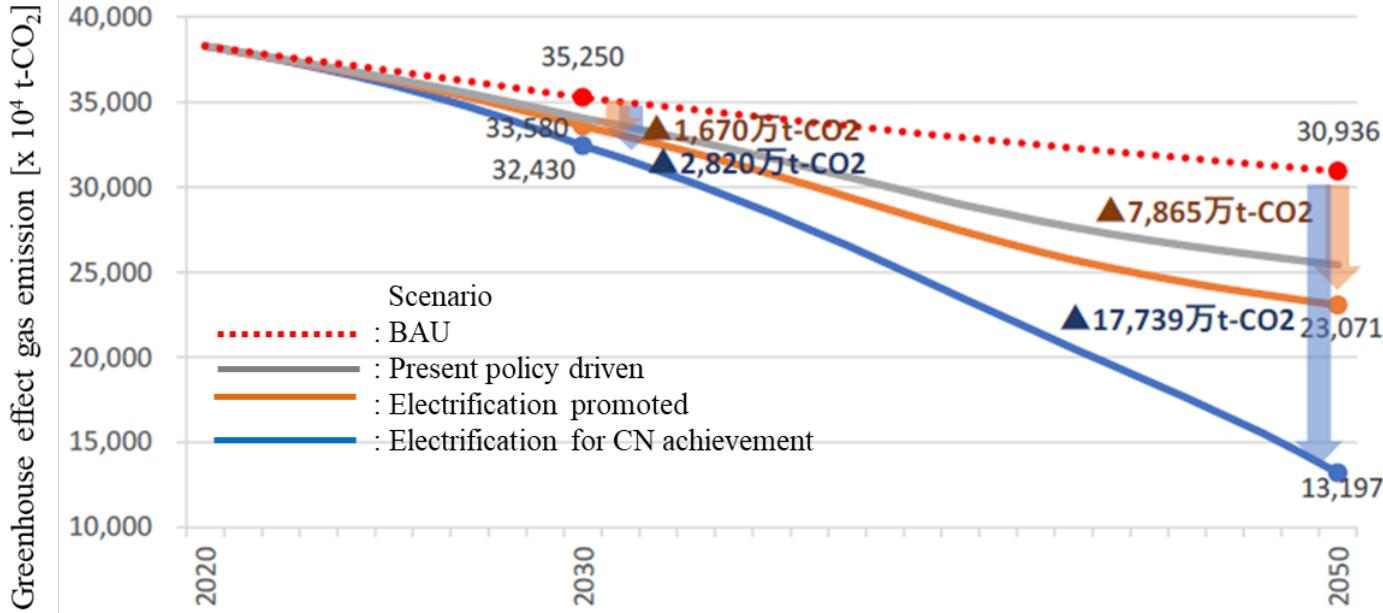
The “quantified contribution to the GHG emission reductions which are estimated throughout the life cycle GHG inventory of environmentally-friendly goods or services in comparison to goods or services that represent what is most likely to occur in the absence of assessed goods or services (baseline scenario)”.

*(Source: Guidelines for Quantifying GHG emission reductions of goods or services through Global Value Chain, METI, 2018)*

## Example: Energy-Efficient Product



# (Ex.) Heat Pump & Electrification Diffusion Prospects

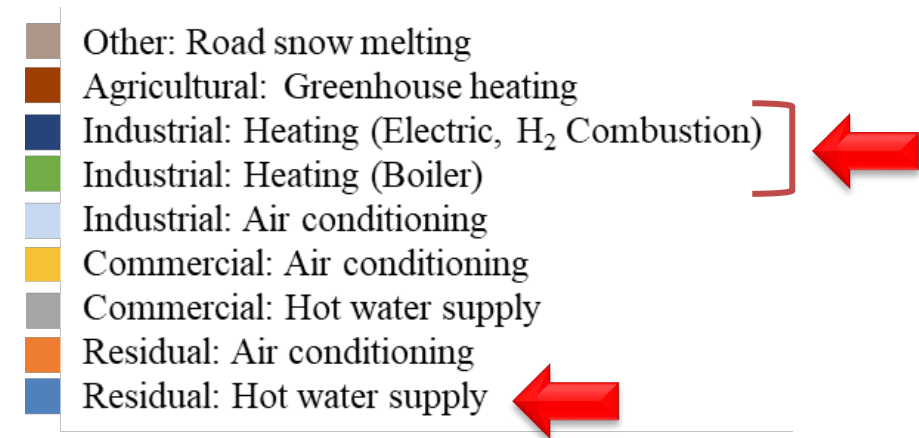
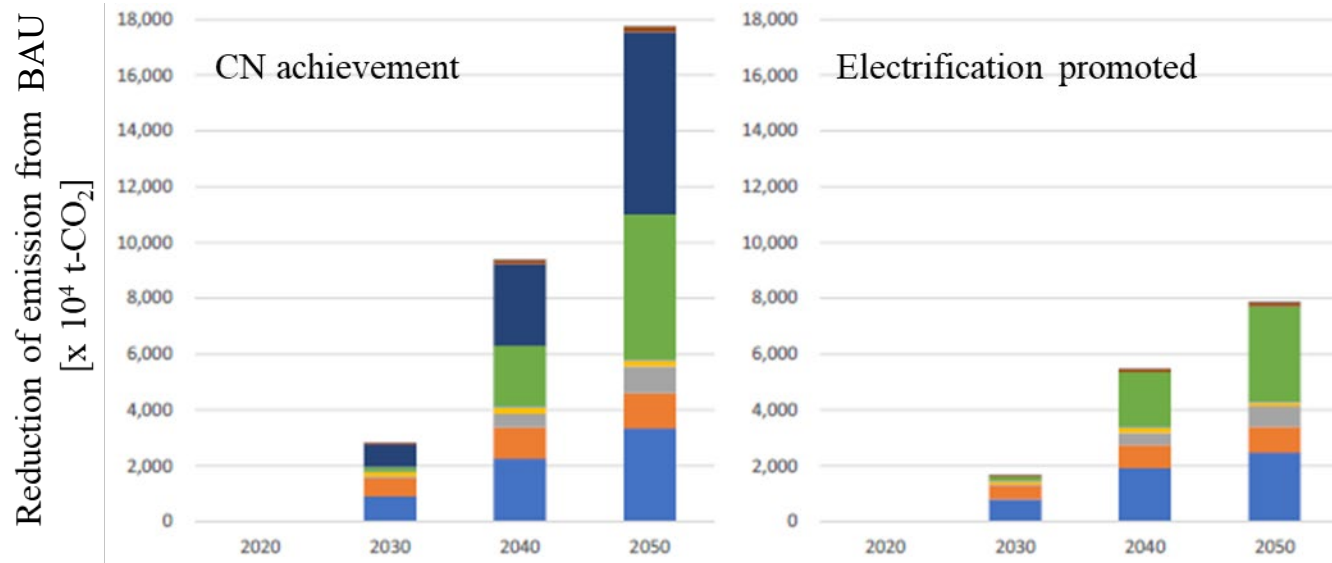


## (Industrial sector)

- Contribution of electric heating and hydrogen combustion is remarkable in addition to heat pump.

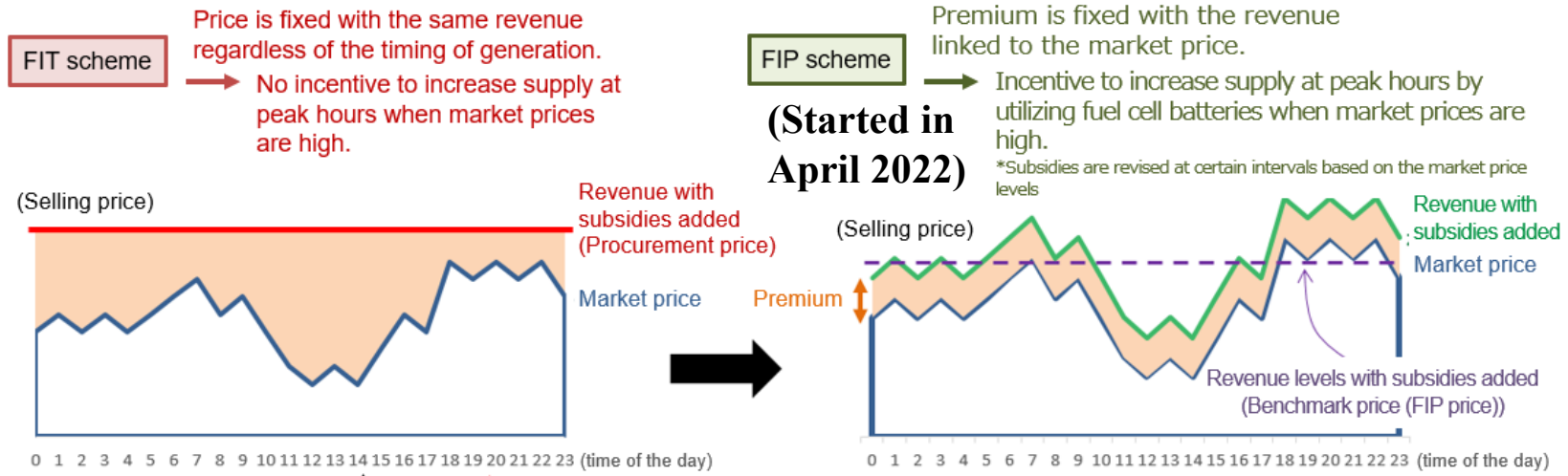
## (Residential sector)

- Hot water supply by heat pumps is the effective way of GHG emission reduction.

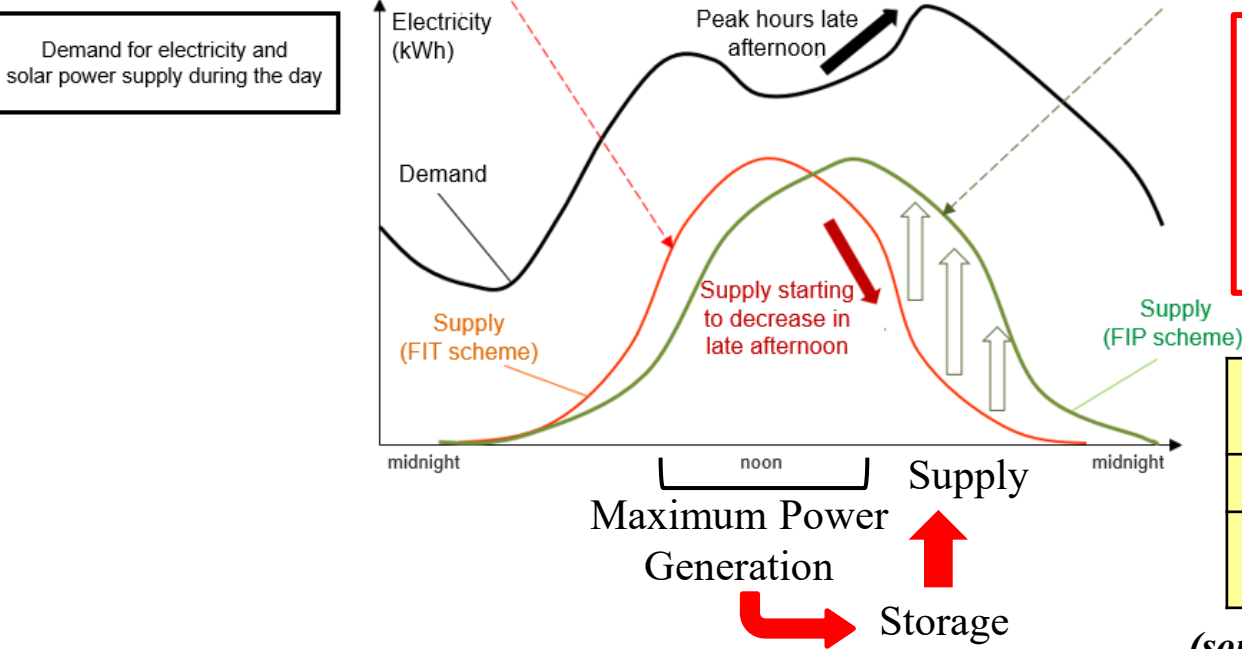


(source) FY2022 Survey on Electrification Diffusion Prospects, Heat Pump & Thermal Storage Technology Center of Japan (HPTCJ) (in Japanese)

# Solar Power Generation & Storage

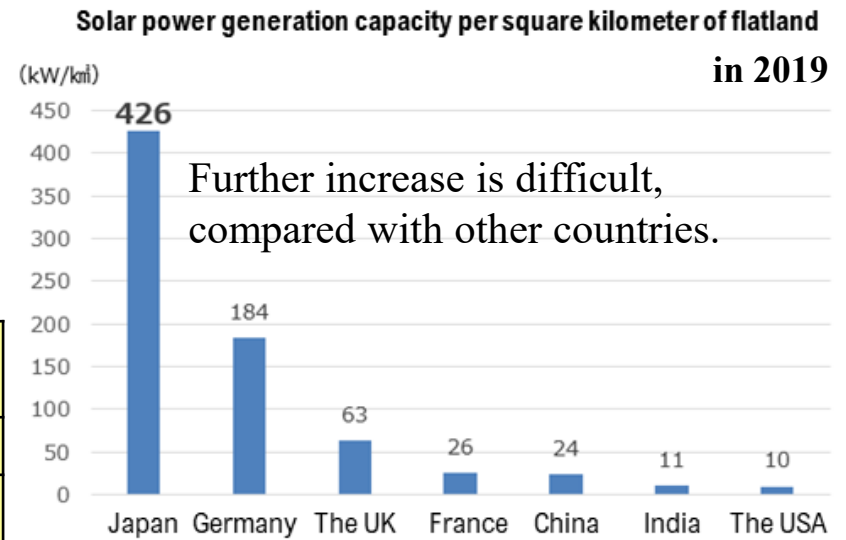


- Excessively generated electricity, controlled by a power conditioner, can be stored in a battery. It is then supplied in the peak demand period.
- (Bottleneck) Rechargeable battery is costly.



**Solar power supply companies are starting to change their scheme from FIT to FIP.**

% of Renewable Energy in Japan (Solar)		
2011	2021	2030
10.4 (0.4)	20.3 (8.3)	36-38 (14-16)



(source) [https://www.enecho.meti.go.jp/en/category/special/article/detail\\_173.html](https://www.enecho.meti.go.jp/en/category/special/article/detail_173.html)

# Transformation & Recycle – Hydrogen, e-Fuel –

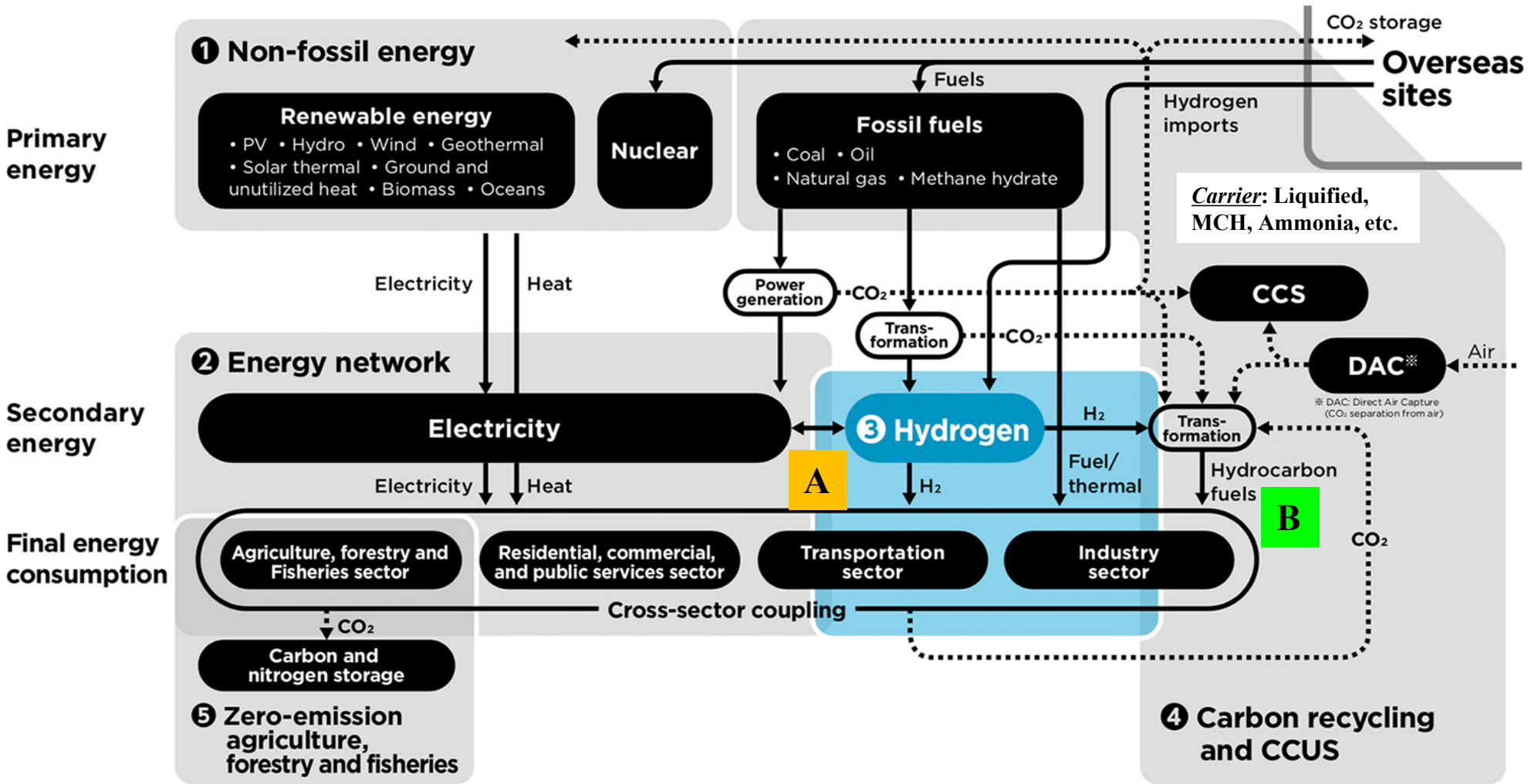
## TOPICS

### Hydrogen

- **A**: About 1 % of the whole electric power will be generated by H<sub>2</sub>/Ammonia combustion in 2030.
- H<sub>2</sub> turbine: Global market of about 23 trillion yen
- H<sub>2</sub>(35%)-city gas mixed combustion has already been demonstrated.
- Japan had around 158 hydrogen stations as of Feb. 2022.

### e-Fuel

- **B**: Ruling, effectiveness, etc. are still controversial.
- Costly: 300-700 yen/L



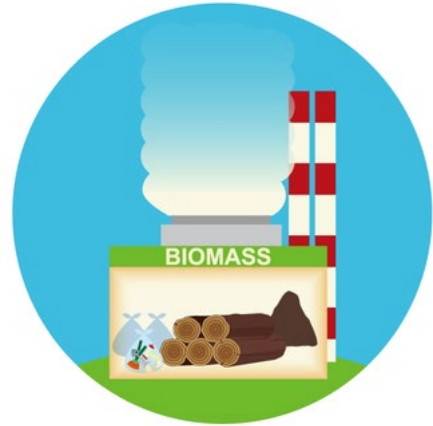
(source) "Tapping Hydrogen's Energy Potential" METI



# CCS (Carbon Capture and Storage)

## TOPICS

### Example of Implementation



**Biomass Power Plant**  
(capacity: about 7,000 kW)



CO<sub>2</sub>-free

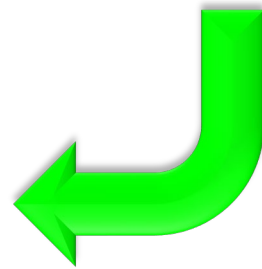


#### CO<sub>2</sub> Recovery System

- space: 6 m x 2 m
- capacity: 0.3 t-CO<sub>2</sub>/day



*Negative Emission*



**Recovered CO<sub>2</sub>:**  
utilized in a greenhouse  
on the same premises  
(photosynthesis)

- Global market of CO<sub>2</sub> recovery facilities: 45 trillion yen in total in 2050 (METI)
- Development of medium/small-scale systems is underway in several companies.
  - => Possibility of distributed CO<sub>2</sub> recovery in small plants and factories, etc.
- How to recover:
  - ✓ Chemical absorption (Amine)
  - ✓ Film separation + adsorption
  - ✓ Film separation + physical absorption etc.

(source) Endo, T. et al., CO<sub>2</sub> Capture Technology Applied for Realization of Carbon Neutral Society, Journal of the JIME, Vol. 58, No. 1, 34-38, 2023.

# Closing Remarks

- **Status Quo – Industrial sector (power generation, heating by combustion, etc.) takes more than 50% of GHG emission in Japan.**

## **(Individual Issue)**

- **Decrease in Electricity Supply Capability of Thermal Power Plant**
- **Avoided Emission: Efficient Electric Heating, Heat Pump, etc.**
- **Sustainable Energy Options:**
  - **Solar Power Generation & Storage: FIT => FIP**
  - **Transformation & Recycle: H<sub>2</sub>/Ammonia-Fossil Mixed Combustion, e-Fuel**
  - **CCS: Medium/Small-Scale CO<sub>2</sub> Recovery System**

# Thank you for your attention!

