



Building Carbon-free Society through Chemical Recycling

July 8, 2021

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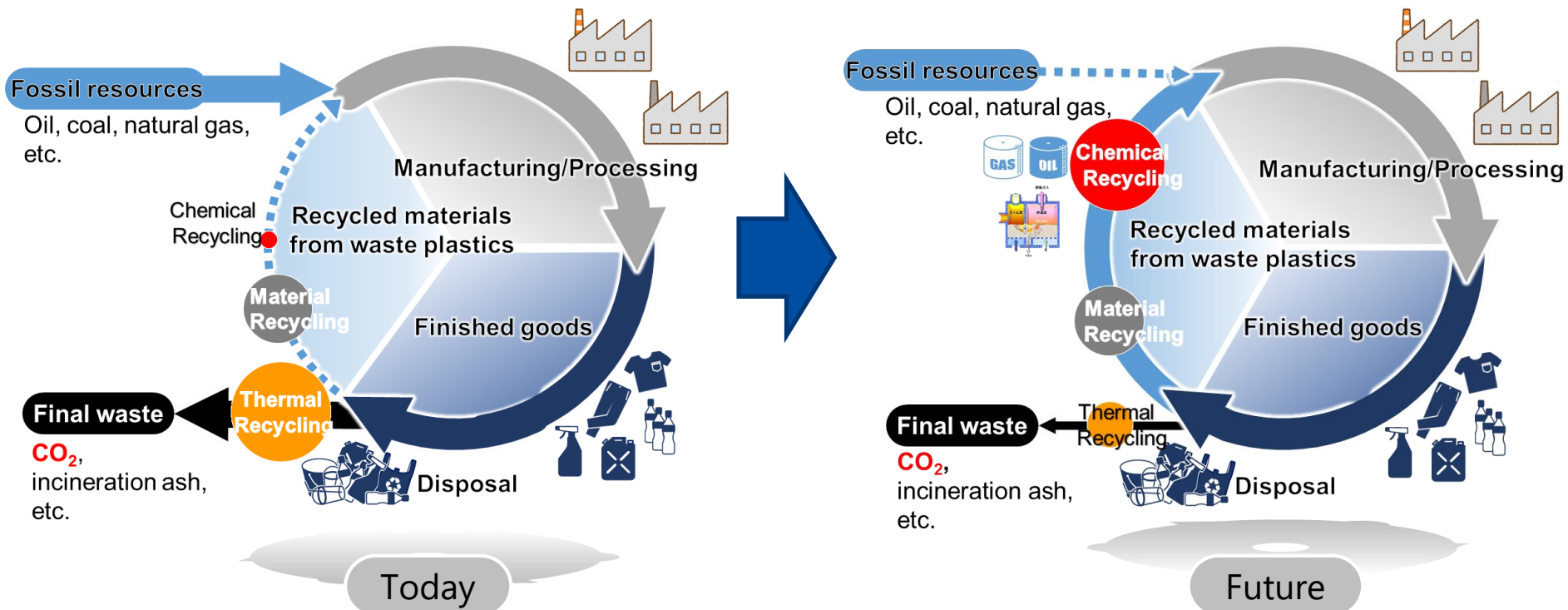
Looking ahead,
going beyond expectations

Ahead > *Beyond*

To Achieve Carbon Neutral

- To realize a carbon-neutral society in the future, it is necessary to reduce the amount of new inputs of carbon resources such as crude oil, which is used as a raw material for fuels and plastics, and to maximize the recycling of available resources.
 => **Transition from "incineration" to turn carbon resources to CO₂, to advanced "resource recycling," to reuse carbon as fossil resources**

Future of Plastic Lifecycle

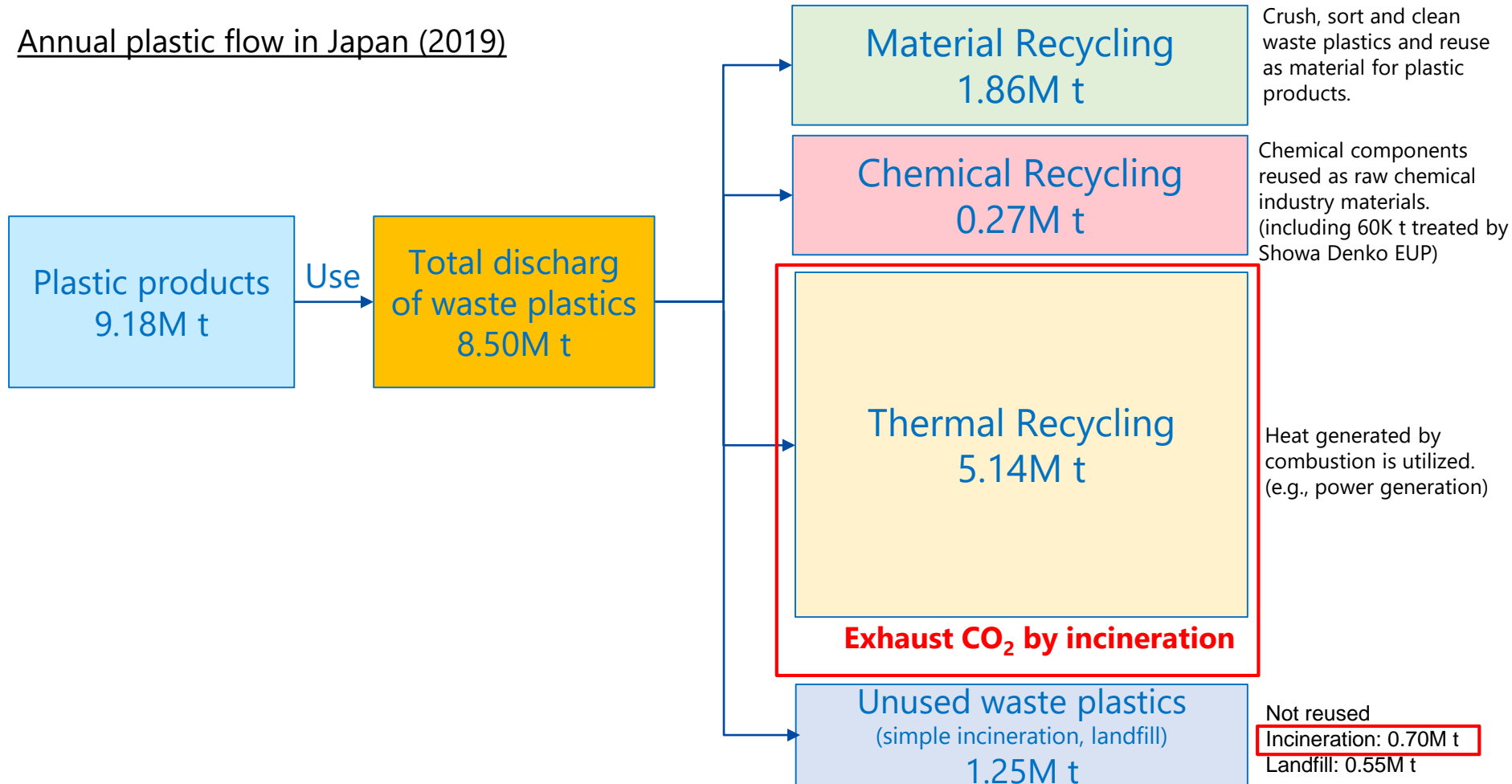


Current Status of Waste Plastic Recycling

- Approximately 16 million tons of CO₂ was discharged by thermal recycling (including simple incineration) in 2019.

Waste Plastics Recycling Methods and Amounts

Annual plastic flow in Japan (2019)



※From "2019 Production, Recycling and Disposal, and Treatment of Plastic Products" by the Plastic Waste Management Institute

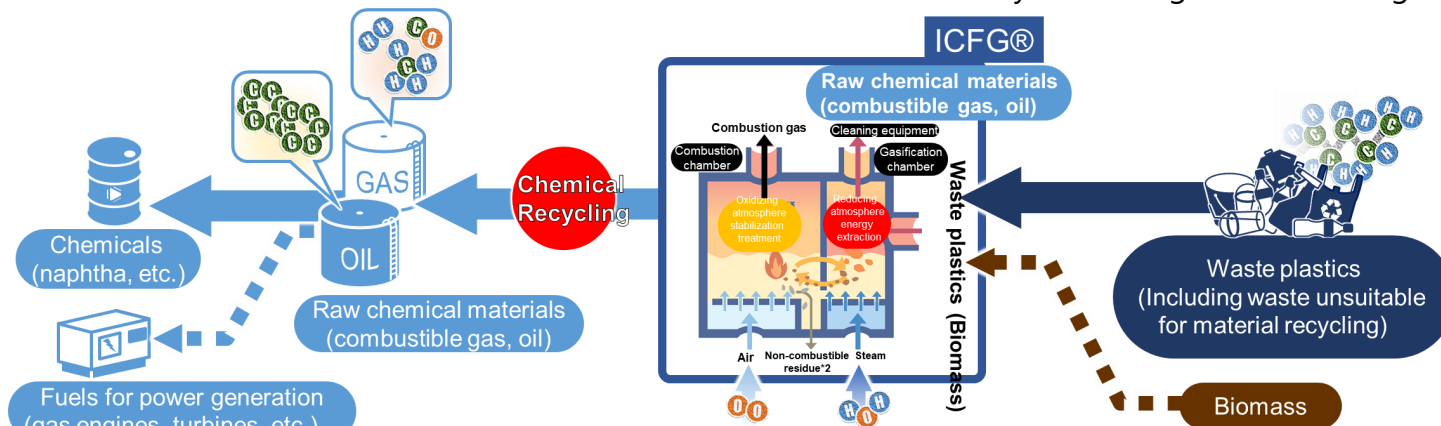
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Promoting Chemical Recycling to Realize Sustainable Society

- Realize chemical recycling using ICFG[®], our proprietary technology, and recycle various waste plastics, which are difficult to recycle as materials, into carbon resources

※ICFG[®]: Internally-circulating fluidized-bed gasification system



※Not only waste plastics but also biomass can be transformed as a chemical raw material

Forecast of Future Waste Plastic Treatment

		(expected throughput ※1)	
Material Recycling (1.86M t)		Material Recycling (2.0M t※2)	Equivalent of 80-120 facilities with 100t/day volume (30K t/year) in Japan
Chemical Recycling (0.27M t)		Chemical Recycling(2.5M-3.5M t)	
Thermal Recycling (5.14M t)		Thermal Recycling(1.5M-2.5M t)	
Simple Incineration/Landfill (1.25M t)		Simple Incineration/Landfill (1.2M t)	
Today		Future	

※1: Our estimation based on data from the Japan Chemical Industry Association and CLOMA

※2: Material recycling is expected to increase due to technological innovation, and thermal recycling is expected to further decrease.



EBARA's Waste to Chemical Initiatives

July 8, 2021

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Division Executive of Engineering Division
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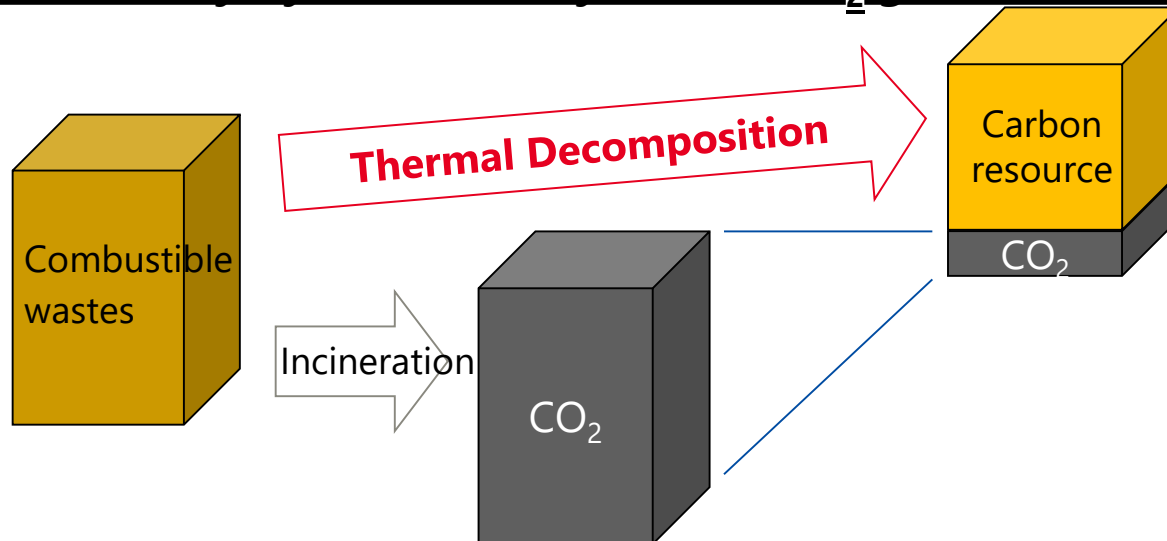
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What We Want to Realize

What We Want to Realize

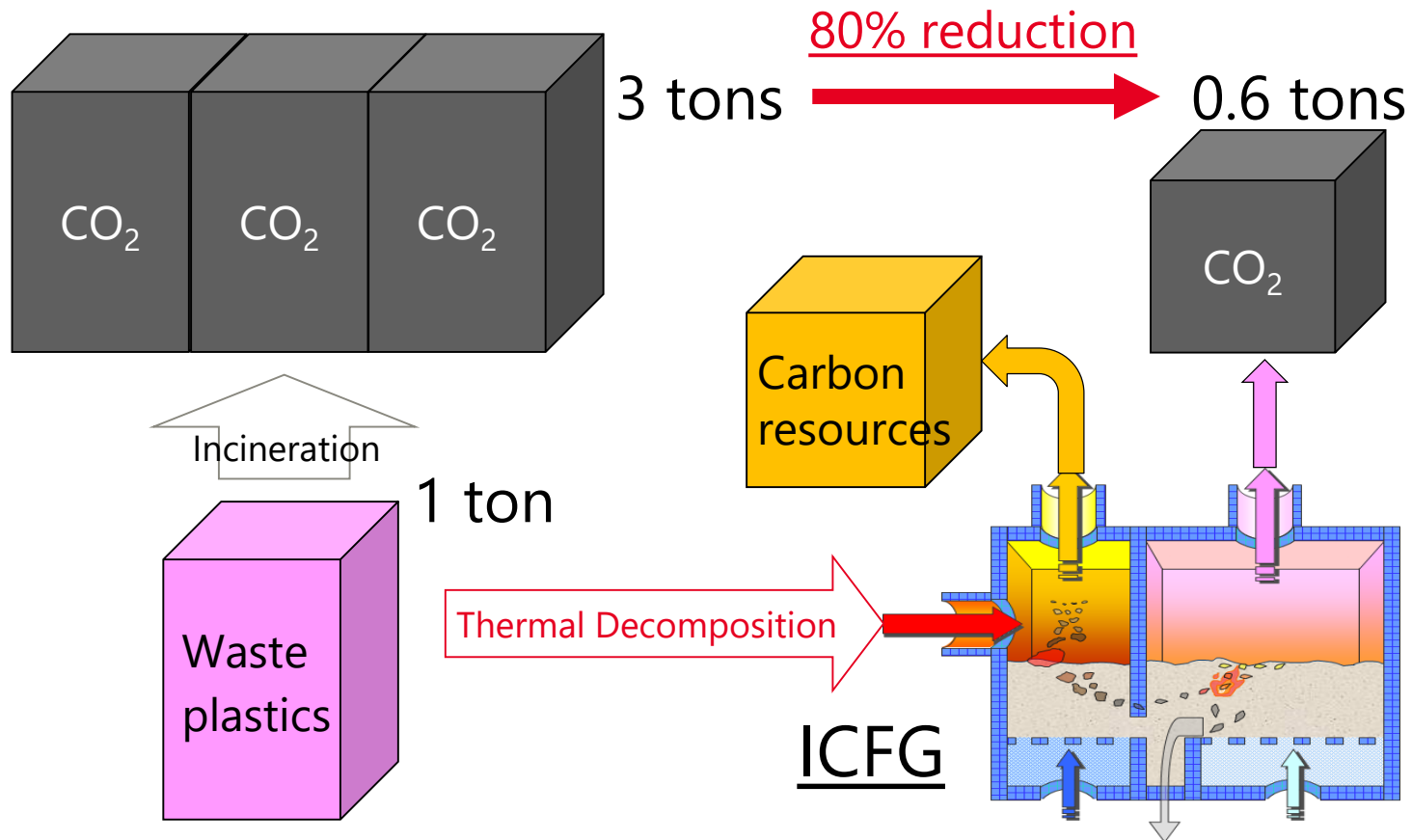
- Incineration has the advantage of hygienically disposing of decaying organic matter, but at the same time, it has the disadvantage that all carbon components in the waste are released as CO₂.
- To solve this issue, we are working on thermal decomposition*, which collect carbon resources from waste. We aim to **contribute to the creation of a carbon neutral society by dramatically reduce CO₂ generation in waste treatment.**



* A process that is principally advantageous and excellent in terms of LCA (requiring less energy input) than recovering CO₂ after waste has been burned into CO₂.

Application for Waste Plastic Treatment

- When one ton of waste plastics is incinerated, approximately three tons of CO₂ is discharged.
- Thermal decomposition of waste plastics reduces CO₂ by approximately 80%.



What ICFG[®] can Do

ICFG: Internally Circulating Fluidized-bed Gasifier

Facts about Waste Plastics (1/2)



- To promote plastic recycling, it is necessary to collect plastics used in various applications.
- There are a variety of types of plastics, and **material recycling is not easy.**



Facts about Waste Plastics (2/2)



- Collected waste plastics are often soiled with food residue and other materials, and it is necessary to treat them hygienically.
⇒ **Unsuitable for material recycling**
- Chemical recycling is capable of recycling even soiled waste plastics and combustible wastes into carbon resources.



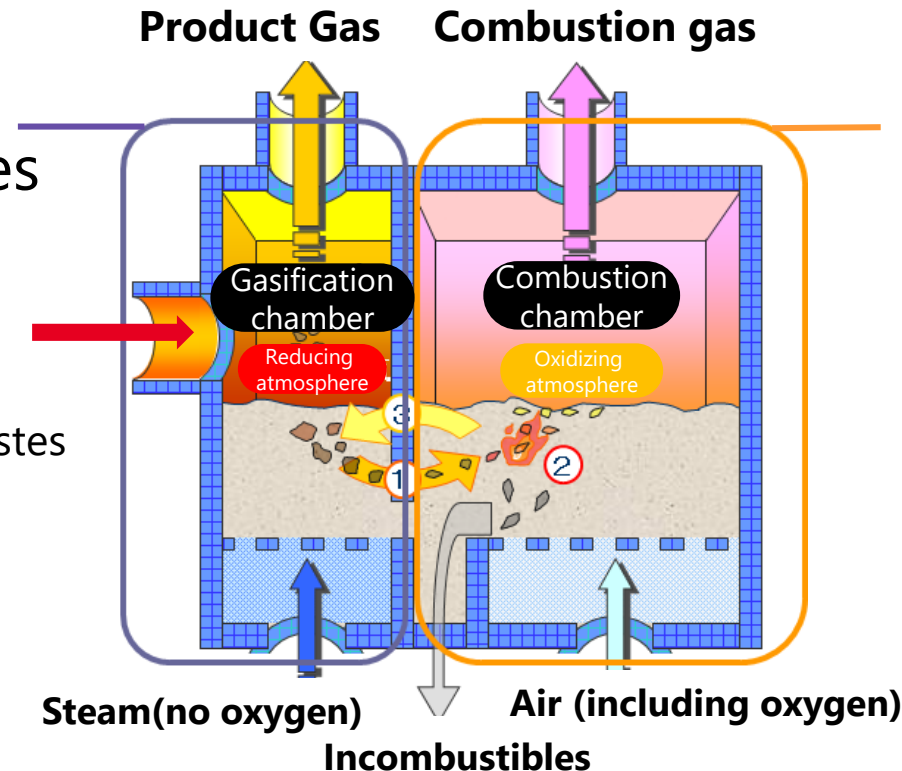
What ICFG Can Do and its Characteristics

- Unique technology that enables both "Extraction of Carbon Resources" by thermal decomposition and "Waste Treatment" by incinerating combustibles which can not be decomposed, in a single furnace.
- In addition, heat generated by incineration can be used as a heat source for thermal decomposition.

Extraction of Carbon Resources

[Raw Materials]

- Waste plastics
- Biomass
- Combustible wastes
- Others



Waste Treatment

ICFG Proof of Concept (PoC) already conducted

- PoC of gasification and power generation (over 6,000 hours in total) using municipal garbage, waste plastics and biomass demonstrated at Sodegaura R&D Center in Chiba Prefecture (-2006)
- PoC of gasification power generation (approx. 2,000 hours) using sewage sludge as a material demonstrated in Kiyose City

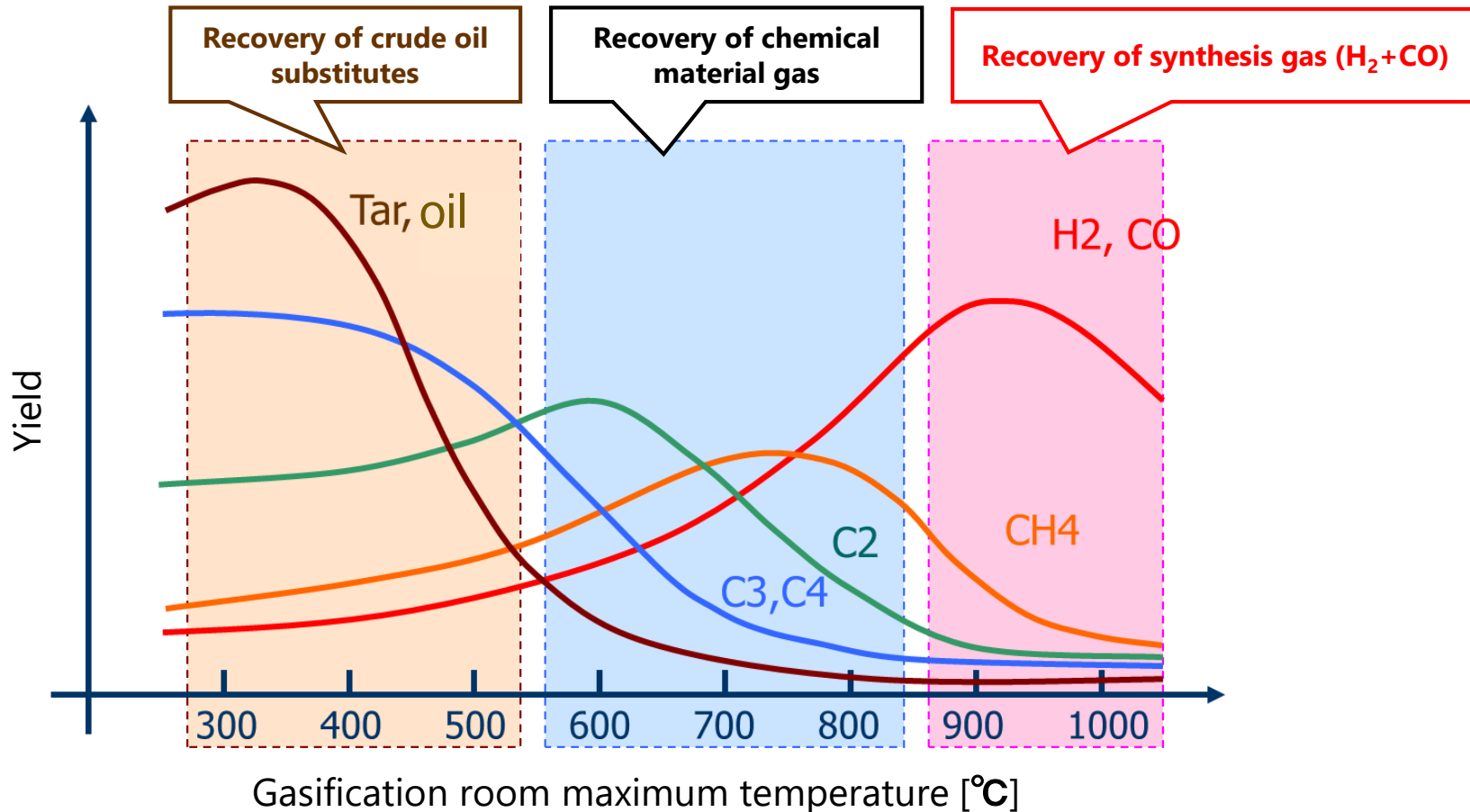


Demonstration plant in 2006 (Sodegaura R&D Center)

Future Development

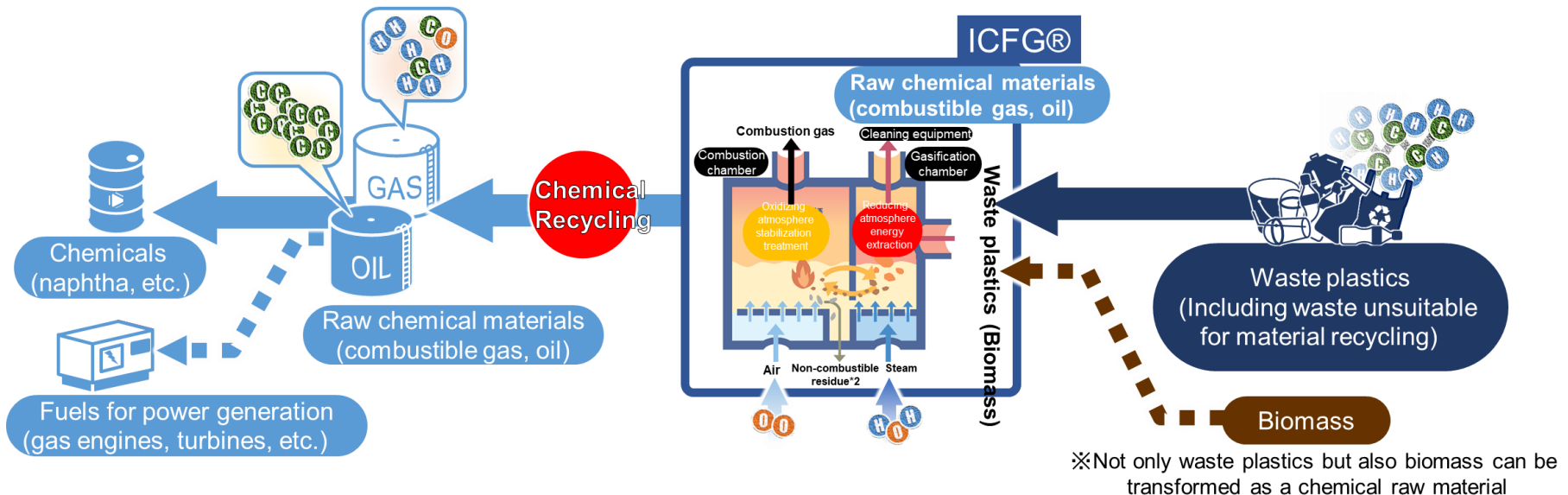
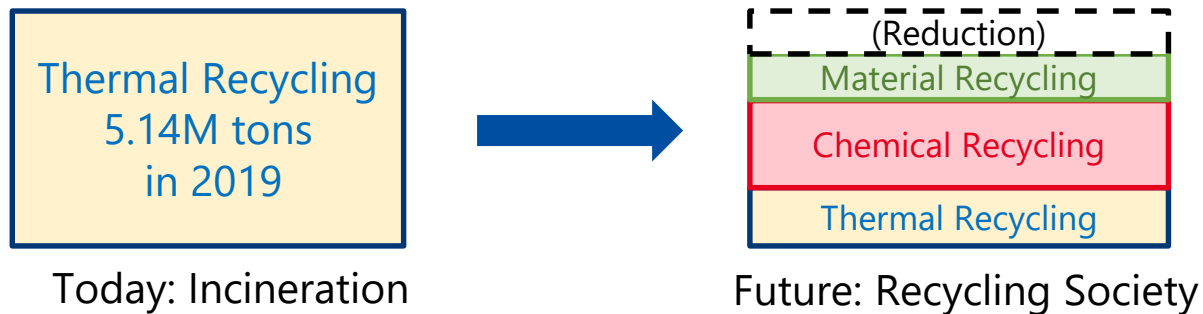
Carbon Resources captured by ICFG

- Carbon content in waste raw materials can be extracted as a variety of carbon resources by changing operating conditions such as decomposition temperature.



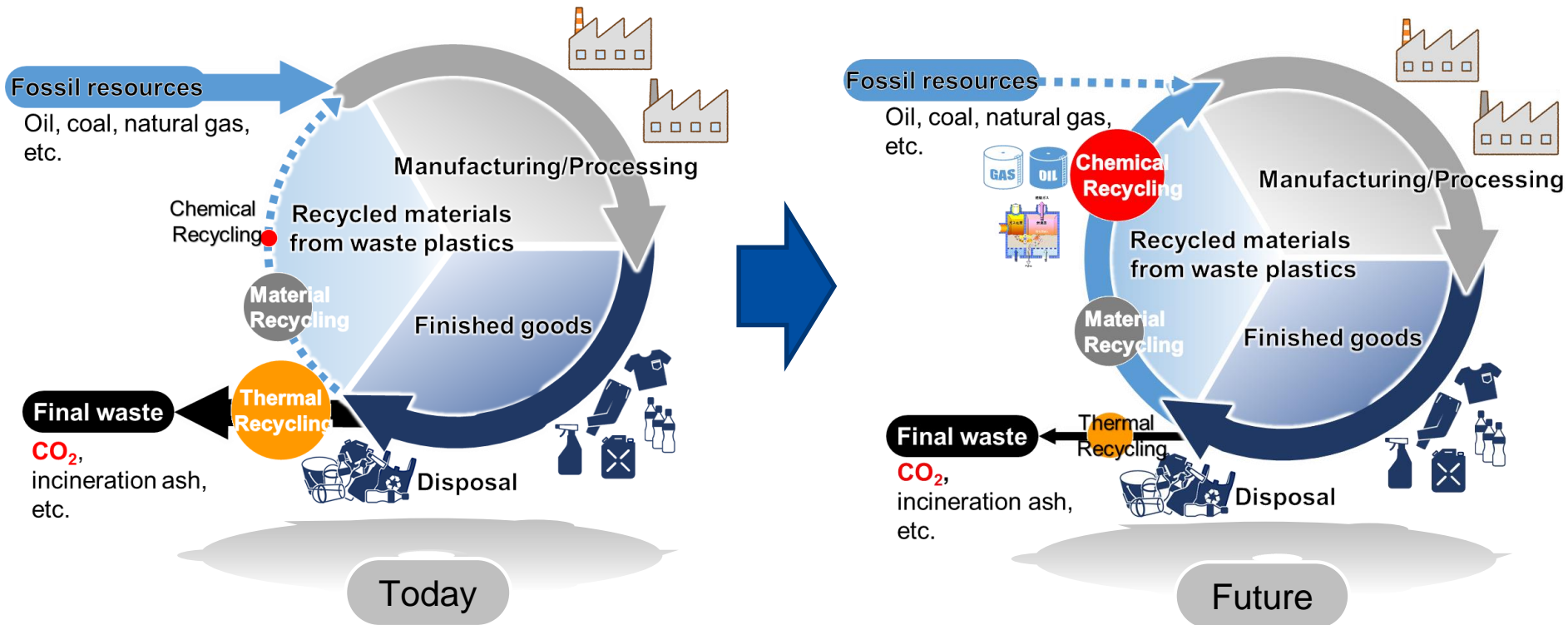
Thermal Recycling to "Carbon" Recycling

- Extract carbon resources from "soiled waste plastics" that have been incinerated to date and turn them into chemical raw materials, and ultimately contribute to the "creation of a recycling society"



Toward Realization of Circular Economy

- Contribute to "reduction of fossil resources consumption" through chemical recycling



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