



WASTE PLASTICS CHEMICAL RECYCLING BY GASIFICATION

To Achieve a Sustainable Society

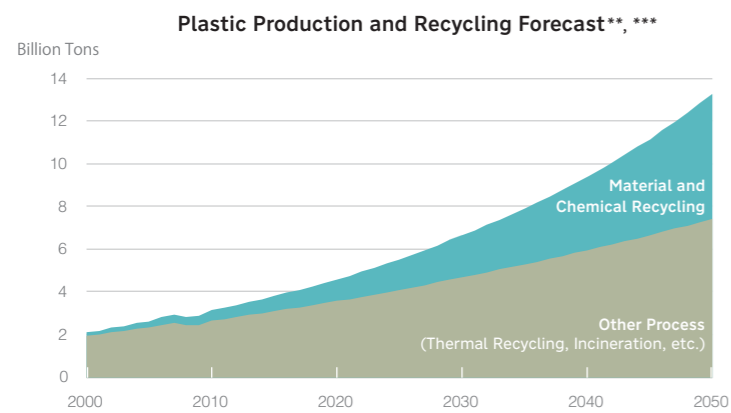
JGC JGC GROUP

Promotion of Plastic Recycling has been one of a global issue.

IDENTIFYING THE PROBLEM

World Demand for Plastics and Current State of Recycling

- ▶ It is estimated that by 2050, the world demand for plastics will be tripled from the 2015's.
- ▶ There is an estimation that the weight of plastics in the ocean will exceed total weight of fish living in the ocean by 2050, if the present trend continues.*
- ▶ Significant increase in amount of the plastics for recycling is highly required.



*THE NEW PLASTICS ECONOMY: RETHINKING THE FUTURE OF PLASTICS & CATALYSING ACTION, ELLEN MACARTHUR FOUNDATION, 2017
**Production, use, and fate of all plastics ever made, Roland Geyer, Jenna R. Jambeck, Kara Lavender Law, 2017
***Improving Plastics Management: trends, policy responses, and the role of international co-operation and trade, OECD, 2018

In addition to Material Recycling, promote Chemical Recycling

Significant improvement in the plastic recycling rate is required worldwide*. While making maximum use of material recycling, it is also required to promote chemical recycling that can be applied to waste plastic which is difficult to recycle, such as "mixed plastic" and "contaminated plastic".

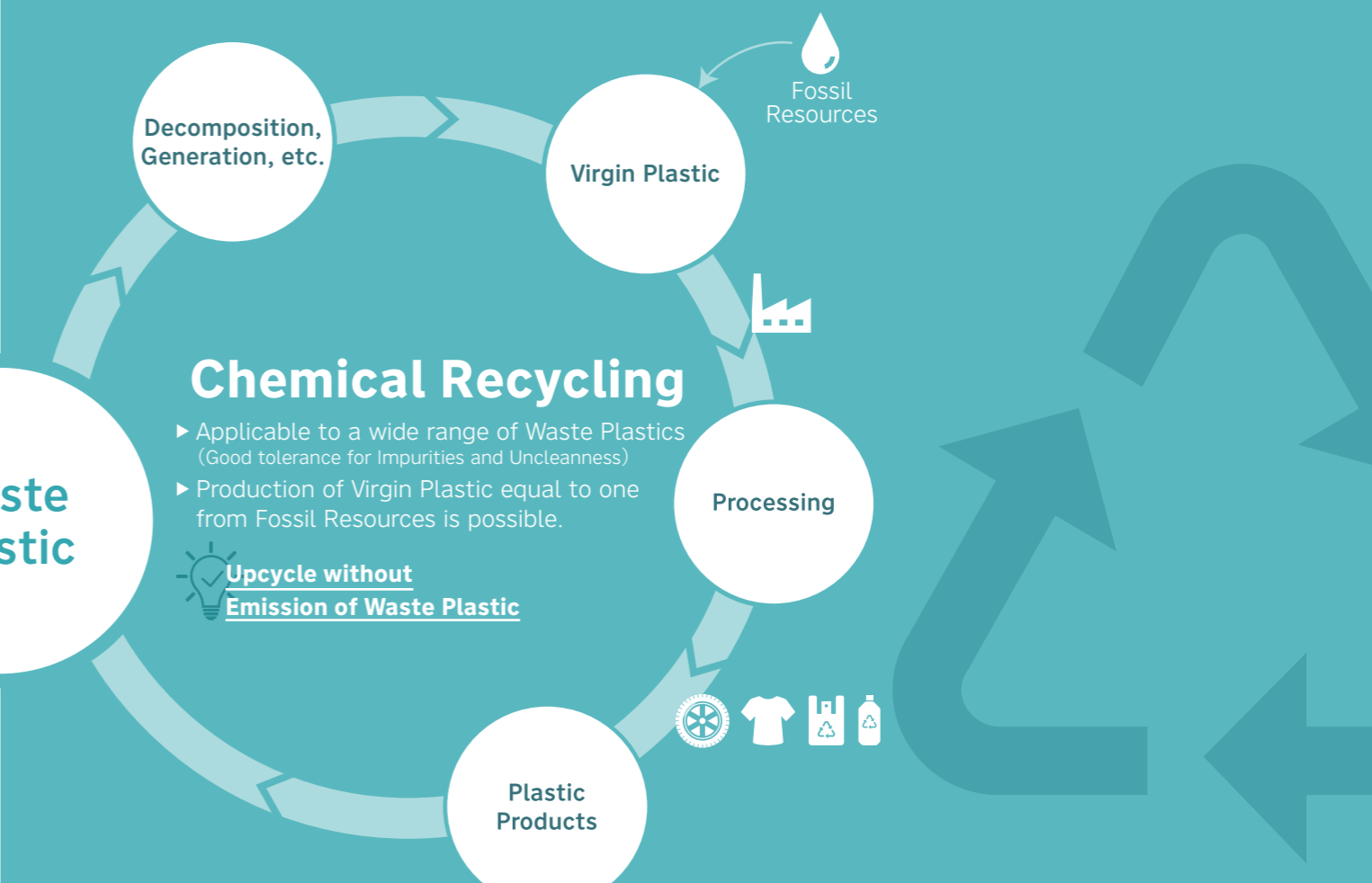
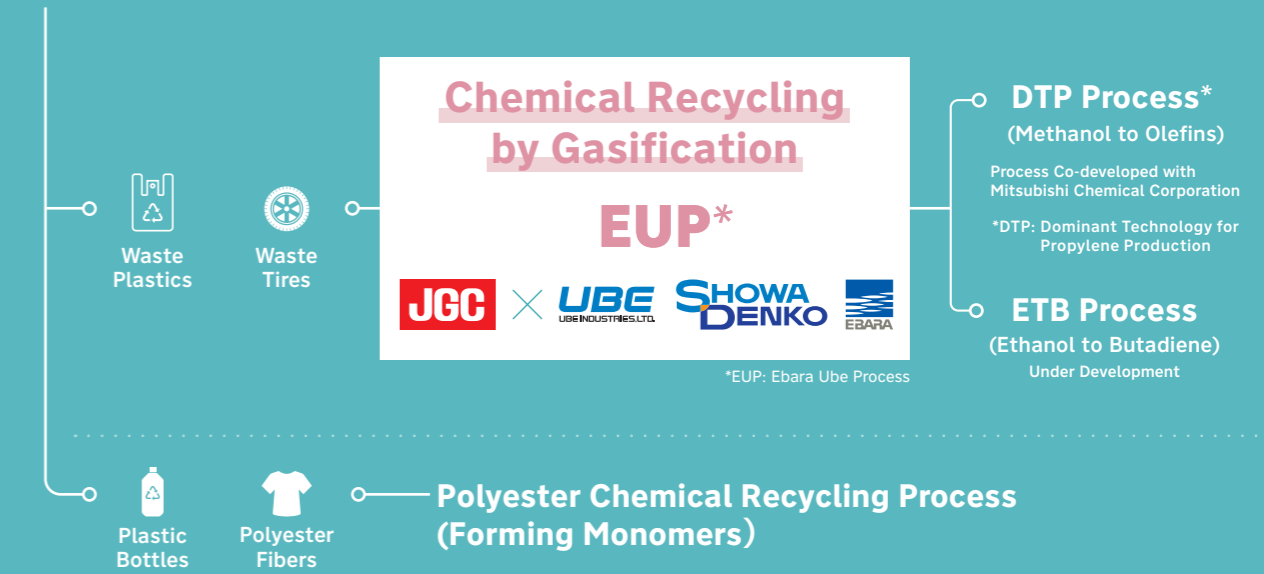
*A European Strategy for plastics in a circular economy
By 2030, all plastic packaging placed on the EU market is to be either reusable or recyclable.



VISION by JGC

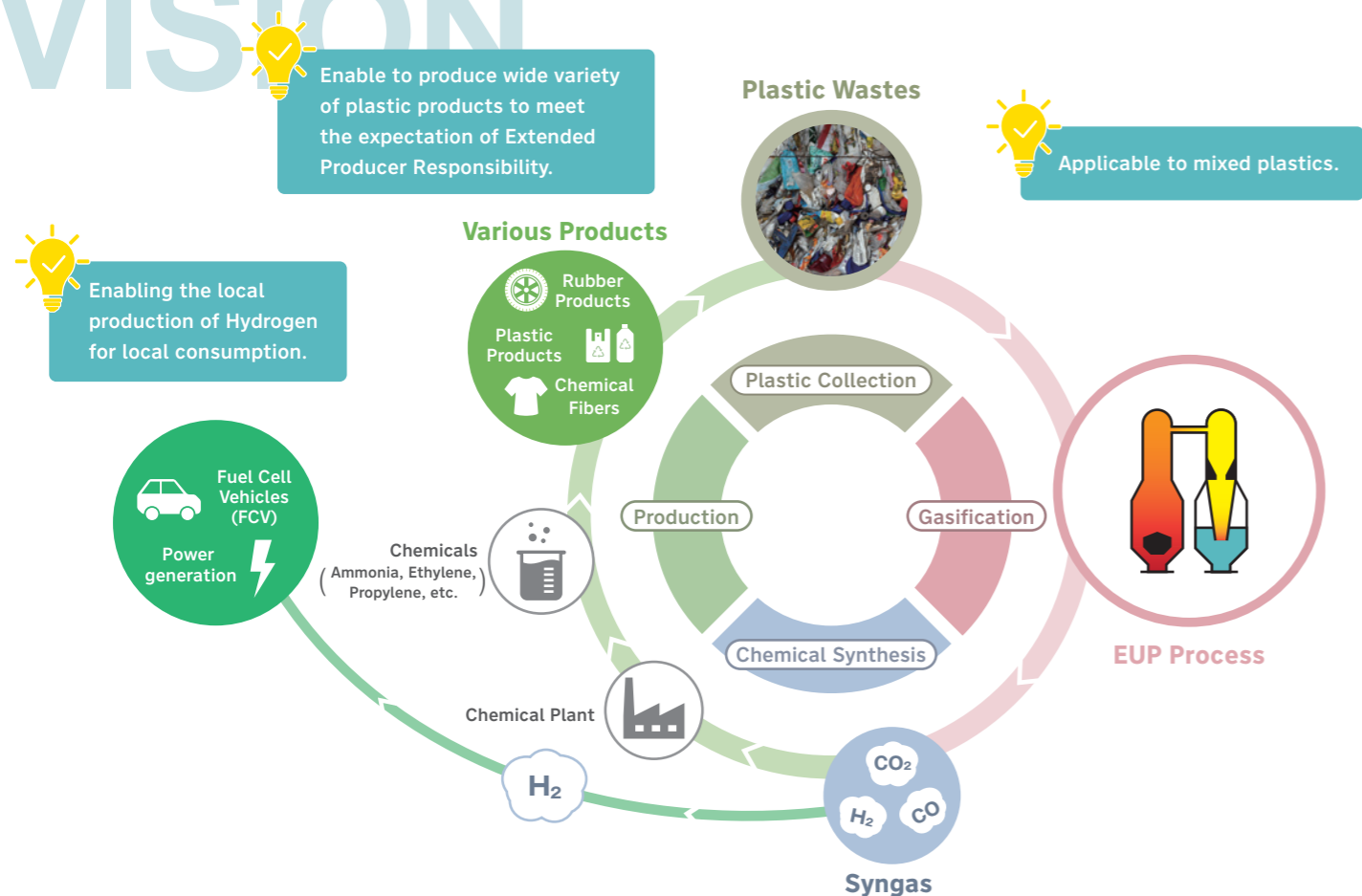
Waste Plastic Reborn as Virgin Plastic! We Propose Realization of a Upcycle

Chemical Recycles promoted by JGC Group



REALIZATION of VISION

EUP, Realizing a Waste Plastic Recycling Society Chemical Recycling by Gasification

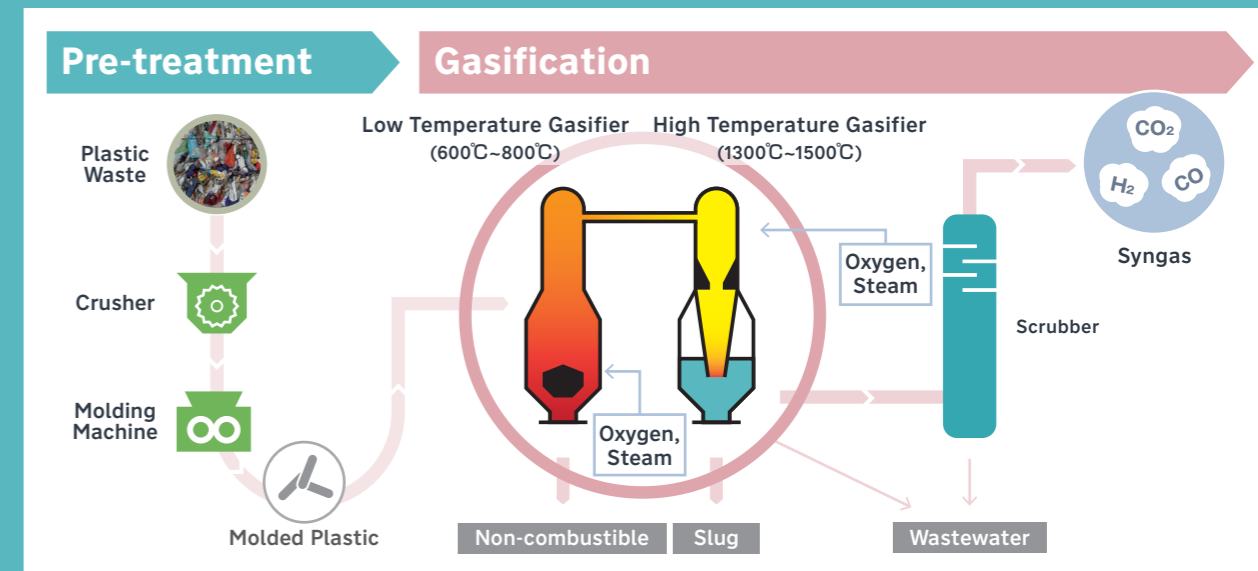


WHY JGC

EUP, the Gasification Chemical Recycling Technology

EUP was jointly developed by EBARA CORPORATION (transferred this business to Ebara Environmental Plant in 2009) and UBE INDUSTRIES LTD. This process produces syngas from waste plastic using partial oxidation with oxygen and steam. Syngas can be utilized for production of ammonia, olefins, and etc.

This EUP is applied for a gasification facility at Showa Denko's Kawasaki Plant which is continuously running from 2003. This is the only technology for gasification chemical recycling in the world with a long-term track record of commercial operation.



Features of EUP

- ▶ High pressure operation (10 barg) promotes chemical synthesis
- ▶ Achieving high gas conversion rate by high temperature operation
- ▶ No dioxin generation

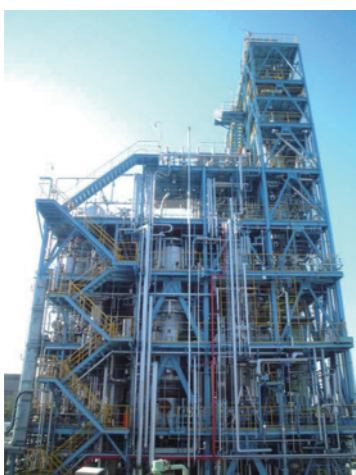
EUP is the first and only Gasification Chemical Recycling Process which has long-term commercial operation track record.

EUP Co., Ltd.

Location:
Ube City, Yamaguchi Prefecture

Processing Capacity:
95 Tons/Day

Operation Record:
2001 ~ 2008



Showa Denko K.K.

Location:
Kawasaki City, Kanagawa Prefecture

Processing Capacity:
195 Tons/Day

Operation Record:
2003 ~ Present



Expertise in
Engineering
and Operation
of EUP

UBE
UBE INDUSTRIES, LTD.

SHOWA DENKO

EBARA



Expertise in
Engineering of
Gasification Plant
and Great Experience

There is a reason for JGC Group leading the promotion of EUP Process.
Superior track record and knowledge in every detail of Gasification Chemical Plants

- ▶ Experiences in gasification projects for various types of feed materials
- ▶ Deep knowledge, specifically to the gasification process
- ▶ High reliable plants enabled by outstanding system integration ability.
- ▶ Support total plant control and plant automation



GTL* Plant

Sarawak, Malaysia

The first commercial plant in the world to produce middle distillates of petroleum products processing natural gas as a feed.

*GTL: Gas to Liquids



IGCC*(Coal) Plant

Hiroshima, Japan

The first CO_2 separation and recovery type oxygen-blown IGCC(coal) plant in Japan.

*IGCC: Integrated Gasification Combined Cycle



IGCC(Residual Oil) Plant

Kanagawa, Japan

The first commercial IGCC plant in Japan

PROPOSAL

Creating a New Value from Waste Plastic through

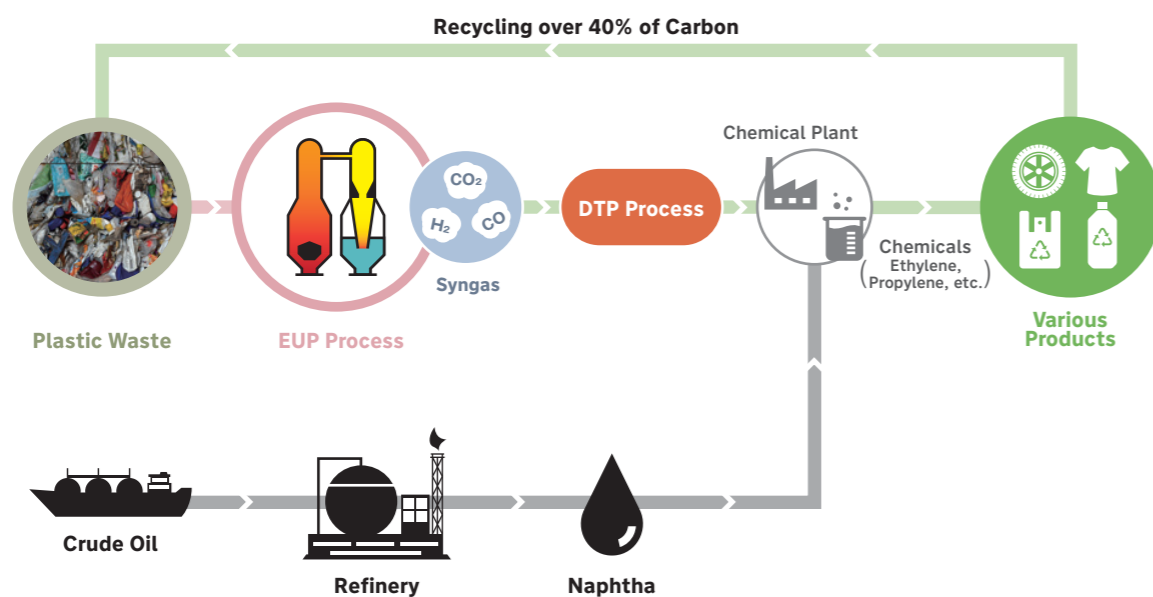
Gasification Chemical Recycling

Applicable Proposal

1 case

Produce Sustainable Plastic Products

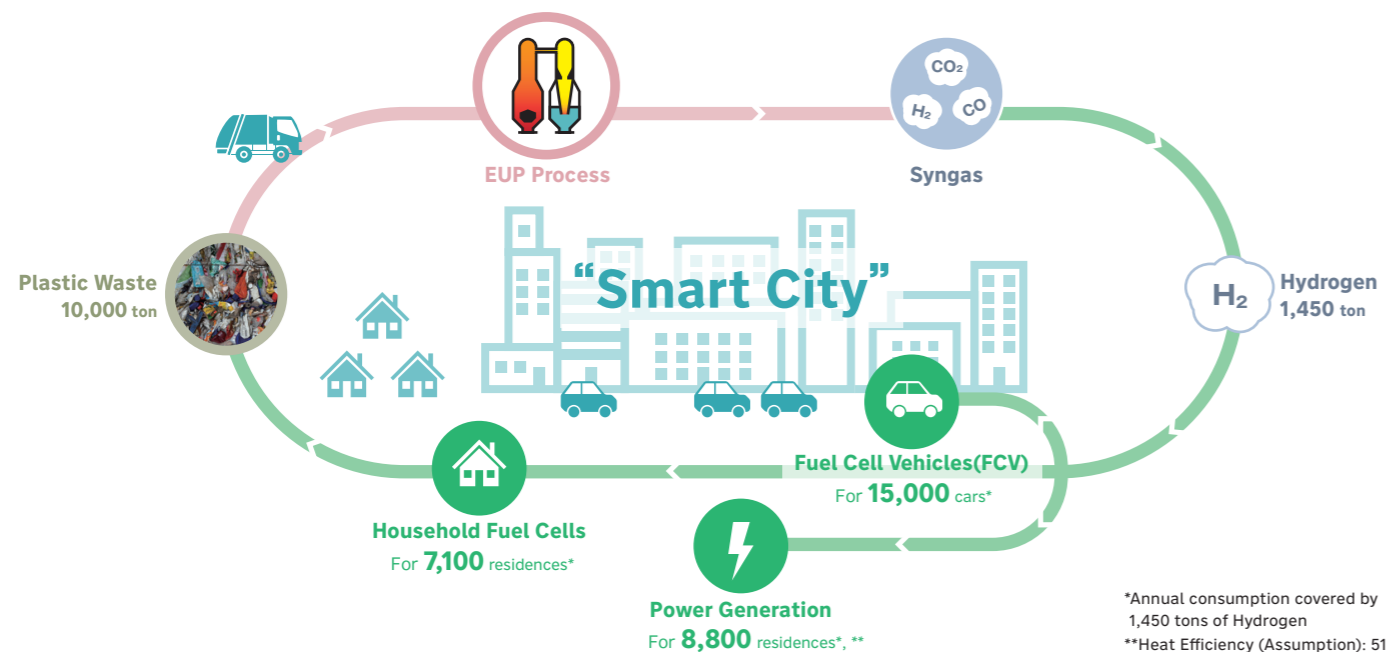
It is possible to expand an EUP Gasification Chemical Recycling facility utilizing existing chemical plant. Waste plastic becomes an alternative raw material, which contributes to saving of Crude Oil and Fossil Fuels.



2 case

Production of locally produced hydrogen for local consumption in the "Smart City"

We will construct Hydrogen Production facility by EUP from scratch. For required local hydrogen production source for local consumption, we will accomplish stable hydrogen supply which contributes to the demand for a higher self-sufficiency rate.



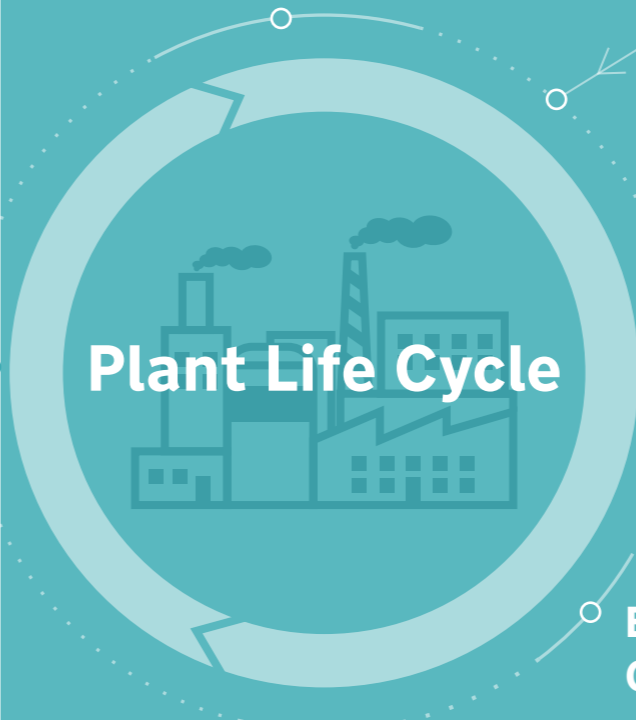
VALUE CHAIN SUPPORT

Gasification Chemical Recycling Plant

Provide Solutions for the Establishment and Operation

Our Business Planning Support will accelerate you to accomplish by including study of stable supply source, and support of partnering with Off-takers of the final product.

Business Planning Support



For Your Business

Aim to establish traceability of the recycling process through visualization of the routing of the recycled material from waste plastics.

Partnering Support of Raw Material Supply

Support for partnering with raw material suppliers such as waste plastic collectors.

Support for Partnering with Off-takers

Support for partnering with off-takers of final product.

Plant Life Cycle

License Design

As the EUP licensor/contractor, we can coordinate with the process development company and can design optimized gasification plant applying past project experiences.

EPC* + Commissioning

Making use of our experience for completing 20,000 projects in 80 countries, we promise to provide you satisfying plants in terms of quality, schedule, cost, and risk control.

*EPC: Engineering, Procurement and Construction

O&M Service

Utilizing the data gained from the long-term commercial operation of the Showa Denko plant, we can provide after-sales service by supporting operation and maintenance.

INTEGNANCE

Consists of an integrated maintenance service ranging from daily diagnosis and maintenance to the planning and execution of a regular maintenance scheme providing total plant maintenance service.

Initiatives of the JGC Group to Achieve a Sustainable and Environmentally Friendly Society

The JGC Group recognizes protecting nature and achieving harmony with the environment through our business activities as an important task. We are making efforts to protect the Earth's environment, such as building LNG plants which have an extremely small environmental impact, developing technology for the recycling of plastics, and promoting the spread of renewable energy.



JGC JGC HOLDINGS CORPORATION

Sustainability Co-Creation Department

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