German-Japanese Business Seminar

Sustainable Materials – Crucial for Recycling and Circular Economy

City of Düsseldorf Economic Development

EUROPE'S HEARTBEAT

NRW.GLOBAL BUSINESS Trade & Investment Agency

AsahiKASEI

Asahi Kasei's Actions & Challenges for the Carbon Neutral Society

Yoshito Kuroda
General Manager of R&D Center, Asahi Kasei Europe GmbH

Tokyo, 14th Sep., 2022

Asahi Kasei Group Overview

AsahiKASEI

Group Philosophy

„Contributing to life and living
for people around the world”

Foundation

in 1922

Sales Revenue

18.9 Billion €

Worldwide presence

20 countries (88 Sites)

Employees

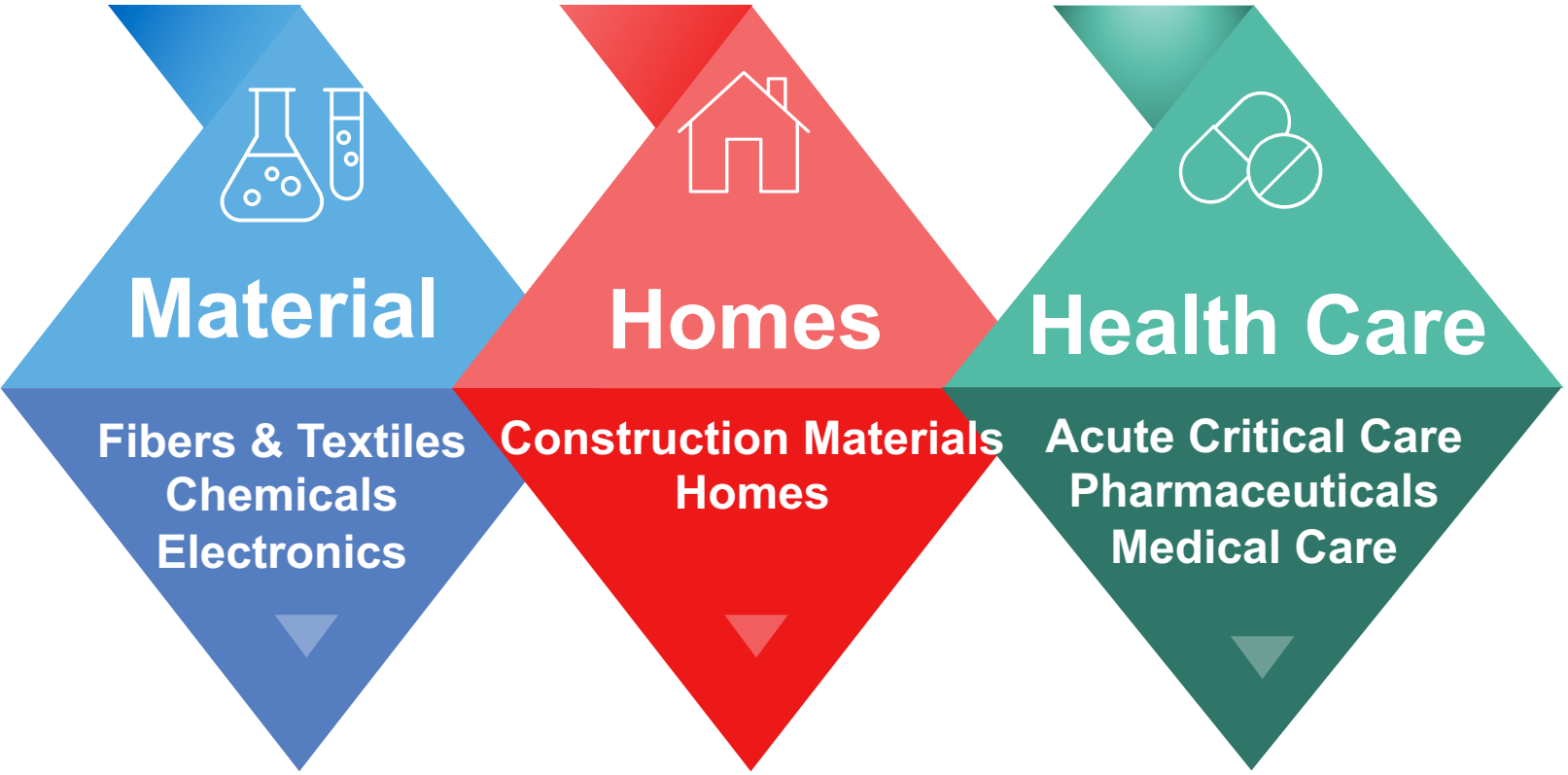
46,751

Financial year 2021 results
Exchange rate of 1€=130JP\

Revenue Per Segment Worldwide

AsahiKASEI

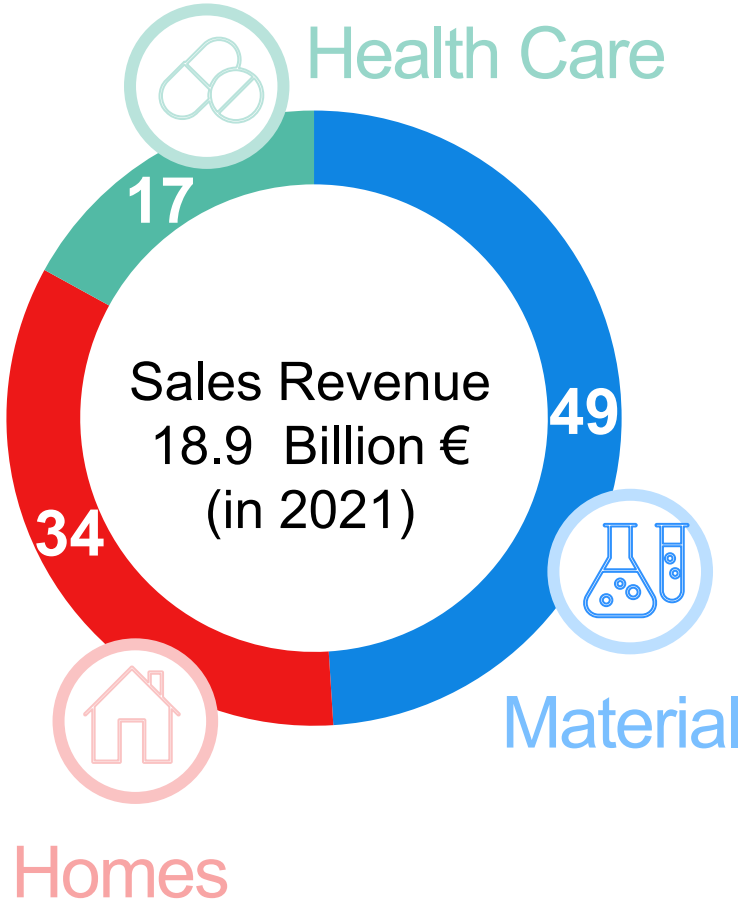
Three Growth Pillars



AsahiKASEI

AKM Senseair CELGARD DAIRAMIC AsahiKASEI ASAHI KASEI HOMES Veloxis PHARMACEUTICALS ZOLL.

MATERIAL HOMES HEALTH CARE



Exchange rate of 1€=130JP\

Asahi Kasei Europe GmbH

AsahiKASEI

Innovation Hub

New proposals for the future automobile based on cross-divisional and cross-AK company collaboration

Communication

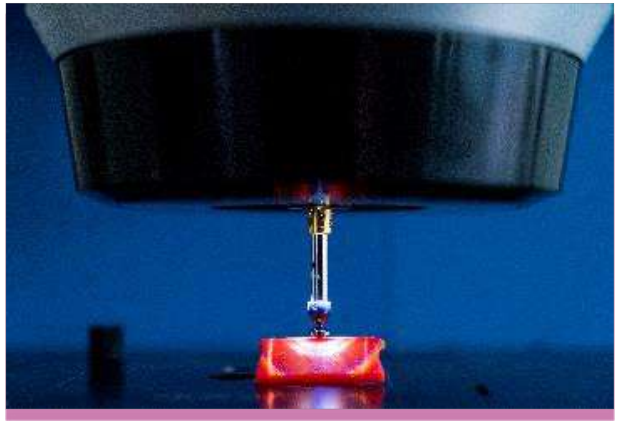
Stronger communication by uniting sales, marketing, logistics, R&D and technical service

Local R&D

Developing new materials fit for the European market together with customers and research institutes

Local Service

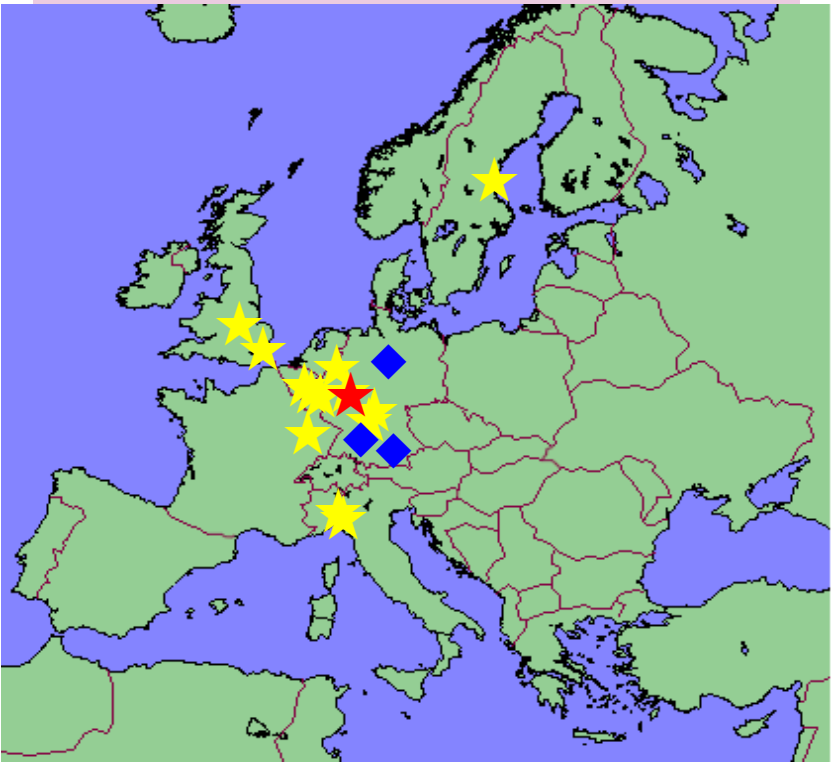
Local technical service with quick data analysis and remote technical support



Why we choose Düsseldorf as the business location?

AsahiKASEI

◆ German OEMs
★ Asahi Kasei Group Company
★ Asahi Kasei Europe GmbH



Business

The customer OEM & Tier1 companies are located in Germany (Middle West)

Centrally located in Europe with good access to the whole of Europe

Center of Asahi Kasei group businesses in Europe

R&D

Many bases of R&D and foundation for industrialization
(well-developed infrastructure)

Germany
NRW State
Düsseldorf

Providing generous support for Newcomer

- Support for establishing home base
- Continuous support for networking with business partners Responding to difficulties

Public Support

Comfortable city to live in for Japanese

livelihood

Innovation Culture (1) NH_3 Production

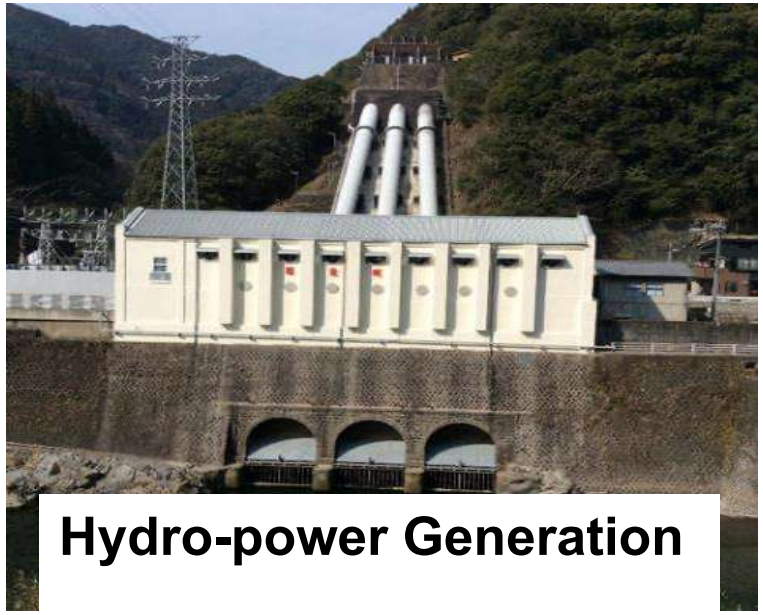
AsahiKASEI

1920s Started NH_3(ammonia) production by Casale method from 1923 as the 1st product at Asahi Kasei.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

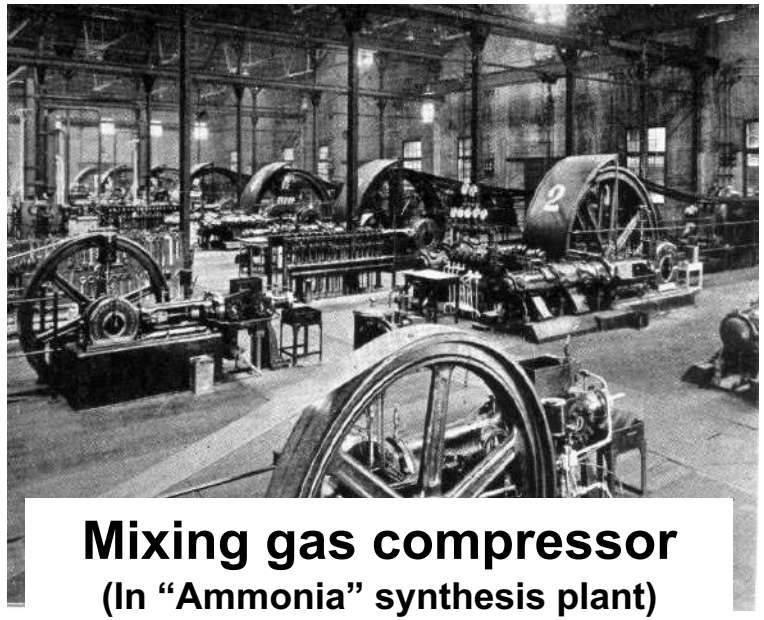
Electricity supplied by hydro-power generation

H_2(Hydrogen) supplied by water electrolysis



Hydro-power Generation

Casale method Monument



Mixing gas compressor
(In "Ammonia" synthesis plant)

Innovation Culture　(2) LIB

AsahiKASEI

1980/90s

Invention and launch of first lithium-ion battery

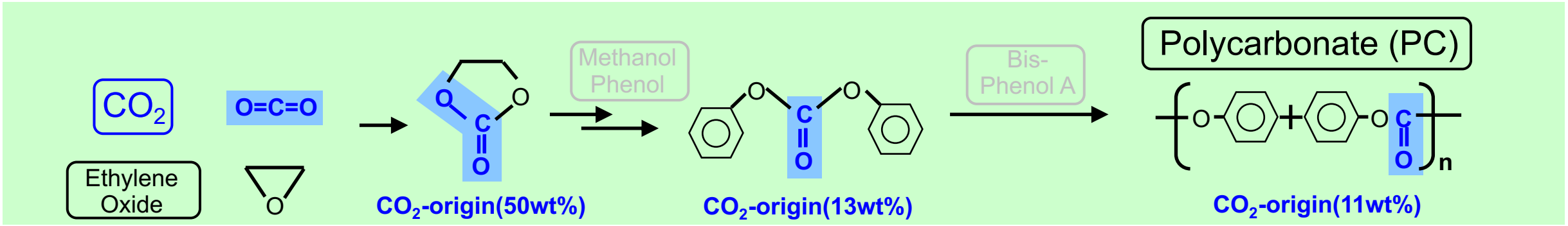
1981	Started new type of secondary battery
1985	Filed LIB patent application
1992	Founded JV A&T Battery
1993	Launched the first LIB

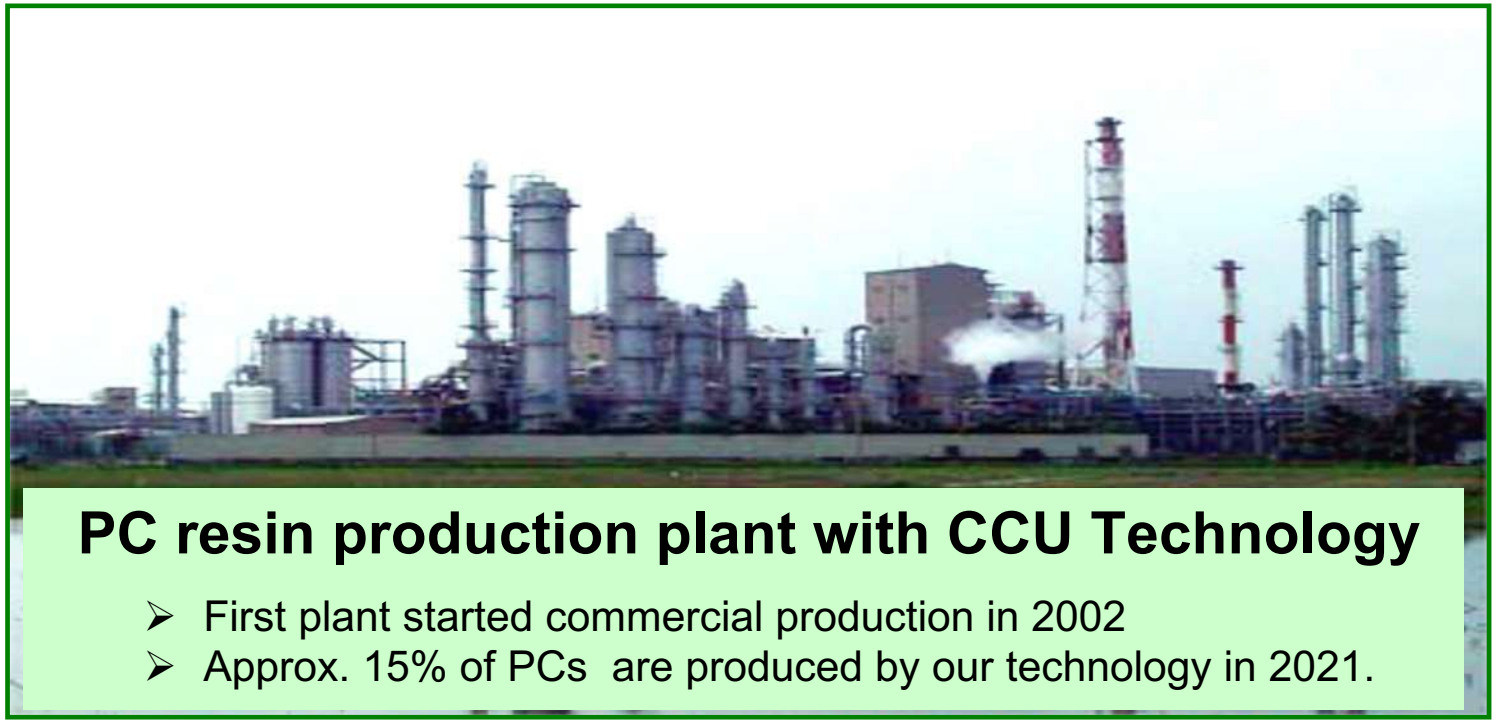
Dr. Yoshino
Inventor of the lithium-ion battery

Innovation Culture (3) CCU for Chemicals

AsahiKASEI

2000s Developed & started the world's 1st commercial plant operation for polycarbonate resin using CO_2 as a raw material.





PC resin production plant with CCU Technology

- First plant started commercial production in 2002
- Approx. 15% of PCs are produced by our technology in 2021.

Our Solutions For A Sustainable & Decarbonized Society

AsahiKASEI

Solar power

Wind Power

Hydro Power

Biogas

CO_2

CCU

Renewable Resources

Customers Consumers

Circular Economy

Reduce
Reuse
Recycle

Renewable Power & its storage

Water Electrolyzer

Hydrogen

Chemicals & Resins

Mobilities

Industries

Household Office

Renewable heat source

Nitrogen

Methanol etc.

Renewable Fuels

Hydrocarbons
Ammonia
(NH_3)

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Household Office

Renewable heat source

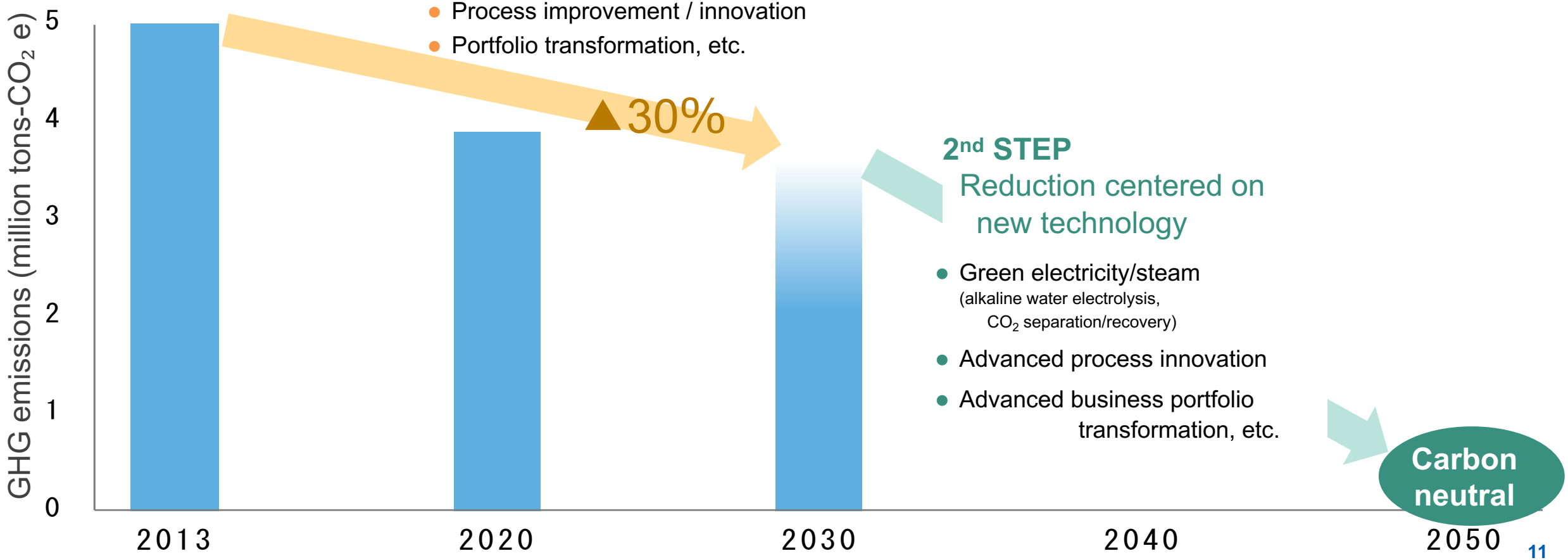
Target & measures for reduction of own GHG emissions

AsahiKASEI

1st STEP

Reduction centered on established businesses

- Low-carbonization of in-house power generation
- Purchase of non-fossil power
- Process improvement / innovation
- Portfolio transformation, etc.



2nd STEP

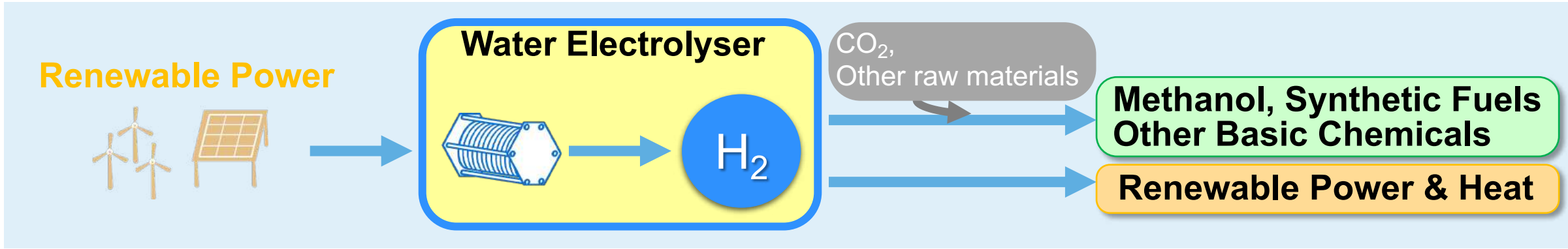
Reduction centered on new technology

- Green electricity/steam
  (alkaline water electrolysis, CO_2 separation/recovery)
- Advanced process innovation
- Advanced business portfolio transformation, etc.

Contributing to Carbon Neutral/ reduced GHG emissions in society

Hydrogen production technology from water

AsahiKASEI



Started the development of Water-Electrolysis system based on Chlor-Alkaline Electrolyte System

Aqualyzer

1923

1975

2010

Launched Chlor-Alkaline Electrolysis System

2018

Joined H2herten Pj

2020

Joined & supplied water electrolyser to ALIGN-CCUS Pj in2020 & Take Off Pj in 2021

2021

Supplied 10MW Water Electrolyser to NEDO Pj (FH2R)

Contributing to Carbon Neutral/ reduced GHG emissions in society

CO_2 Separation Technology

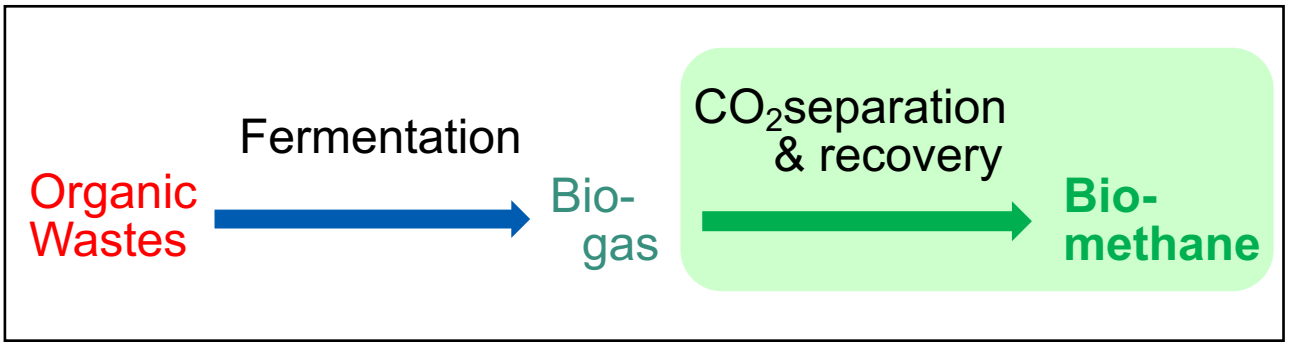
AsahiKASEI

New inorganic materials to separate CO_2 from Biogas or N_2 mixture

➢ Key material

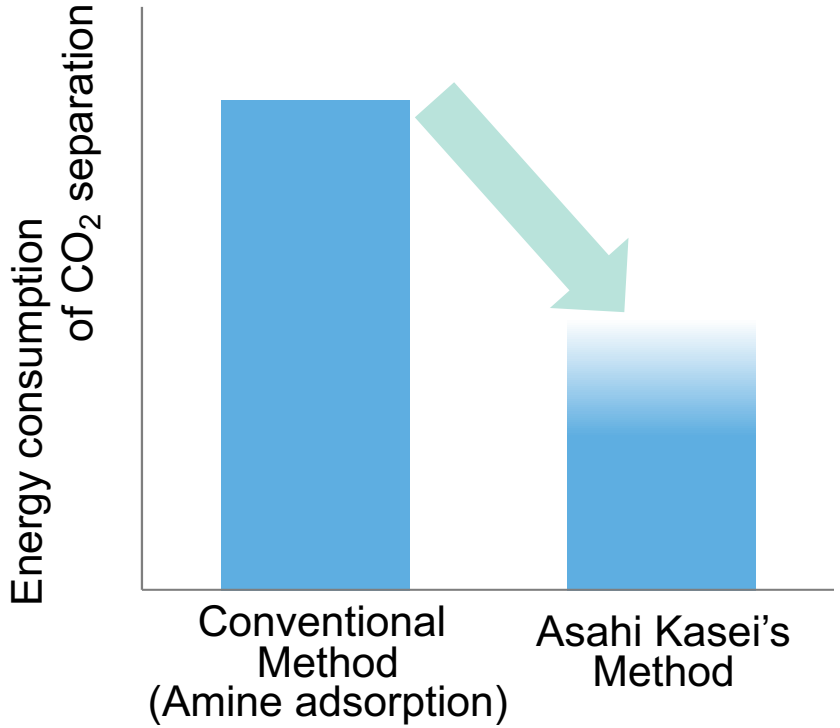
The New Asahi's "Zeolite"

＊Zeolite
Microporous crystallinity with controlled pore size



➢ Technology features

Total CO_2 separation & recovery energy expect to be reduced to approx. 1/2.



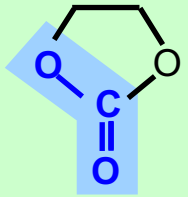
Contributing to Carbon Neutral/ reduced GHG emissions in society

CCU Technology

Asahi Kasei owns an original production technology to produce **EC** and **DMC** **utilizing CO_2**, which can be applied for **a more sustainable "LIB Electrolyte"**.

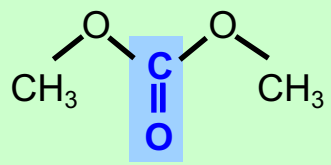
Ethylene Oxide

CO_2 O=C=O



EC
(Ethylene carbonate)
CO_2-origin(50wt%)

Methanol

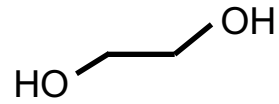


DMC
(Dimethyl carbonate)
CO_2-origin(31wt%)

Phenol

Bis-Phenol A

Polycarbonate resin



EG
(Ethylene Glycol)
CO_2-origin(26wt%)

Major chemical substances of LIB Electrolyte

Typical chemicals for coolants

Key components of LIB
Electrode (Cathode/Anode)
Separator
Electrolyte

Contributing to Carbon Neutral/ reduced GHG emissions in society

New LIB for Energy Storage

Jointly developing a **new lithium-ion battery cell with improved properties** in "**HEADLINE Project**" **funded by BMBF** (The Federal Ministry of Education and Research)

Participants

Fraunhofer Institute for Ceramic Technologies and Systems (IKTS)
9 German Companies including Asahi Kasei Europe

➢ Key materials

- ✓ **New highly conductive liquid electrolytes**
- ✓ Electrodes made by non-toxic extrusion process

➢ Technology Features

- ✓ Highly capacitive
- ✓ Fast-charging
- ✓ Cost-effective
- ✓ More sustainable
  (No NMP required)

Contributing to Carbon Neutral/ reduced GHG emissions in society

More Sustainable Materials

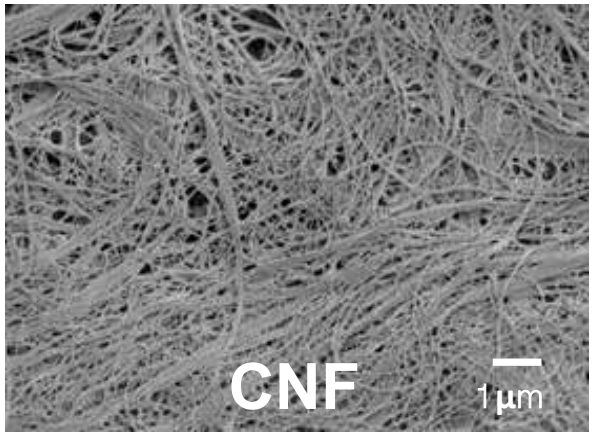
AsahiKASEI

New materials to replace glass fiber reinforced plastics

➢ Key material

The New Asahi's
"Cellulose Nano Fiber (CNF)"
produced from biomass

- ✓ Smaller fiber diameter
- ✓ Can be compounded with resins to produce CNFRP*



➢ Applications & its features of CNFRP

- ✓ Repetitive mechanical recyclability
- ✓ High heat resistance
- ✓ High elastic modulus
- ✓ Low linear coefficient of expansion

Polyamide composite　Polyacetal composite

*CNFRP: Cellulose Nano Fiber Reinforced Plastic

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Bio gas

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Industries

Household Office

Renewable heat source

Nitrogen

Methanol etc.

Renewable Fuels

Hydrocarbons

Ammonia (NH_3)

AsahiKASEI

Creating for Tomorrow

THE COMMITMENT OF THE ASAHI KASEI GROUP:

To do all that we can in every era to help the people of the world
make the most of life and attain fulfillment in living.
Since our founding, we have always been deeply committed
to contributing to the development of society,
boldly anticipating the emergence of new needs.
This is what we mean by “Creating for Tomorrow.”