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Aqualyzer

A Way to a Sustainable Future: Asahi Kasei Group's Insight, Innovation, and Challenges in the Environmental Energy Sector

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Wirtschaftstag Japan 2024

Dr. rer. nat. Naoki Matsuoka
General Manager, R&D Center
Lead Expert for Lithium-ion Batteries
Asahi Kasei Europe GmbH

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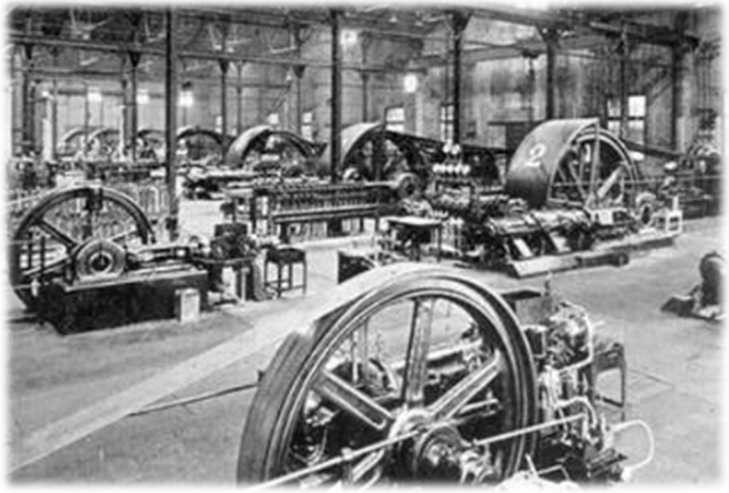
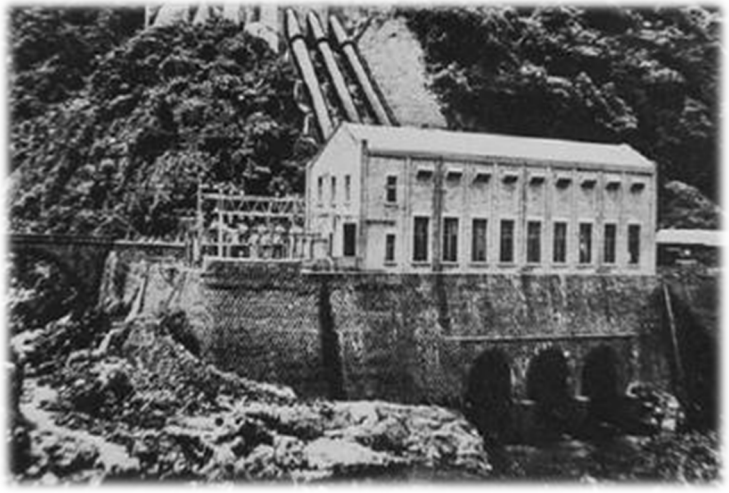
One Century of Innovation

Asahi Kasei was founded in 1922. In 1923, the company started the production of its first product “NH_3 (ammonia)” utilizing the Casale method using “Green Hydrogen” and renewable energy.

Over the past 100 years, Asahi Kasei has continued to take on challenges to develop and grow the businesses while receiving various support from our stakeholders.





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History of Business Portfolio Transformation

1922 –	1940 s–	1960 s–	1980 s–	2000 s–
Japan's first production of synthetic ammonia	Expansion into synthetic resins and synthetic fibers	Expansion into petro-chemicals, homes, health care, and electronics	Progress in overseas business, focus on business restructuring	Accelerated globalization through M&A, expansion of health care business

- Material
- Homes
- Health Care

Growth as a diversified chemical manufacturer

Branching into new fields

Growing globalization

Taking on new challenges

1922 Origins


Ammonia plant

1923

1931

1957

1959

1960

1967

1968


Naphtha cracker (completed in 1972)

1972

1974

1978

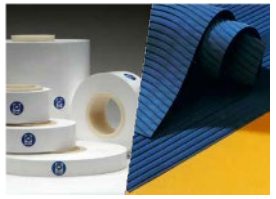
1983

2012


ZOLL

2013

2015


POLYPORE

2018


SAGE

2020

TCS 075

Veloxis PHARMACEUTICALS an Asahi Kasei company

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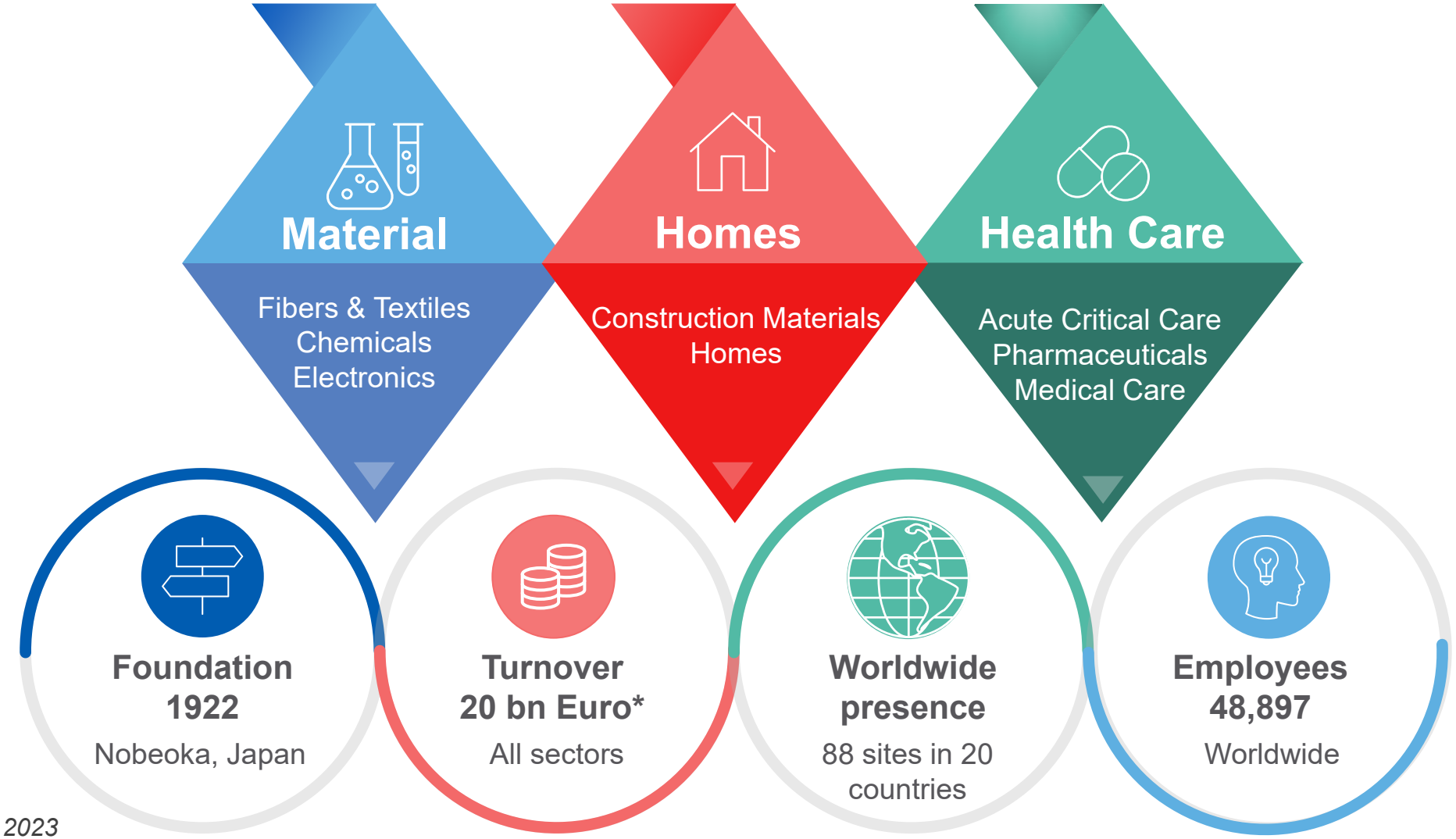
Asahi Kasei at a Glance: Three Sectors



** As of 31 March 2023*
Fiscal year 2022 result roughly converted from JPY to EUR

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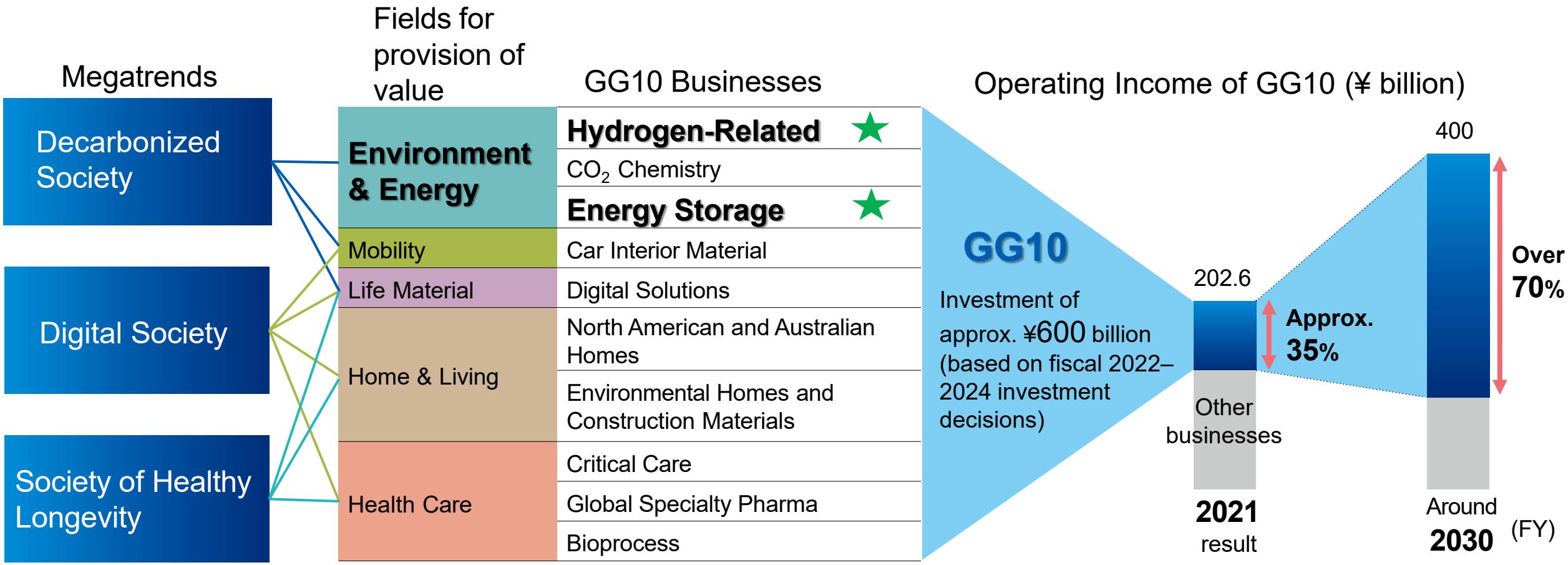
Insight: 10 Growth Gears (GG10)



Note: Proportion of business income from GG10, excluding corporate expenses and eliminations

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Corporate Venture Capital (CVC) Activities

Investment in Startups and Other Promising Companies

Original CVC Investment Framework

Care for People

Scope

DX, Health Care sector, Homes sector

Objectives

Aiming to create new businesses, partnerships, and acquisitions based on corporate and division strategies

Time Frame

Aiming for commercialization within 5 years

Parallel Effort

New CVC Investment Framework

Care for Earth

NEW $100M (2023-2027)

Scope

Areas related to decarbonization centered on hydrogen, carbon management, biochemicals, and batteries

Objectives

1. Reduction of GHG emissions for Asahi Kasei and society
2. Creation of new businesses related to decarbonization
3. Participation in sustainable ecosystem

Time Frame

Aiming for commercialization within 5–10 years

CVC investment categories

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History of Electrolysis

1923 Started ammonia production using hydrogen from water electrolysis. Electricity was supplied by our own hydroelectric power plant

1975 Launched chlor-alkali electrolyzer system (Acilyzer™), using ion exchange membranes (Aciplex™)

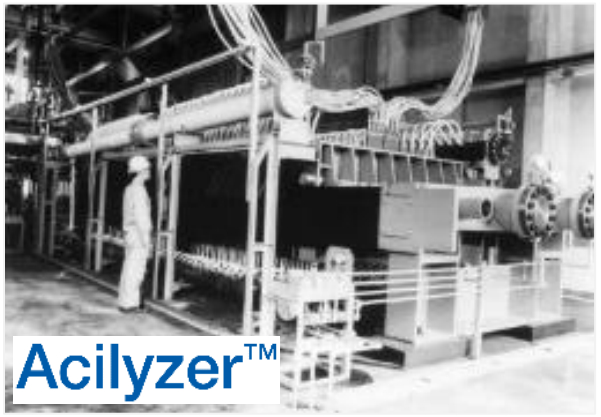
2010 Started the development of alkaline water electrolyzer system based on our chlor-alkali know-how

2020 Joined ALIGN-CCUS/Take-Off project in Germany as an electrolyzer supplier

Installed 10MW scale electrolyzer at FH2R[1] project in Japan

1. FH2R is a project commissioned by the New Energy and Industrial Technology Development Organization (NEDO).

2025 **Commercialisation**



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Open Innovation: ALIGN-CCUS

- Asahi Kasei participated in ALIGN-CCUS project as an electrolyzer supplier.
- Asahi Kasei provided electrolyzer module at RWE's Coal Innovation Centre in Niederaussem, Germany.
- Start of basic engineering for the project in 2019. Demonstration of total DME production process in 2020.

The Team

RWE Power
Operates CO_2 capture plant and demonstration plant 24/7

Mitsubishi Power Europe
DME synthesis and full-scale plant study

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Alkaline electrolyser for H_2 production

RWTH Aachen University
Adaptation of diesel engine for DME/OME use

FEV Europe
Retrofitting of engine for DME/OME use

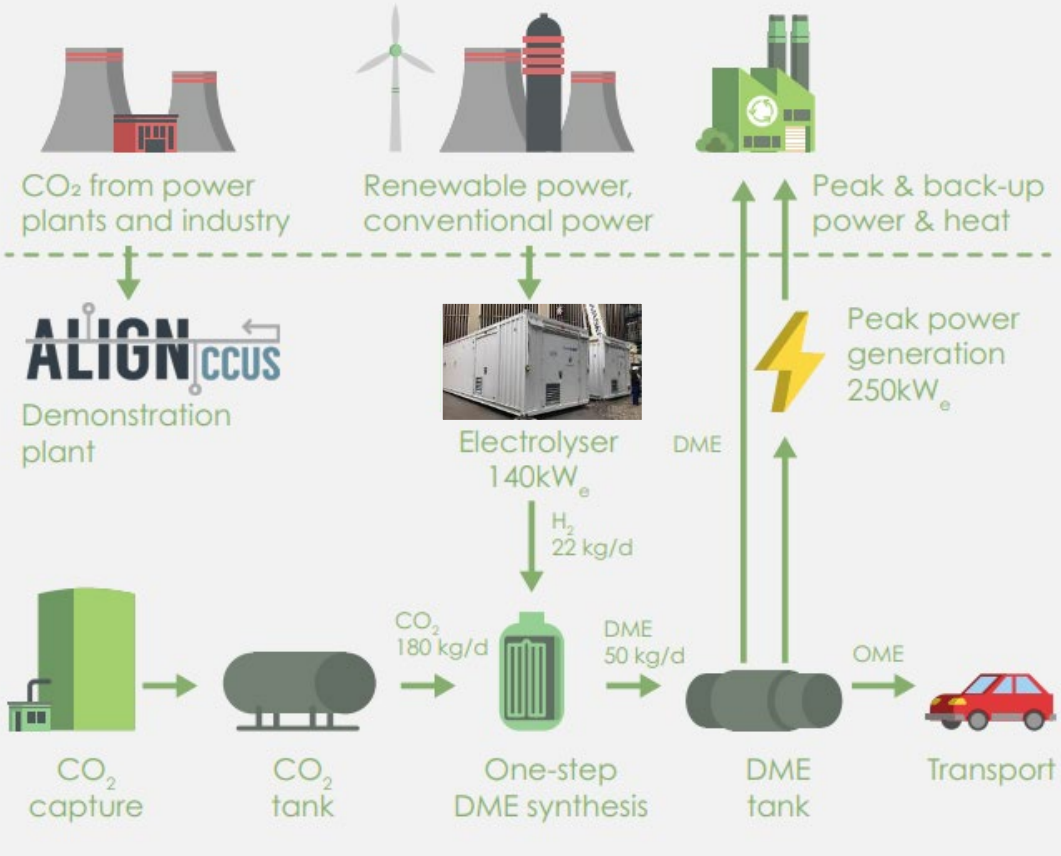
TNO
Process optimisation & DME synthesis

Forschungszentrum Jülich
Technical and economic analysis, Life cycle analysis

Bosch
Fuel injector for DME/OME

Making low-carbon fuel

Our first-of-a-kind project has made the synthetic fuel DME from CO_2 and hydrogen – produced using renewable energy – which could transform how we live and work.



ACT ALIGN-CCUS Project No 271501
This project has received funding from RVO (NL), Gassnova (NO), UEFISCDI (RO) and BEIS (UK) and is co-funded by the European Commission under the Horizon 2020 programme, Accelerating CCS Technologies (ACT), Grant Agreement No 691712.

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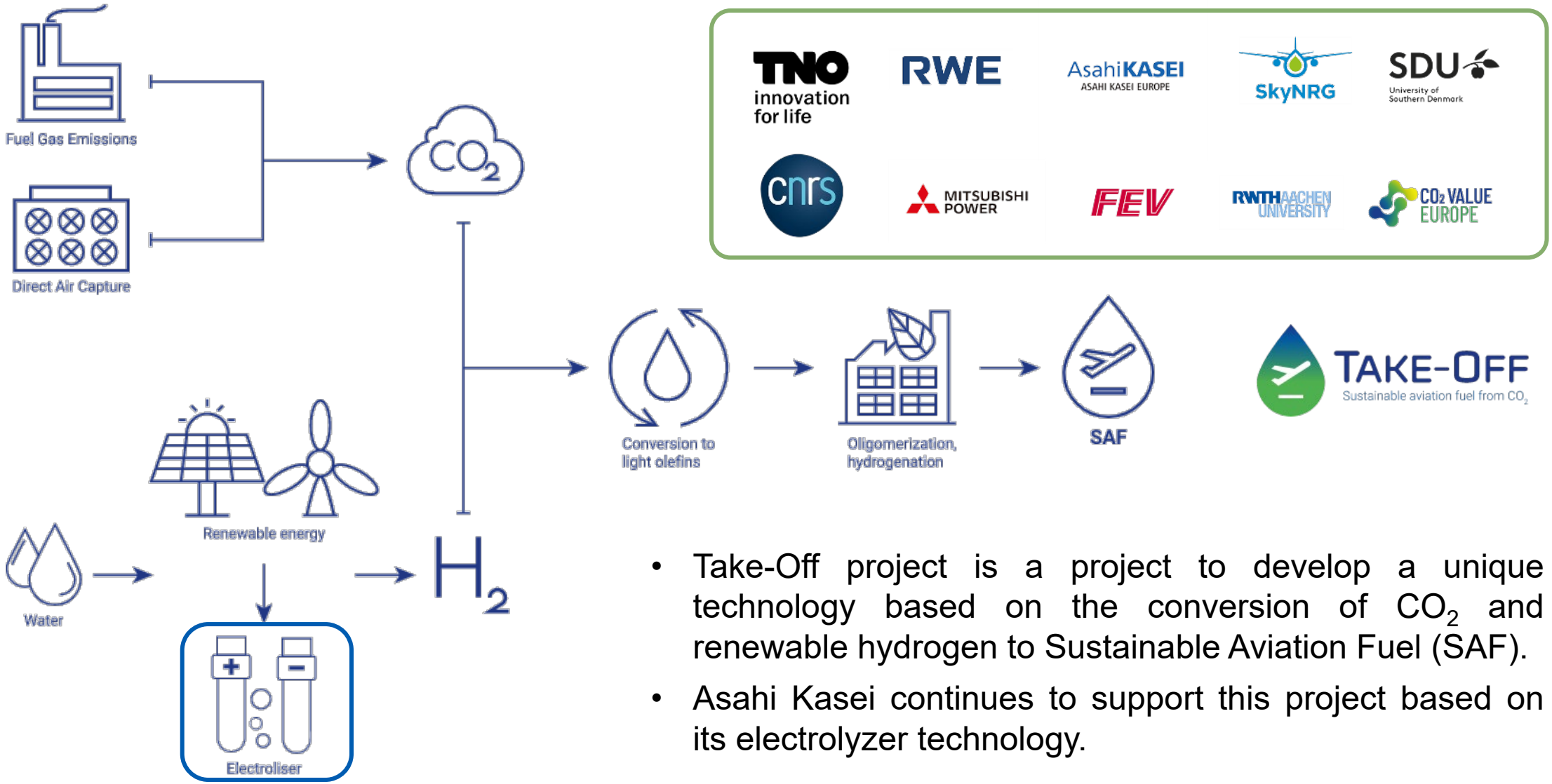
Open Innovation: TAKE-OFF



- Take-Off project is a project to develop a unique technology based on the conversion of CO_2 and renewable hydrogen to Sustainable Aviation Fuel (SAF).
- Asahi Kasei continues to support this project based on its electrolyzer technology.

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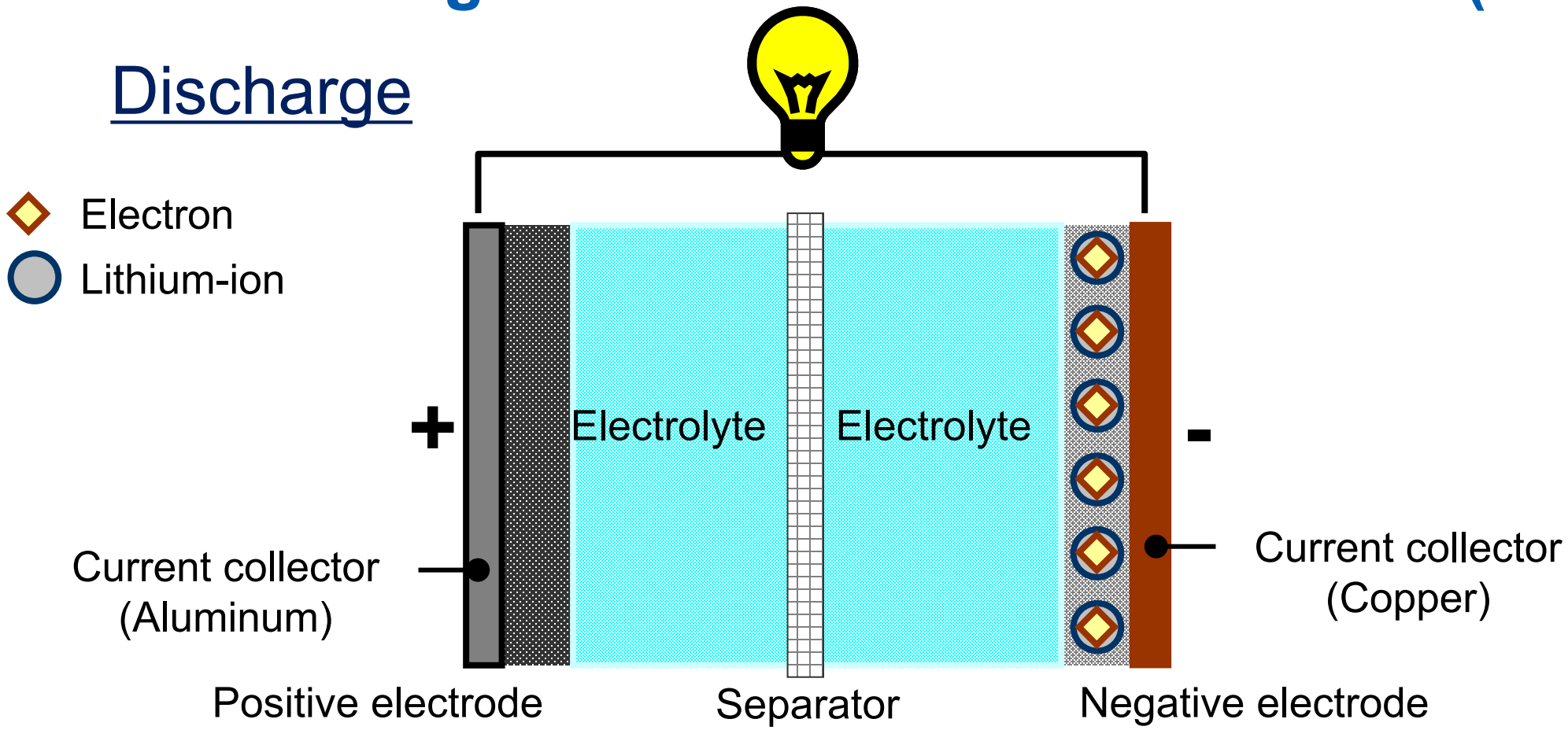
N. Matsuoka, H. Kamine, Y. Natsume, A. Yoshino, ChemElectroChem **2021**, *8*, 3095–3104.

Technical Background of Lithium-Ion Batteries (LIBs)

Discharge



Our solution:
Super high ionic conductivity electrolyte by using acetonitrile

- **Capacity:** **controlled by electrode active materials**
- **Power:** **controlled by thickness of electrodes**
- Durability: mainly controlled by electrolyte
- Safety: mainly controlled by separator

Demonstration of Asahi Kasei Electrolyte

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Asahi Kasei Electrolyte for Rechargeable Batteries

Conventional electrolyte	Developed electrolyte
	
Max Speed = 8km/h Run Time = 17.09 sec	Max Speed = 17km/h Run Time = 37.39 sec

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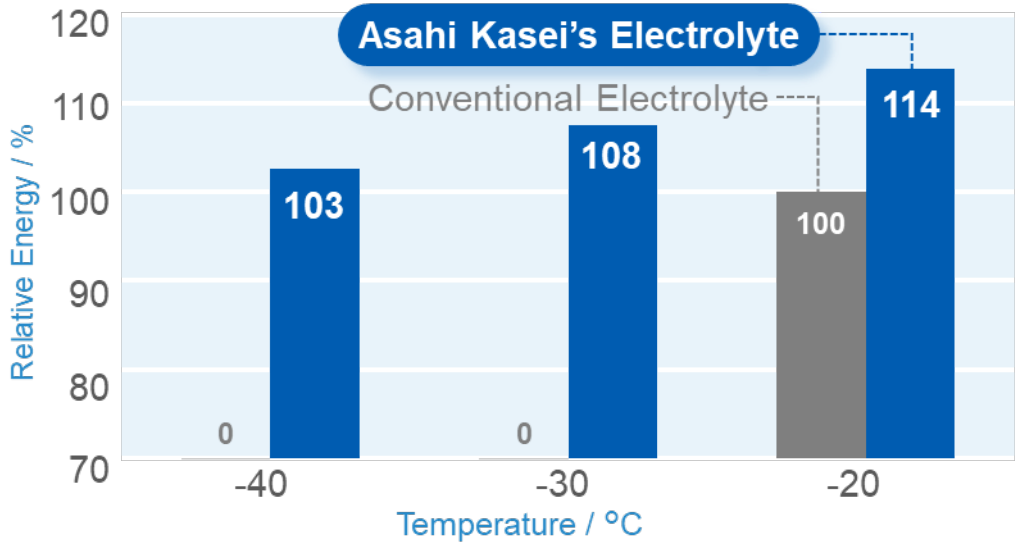
Successful Proof of Concept

Asahi Kasei's technological breakthrough allows for an increased battery power output at low-temperatures of even -40 °C, and improved durability at high temperatures of up to 60 °C.

**Relative to the performance of a LFP battery with a conventional electrolyte*

Performance at Low Temperature

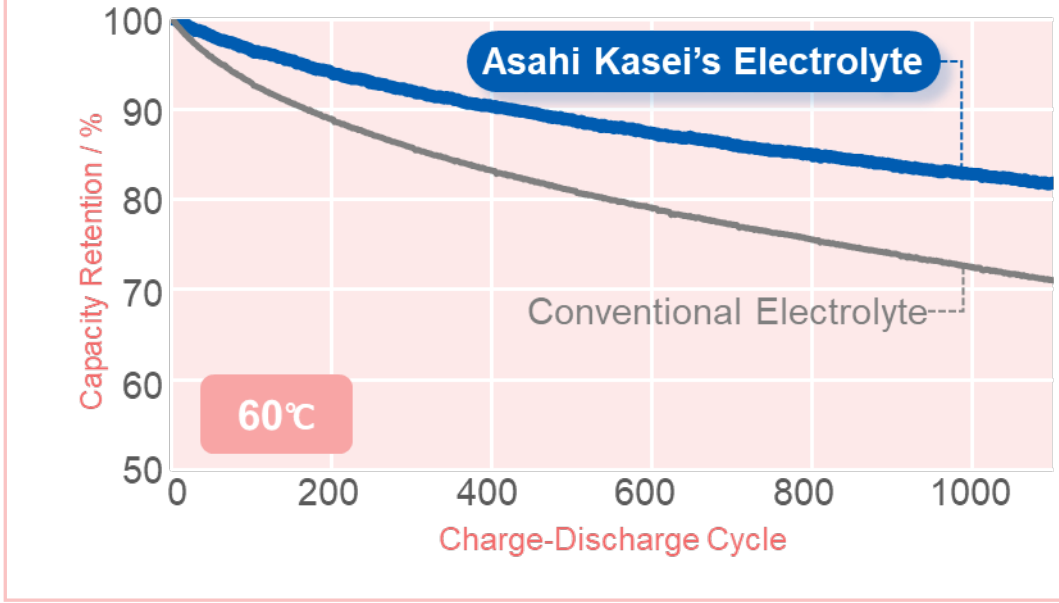


(Indexed to conventional electrolyte at −20°C as 100%)

【Cell specification】
Cell type: Cylindrical cell
Positive electrode: LFP
Negative electrode: Graphite

【Test condition】
Charge : 0.5 C, 3.6 V CCCV, 25°C
Discharge : 10 C, 1.0 V CC

Durability at High Temperature



【Cell specification】
Cell type: Cylindrical cell
Positive electrode: LFP
Negative electrode: Graphite

【Test condition】
Charge : 0.5 C, 3.6 V CCCV
Discharge : 1 C, 2.0 V CC

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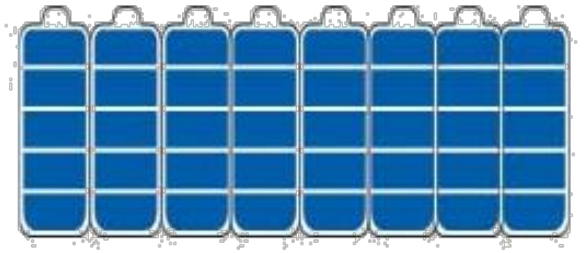
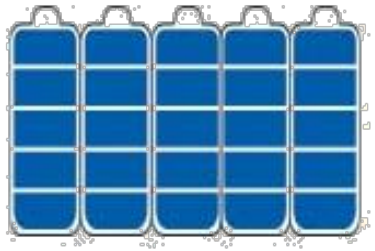
Advantages of Electrolytes with High Ionic Conductivity

Contributing to a low-carbon society by increasing the value of lithium-ion batteries with superionic conductive electrolyte technology





Reduction of size & cost

High Power

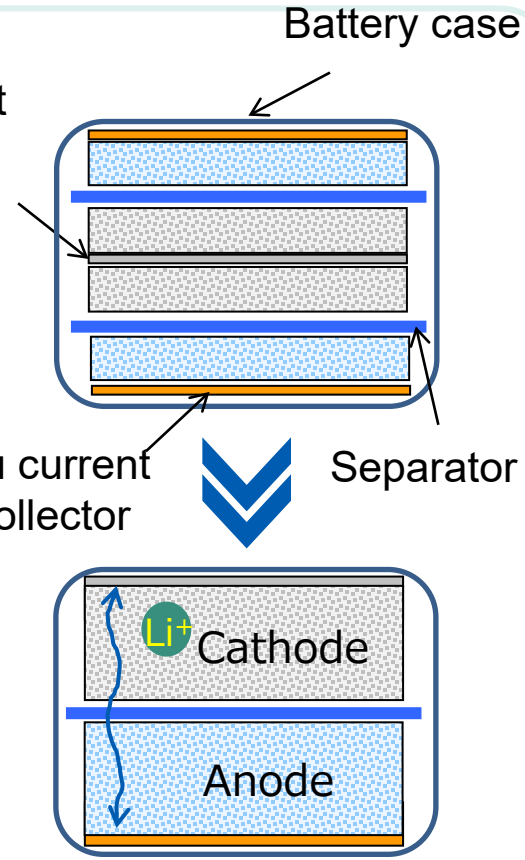
Fast Charging

High Ionic Conductivity

High Capacity

Low Temperature Performance

Material Cost Reduction



Thick electrodes
→ Energy density increased, cost reduced

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Open Innovation: HEADLINE

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

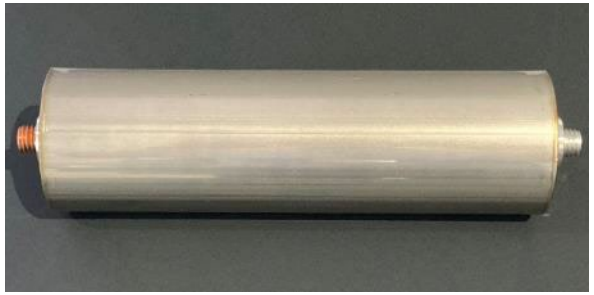
Fraunhofer Institute for Ceramic Technologies and Systems (IKTS)
Nine German Companies including **Asahi Kasei Europe GmbH**

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)



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Innovation Hub

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

Communication

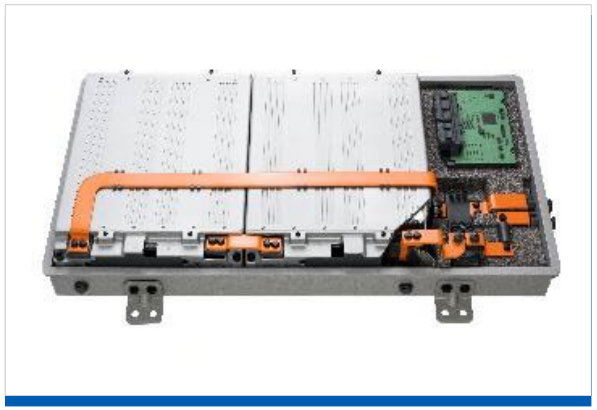
Stronger communication by uniting sales, marketing, logistics, R&D and technical service

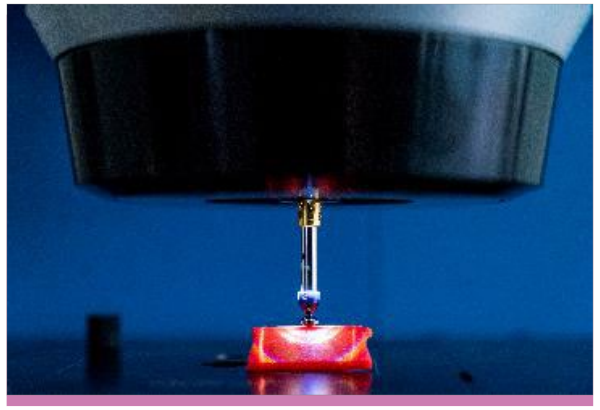
Local R&D

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





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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.”