Current development of water electrolysis technology and business at Asahi Kasei

October 15, 2024

Masami Takenaka

Senior General Manager

Green Solution Project

Environmental Solutions SBU

Asahi Kasei Corporation

Asahi Kasei at a glance

AsahiKASEI

*1USD = JPY151.40

Founded
1922

FY 2023 Annual sales
USD 18.4 bn*

Worldwide presence
88 sites in 20 countries

Employees
49,295

- Company Slogan
Creating for tomorrow

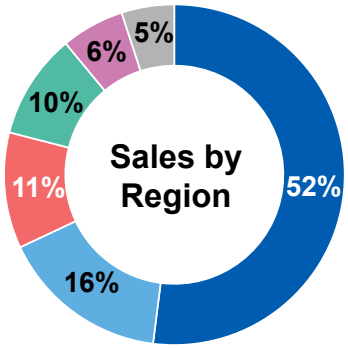
3 business sectors

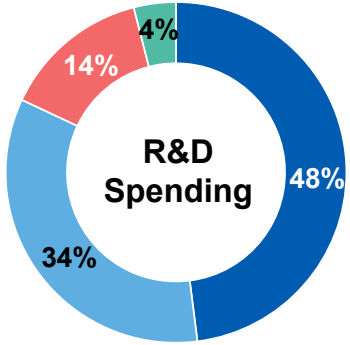
47% **Material**
Fibers and textiles
Chemicals/plastics
Electronics

33% **Homes**
Homes
Construction materials

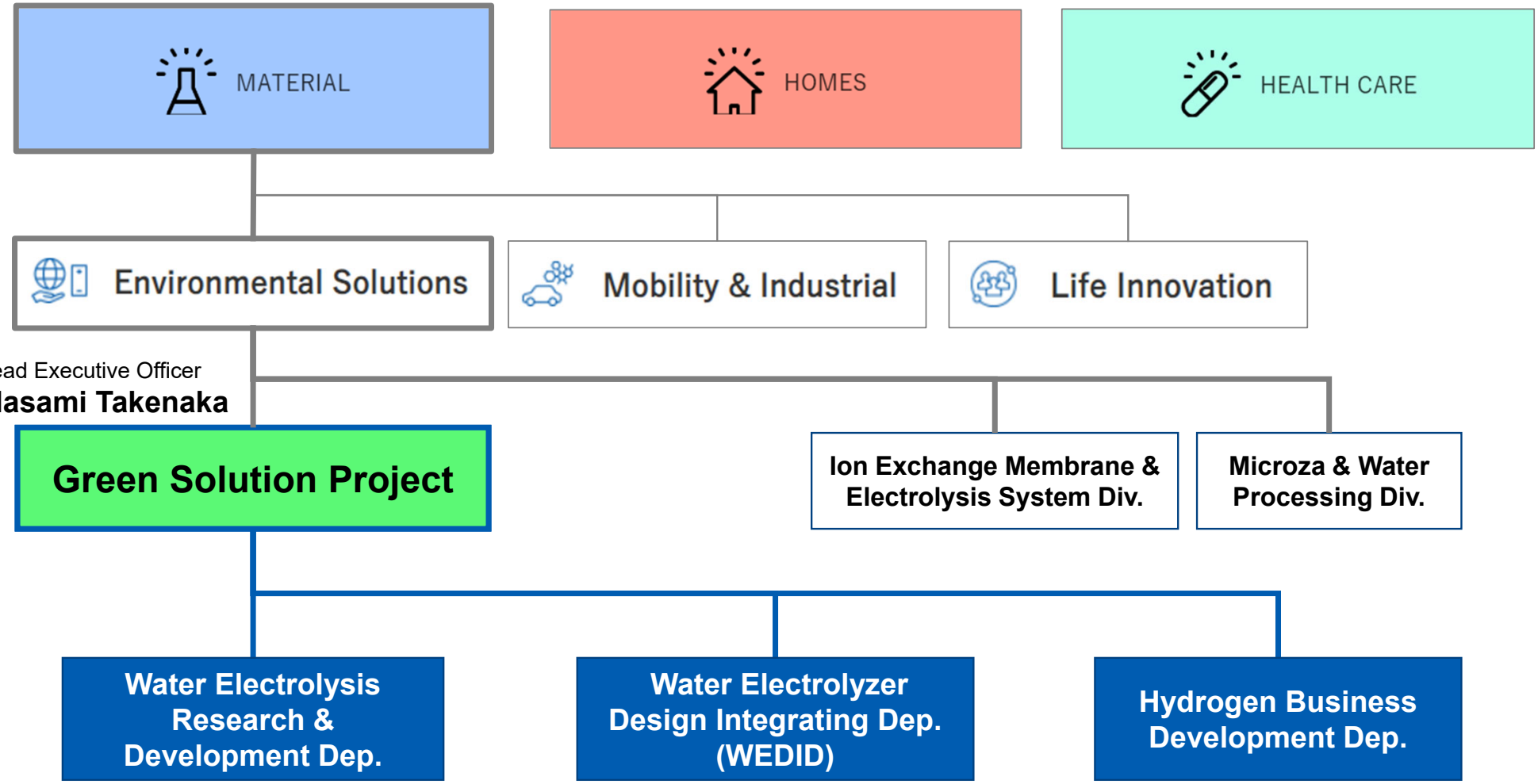
20% **Health Care**
Pharmaceuticals
Medical care
Acute medical care

*Percentage of annual revenue





Organization



History of electrolysis

1923

Started ammonia production using hydrogen from Water Electrolysis. Electricity was supplied by our own hydroelectric power plant

Acilyzer™

1975

Launched Chlor-Alkali Electrolyzer system using Ion Exchange Membranes

Aqualyzer™

2010

Started the development of the Alkaline Water Electrolyzer (AWE) system based on our Chlor-Alkali know-how

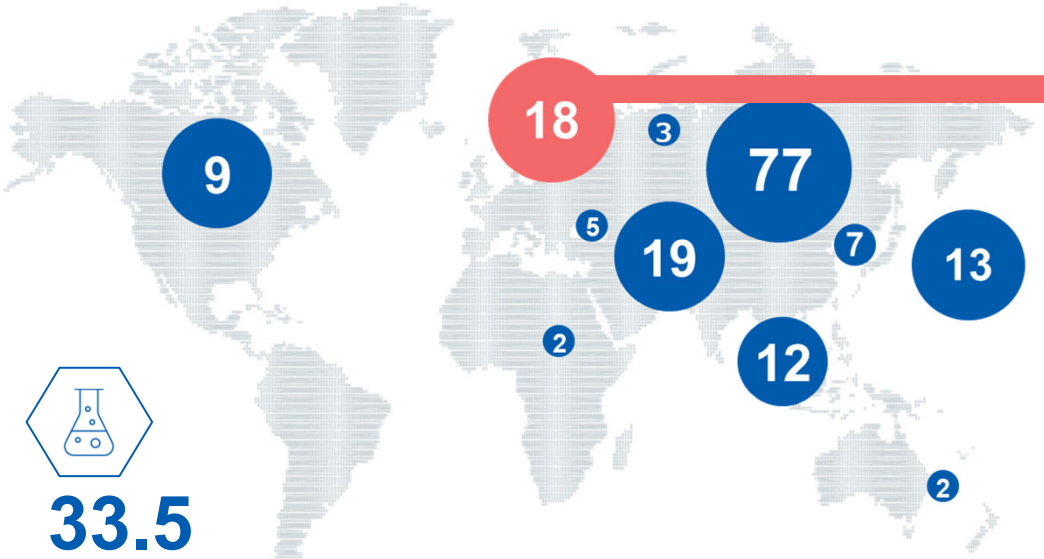
2020

Joined Germany ALIGN-CCUS project as an AWE supplier
Started 10MW scale AWE to FH2R[1] project in Japan

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

Asahi Kasei's chlor-alkali business at a glance

Number of plants using our electrolyzer



33.5
mil. dry metric tons (MDT) /year[1] NaOH production capacity

Installed systems for chlor-alkali production in Europe

>45 years experience

Membrane supply

Maintenance facilities

>1GW of electrolyzer manufacturing capacity with a plan to increase up to multiple GW

Worldwide installations at 167 end user plants

1. As of February 2021, including KOH

Asahi Kasei Europe GmbH

- Established in 2016 in Düsseldorf, Germany
- Focus on business expansion in the automotive and environmental industry
- Consolidation of sales, marketing, R&D, logistics and technical service at one single location
- Strong commitment to Germany and Europe

Demonstrations in Europe

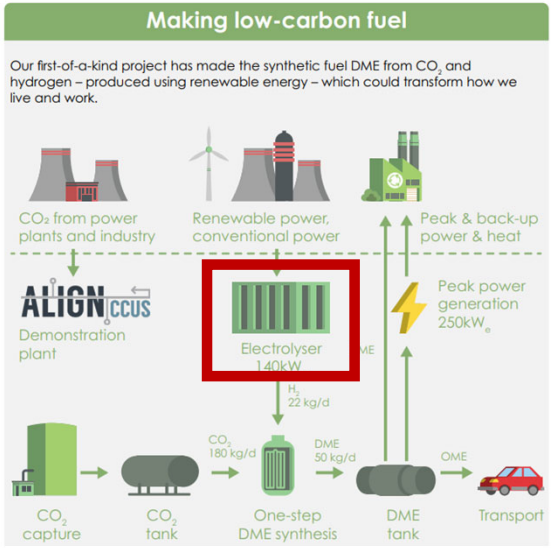
✓ Participated in Projects based on Asahi Kasei's alkali water electrolysis technology

ALIGN CCUS 2017～2020

- ✓ 31 industrial companies and research institutes from five European countries
- ✓ Hydrogen from Asahi Kasei's electrolysis system (generation 0) is combined with CO_2 captured at power plants to synthesize alternative fuels such as green methanol and green dimethyl ether (DME).

The Team

- **RWE Power** — Operates CO_2 capture plant and demonstration plant 24/7
- **Mitsubishi Power Europe** — DME synthesis and full-scale plant study
- **Asahi Kasei** — 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

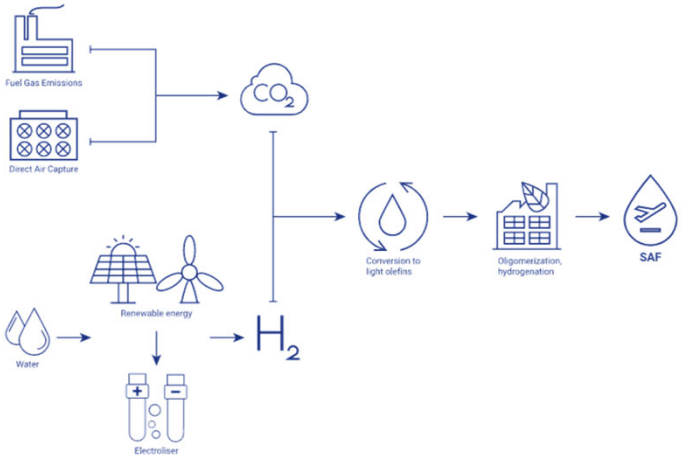


ACT ALIGN-CCUS Project No 271501
This project has received funding from RVO (NL), Gassnova (NO), UEFISCDI (RO) and BEIS (UK) and is co-funded by the European Commission under the Horizon 2020 programme, Accelerating CCS Technologies (ACT), Grant Agreement No 691712.

TAKE-OFF Sustainable aviation fuel from CO_2 2021～

- ✓ Project for development and demonstration of the technology to produce SAF
- ✓ Asahi Kasei Europe continues to support this project based on its electrolysis technology (generation 0).

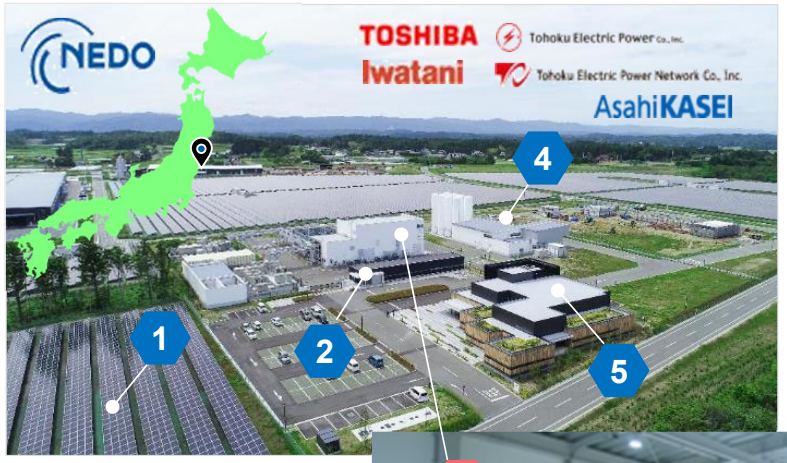
TNO innovation for life, cnrs, RWE, MITSUBISHI POWER, AsahiKASEI ASAHI KASEI EUROPE, FEV, SkyNRG, RWTH AACHEN UNIVERSITY, SDU University of Southern Denmark, CO_2 VALUE EUROPE



Demonstrations in Japan

Fukushima Hydrogen Energy Research Field (FH2R)*1

- In operation since 2020
- Cumulative operating time reached more than **10,000 hours**



1. PV (20MW)
2. P2G Control system
3. **10MW alkaline water electrolyzer facility**
4. H_2 compression and loading facility
5. Visitor center

In-House pilot facilities

1 module facility

- In operation since Q2 2023
- Acceleration of **material development**

4 modules facility*2

- In operation since Q1 2024
- **Multi-module operation**

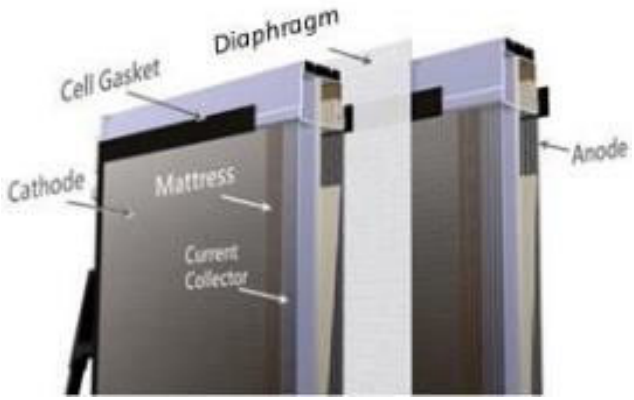
*1: Development of Technologies for Realizing a Hydrogen Society / Development of Hydrogen Energy Utilization Systems / Technical development concerning business model construction and large-scale proof of a hydrogen system for energy reuse
*2: Green Innovation Fund / Hydrogen Production through Water Electrolysis Using Power from Renewables / Technology development for increasing the size of water electrolysers, and Power-to-X large-scale demonstrations / Large-scale Alkaline Water Electrolysis System Development and Green Chemical Plant Demonstration

Easy maintenance of filter press type Aqualyzer™ module

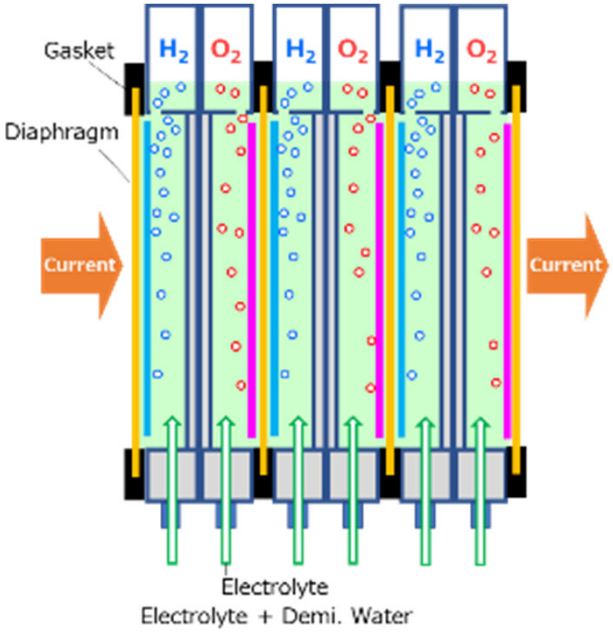
AsahiKASEI

Aqualyzer

Cell



Assembly / Current flow /Gas-Liquid flow



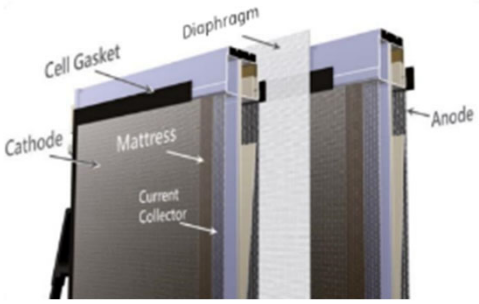
Module (Filter press type with hydraulic press)

The feature of Chlor-Alkali type AWE is that maintenance to be done at customers' site as much as possible, such as periodical replacement of diaphragm and/or minor trouble within a module

Ongoing RD&D

Asahi Kasei is continuously working on optimization of its entire electrolysis system to reduce the total cost of ownership through material and system development

Cell design and performance improvement

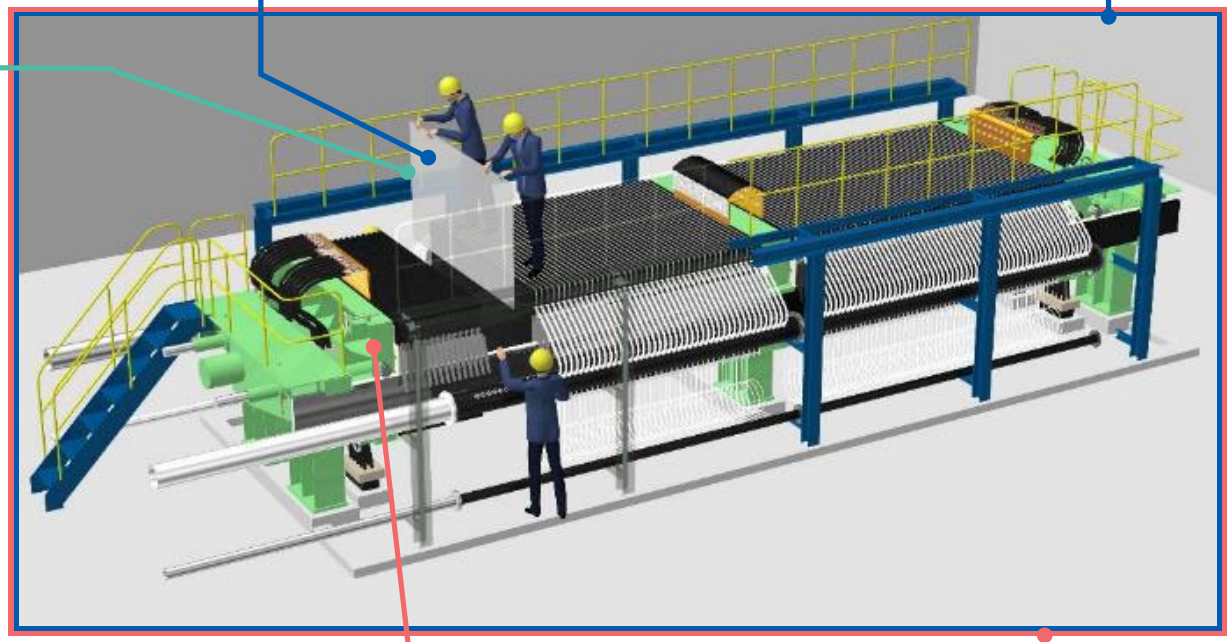


- Improved cell cost performance
- Improved internal circulation and uniformity
- Optimized with diaphragms, membranes, electrodes, and gas/liquid separation

Downtime reduction

Easy replacement of diaphragms, membranes, electrodes and gaskets

Automatic sequence



Enhanced safety

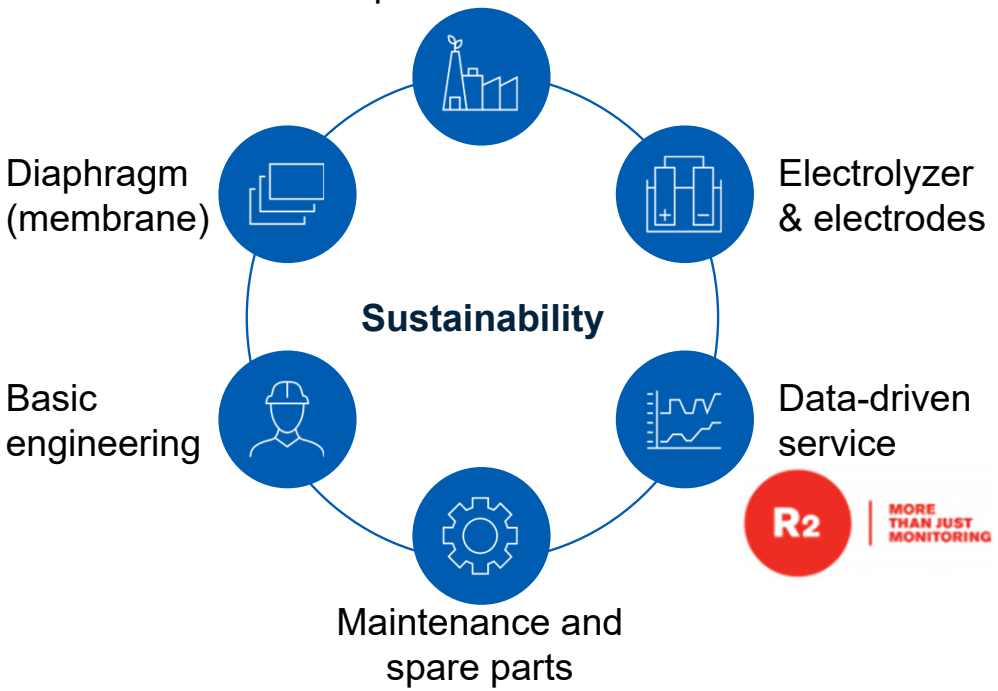
Automatic lock adjustment

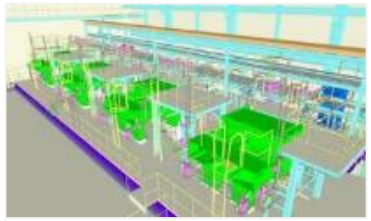
R2

- Performance monitoring and optimized operation control
- Predictive maintenance

Asahi Kasei's business model "One-stop Solution"

Research, Development, and Demonstration (RD&D)





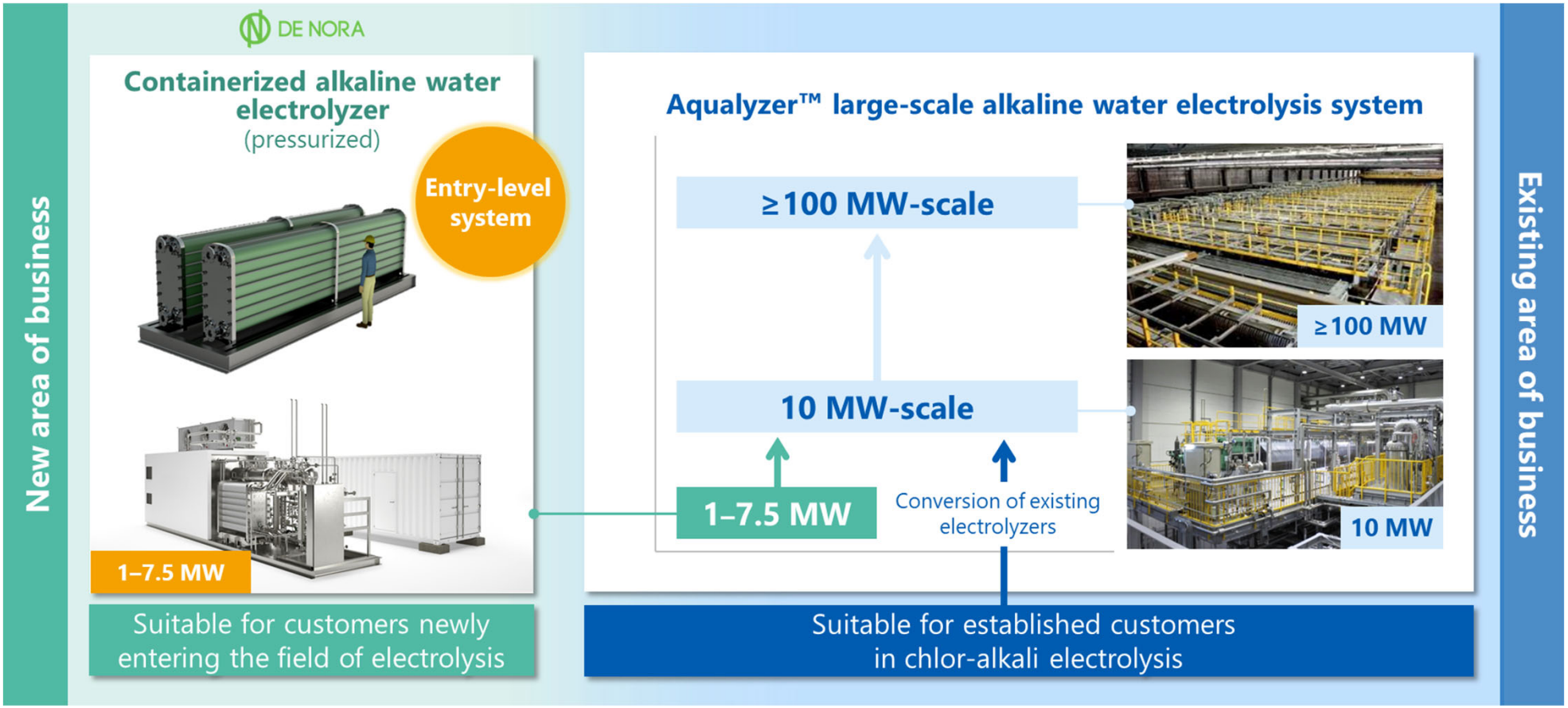
Customer

In-house RD&D in Japan

Funding and cooperation

MOU for joint development of small-scale electrolyzer

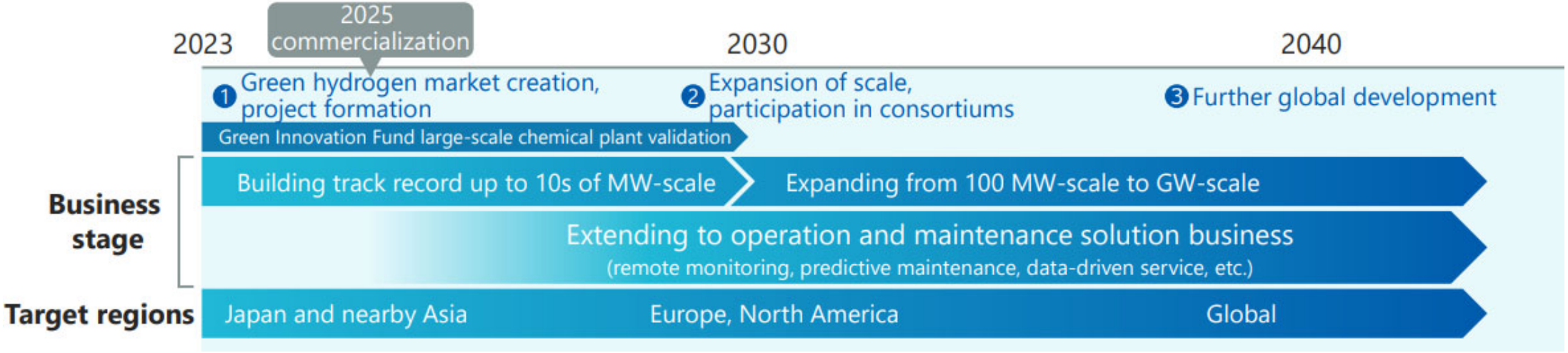
- Collaboration with De Nora for development and sale of small-scale containerized electrolyzer
- Leverage the experience and know-how in the chlor-alkali electrolysis field to establish a close cooperation framework for development, production, and sales/support in the water electrolysis field



AsahiKASEI

Growth strategy of hydrogen-related business

Aiming for commercialization in 2025 and sales on the order of ¥100 billion around 2030 as a leading supplier of electrolysis systems



Asahi Kasei contributes to realization of hydrogen society through optimization of the hydrogen production

Extensive knowledge and experience in designing electrolyzers

Proven experience of a 1GW manufacturing factory

Continuous material/System development thanks to in-house facilities

Collaborations with partners are important


AsahiKASEI
Creating for Tomorrow