

The Role of "Power-to-Gas" in the coming Green Society and Asahi Kasei's Activity in Europe

- Brief introduction of us
- Role of Power-to-Gas
- Our Activities in Europe
- Summary

December 13th, 2017
Asahi Kasei Europe GmbH

Brief introduction of Asahi Kasei

Asahi**KASEI**

- ❑ A diversified chemical company with three business sector
- ❑ 33,000 employees over 15 countries, headed in Tokyo Japan
- ❑ Around \1,900 billion (€16B) net sales (2016)

Trade name

Asahi Kasei Corp.

Head Office

Chiyoda, Tokyo

Founding

1922

President

Hideki Kobori

Paid-in capital

\ 103.3 billion

Employees*

33,720 * As of March 31, 2017

Fiscal 2016 results

Net sales \ 1,8830 billion (€15.8B)
Operating income
\ 159.2 billion (€1.34B)



Asahi Kasei Corp. [holding company function]

Material



- Asahi Kasei Corp.
[operating function]
- Asahi Kasei Microdevices Corp.

Homes



- Asahi Kasei Homes Corp.
- Asahi Kasei Construction
Materials Corp.

Health Care



- Asahi Kasei Pharma Corp.
- Asahi Kasei Medical Co., Ltd.
- ZOLL Medical Corporation

Our Major Products

Asahi**KASEI**

- Our products range from basic chemical materials to electronic and healthcare components.
- We are a strong market leader in the world/region with these products.

● Material

● Homes

● Health Care

● Administrative & Other



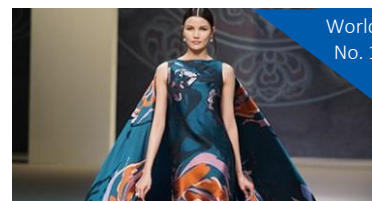
World
No. 2

● Acrylonitrile



World
No. 1

● Ion-Exchange Membrane



World
No. 1

● Cupro fiber/fabric



● UVC-LEDs



Asia
No. 1

● S-SBR (synthetic rubber)



World
No. 1

● Hipore™ Celgard™
Lithium-ion battery separator



● Leona™ PA66 resin



● Hebel Haus™ unit homes



Japan
No. 1

● Saran Wrap™
food wrapping film



World
No. 1

● Planova™
virus removal filters



World
No. 1

● Electronic compass



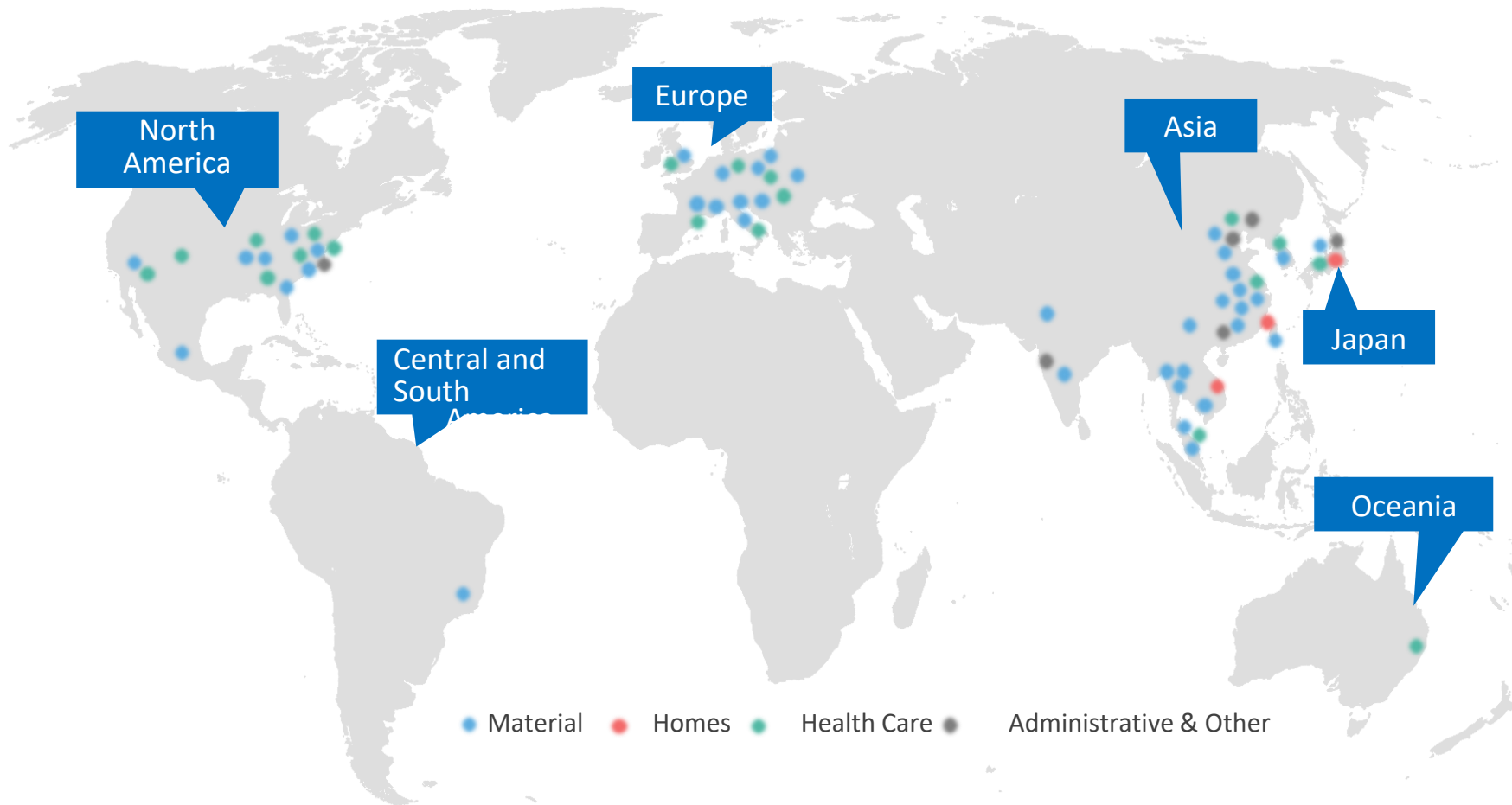
World
No. 1

● LifeVest™
wearable defibrillator

Our Global network

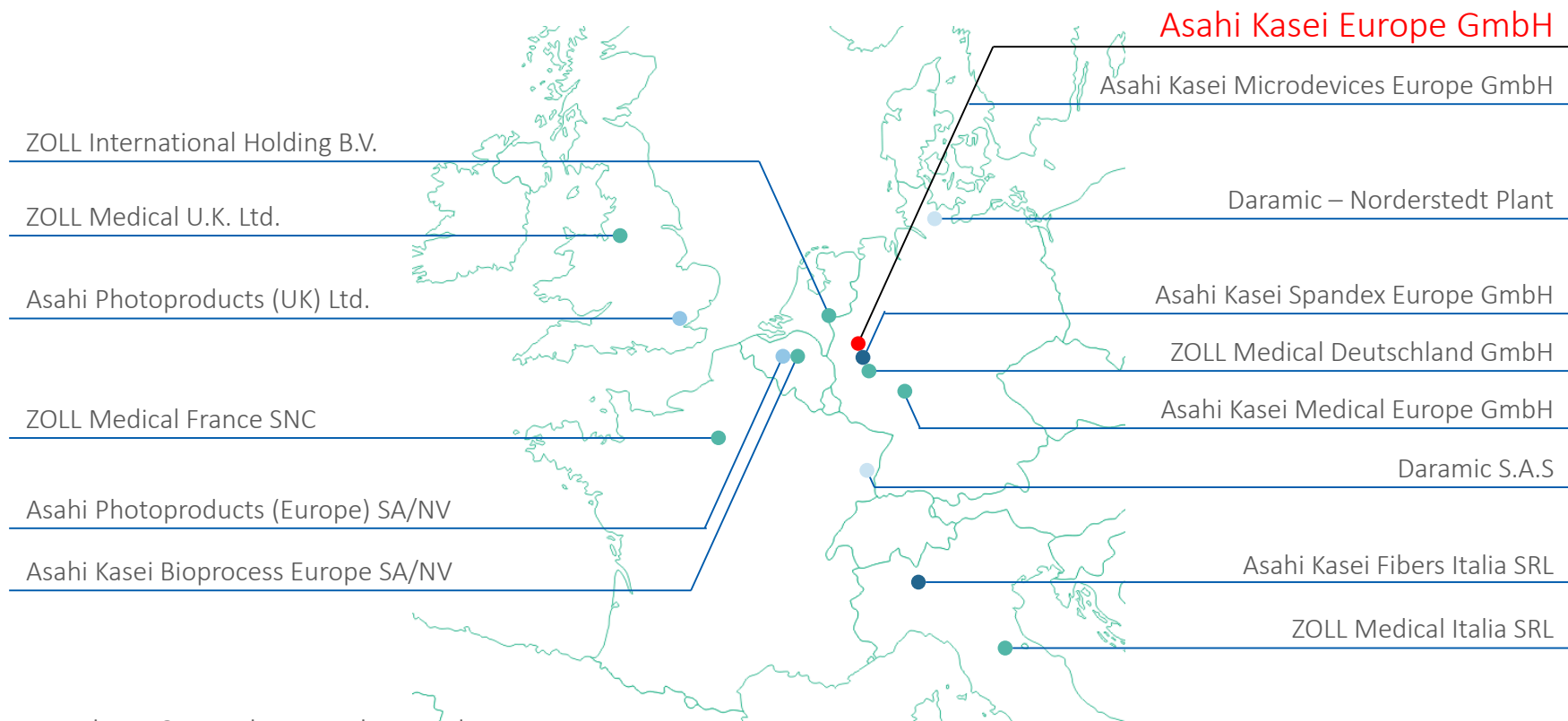
Asahi**KASEI**

- More than 20 countries for manufacturing, sales, and R&D sites to meet a wide range of needs in the global market.



Operation in Europe

- Asahi Kasei Europe GmbH was established in Düsseldorf, Germany as a European headquarter on April 1st, 2016.
- Materials for Automotive, Medical and Chemical industries are the biggest business now. Environment related business is also our current focus-point.



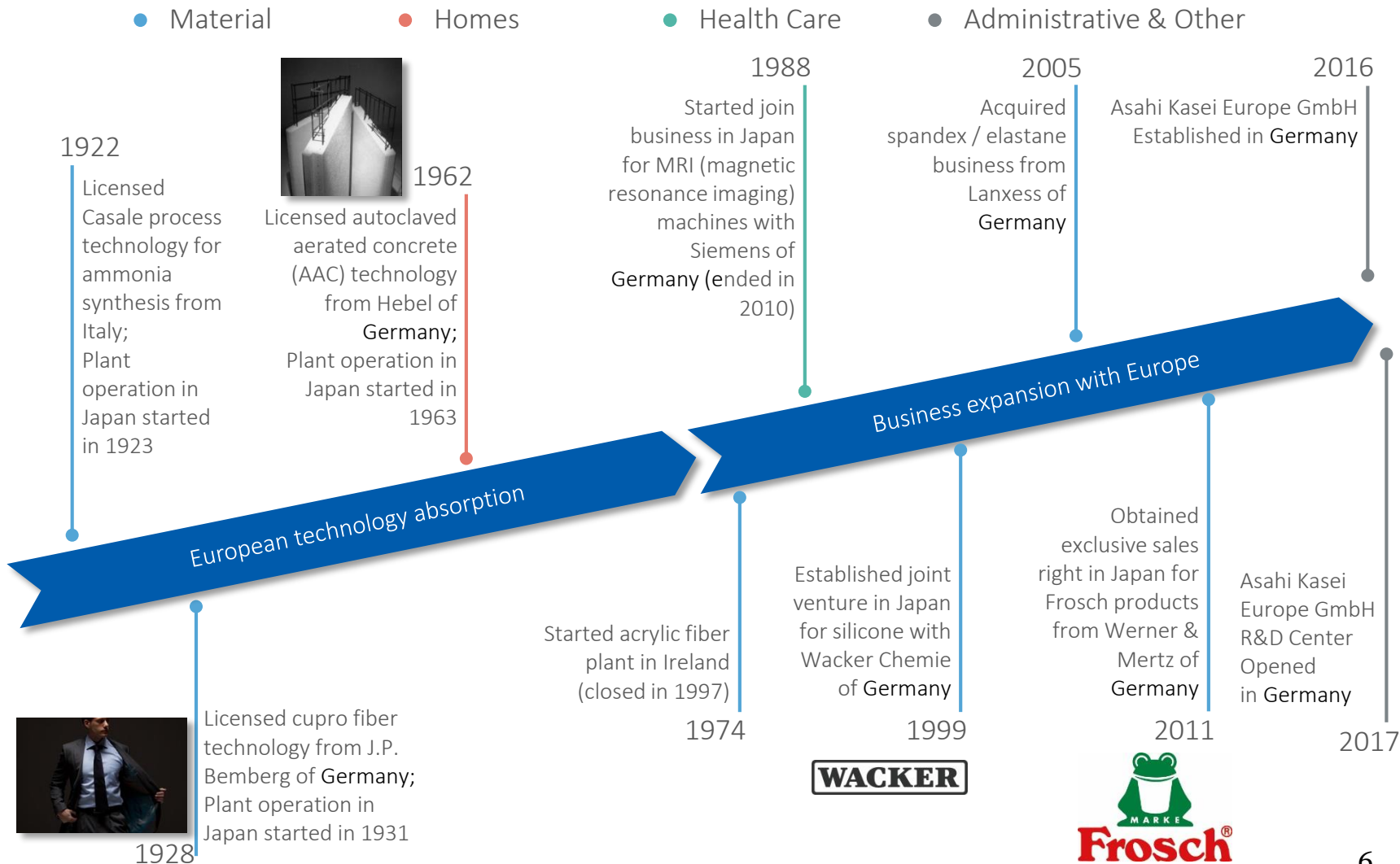
- Fibers & Textiles
- Chemicals
- Electronics
- Health Care
- Administrative & Other

| | |
|------------------------|---------------|
| Entities in Europe | 15 |
| Annual sales in Europe | 700 million € |
| Employees | 770 |

Historical relationship with Europe

AsahiKASEI

□ We have a long history of collaboration with European corporations.



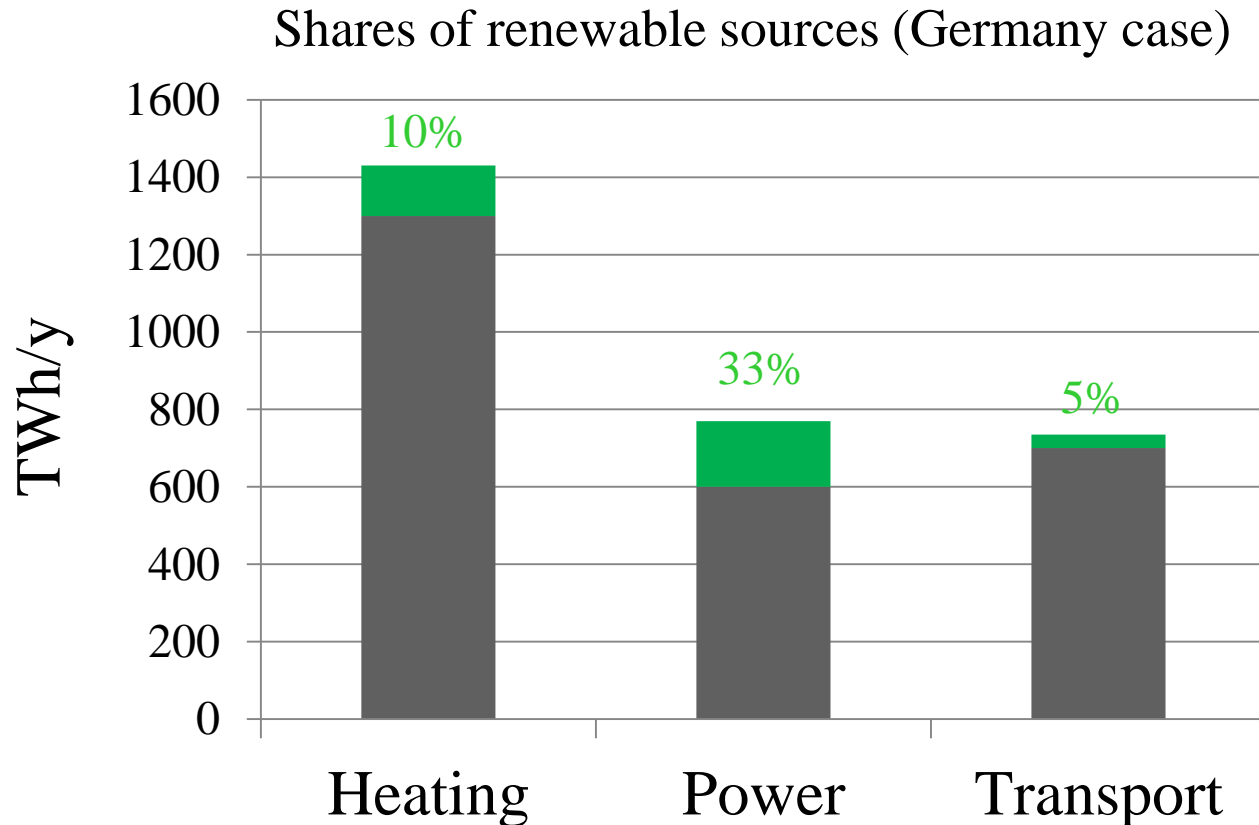
- EU has set a high target for renewables, having a lead over the rest of world.
- More ambitious targets are being discussed to be implemented (RED II).
- This is why we think Europe will be the place where new environmental business (incl. H₂) will appear.

Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (Text with EEA relevance)

(13) In the light of the positions taken by the European Parliament, the Council and the Commission, it is appropriate to establish mandatory national targets consistent with a 20 % share of energy from renewable sources and a 10 % share of energy from renewable sources in transport in Community energy consumption by 2020.

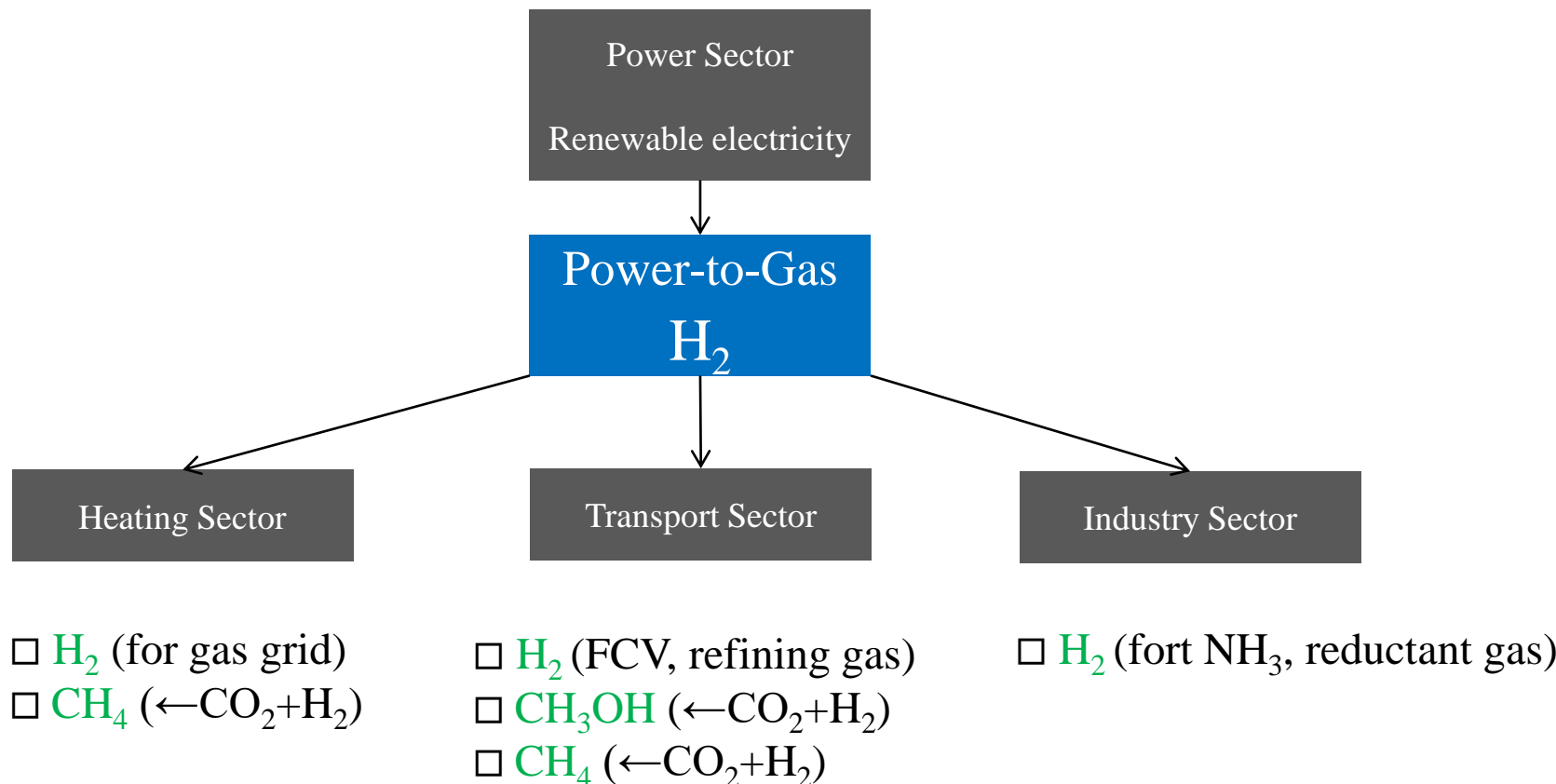
The challenge of Renewables

- Renewable share of Power sector is increasing as expected, but those of Heat and Transport sector remain limited and should be increased.
- Curtailment of renewable power (caused by a demand/supply mismatch or a limitation of grid capability) is also an issue.



Source: RWE, BMU

- Power-to-Gas is an enabling technology which can increase the renewable share of Heating and Transport sectors by using the renewable power and can solve the curtailment issue at the same time.



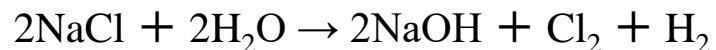
Our Electrolysis Technology

Asahi**KASEI**

- We are one of the largest supplier of Chlor-Alkali electrolyzer system, on which we will provide a technology for Power- to-Gas (water electrolysis : $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$).



Since 1975, Asahi Kasei has supplied Chlor-Alkali Electrolyzer system all over the world and still continue to polish our system.

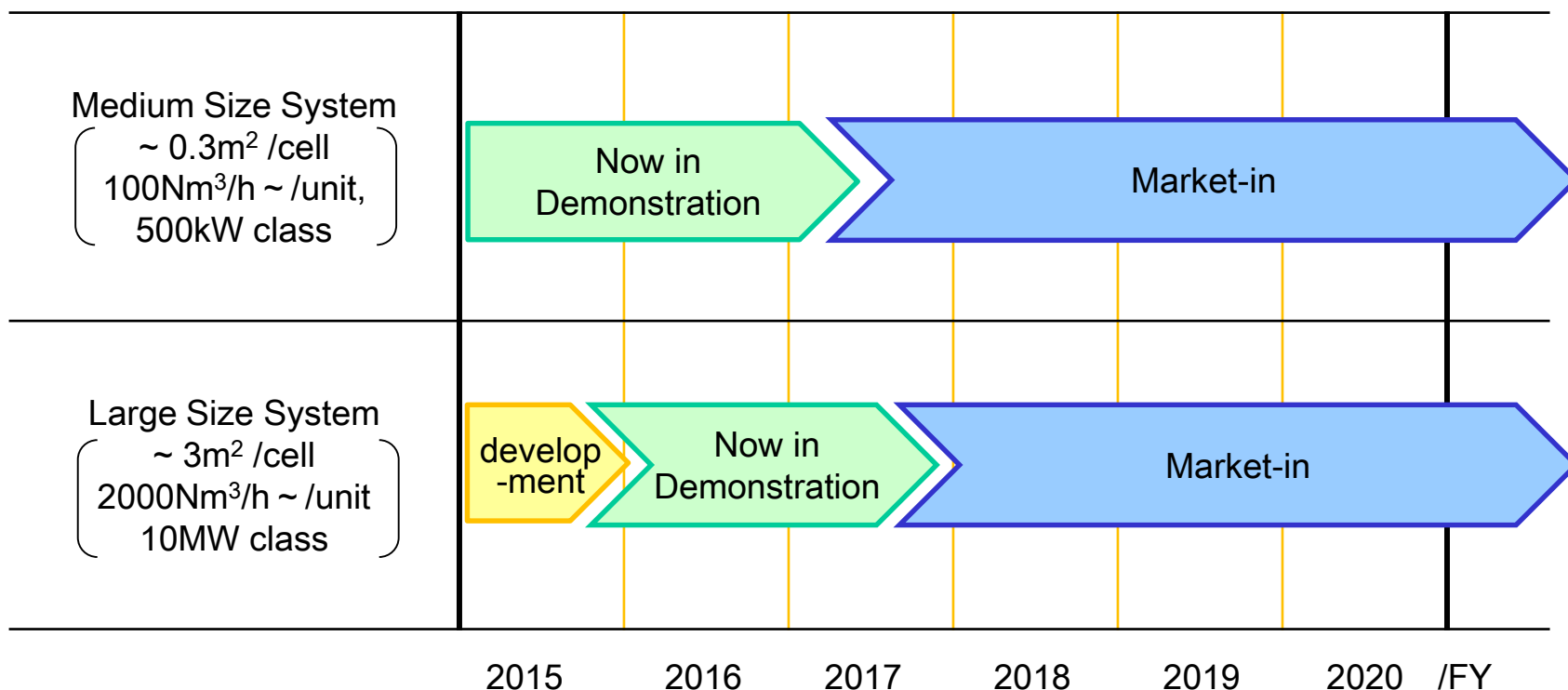


- Total production capacity installed by us
- over 7.5billion $\text{Nm}^3\text{-H}_2$ /y (Global No.2)
 - over 26 countries, 126 production sites

Our Water Electrolyser

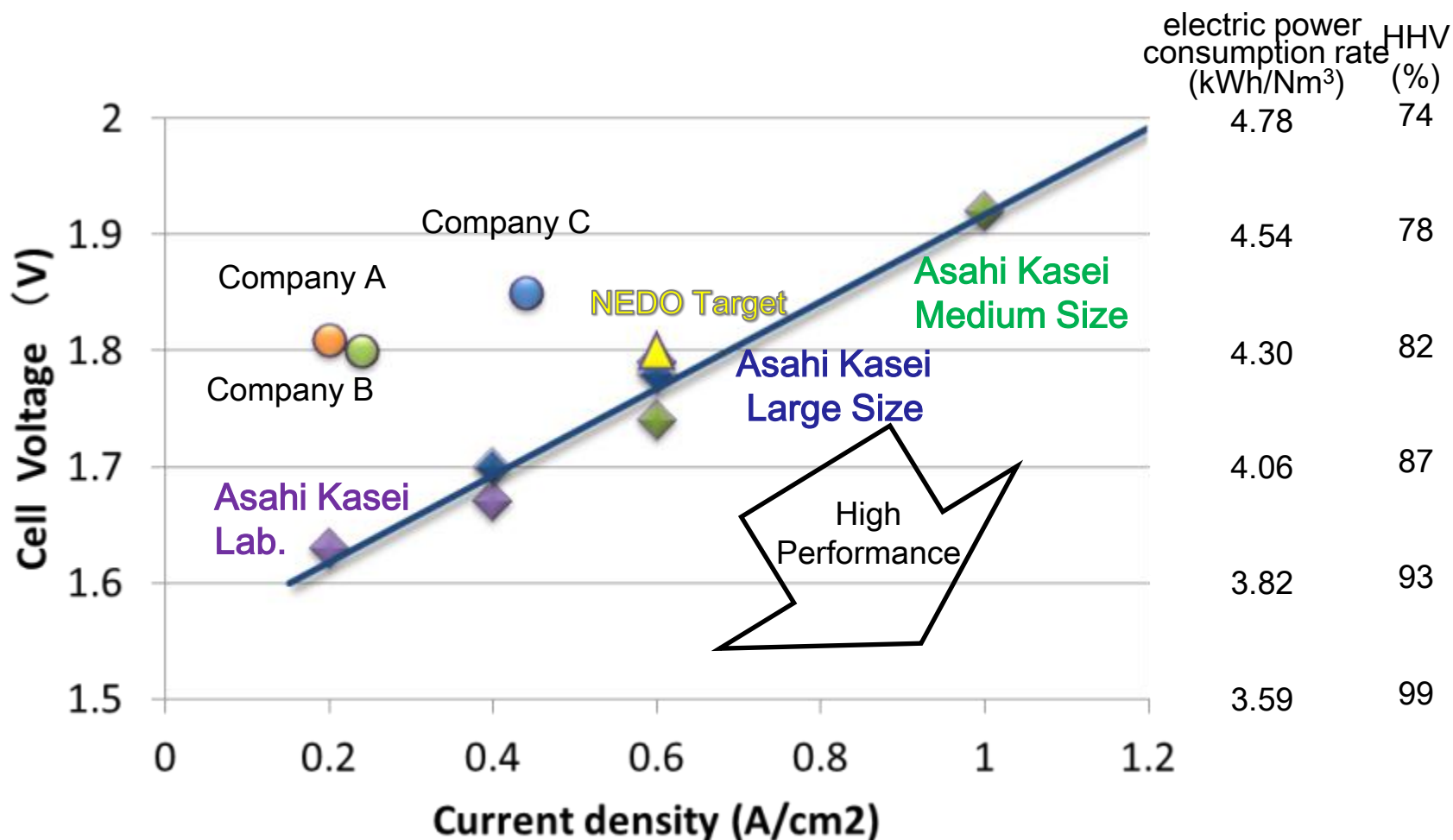
AsahiKASEI

- Our water electrolyser has following distinctive features with two systems.
 - 1) Large-Scale (10MW as a single unit)
 - 2) Highly Efficient (Low power consumption)
 - 3) Adaptable to fluctuating input power

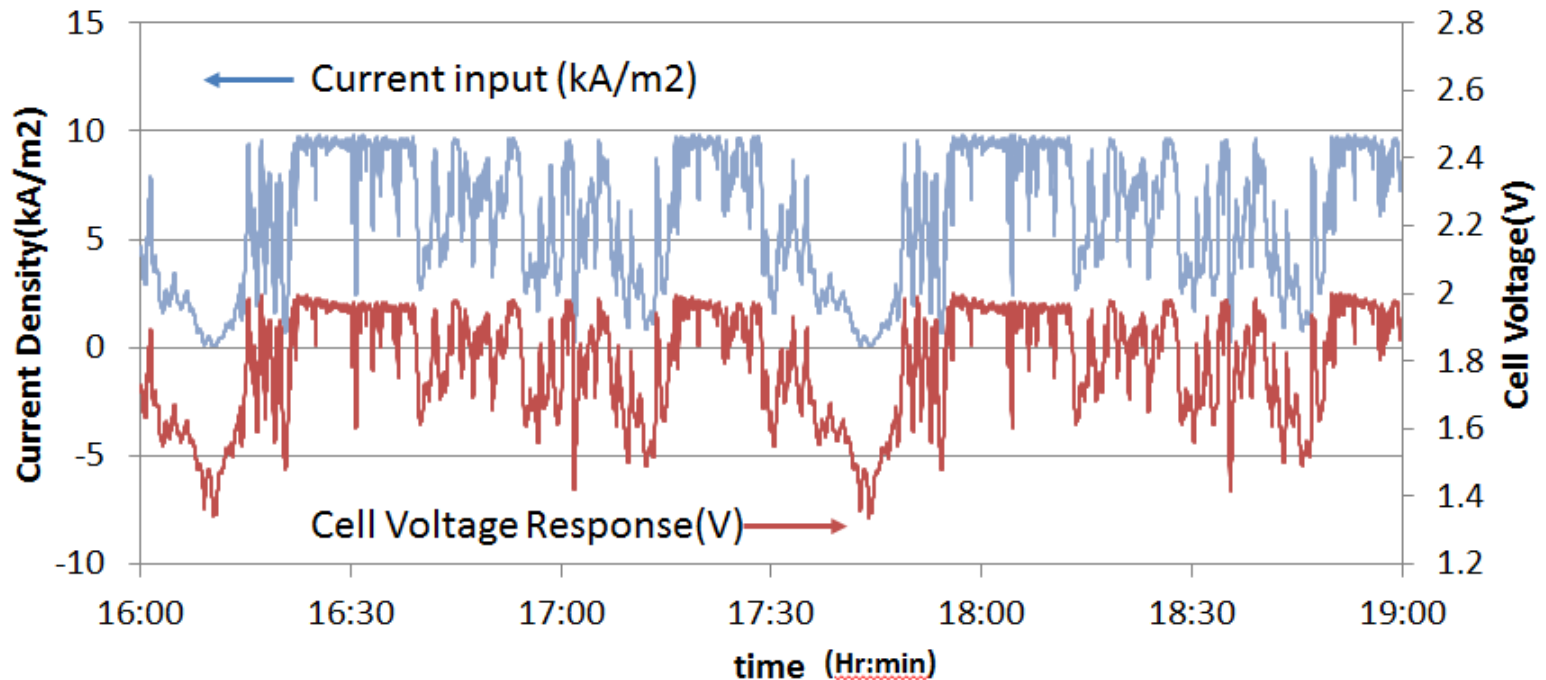


Our Achievements

- 10% more efficient than the existing systems (4.3 kWh / Nm³ @0.6A/cm² for AK Large system)



- Our electrolyzer responds well with simulated wind power inputs.



Input current data: 2MW Wind power generator (Stand-alone)
(Current density range: 0kA/m² ⇔ 10kA/m²)

Our Demonstration in Japan

Asahi**KASEI**

- We have achieved 10,000h stable operation for our large size system.

Medium size; since Jul. 2015

- ① Cell Voltage : **1.92 V (1.0 A/cm²)**
- ② Active Area : **0.25m² /cell**
- ③ Current Density : max. 1.0 A/cm²
- ④ Hydrogen Production : ~21Nm³/h
- ⑤ Temperature ; < 90°C
- ⑥ Pressure; Normal Pressure



Large size; since Nov. 2015

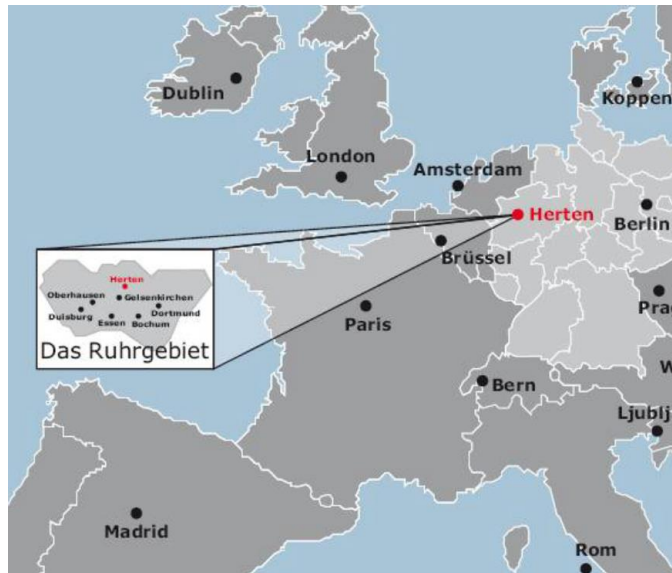
- ① Cell Voltage : **1.78 V (0.6 A/cm²)**
- ② Active Area : **~3m² /cell**
- ③ Current Density : max. 0.6 A/cm²
(limited by power supply)
- ④ Hydrogen Production : ~25Nm³/h
- ⑤ Temperature ; < 90°C
- ⑥ Pressure; Normal Pressure



**Achieved
10,000h
stable
operation**

Our Demonstration in Europe

- We will start a Power-to-Gas demonstration in Herten, NRW (Germany) from next year to show our technologies to European customers.



H2herten location
(50km from Düsseldorf)

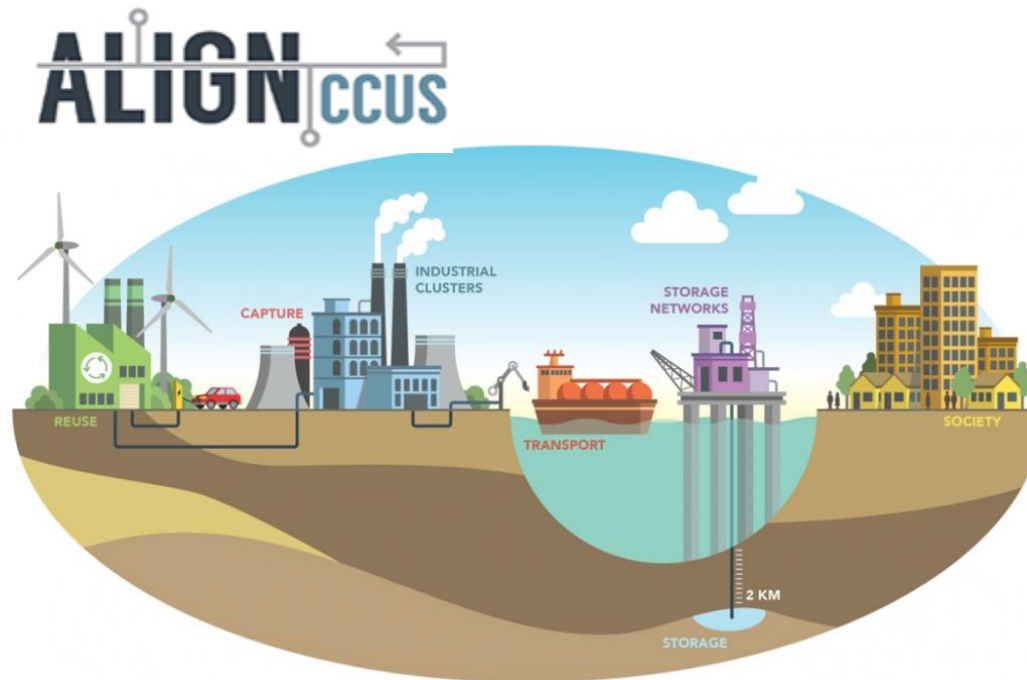


Photo of H2herten Research Bulding

Our Demonstration in Europe

Asahi**KASEI**

- ❑ We have become a member of multi-national European CCUS project. (CCUS: Carbon Capture, Utilization, Storage)
- ❑ Green Synthetic fuel (Methanol, Dimethylether, etc.) will be synthesized from CO₂ and H₂ which AK's electrolyser produces.



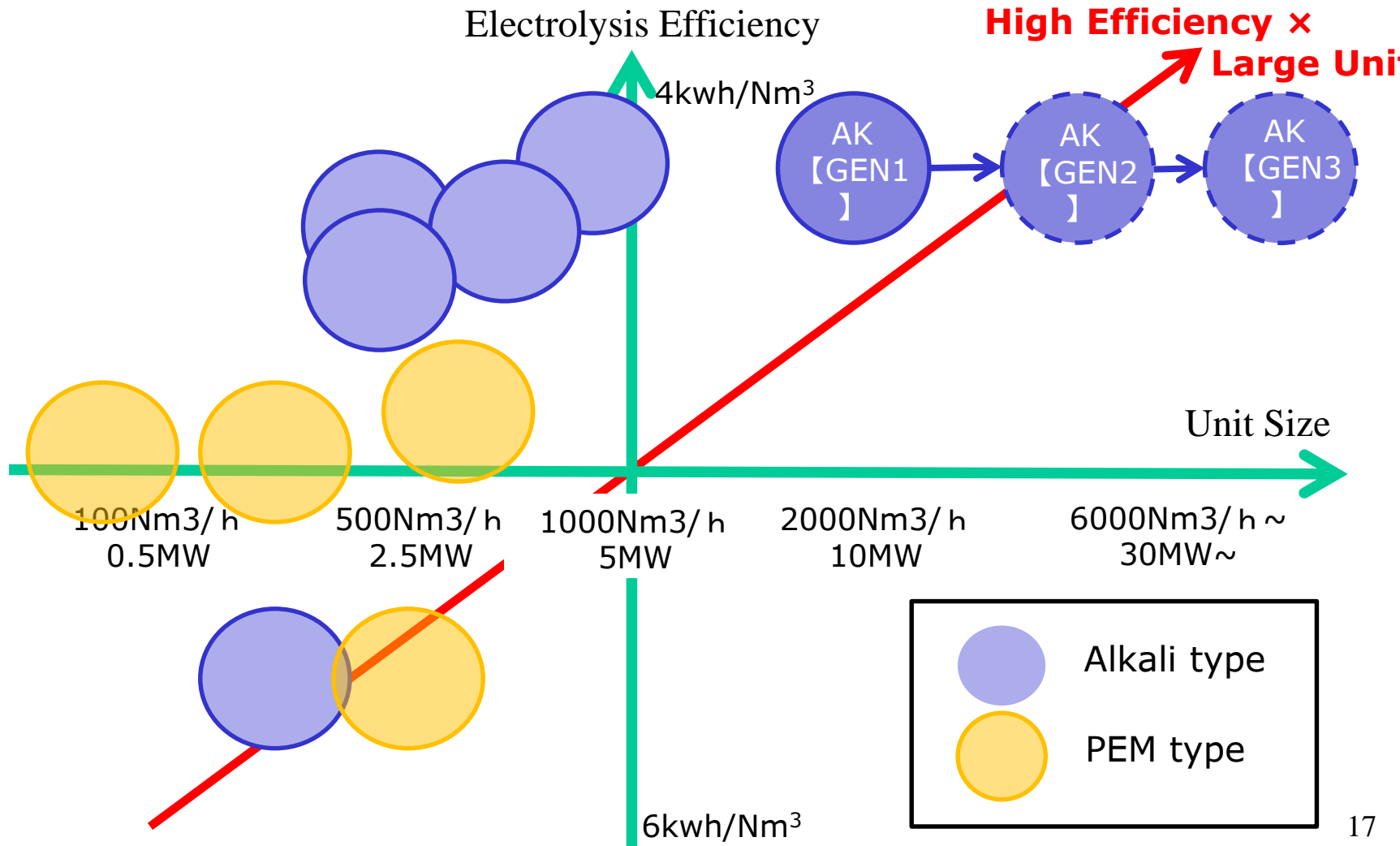
Large-scale energy storage and conversion

- CCU demonstrator construction
- Engine adaption
- Operation and testing
- CCU integration and scale-up



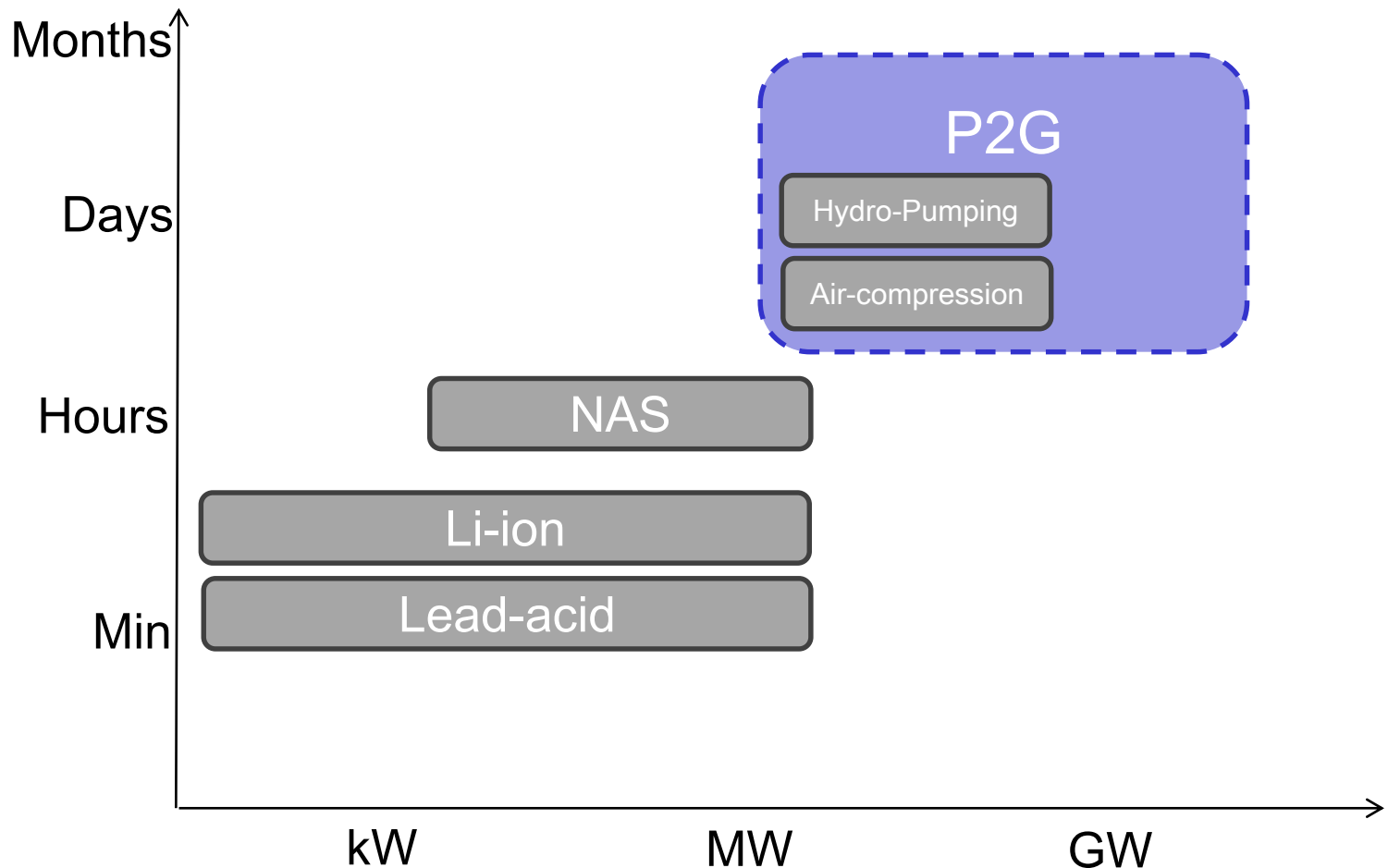
Our Future Plan

- To meet a huge demand for Power-to-Gas in GW scale, we will continue to develop electrolyser with higher efficiency and larger size.



Comparison with other storage systems AsahiKASEI

- P2G is expected to be a 1) long-time and 2) large scale storage systems. Large scale electrolyser is needed for large scale storage.



- ❑ Power-to-Gas is an enabling technology which can increase the renewable share of Heating and Transport sectors by using the renewable power and can solve the curtailment issue of the renewable power at the same time.
- ❑ We are thinking that we would like to contribute to increase the renewable share in the whole energy consumption and would like to work for that with our electrolyser technology.
- ❑ We have established both a regional headquarter and a R&D center in Europe and are ready for working with European partners. We are looking forward to such collaborations in Europe.

Part of this work was done in trust from “Technology, Development for storage and transport of the renewable energy” given by Ministry of Economy, Trade and Industry (METI) and “Hydrogen utilization technology development” given by New Energy and Industrial Technology Development Organization (NEDO).

We would like to express our deep appreciation to METI and NEDO for such support.

Thank you so much for your kind attention.

AsahiKASEI