AsahiKASEI

Recent Developments in Chlor-Alkali Technology

12th November 2024
Technology Developments & Growth Scenario in Chlor-Alkali Industry
(Global and Indian Perspective)
Organized by Indian Institute of Chemical Engineers
New Delhi

Taisuke Nakamura

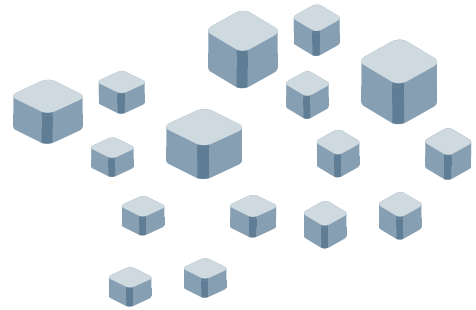
Who am I?

Name	Taisuke Nakamura
Company	Asahi Kasei Corporation
Job	Sales & Marketing
Career	Sales & Marketing of Chlor-Alkali electrolyser & Ion Exchange Membrane (2021.4 - Present)
Educational Background	Master’s degree in Biotechnology, University of Tokyo

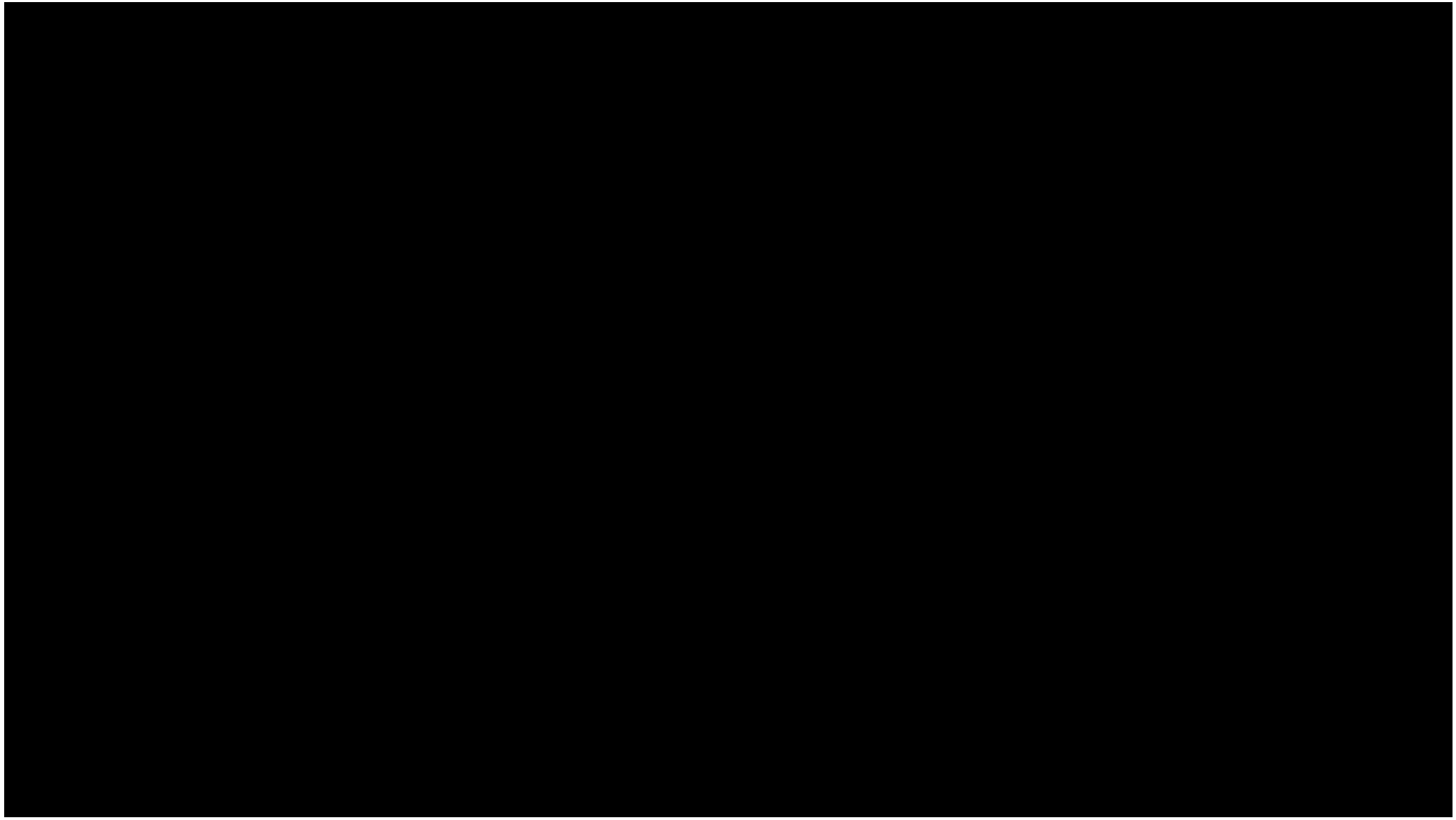
Today's topic

1. History of our innovation
2. New developments
   - Membrode™
   - New Acilyzer™ NC40Z
3. New website

1. Our history of Innovation



Asahi Kasei as unique total supplier



Asahi Kasei as unique total supplier

History of our innovation

Membrane

1975
Double layered membrane
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1982
Reinforcement sacrificial thread

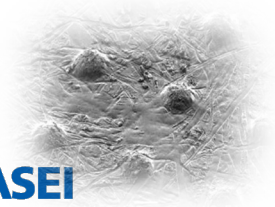
1987
Surface coating

1991
Natural circulation

1999
Higher current density operation (6 kA/m^2)

2003
Zero gap mass production
AsahiKASEI

2004
δ-technology
AsahiKASEI



2015
Σ-technology
Non-polarization
AsahiKASEI

2018
3i-technology
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1975
Bipolar cell
Filter press
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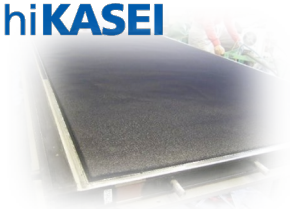
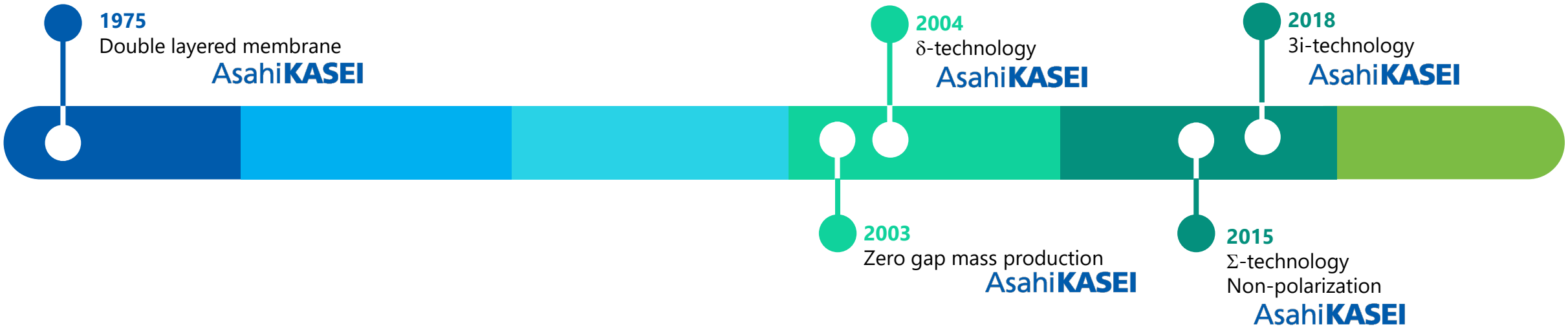
Electrolyzer



History of our innovation



History of our innovation

2004
δ-technology
AsahiKASEI

2018
3i-technology
AsahiKASEI

2003
Zero gap mass production
AsahiKASEI

2015
Σ-technology
Non-polarization
AsahiKASEI

1975
Double layered membrane

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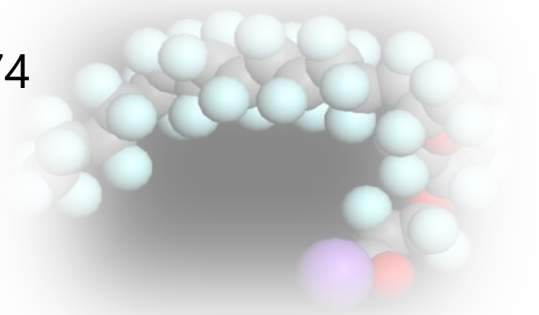
The effect of carboxylate ion-exchange site was found in 1974 contributing higher current efficiency



History of our innovation

1975
Double layered membrane
AsahiKASEI

2004
δ-technology
AsahiKASEI

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3i-technology
AsahiKASEI

2015
Σ-technology
Non-polarization
AsahiKASEI

2003
Zero gap mass production
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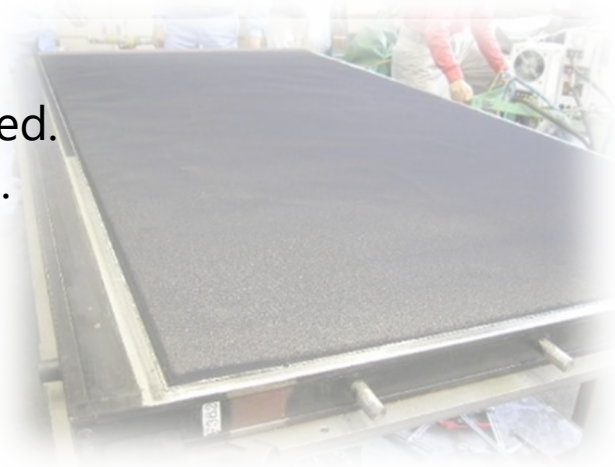
Power consumption and cell voltage was drastically reduced.
Asahi kasei has produced more than 95,000 zero gap cells.



History of our innovation

1975
Double layered membrane
AsahiKASEI

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2018
3i-technology
AsahiKASEI

2004
δ-technology

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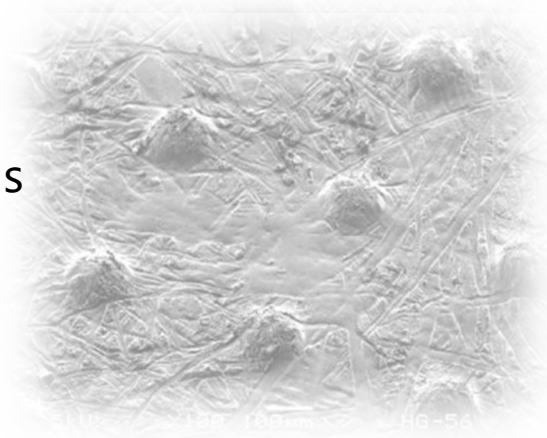
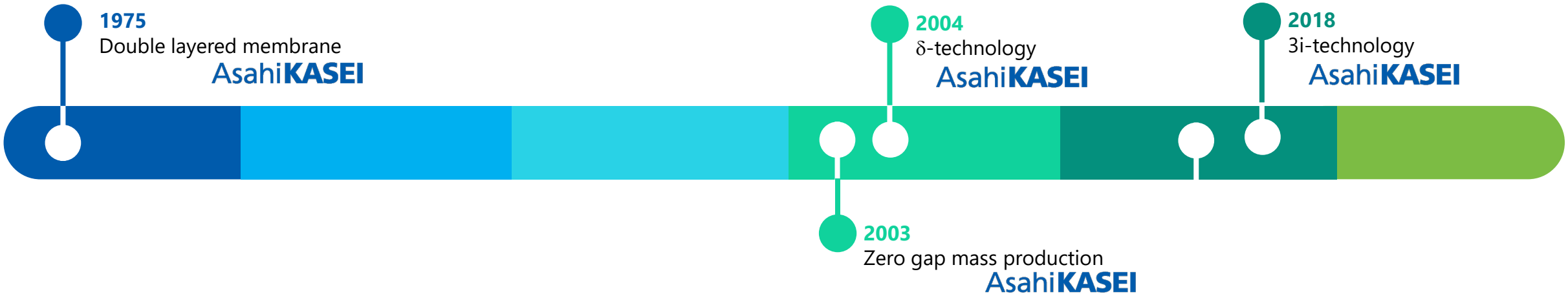
Unique membrane surface topography contributes
to stable operation in high current density and zero gap cells



History of our innovation



2015

Σ-technology

AsahiKASEI

Polarization is not required during shutdown
enabling long-term stable operation

History of our innovation

1975
Double layered membrane
AsahiKASEI

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δ-technology
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Zero gap mass production
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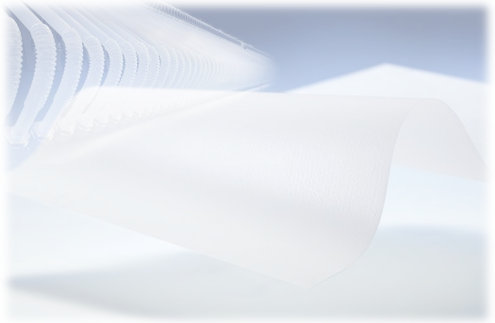
2015
Σ-technology
Non-polarization
AsahiKASEI

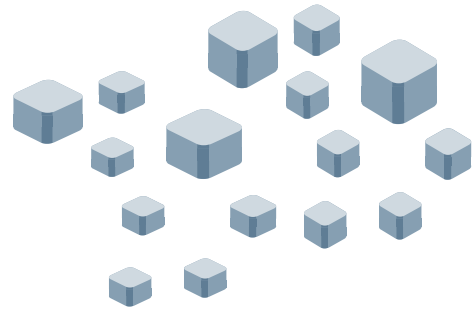
2018
3i-technology

AsahiKASEI

ion channel control, improved coating, improved structure contributed to low power consumption.



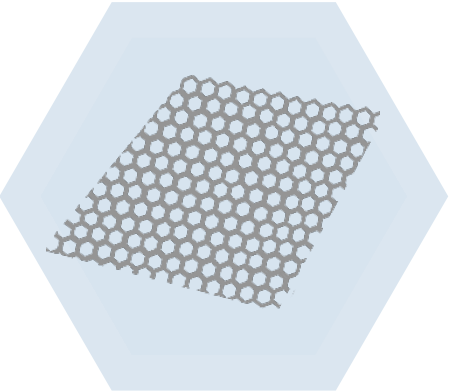
2. New developments



Benefit of New Developments

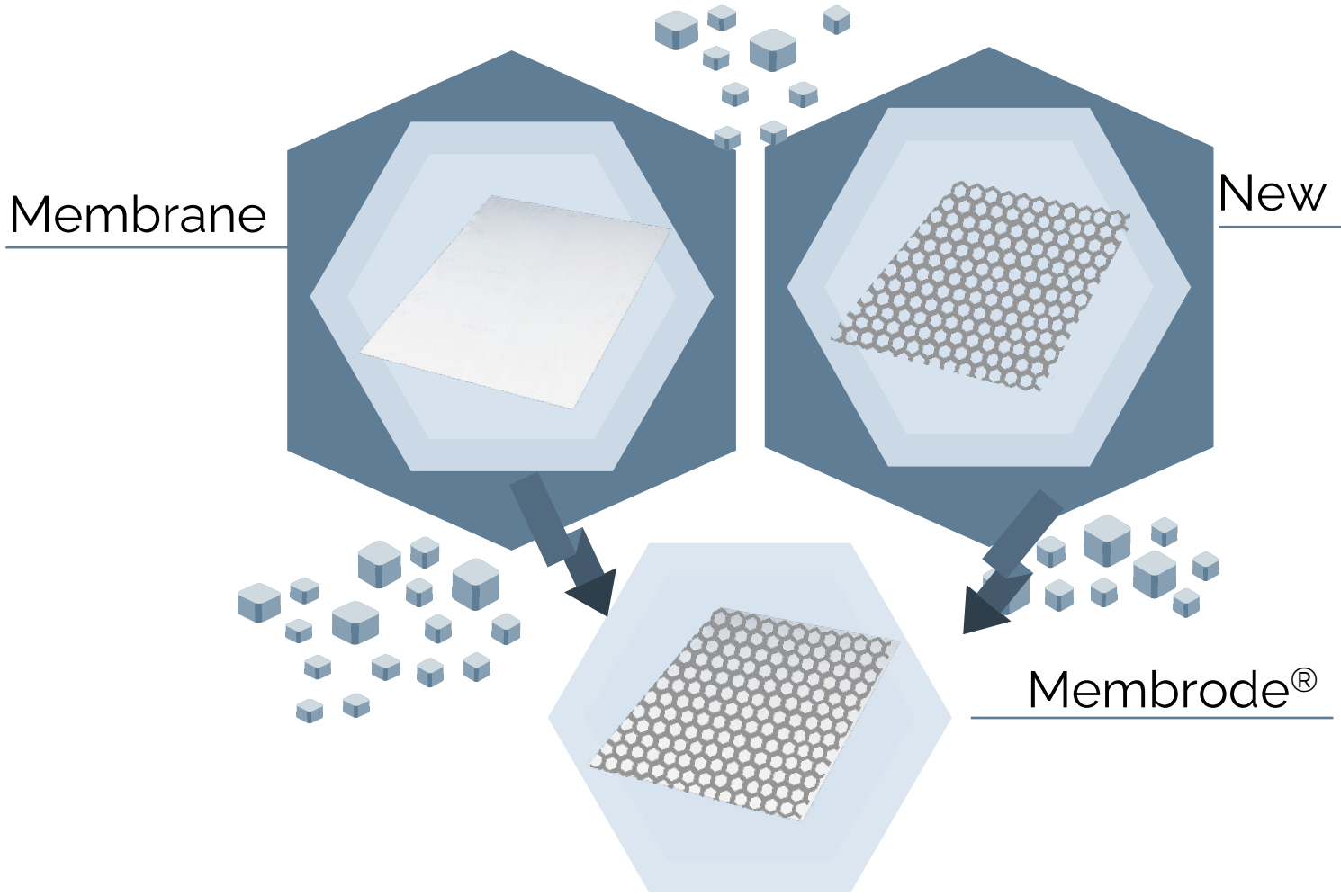
New Development	Improvement
Membrode™	Easier & Faster Electrode renovation
New Acilyzer™ NC40Z	Larger effective area on the same footprint

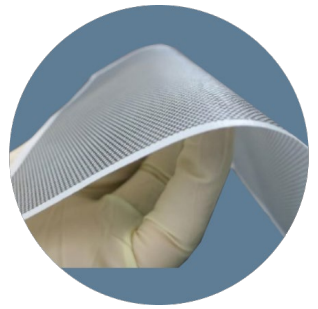
2-1. Membrode™

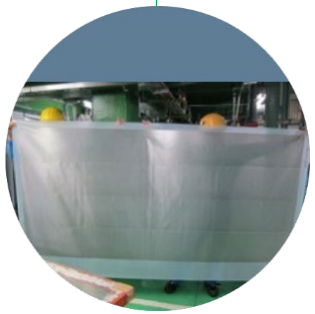


Concept of Membrode™

Concept of Membrode™

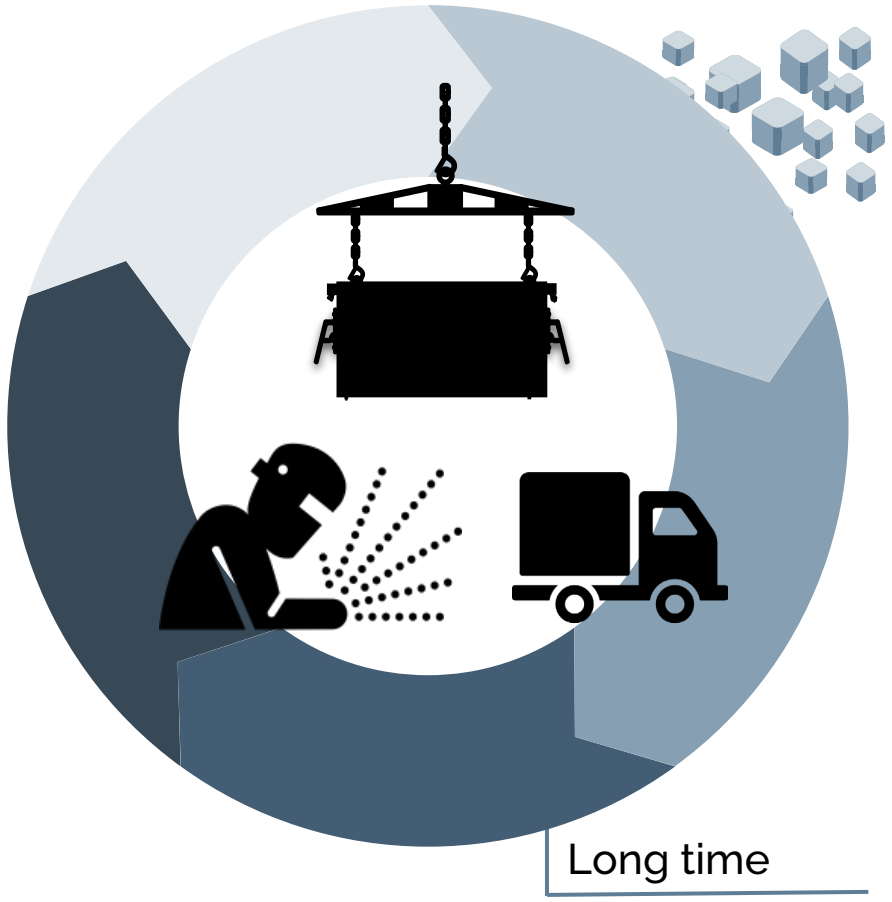






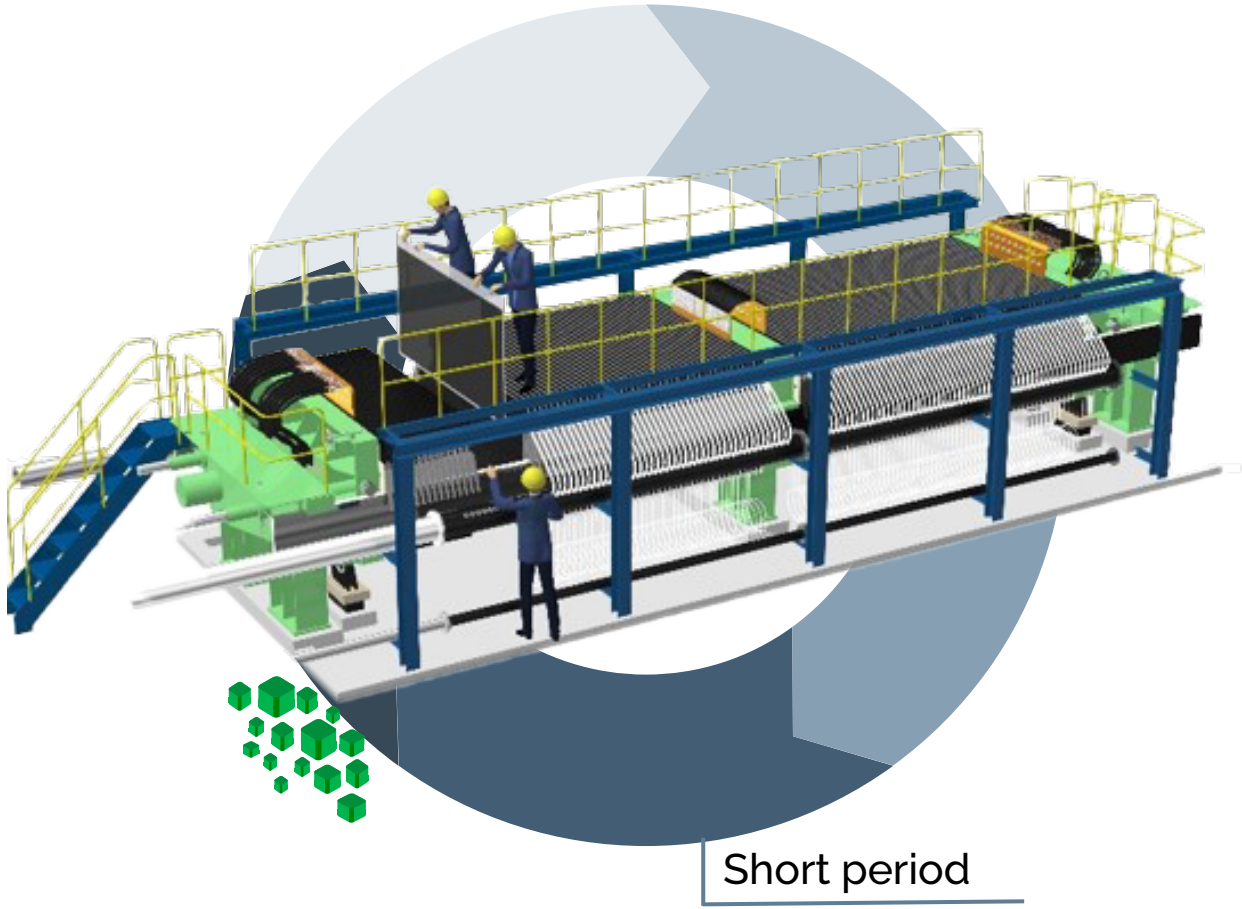
Concept of Membrode™

Today



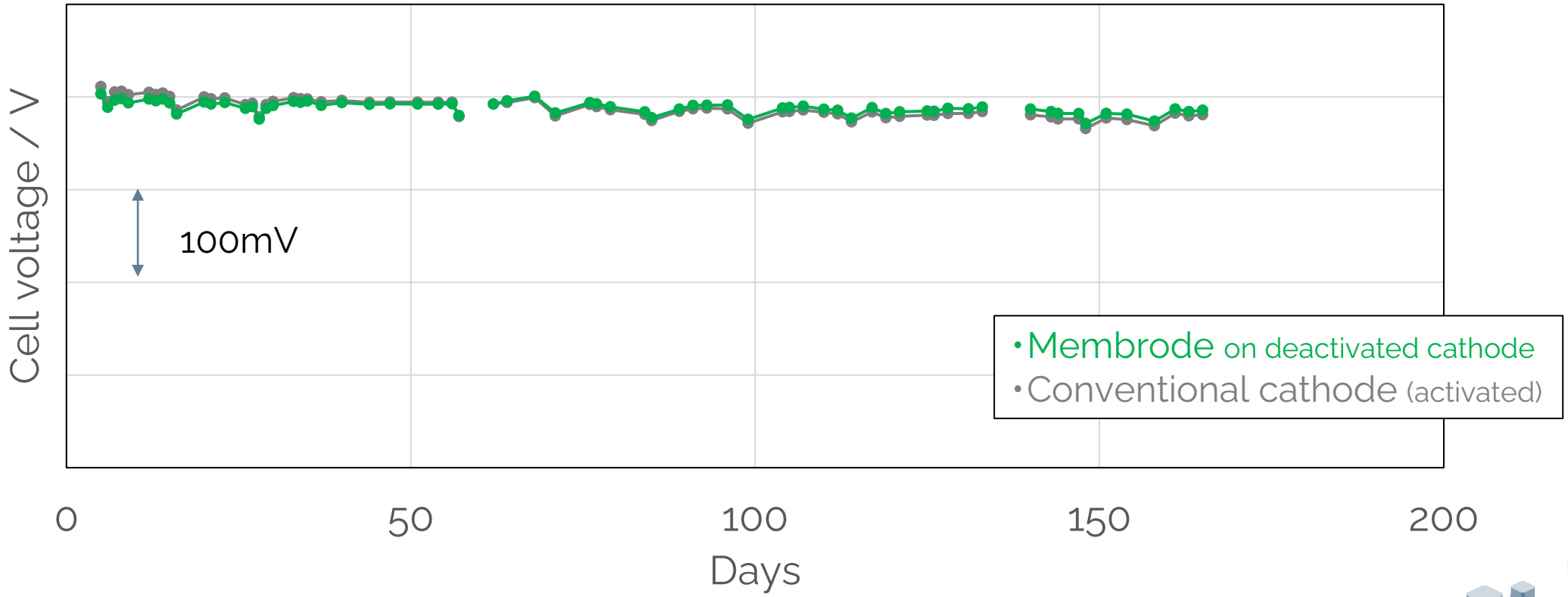
Long time

Future with Membrode™

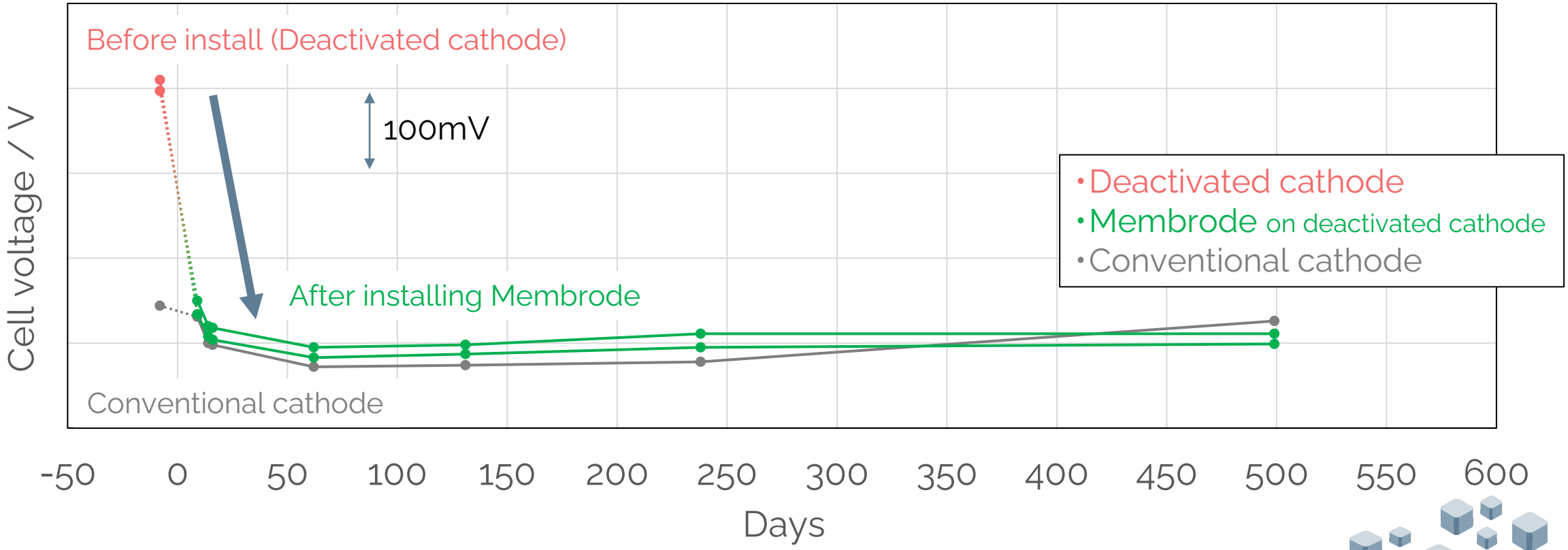


Short period

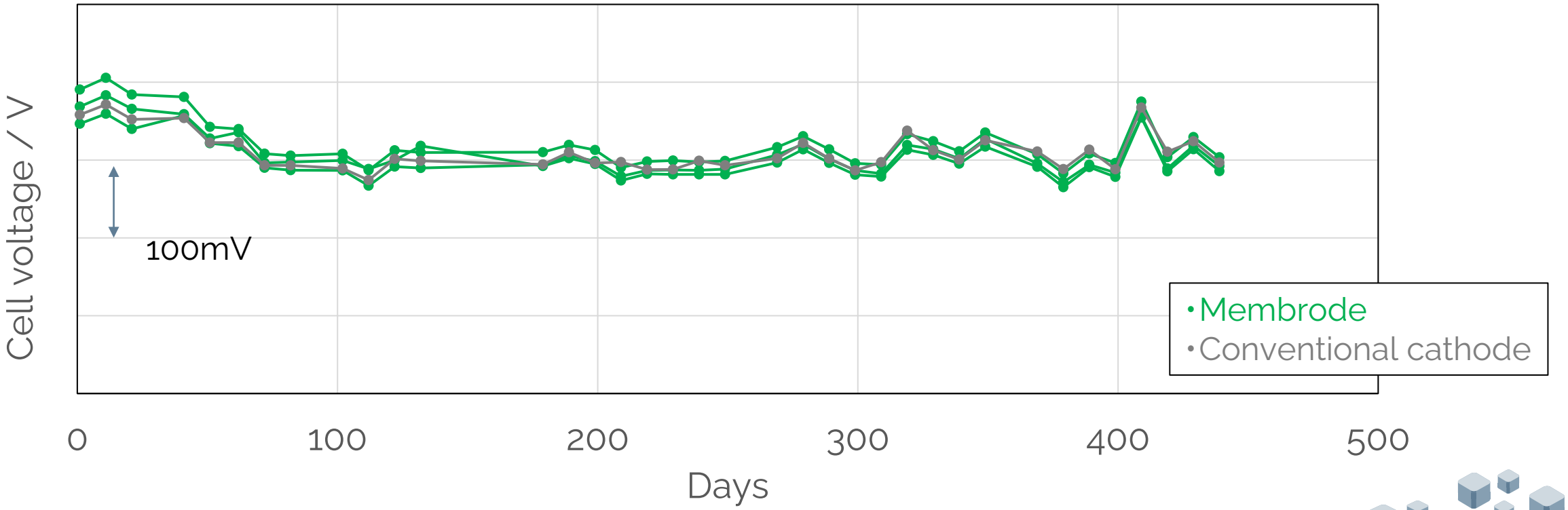
Evaluation of Membrode™



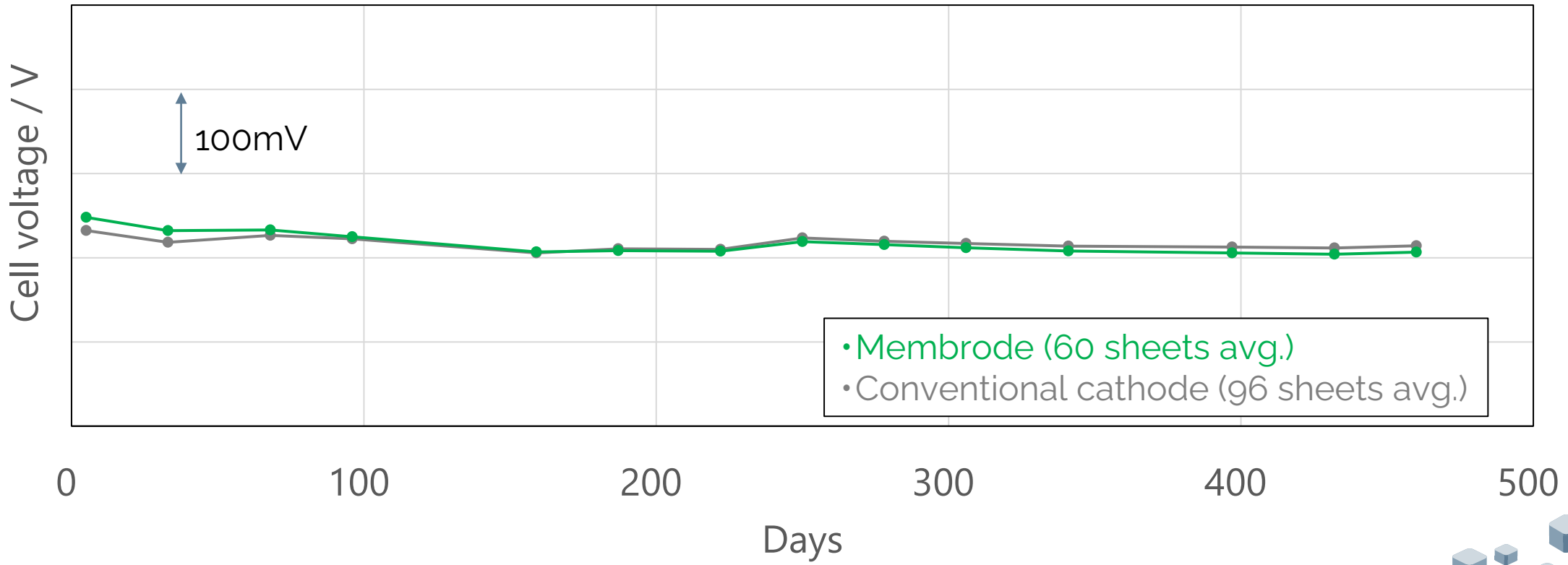
Evaluation of Membrode™



Evaluation of Membrode™



Evaluation of Membrode™



Summary of Membrode™

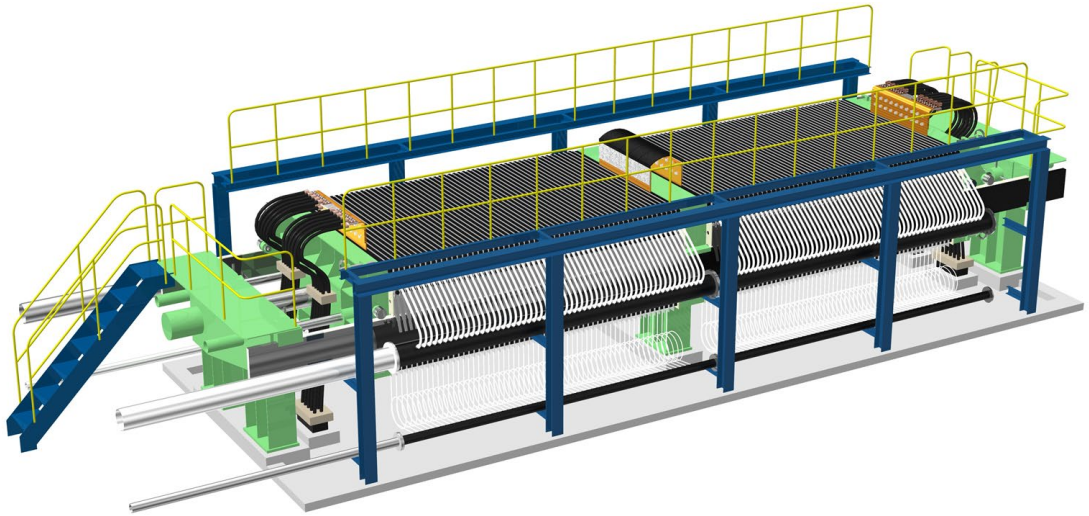
- Membrode
  Potentially reduces the time for cathode remeshing/recoating significantly

  - Cathode Membrode
    under evaluation in several customer's plant

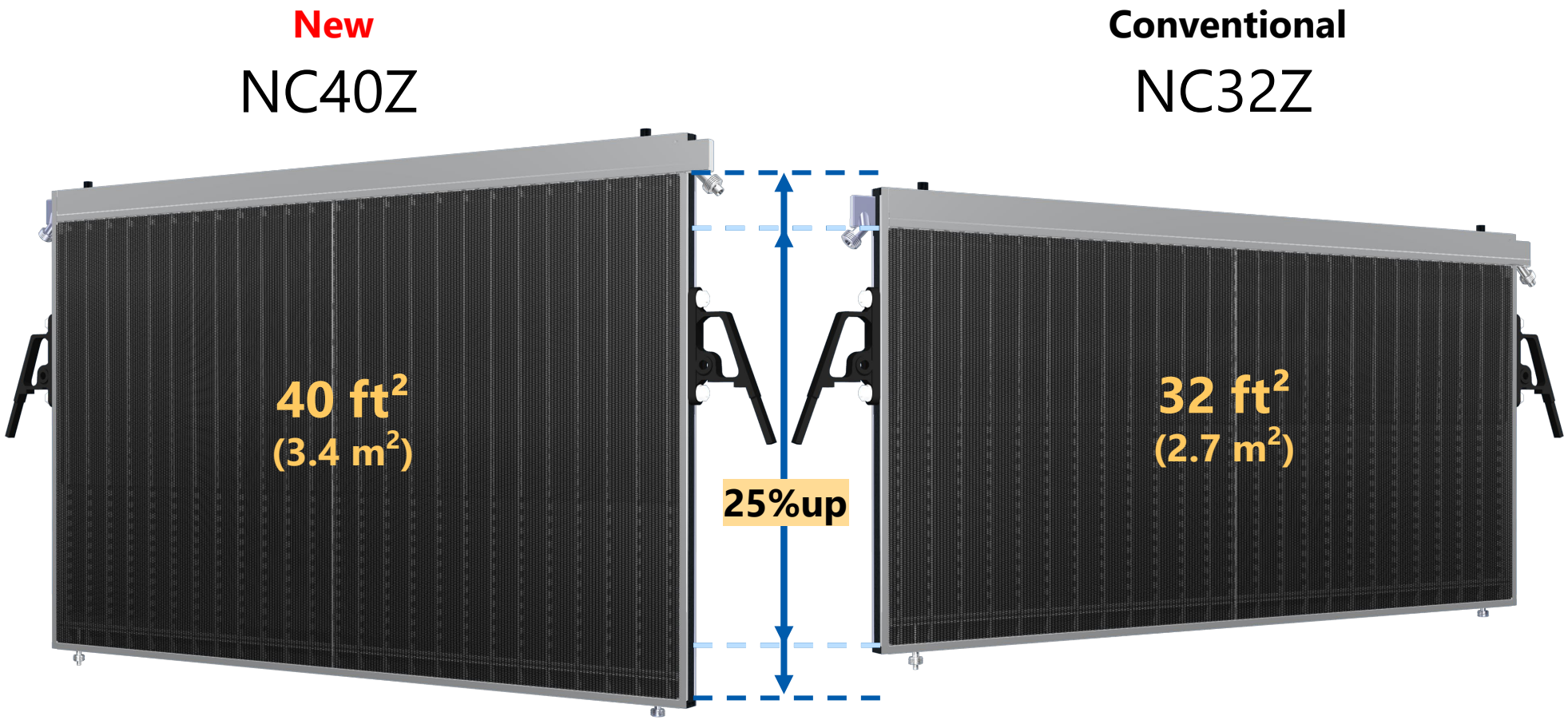
  - Anode Membrode
    under the research and development

2-2. New Acilyzer™ NC40Z

(5 ft x 8 ft cell element)



New Acilyzer™



- ✓ Decrease current density while maintaining the same production level
- ✓ Increase production value while maintaining the same current density level

Benefit from New Acilyzer™ NC40Z（3.4㎡）

Maintain production level

Maintain current density level

Current density reduction

Production increase

Less impact of brine impurities

Reduction in power consumption

Stable efficiency over membrane lifetime

Reduction of electricity costs

Reduction in production costs

Benefit from New Acilyzer™ NC40Z（3.4㎡）

Maintain production level

Maintain current density level

Current density reduction

Production increase

Less impact of brine impurities

Reduction in power consumption

Stable efficiency over membrane lifetime

Reduction of electricity costs

Reduction in production costs

Performance comparison table

■ Case1 Maintain production volume; P・C reduction of approx. 70 kWh/t-NaOH
■ Case2 Maintain current density; Production volume increase of approx. 25%

	NC32Z-Σ Conventional	NC40Z-Σ New Case1	NC40Z-Σ New Case2
Cell size	4feet×8feet	5feet×8feet	5feet×8feet
Effective area for each cell (m^2)	2.7	3.4	3.4
Current density (kA/m^2)	6.0	4.8	6.0
Power consumption (kWh/t-NaOH)	-	**-70**	Same
Production volume	-	-	25% up

P・C reduction of 70（kWh/t-NaOH)
or 25% increase of production volume

*Representative value. Not guaranteed.

Benefit from New Acilyzer™ NC40Z（3.4㎡）

Maintain production level

Maintain current density level

Current density reduction

Production increase

Less impact of brine impurities

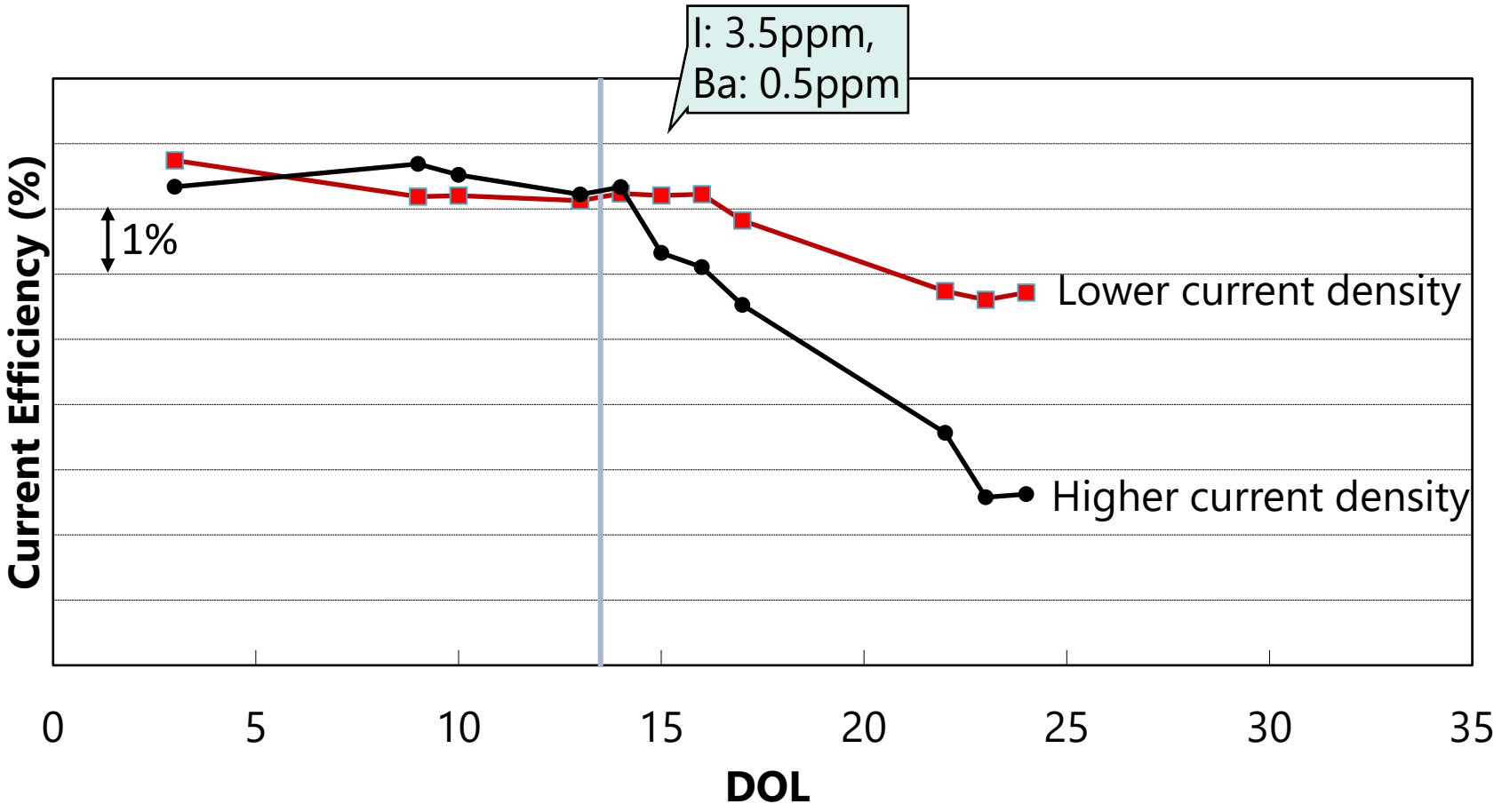
Reduction in power consumption

Stable efficiency over membrane lifetime

Reduction of electricity costs

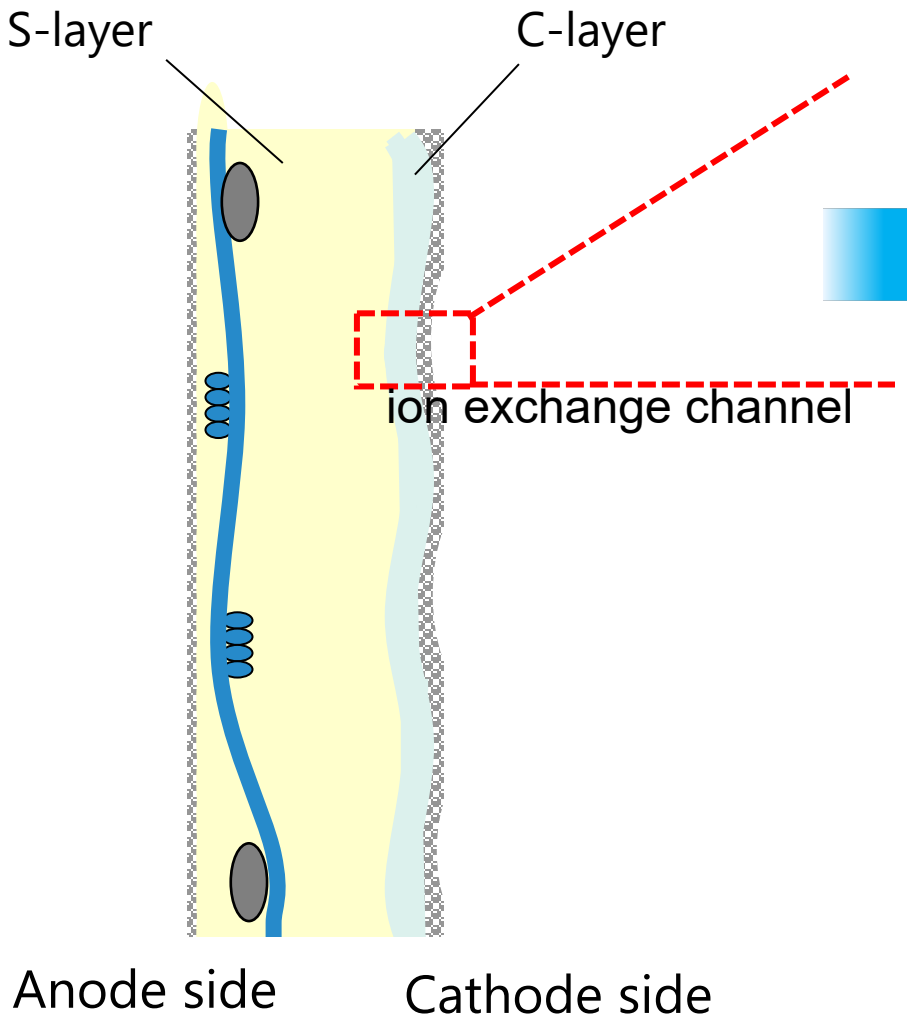
Reduction in production costs

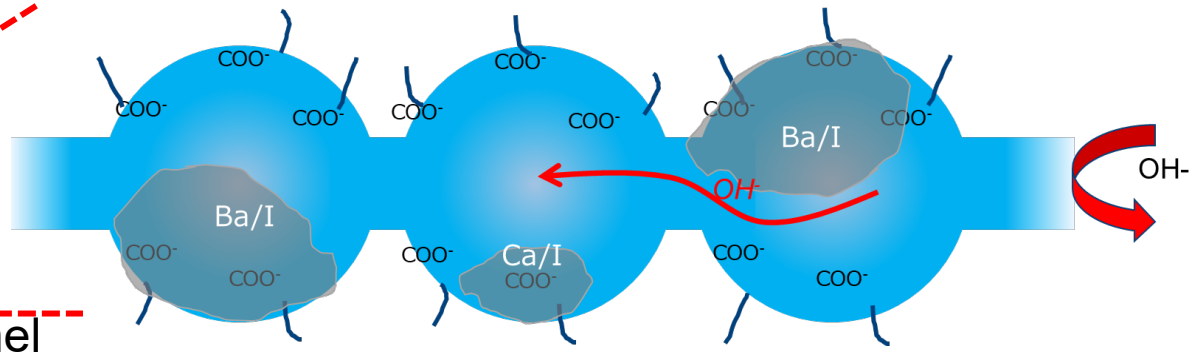
Prevention of CE decline with lowering C.D.



Improved CE stability against impurities with lower current density

Mechanism of CE decrease by impurity





Impurities precipitation in C- layer

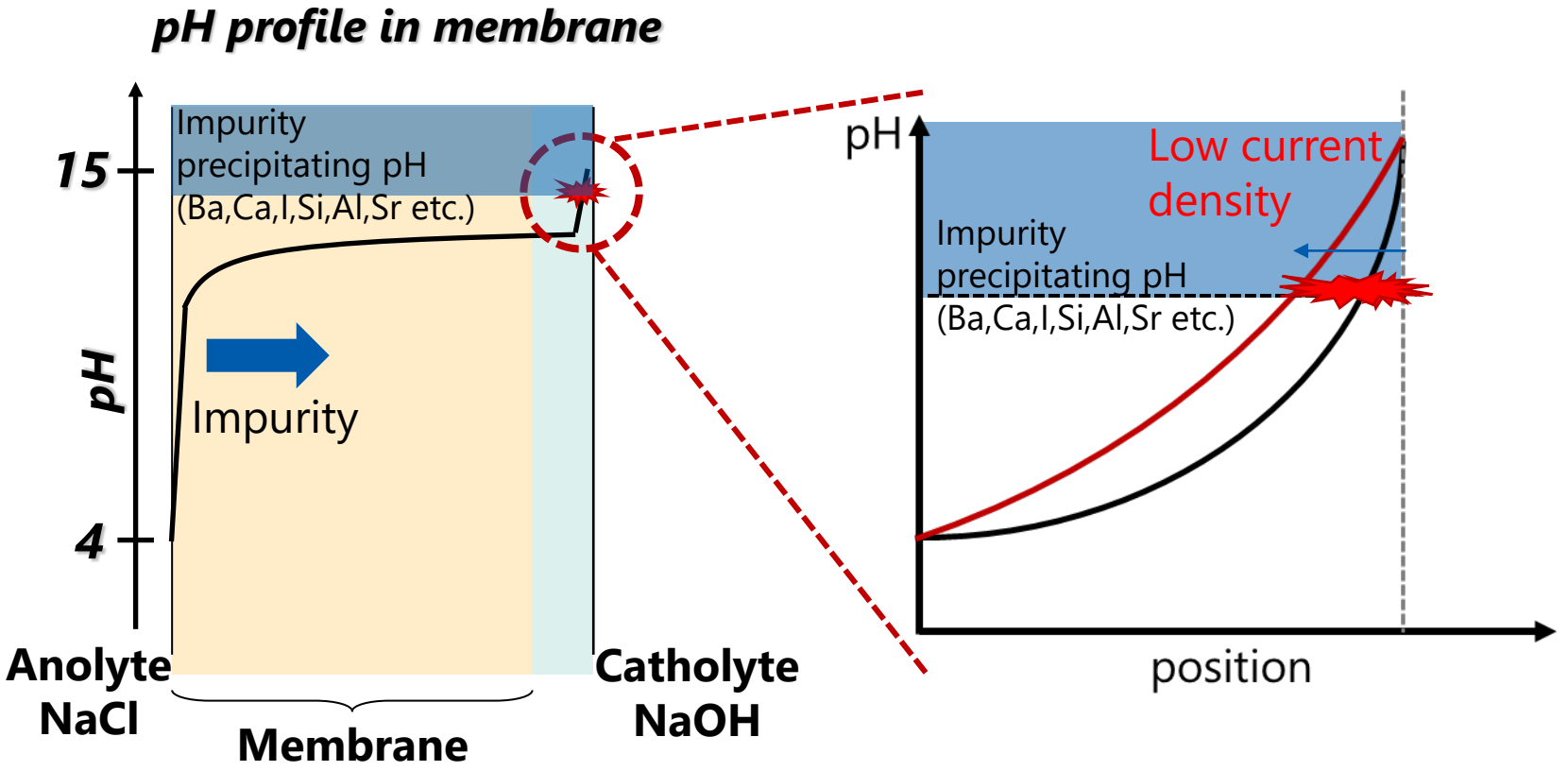
▼

OH- inverse diffusion increase

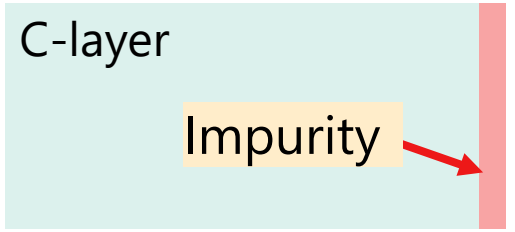
▼

CE decrease

Mechanism of CE decrease by impurity



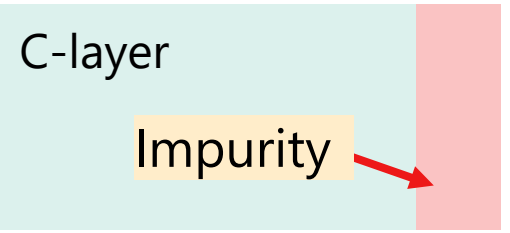
High current density



High density precipitation
in narrow area

Larger decrease in CE

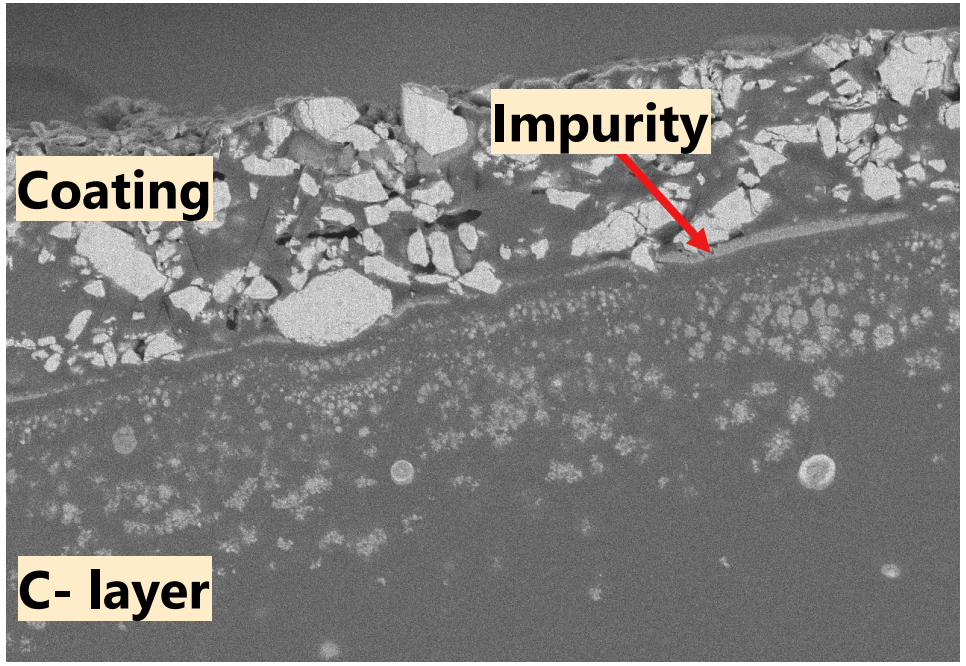
Low current density



Low density precipitation
In wide area

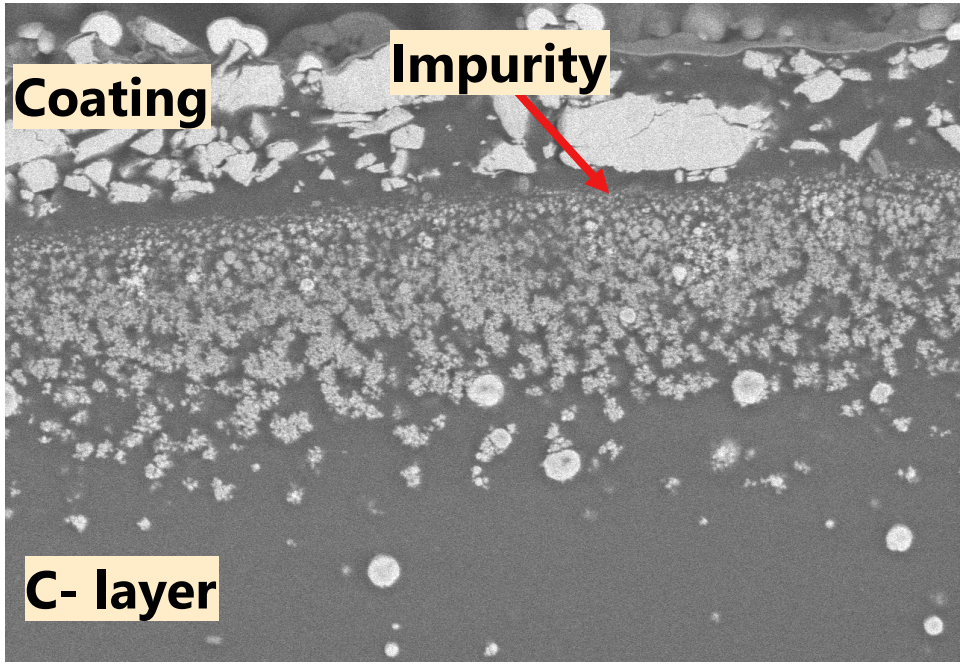
Smaller decrease in CE

Mechanism of CE decrease by impurity



High density accumulation of impurity at film/coating interface

Lower C.D.



Lower density accumulation of Impurity at wide range

It is possible to reduce membrane degradation by impurities with keeping production volume by NC40Z

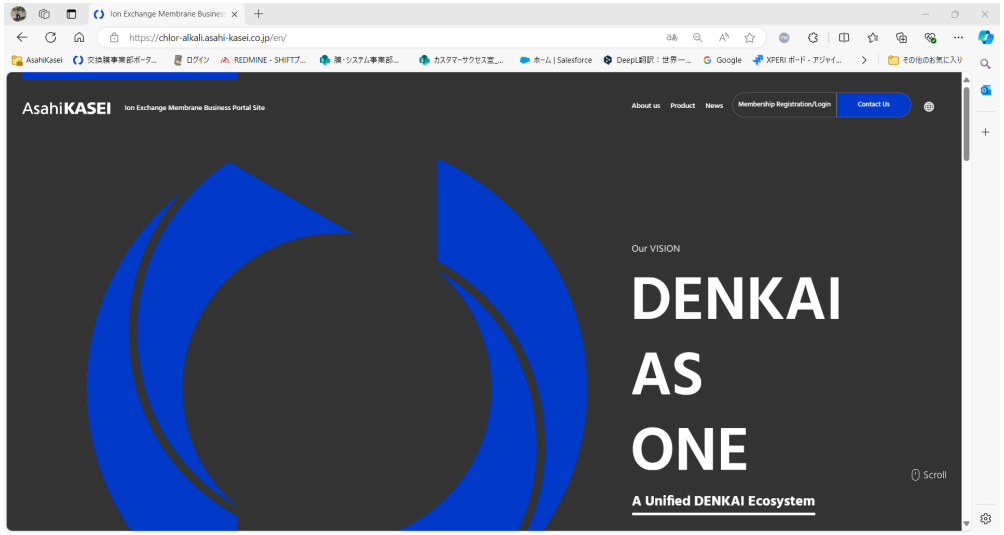
Benefit of New Developments

New Development	Improvement	Customer benefits
Membrode™	**Easier & Faster Electrode renovation**	**Minimizing down time** occurred by electrode renovation/recoating
New Acilyzer™ NC40Z	**Larger effective area on the same footprint**	**Larger production** or **Less power consumption** (**Higher stability**)

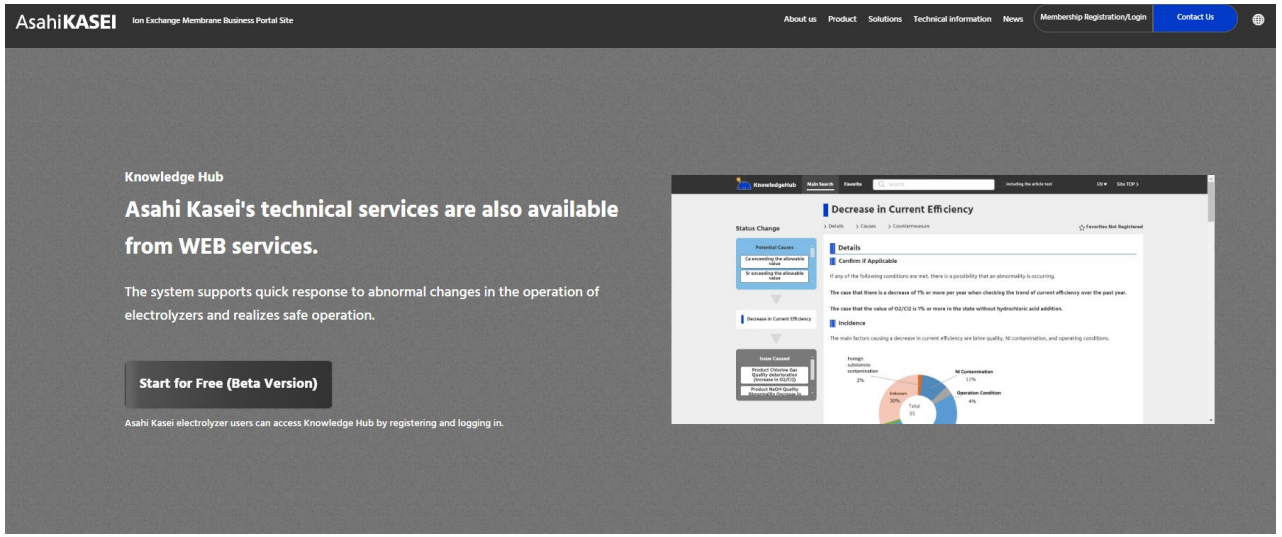
3. New website

Recent activity – New website

https://chlor-alkali.asahi-kasei.co.jp/en/



What's Knowledge Hub?



What' New?

- New branding design
- Membership system
- Introduction Movie
- Document download
- **Knowledge Hub**

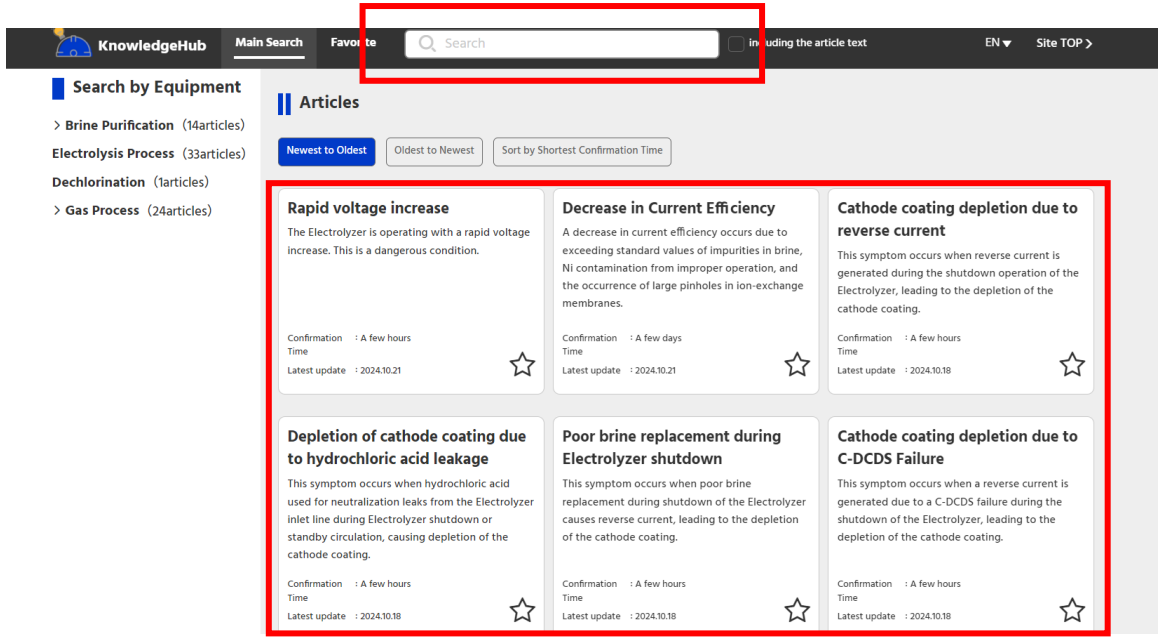
What's feature?

- Reduce cause identification time
- Prevent anomaly escalation
- Implement mechanism-based solutions
- Streamline internal reporting

Recent activity – New website

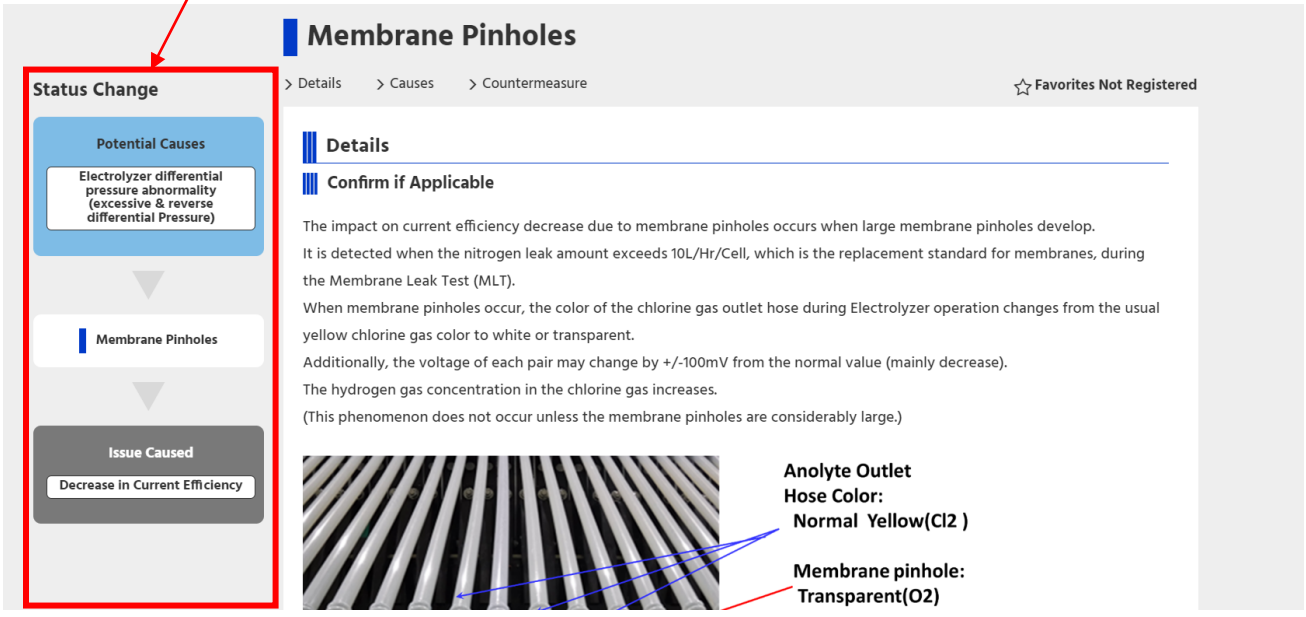
Knowledge Hub image

Search for Symptoms



Select Relevant Symptoms from Options

Symptom transition chart



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Creating for Tomorrow