New Developments & Innovations in thyssenkrupp nucera electrolysis technologies

Alkali Manufacturer Association of India (AMAI)

11 -12 February 2026

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Agenda

Chlor-Alkali Electrolysis Market Overview

Next BM Generation - Strong Energy Performance, Superior Resilience

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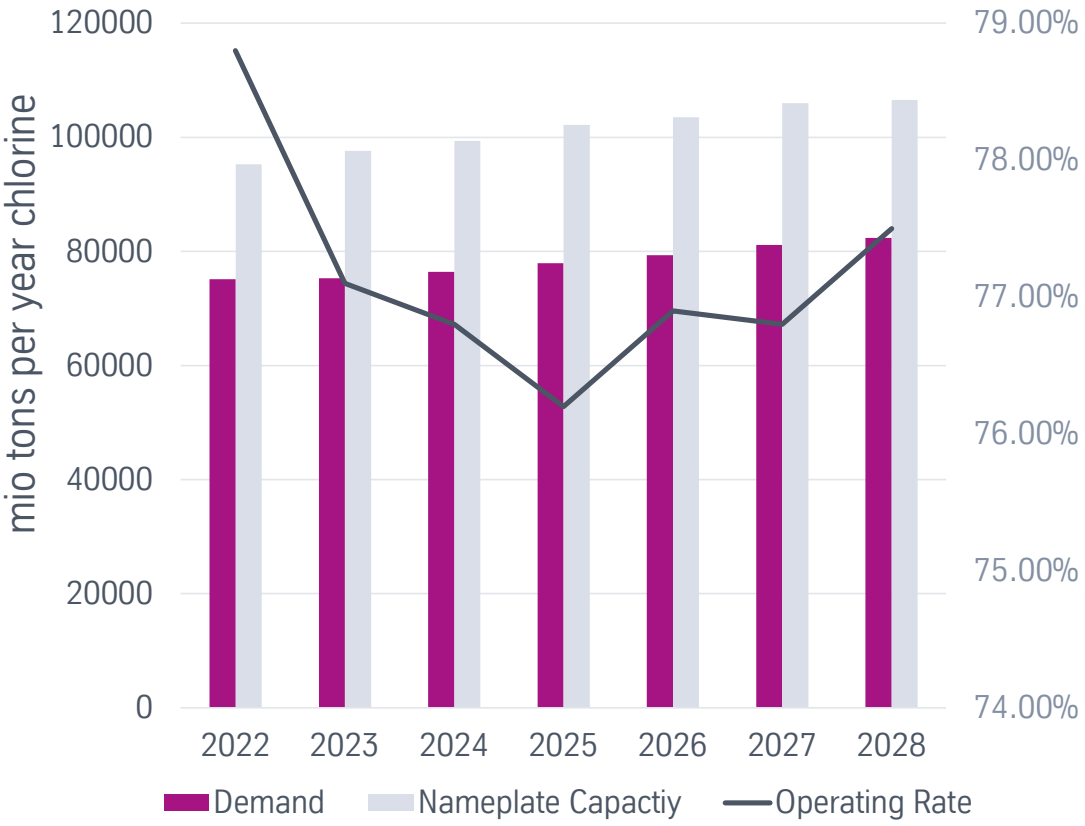
Chlor-Alkali Electrolysis Market Overview

Next BM Generation - Strong Energy Performance, Superior Resilience

Global Market Overview I Why the CA Market matters

Global chlorine capacity and demand



- Chlorine demand recovering, driven by construction & PVC
- Growth focused in low-cost export regions
- Global utilization pressured by new capacity

Source:
Chemical Market Analytics

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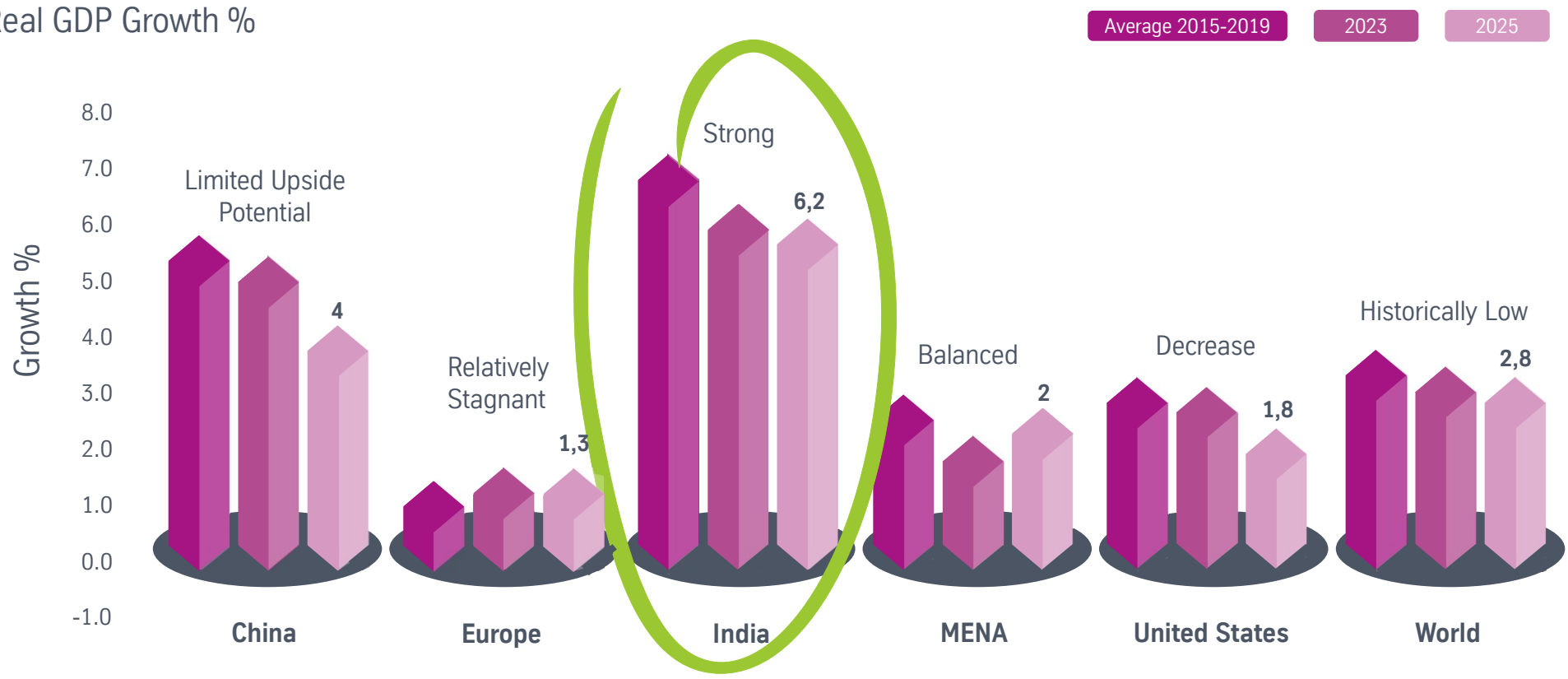
Global Market Overview I GDP Growth Overview



Source:
https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD

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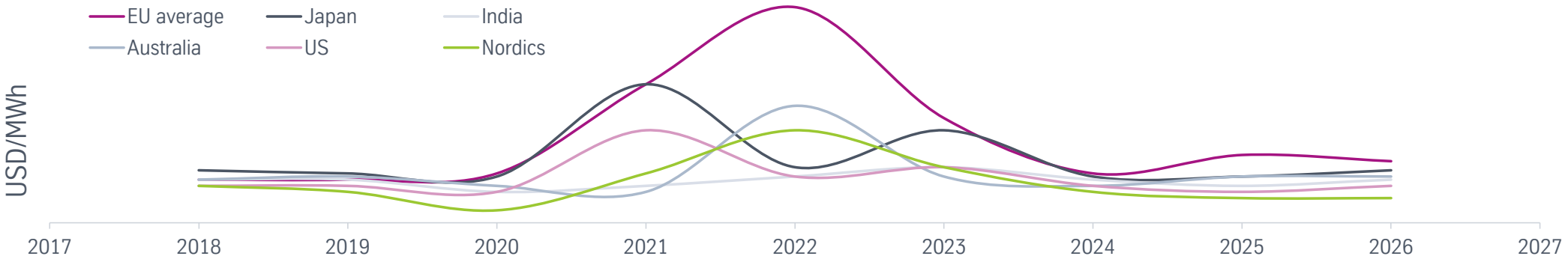
Global Market Overview I Average Wholesale Price Trends



2018 - 2020	2020 – mid 2021	Mid 2021 - 2023	2023 - 2025	2025 - 2027
COVID-19 shock (2020): Demand collapse pushed prices to historic lows	**US & Japan:** Early price rises from fuel & weather **Other regions:** mostly stable, some showing sharp upward trends	**Global price spike in 2022** especially in Europe, due to the Ukraine war and energy crisis	**Prices fell globally**, nearing pre-crisis levels	**Renewables drive growth** keeping price down

Source:
https://iea.blob.core.windows.net/assets/0f028d5f-26b1-47ca-ad2a-5ca3103d070a/Electricity2025.pdf // https://www.iea.org/data-and-statistics/charts/quarterly-average-wholesale-prices-for-selected-regions-2018-2026

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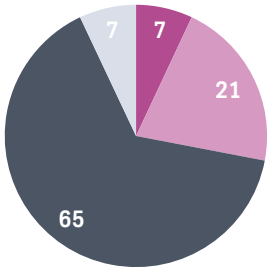
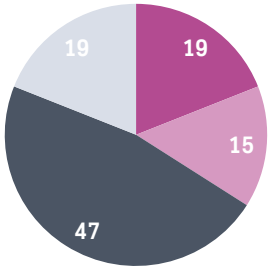
Regional Highlights I India: Emerging Forces

Chlorine Demand



- Vinyl (PVC)
- Water Treat.
- Chlorinated Int.
- Other

Caustic Soda Demand



- Alumina
- Textile
- (In-)Organic Ch.
- Other

- Region with highest GDP growth
- India is a market driven by caustic demand
- Adani's Mundra project and Reliance's expansion will transform the Indian caustic soda landscape – adding 2 mio tons NaOH capacity

Electricity Price
5 - 7 US-Cent / kWh

GDP
6,2 %

Source: https://www.databridgemarketresearch.com/reports/middle-east-and-africa-chlor-alkali-market?srsltid=AfmBOooAOkAPNr08YEOhiGSZM0skFz_8NU7BDMeoERigPrdZY3EViUcK
https://chemkraft.ir/en/caustic-soda-market-analysis-in-the-middle-east/
https://www.imarcgroup.com/india-chlor-alkali-market Gobal Market Analytics

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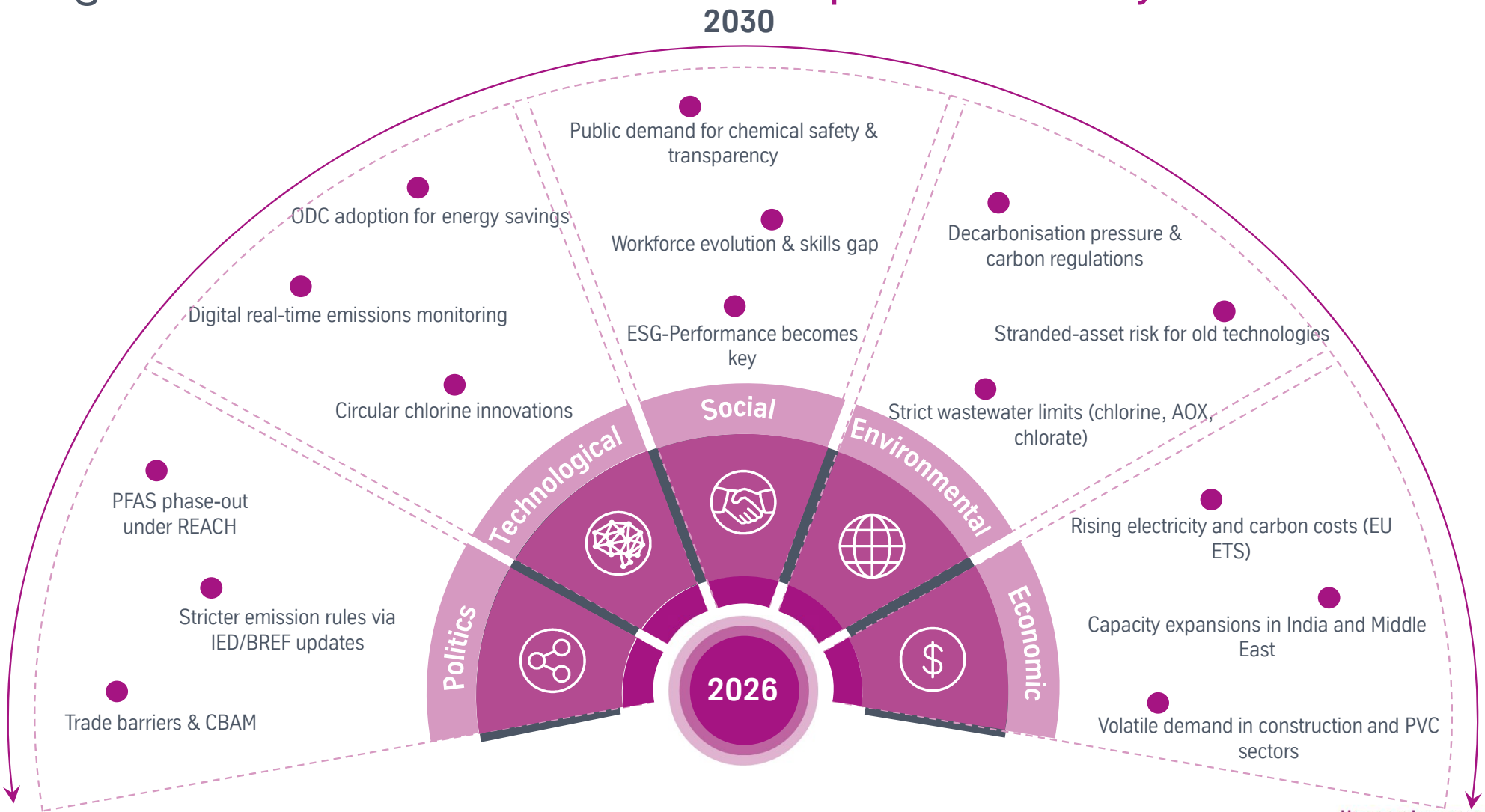
Strategic Market Outlook I What will shape the next 5 years?



Source:

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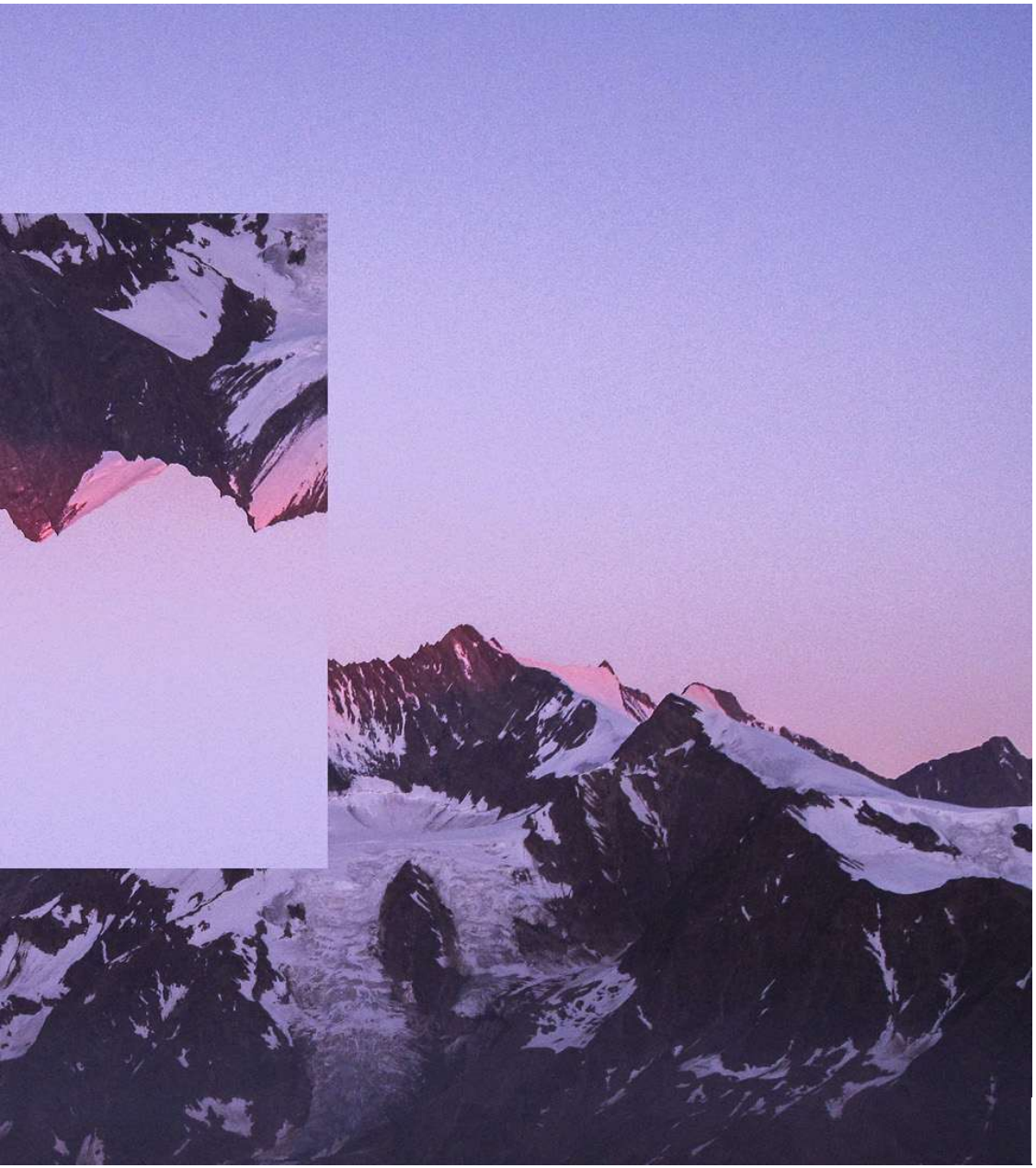

Is the Chlor-Alkali Market reaching its Limits –
or just rethinking the Rules?

The CA Market is evolving – not stalling. And we're driving that Evolution forward.

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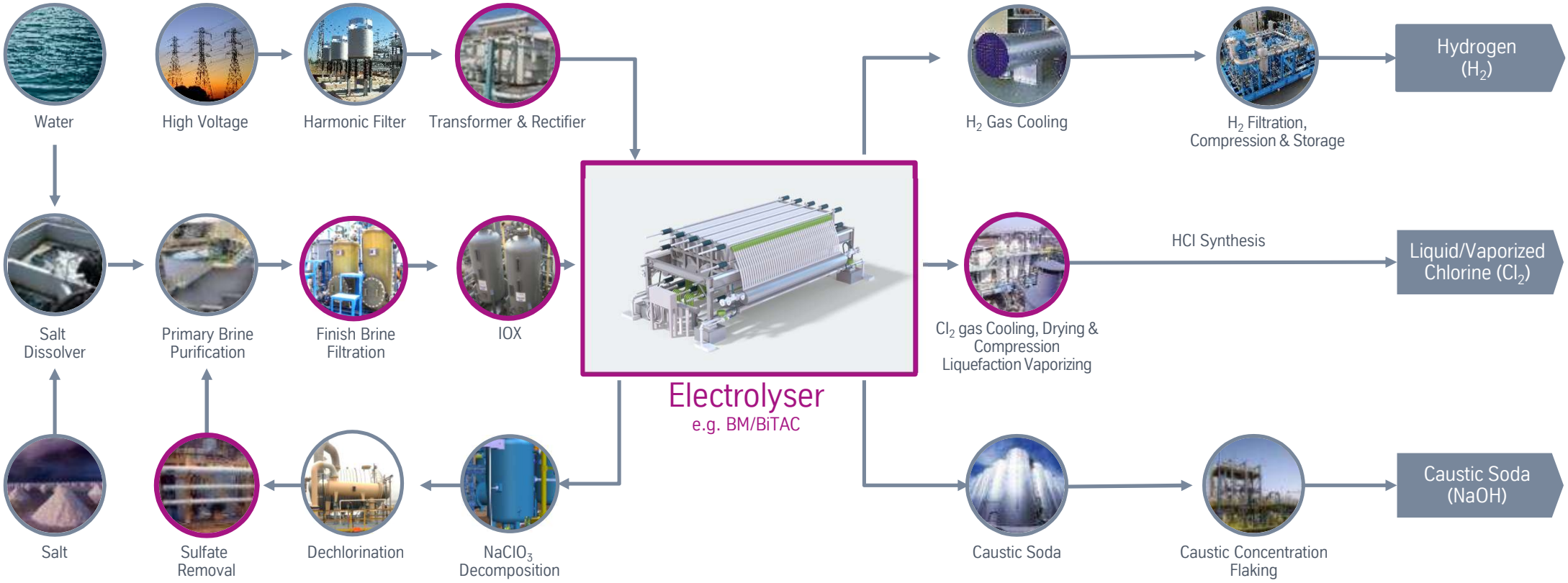
Chlor-Alkali Electrolysis Market Overview

Next BM Generation - Strong Energy Performance, Superior Resilience

thyssenkrupp nucera integrates whole units required for electrolysis plant



Globally leading know-how to integrate adjacent technologies into CA plants

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10
Locations

1,000+
employees worldwide

600+
successful electrochemical projects worldwide

>10GW
electrolyzer capacity installed

3GW+
contracted green hydrogen capacity

>1.5GW
manufacturing capacity p.a. today

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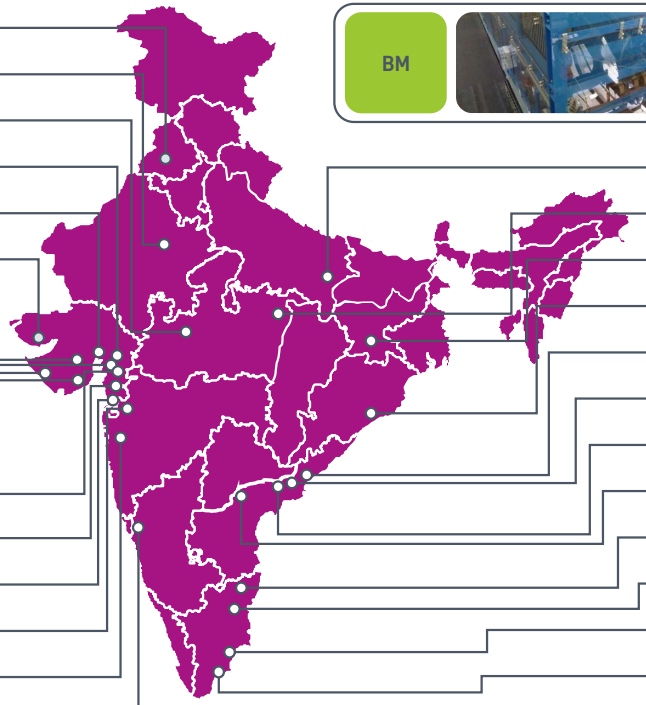
thyssenkrupp nucera Chlor-Alkali Plants – India Footprint

Primo Chemicals (former Punjab Alkalies) – Nangal, Punjab
Lords Chloro Alkali – Alwar, Rajasthan
Grasim Industries– Nagda, Madya Pradesh
Grasim Industries– Vilayat, Gujarat
GACL– Vadodara, Gujarat
Kutch Chemicals- Ghadhidham, Gujarat
Nirma Ltd. – Bhavnagar, Gujarat
Reliance Industries – Dahej, Gujarat
Tata Chemicals - Mithapur, Gujarat
Aditya Birla Nuvo – Veraval, Gujarat
GNAL – Dahej, Gujarat
GACL – Dahej, Gujarat
UPL Ltd. – Jhagadia, Gujarat
Century Rayon - (Kalyan) Thane, Maharashtra
Atul Ltd – Valsad, Gujarat
Grasim Industries – Karwar, Karnataka



BM

BM+BiTAC

BiTAC

Grasim Industries – Renukoot, Uttar Pradesh
Orient Paper – Amlai, Madhya Pradesh
Grasim Industries – Rehla, Jharkhand
Grasim Industries – Ganjam, Odisha
Grasim – Balabhadrapuram, Andhra Pradesh
Andhra Sugars – Saggonda, Andhra Pradesh
Andhra Sugars – Kovvur, Andhra Pradesh
TGV Sree Rayalaseema – Kurnool, Andhra Pradesh
Tamilnadu Petroproducts – Chennai, Tamil Nadu
Chemfab Alkalies – Pondicherry
Chemplast Sanmar – Karaikal, Pondichery
DCW Ltd.–Tuticorin, Tamilnadu

Technology → Engineering → Implementation → Commissioning → After-sales services

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thyssenkrupp nucera's Electrolysis Technologies

Chlor-Alkali Electrolysis

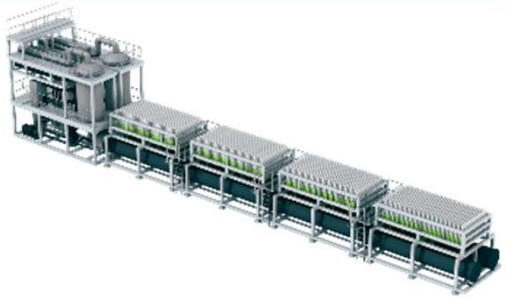
nucera Single Element / BM2.7
Filter Press BiTAC
NaCl ODC


Hydrochloric Acid Electrolysis

HCl Diaphragm
HCl ODC

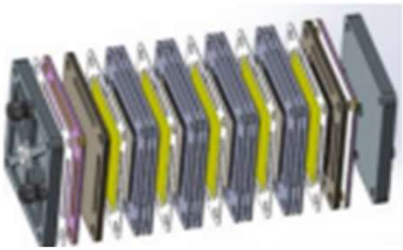

Alkaline Water Electrolysis (AWE)

scalum®

Solid Oxide Electrolysis Cell (SOEC) – Pilot Plant

Strategic Partnership with Fraunhofer IKTS, Germany

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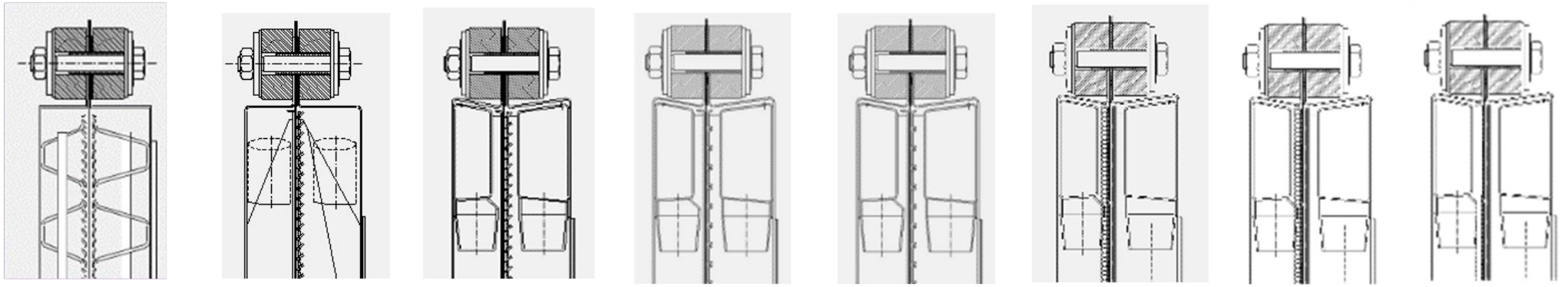
Generation 7 marks a new Milestone in BM Single Element Development

Gen. 2	Gen. 3	Gen. 4	Gen. 5	Gen. 5plus	Gen. 6	Gen. 6plus	Gen. 7
1989	1997	2005	2008	2011	2012	2019	2026



More than 30 years of history of BM Single element generations are now continued with Generation 7

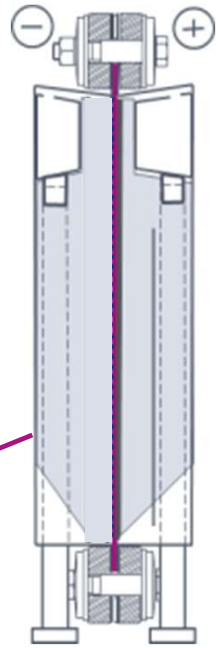
Generation 7 is advancing the Evolution by a new Cathode Design

2012

2019

2026

BM2.7v7

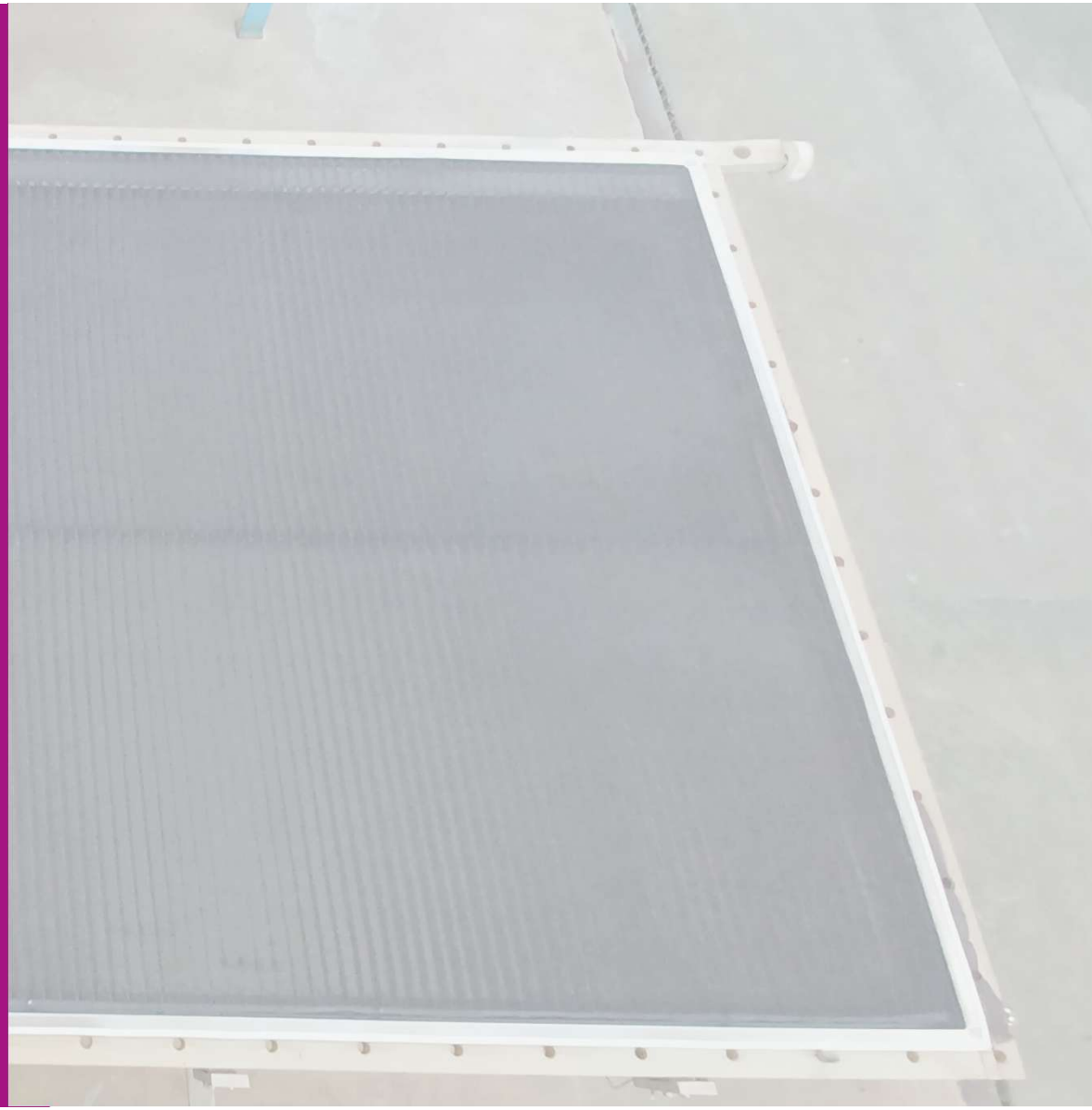


New Cathode internal Structure

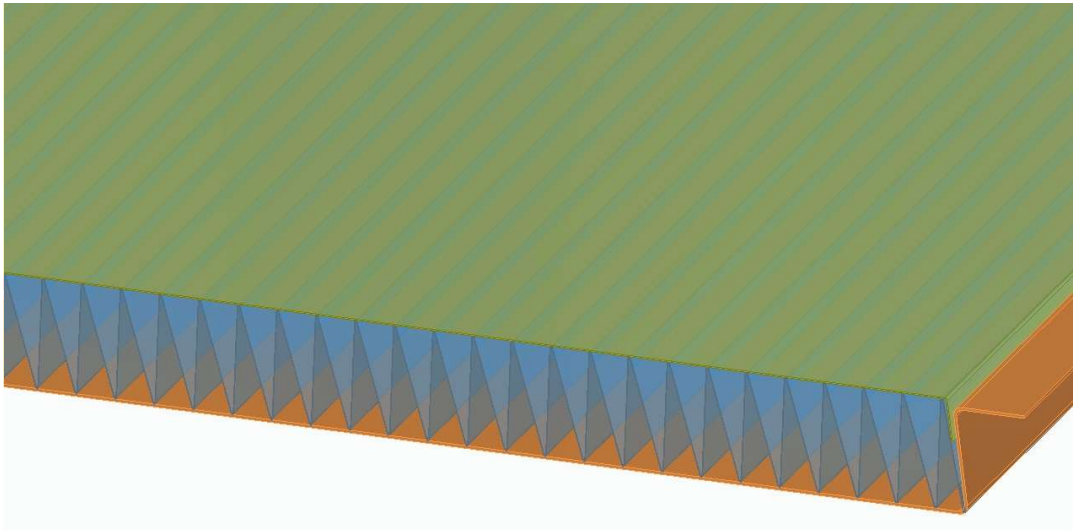
Cathodic Protection System

REES

Resilient Elastic Element Structure



REES – Resilient Elastic Element Structure



- More simplistic design, increasing the maintenance friendliness
- Fast assembly of element
- Easy replacement of cathode electrode

REES works as a spring and enables zero gap by its elastic behaviour

- In BM Generation 6 the current is introduced directly at the web positions
- Enhanced current distribution over the cathode assembly in Generation 7:
  - Improved current flow through backwall of the halfshell
  - Increased conductive cross section of REES by 50%

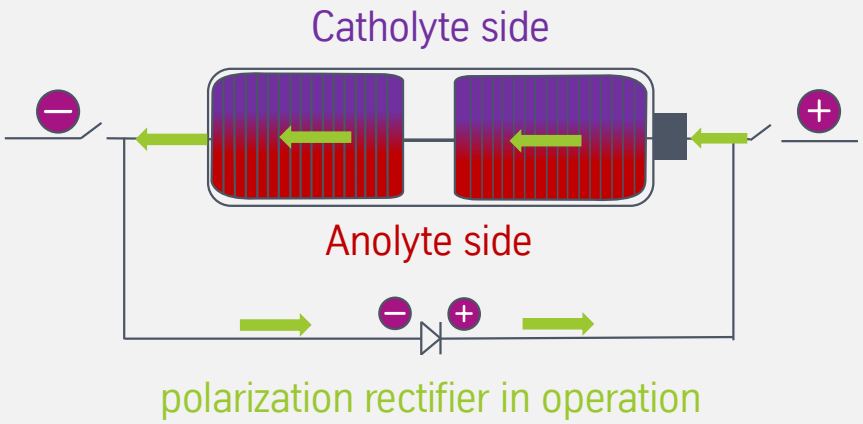
Superior Performance by improved current distribution in Generation 7

Cathodic Emergency Protection System

Be always one Step ahead by ensuring Polarization

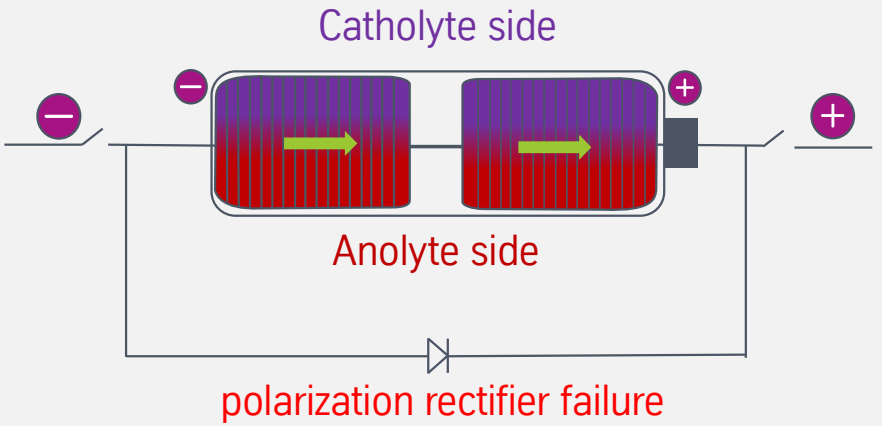
Key for long-lasting stable electrolyzer performance

Ensured polarization protects electrolyzer



- Less down-time
- Proper & safe electrolyzer storage
- Long-lasting stable cathode usability

Missing polarization sets electrolyzer at risk



- Reverse current can substantially harm coating
- Enables corrosion reactions
- Leads to performance decay and lower lifetime

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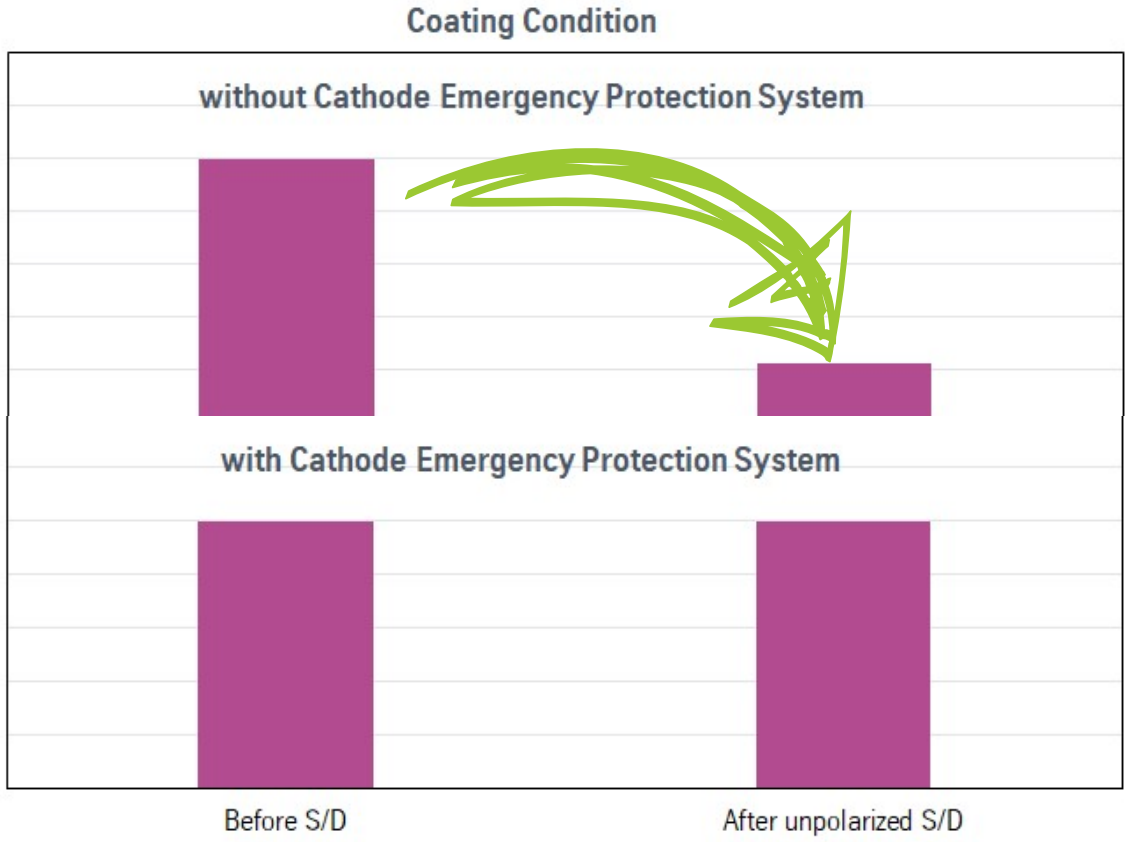
Cathodic Emergency Protection System

- Safety net for coating against unpolarized shutdown
- Additional small electrodes in the cathode assembly
- Easy installation during manufacturing
- Upgrade compatible to Generation 6
- Protection of coating in case of an unpolarized shutdown:
  Absorption of the reverse current by protection electrodes
- Protection can be regenerated
- No removal of Nickel Staining

Enhanced cathode resilience in case of unpolarized shutdown

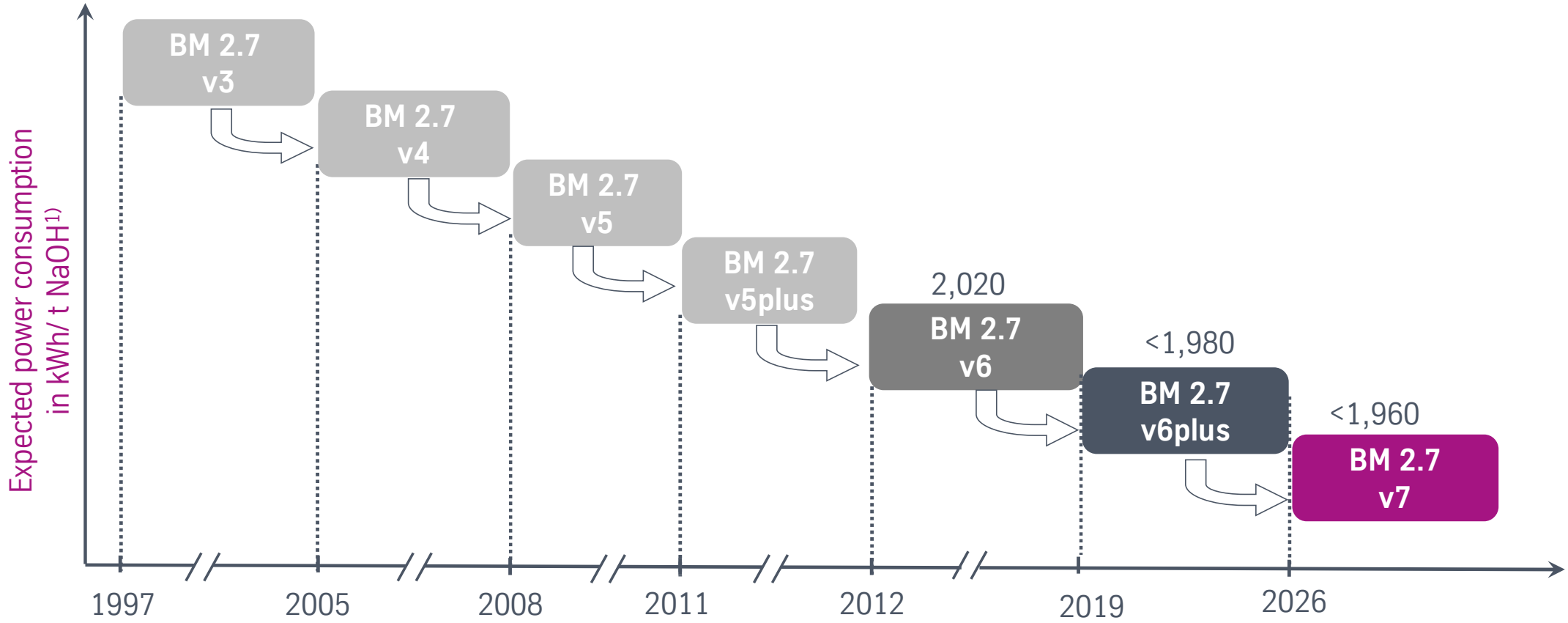
Cathodic Emergency Protection System

Protected shutdown by additional safeguard after power outage



Protection of Cathode Coating in case of unpolarized S/D

History of Power Consumptions for BM Series



Power consumption for Generation 7 reaches less than 1960 kWh / mt NaOH at 6kA/m^2

- [1] 6 kA/m2, 90°C, 32 % NaOH

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Key Highlights

Global Market:

✓ The CA Market is evolving – not stalling, Innovation continues…..

Strong Performance:

✓ Power consumption <1960 kWh/t NaOH[1)]

[1)] 6kA/m^2, 90°C, 32% NaOH

Superior Resilience:

✓ Simplified cell design

✓ Cathode protection

Smart Maintenance:

✓ Decreased assembly time

✓ Easy cathode electrode replacement

✓ Cathodic Emergency Protection System Upgrade compatible to Generation 6

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