
CLOROSUR
Technology Services and Latest Improvement in product portfolio
Buenos Aires, 17th November 2016
Albert Zimmermann
thyssenkrupp Uhde Chlorine Engineers (Italia) S.r.l.
engineering.tomorrow.together.
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thyssenkrupp Uhde Chlorine Engineers – a reliable partner

Building on a strong past

- UHDENORA founded as JV 2001 between DeNora (founded 1923) and Uhde (founded 1921)
- Chlorine Engineers founded 1973, acquired in 2011 by Industrie de Nora S.p.A., the parent holding company of De Nora
- ThyssenKrupp Electrolysis GmbH (former Uhde Product Unit Electrolysis, founded in 1960)

UHDENORA + + ThyssenKrupp

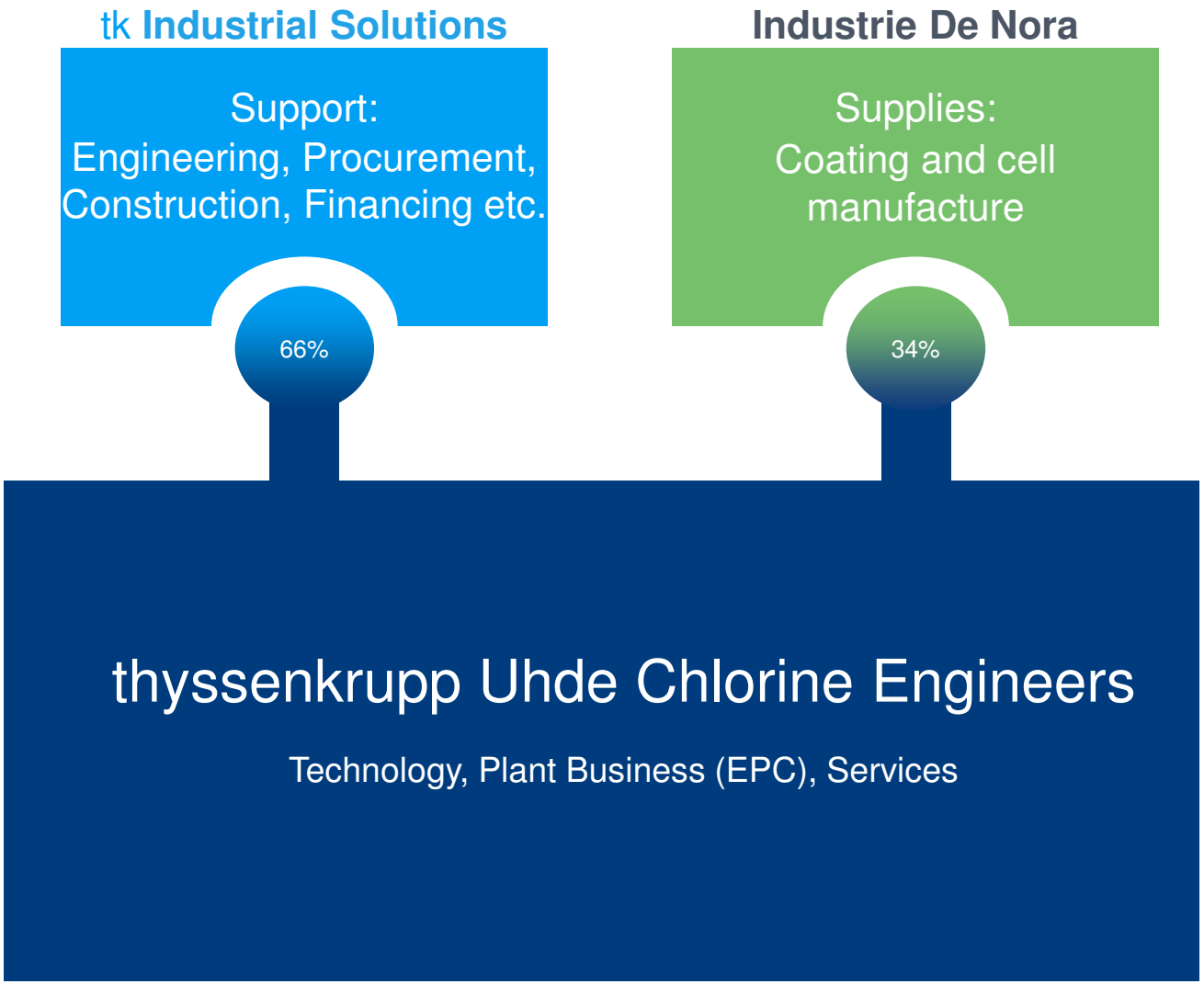
ThyssenKrupp Electrolysis

Since 1.4.2015 =

thyssenkrupp Uhde Chlorine Engineers

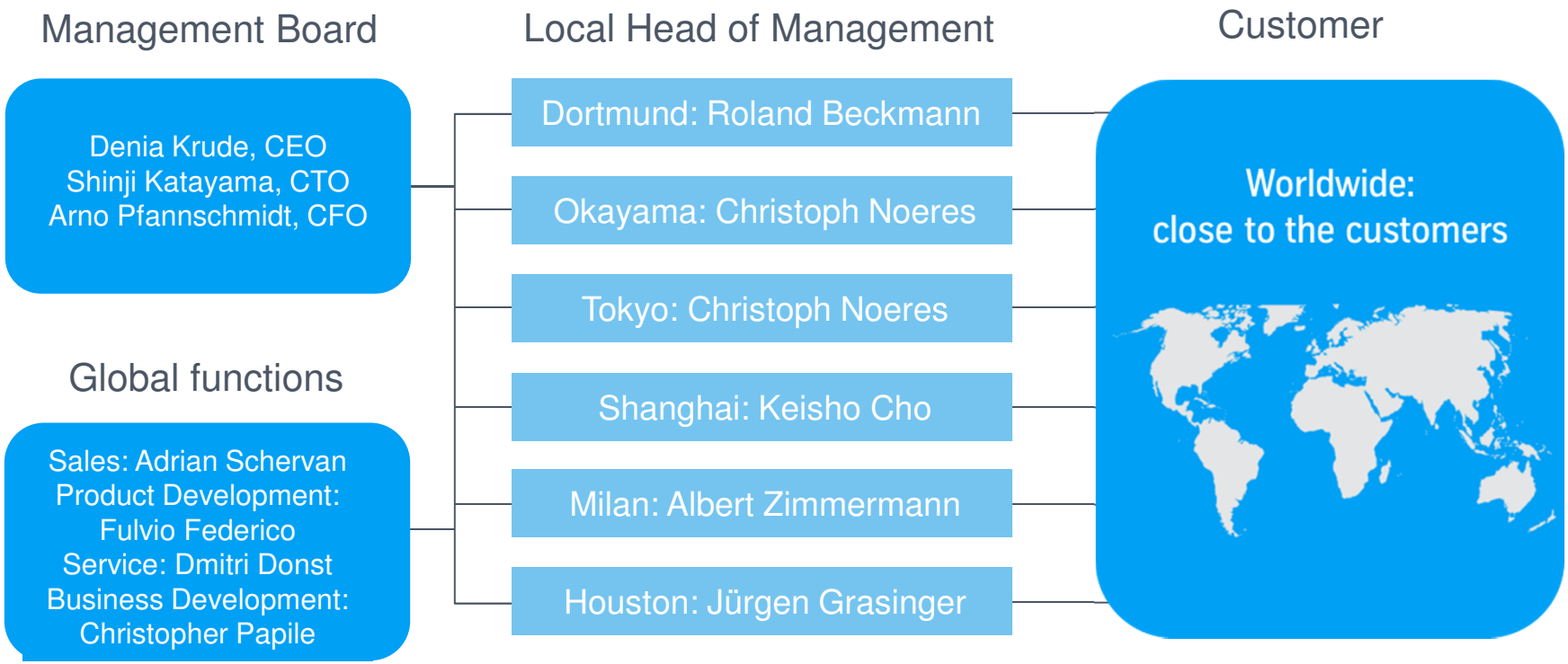
To ensure excellent support on a global scale

thyssenkrupp Industrial Solutions and Industrie De Nora joined forces

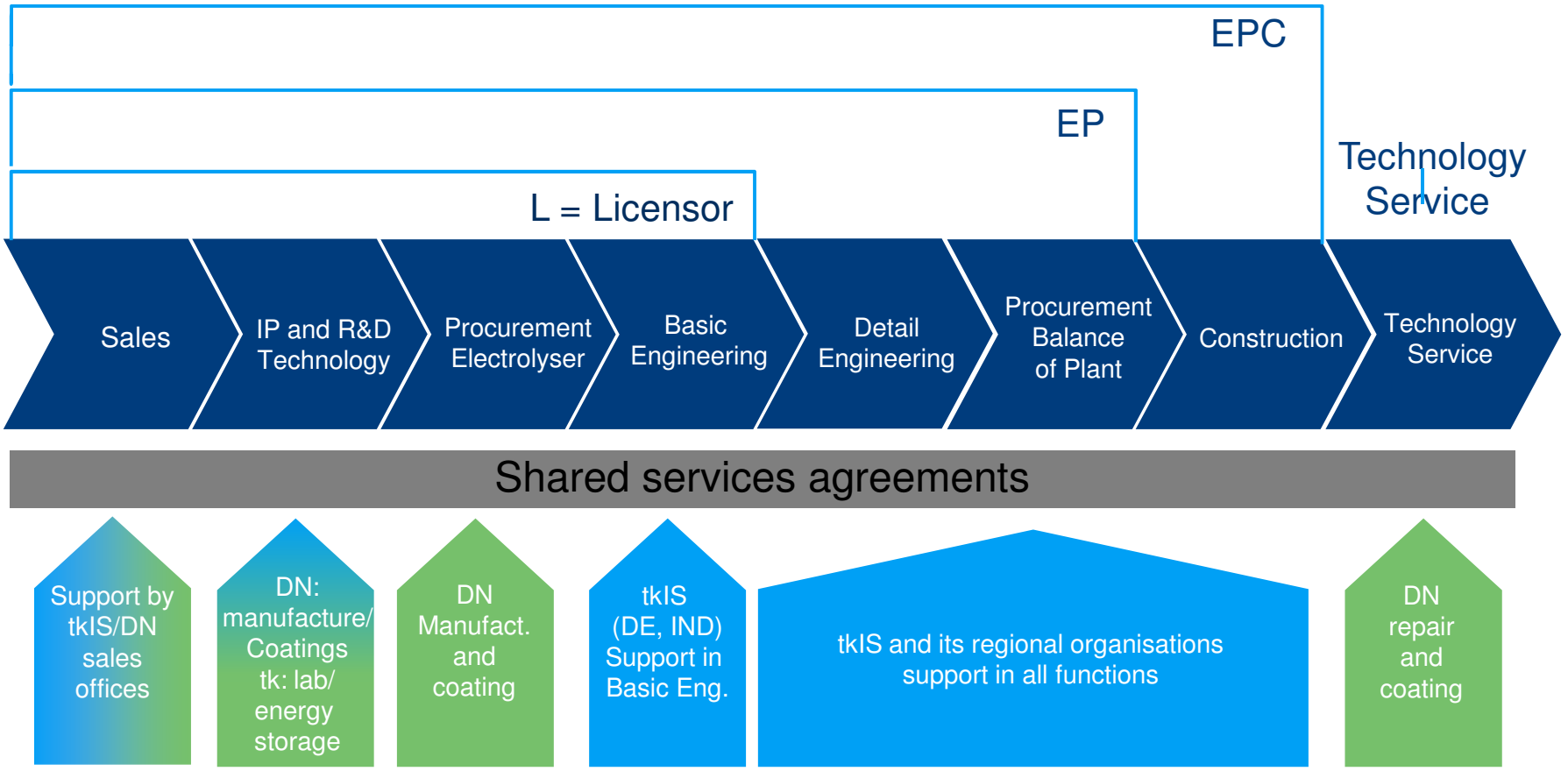


Being closer to our customers

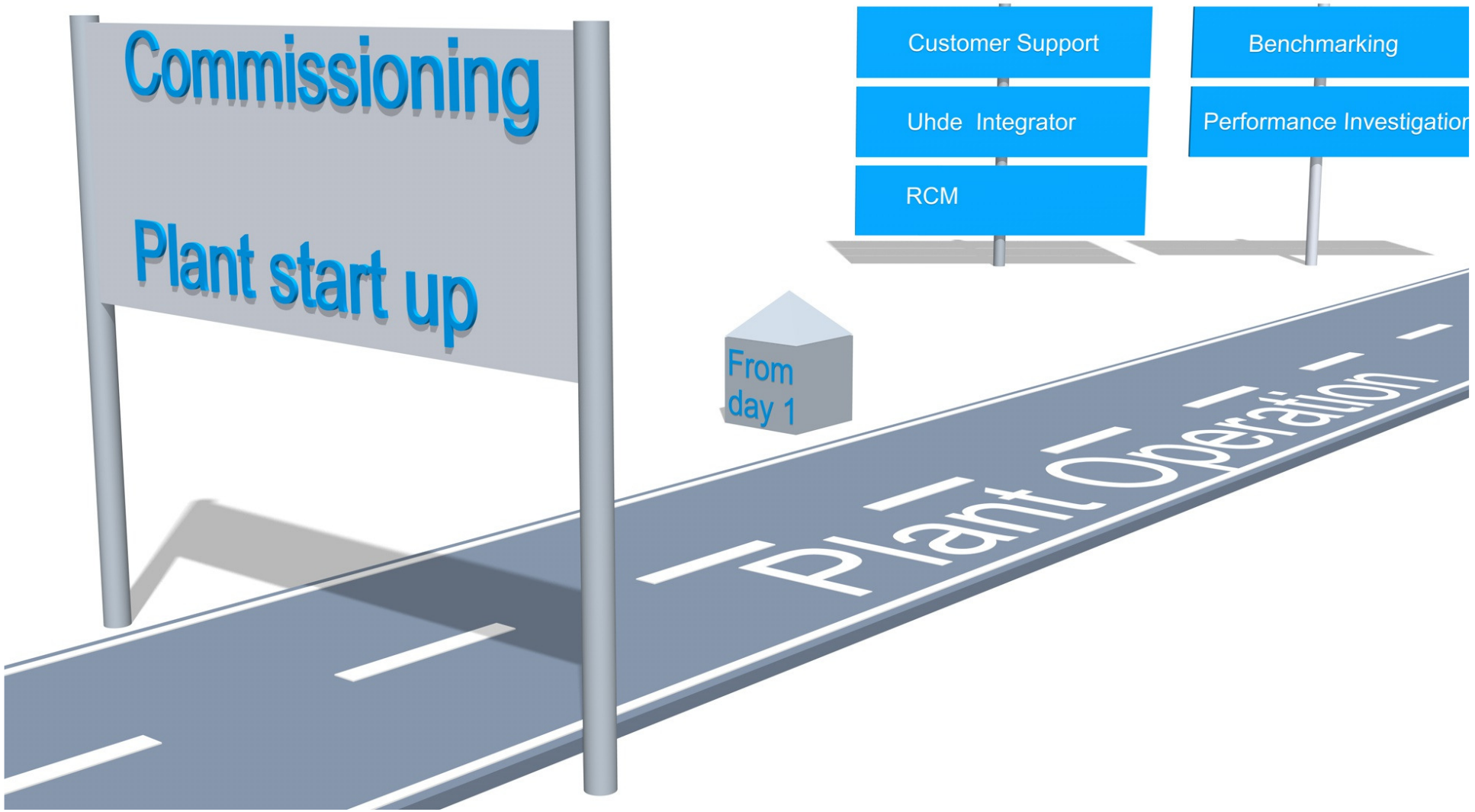
Together with more than 300 experts and strong shareholders we provide technological and execution power



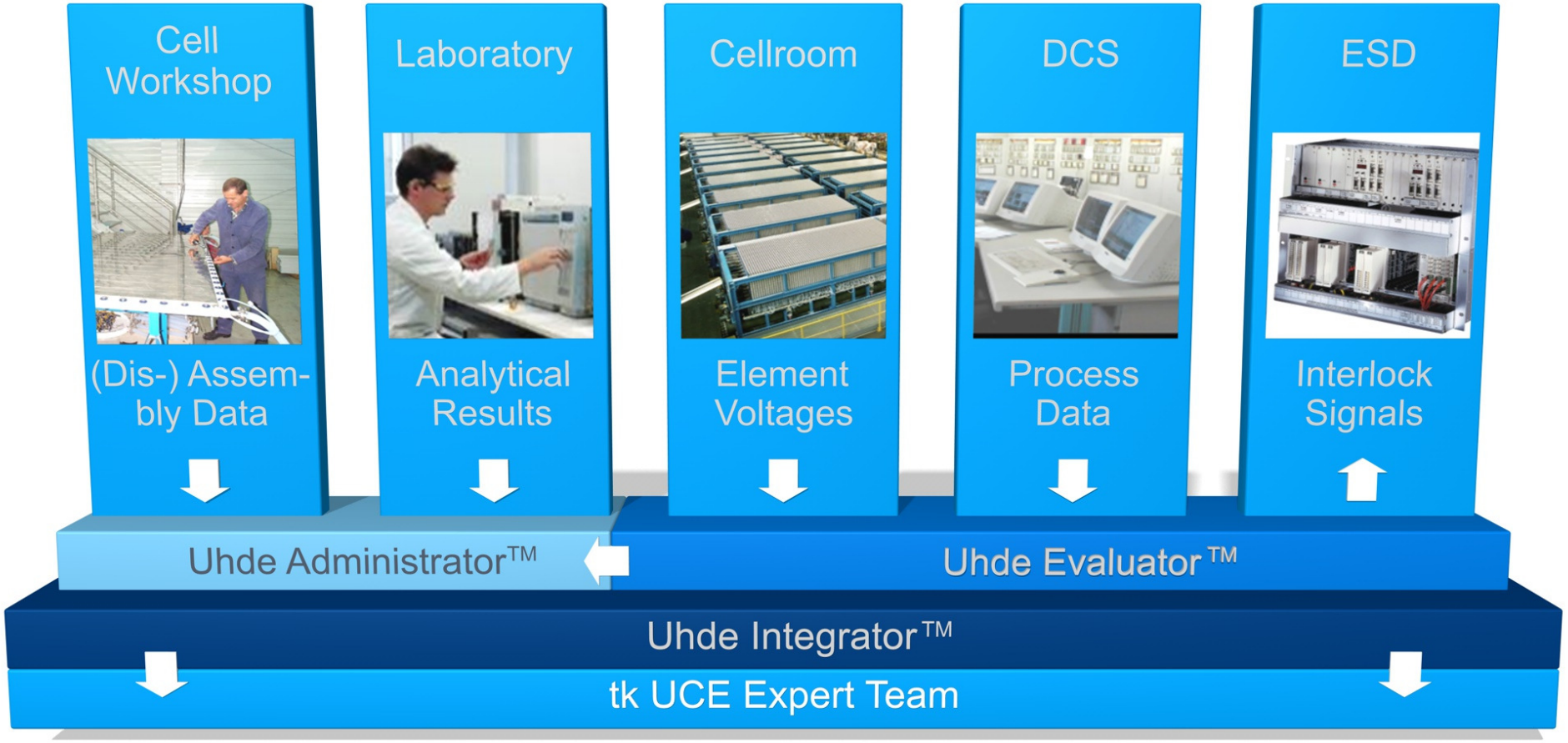
We offer complete scope from Sales to EP/EPC and Technology Service



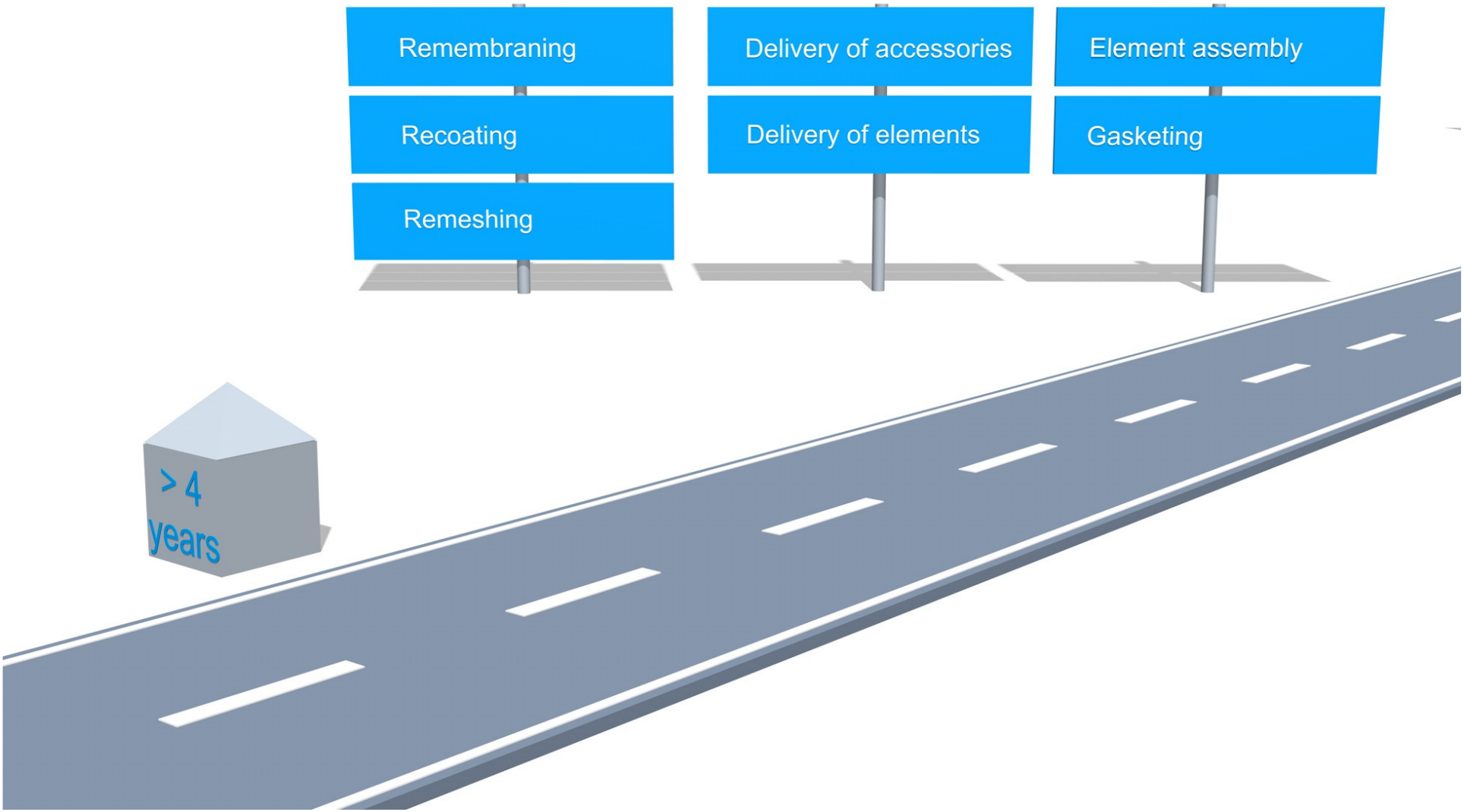
Some Technology service products can be used immediately after commissioning of the plant



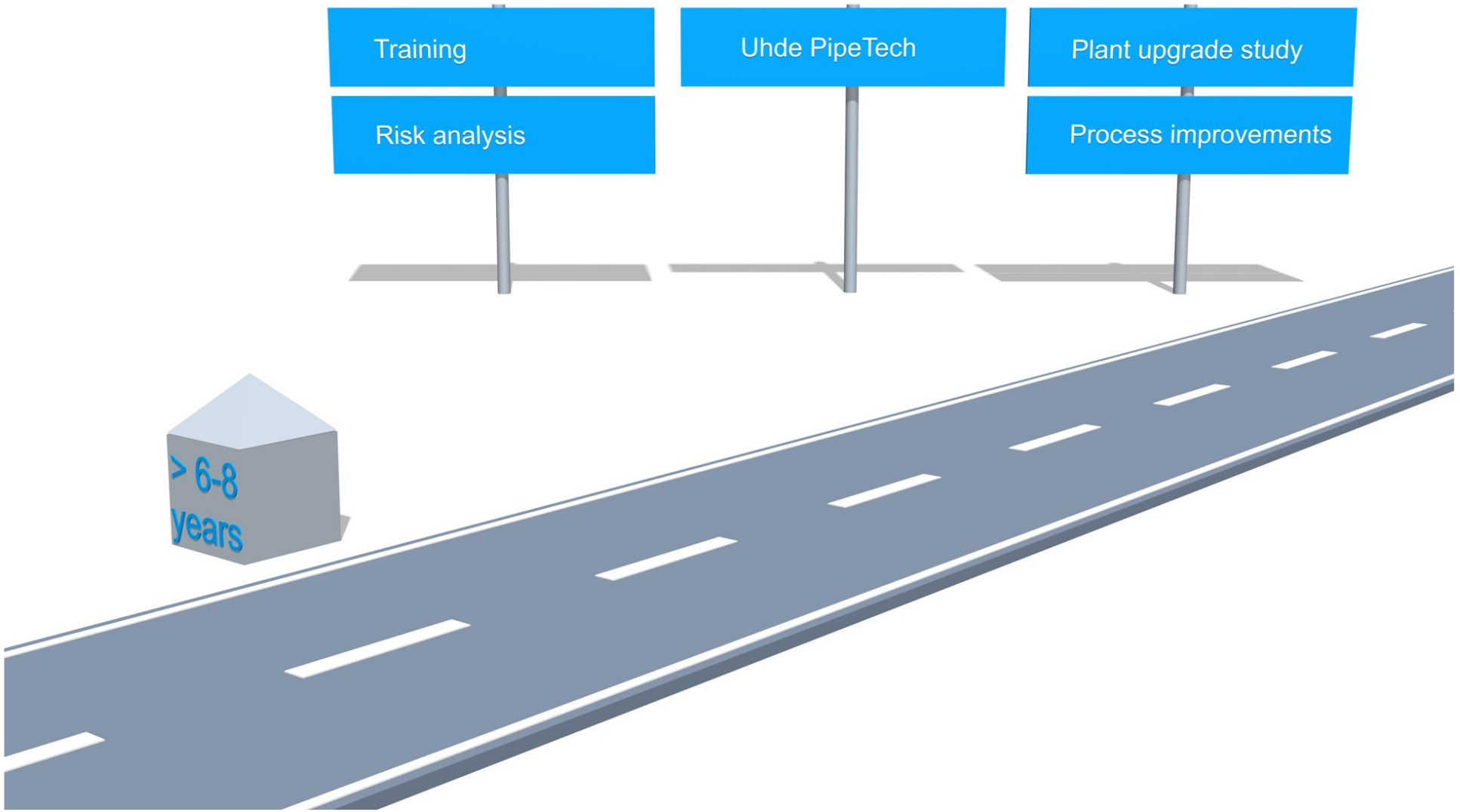
Uhde Integrator™ is a system for comprehensive data recording and analysis



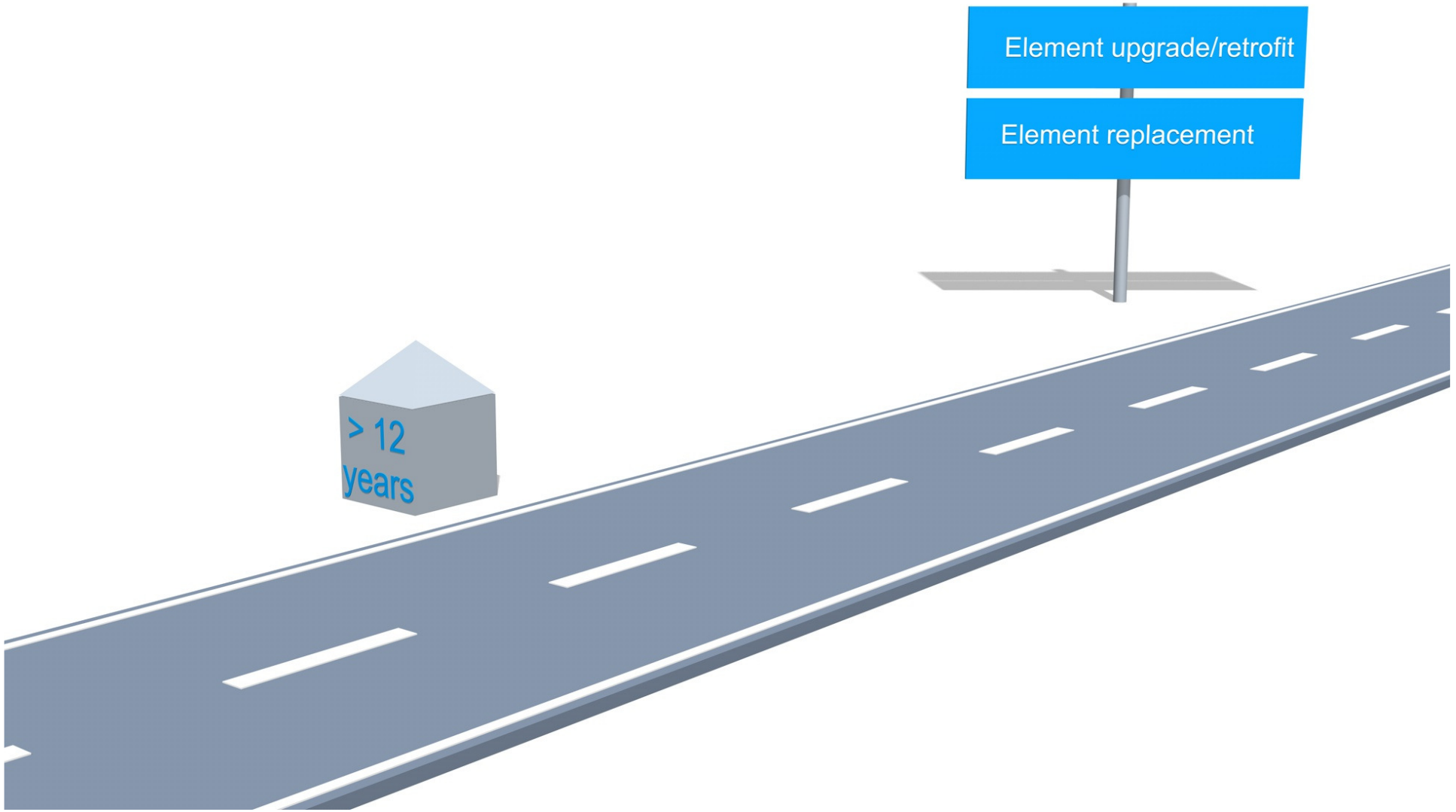
Remembraning/recoating/remeshing campaigns and associated services are points of intense cooperation client/tk UCE



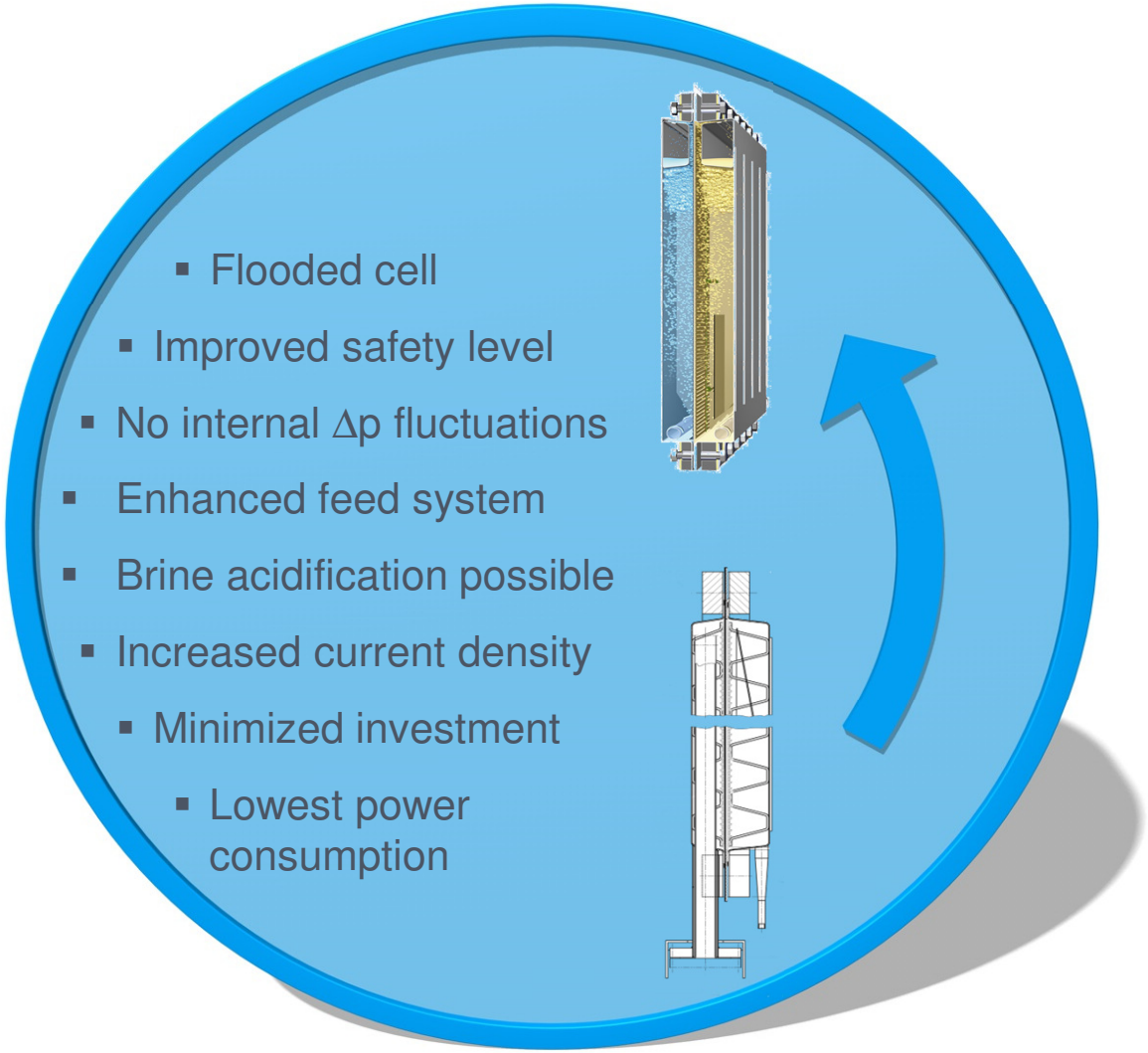
Some technology service products are especially interesting for plants being already in operation for a longer time



Element upgrade/retrofit and element replacement reduce power consumption significantly

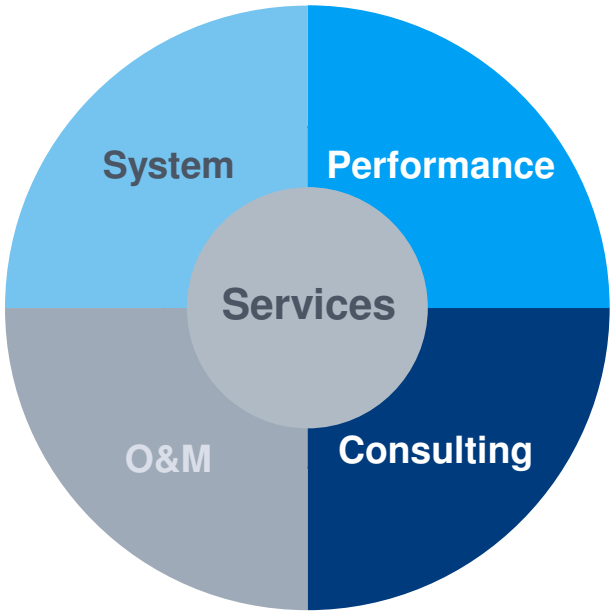


Replacement of old elements by latest generations reduces power consumption



thyssenkrupp Uhde Chlorine Engineers service concept allows to use modules or full service packages

System Service
Customer Support
Benchmarking
Performance Investigation
Delivery of Elements
Delivery of Accessories
Training
Element Assembly
RCM, Uhde Integrator™
Remembr./Recoat./Remesh.
Uhde PipeTech™
Gasketing



Performance Service
Element Replacement
Element Upgrade/Retrofit
Process Improvements

Consulting Service
Plant Upgrade Study
Risk Analysis
Project Management

Technology Service - Full Service reference

Conventional Chlor-Alkali Electrolysis

Customer:	Confidential
Location:	Western Europe
Capacity:	Confidential
Process:	tk UCE
Speciality:	EPCm

Key Highlights of Full Service 2014/2015:

Scope of Supply:	New v5 anode halfshells and cathode recoating for 6 electrolyzers
	Recoating of anode and cathode electrodes for 12 electrolyzers
	Element accessories
Scope of Services:	Removal of elements from electrolyzers
	Disassembly and reassembly of elements
	Installation of recoated/upgraded elements in electrolyzers

Latest Improvement in product portfolio

Electrolyzers

- Uhde BM 2.7 Single Element electrolyzers
- BiTAC filter press electrolyzers

NaCl – Oxyden Depolarised Cathode (ODC) Technology

- Uhde Single Element BM 2.7 - ODC Technology

HCl - ODC Electrolysis

- HCl recycle through HCl electrolysis from MDI/TDI and other sources

Skid Mounted Chlorine Plants

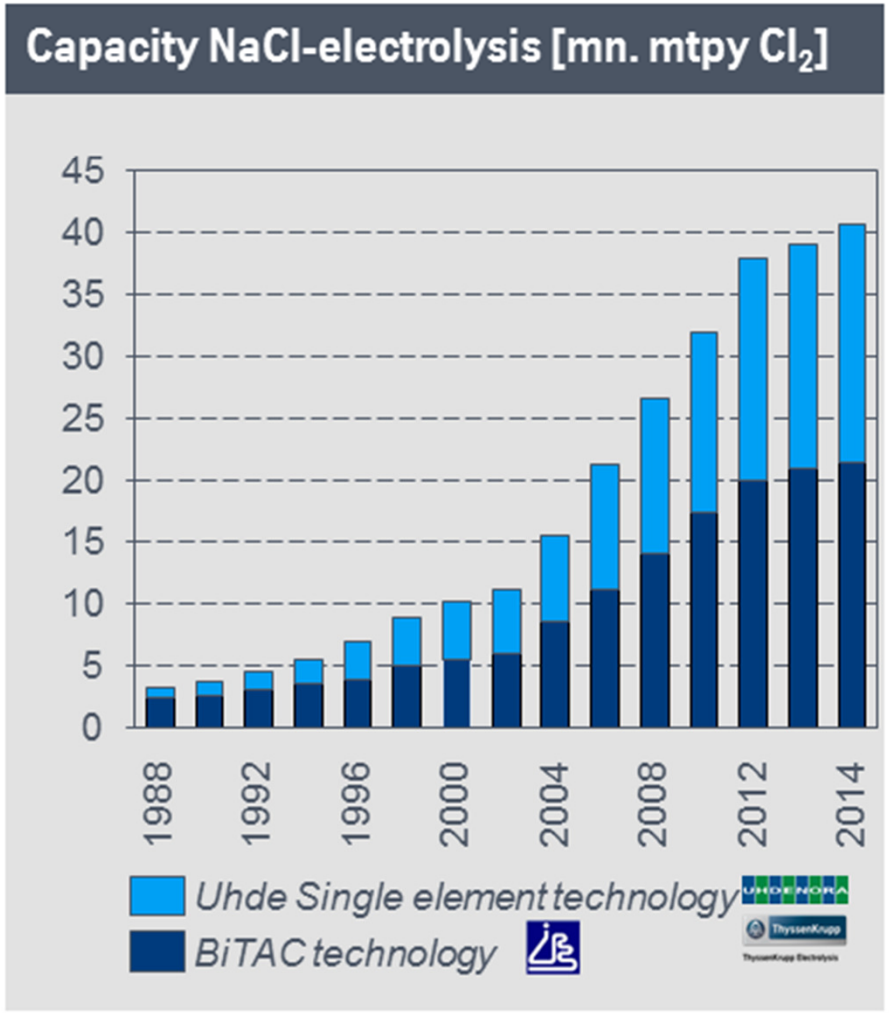
- Cost competitive plants for reduced chlorine production

Water electrolysis and Electrochemical energy storage systems

- Electrochemical Renewable Products

Our technologies and competencies have been attractive

Accumulated contract awards



BiTAC

Uhde BM 2.7 Single Element

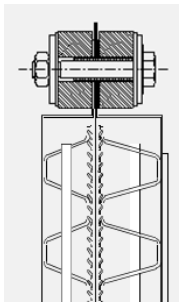
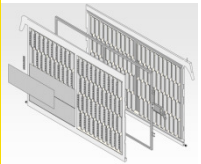
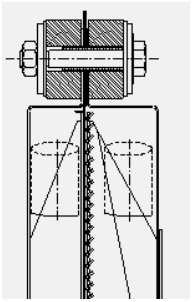
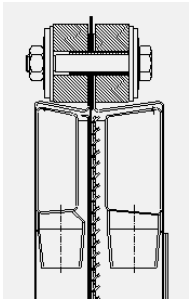
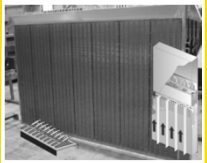
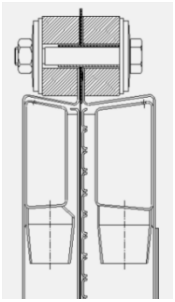
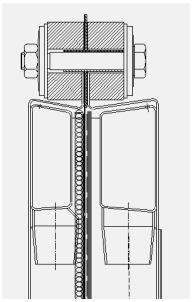
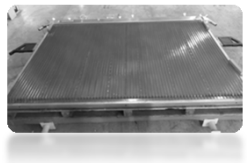
About 50% of world installed capacity with over 400 projects in 48 different countries

BiTAC (Chlorine Engineers) and BM (Uhde) – two success stories

BM

BiTAC

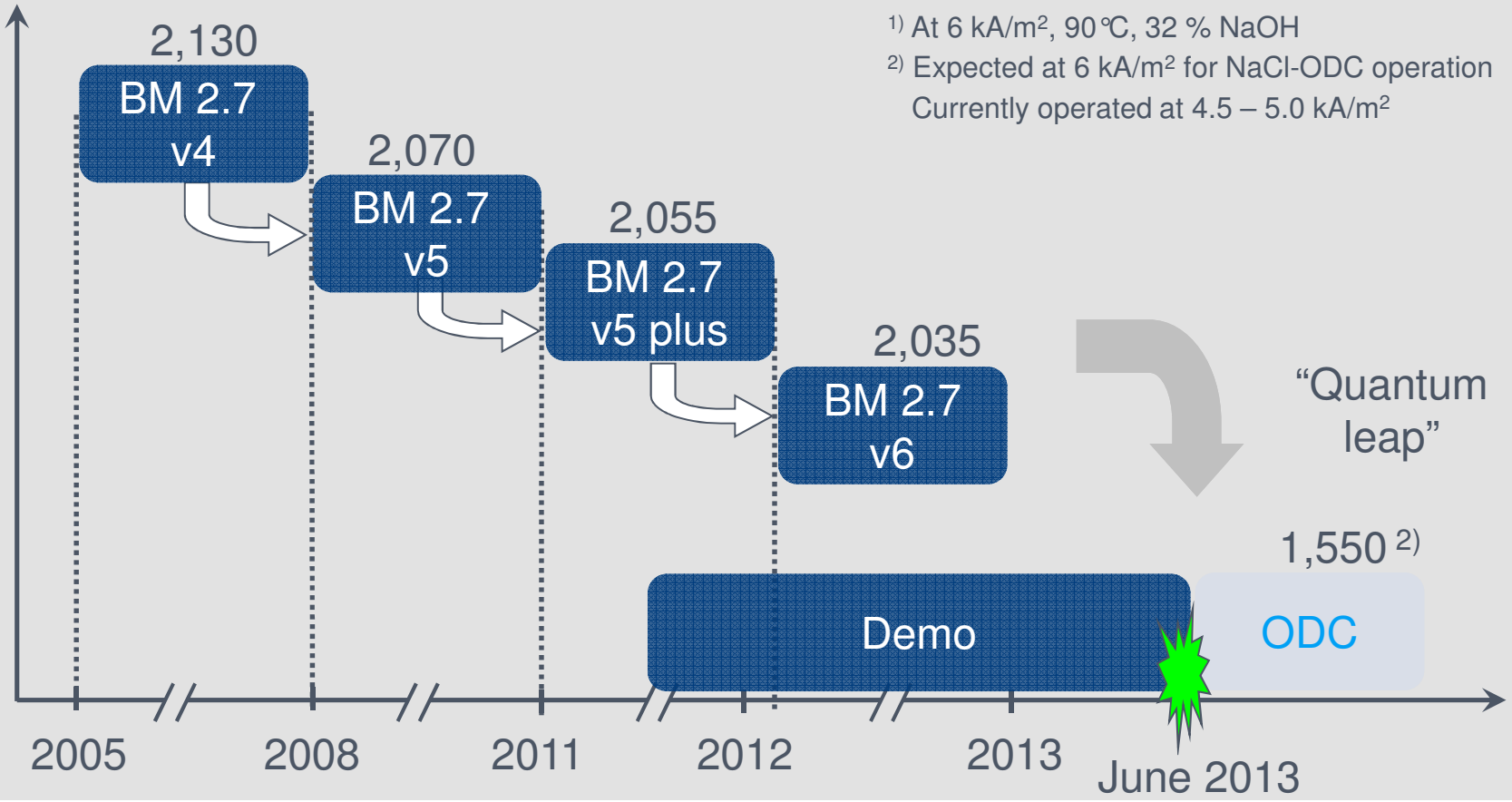
1989 BM2.7v2	1994 BiTAC	1997 BM2.7v3	2005 BM2.7v4	2005 n-BiTAC	2008 BM2.7v5	2012 BM2.7v6	2013 nx-BiTAC
Louver electrodes	First zero-gap cell @6kA/m²	Pure brine acidification, first laser welded cell	Collecting channel, inclined cell top	Fine cathode mesh	Prebent C-profile anode	Full zero gap, elastic element	Fine anode mesh
Power Consumption *) >2200kWh/t	Power Consumption 2200 kWh/t	Power Consumption 2200 kWh/t	Power Consumption 2130 kWh/t	Power Consumption 2060 kWh/t	Power Consumption 2070 kWh/t	Power Consumption 2025 kWh/t	Power Consumption 2025 kWh/t

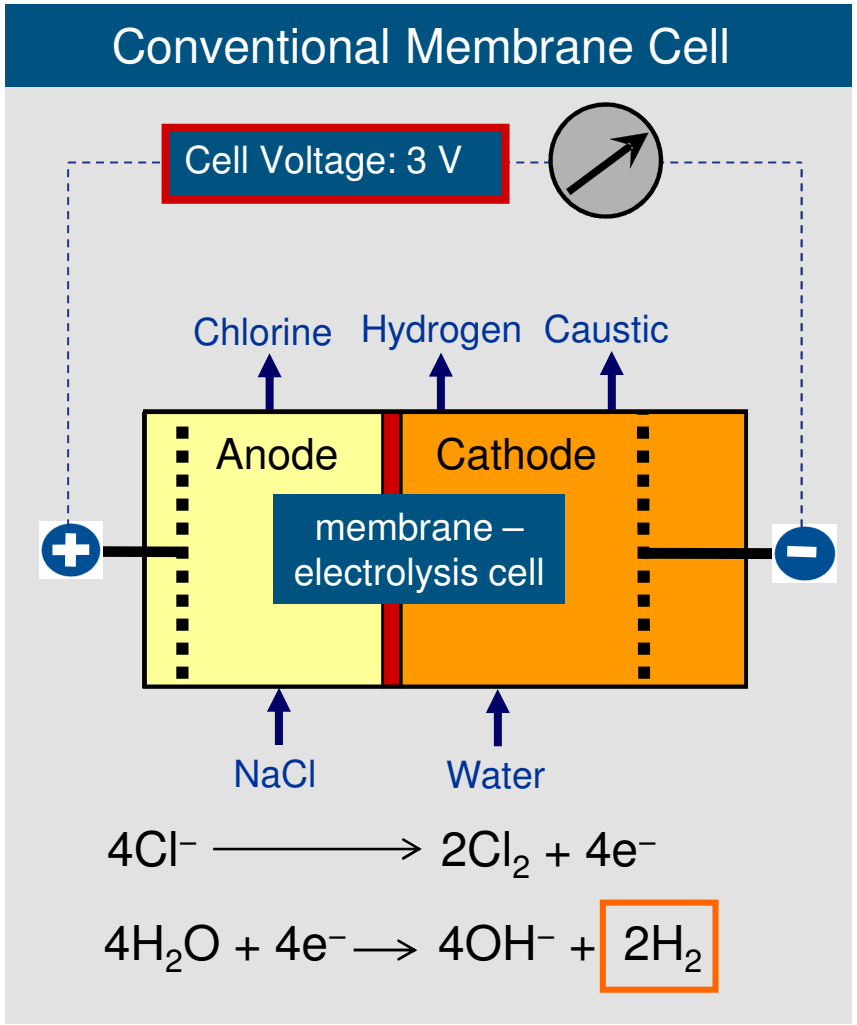
*) At 6 kA/m², 90°C, 32 % NaOH

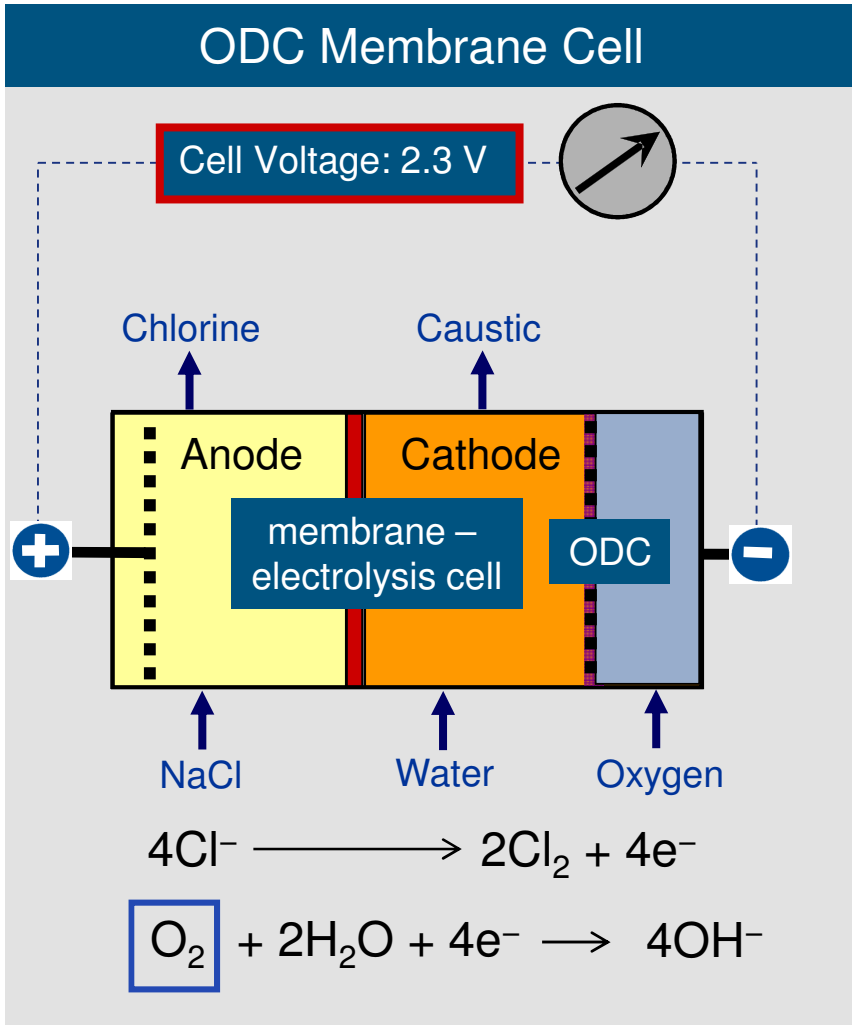
Our newest product was launched in June 2013…
…. the tk Uhde Chlorine Engineers NaCl-ODC technology

Power Consumption in kWh/ t NaOH[1)]



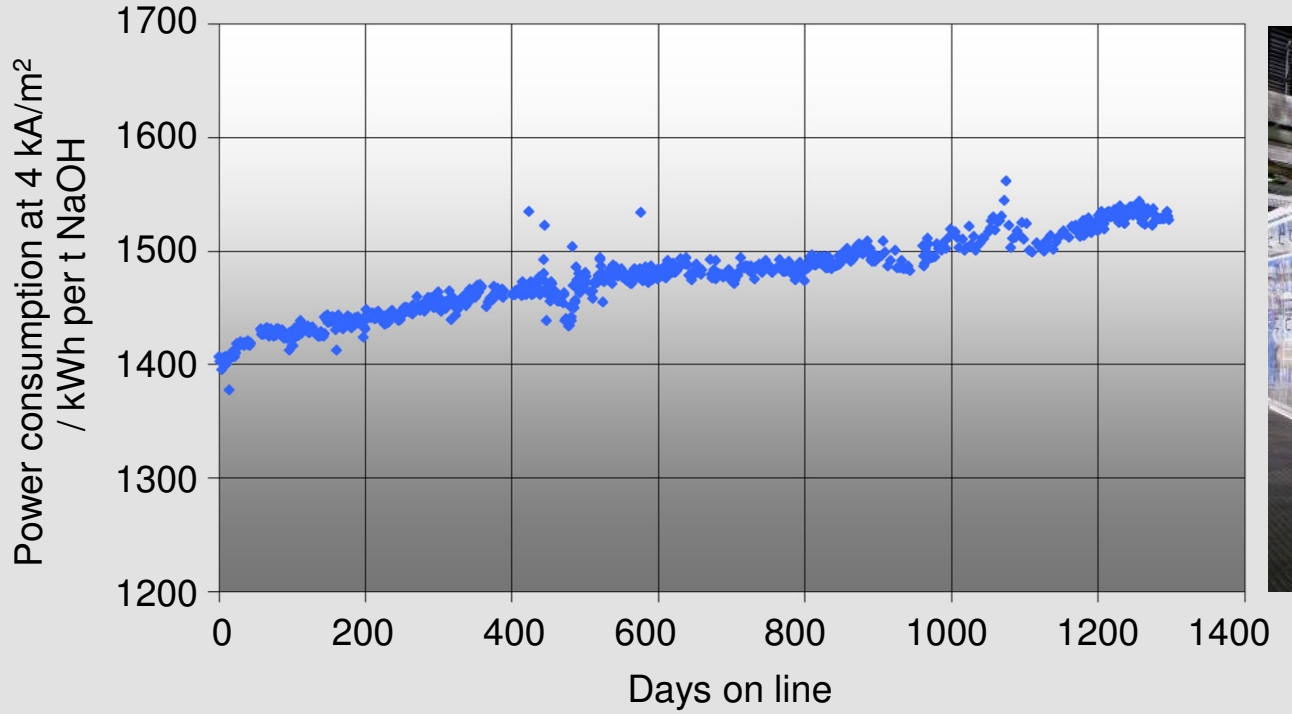
NaCl – ODC: 25% reduction of electrical energy consumption





The NaCl-ODC Technology is Demonstrated for 4 years by now

- **Over 25% Energy Saving** Vs Conventional Electrolysis
- Operation up to **5 kA/m²**
- Stable operation proofs a **robust technology**



Covestro (Germany)
22.500 TPY NaOH 100%

Selected References

Oxygen Depolarized Cathode (NaCl-ODC) Chlor-Alkali Electrolysis

Customer: Befar Group Co, Ltd

Location: P.R. China

Capacity: 40,000 t/year of NaOH
35,500 t/year of Cl_2

Process: tkUCE / Bayer

Commissioning: 2015

Specialty: First commercial NaCl – ODC plant worldwide

Key Highlights:

Technology: NaCl-ODC (Oxygen Depolarized Cathode)

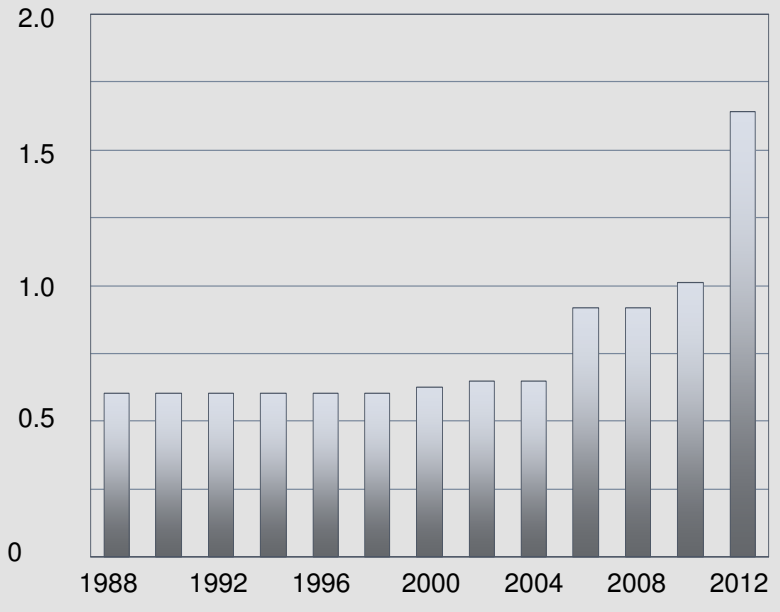
Project: Plant Expansion

Scope of Supply: BM 2.7 –ODC Electrolyzers
Electrolysis Room Accessories
Key Catholyte Circulation Equipment
Uhde EVALUATOR Monitoring System

Growing HCl-ODC market due to growing isocyanate business

Customer:	Yantai Juli
Location:	Laiyang, China
Capacity:	100,000 t/year of Cl_2
Process:	ODC Technology
License:	tkUCE/Bayer
Commissioning:	1st quarter 2012

Accumulated contract awards
HCl Capacity [Mio. tpy Cl_2 100 %]



- Sustainability, careful use of resources and ecological responsibility.
- Generation of Cl_2 with very high purity (99.8 % vol., O_2 (20 ppm/wt.).
- ~100 % conversion rate (HCl/Cl_2) at flexible plant operating window

Skid Mounted Chlorine Plants

Cost competitive plants for reduced chlorine production

Pre assembled – skid mounted chlorine plant

Capacity up to **15.000** t/year of Cl_2

Standardized engineering and configuration

40” container transportation

Fast plant implementation

Pre assembled – skid mounted chlorine plant

Capacity up to **5.000** t/year of Cl_2

Standardized engineering and configuration

Designed for water purification inorganic chemicals production

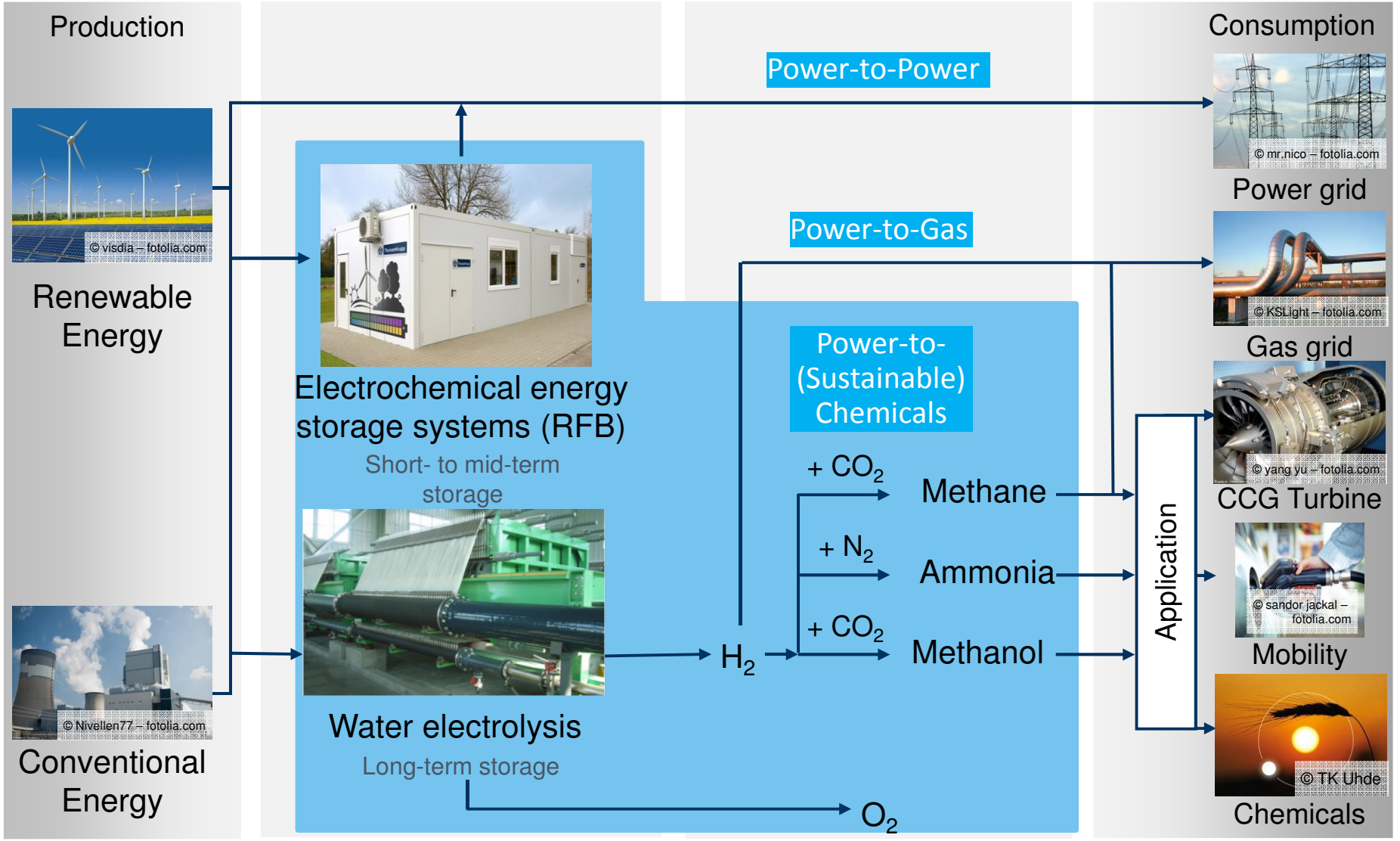
Fast plant implementation

Selected References (EP – Skid mounted plants business)

Skid Mounted Chlorine Plants

Customer:	Produquimica Industria & Comercio
Location:	Brazil
Capacity:	17,000 t/year of NaOH 15,000 t/year of Cl_2
Process:	tk UCE
Commissioning:	2014
Specialty:	EP
Key Highlights:	
Project:	Skid Mounted Chlorine Plant (total 7 skid mounted process units)
Scope of Supply:	Electrolysis, Catholyte Circulation, Brine Dechlorination, Cl_2 and H_2 Cooling and Filtration Brine Filtration Secondary Brine Purification Waste Gas Dechlorination Sodium Hypochlorite Production Chlorine Drying

Portfolio of Electrochemical Renewable Products



thyssenkrupp portfolio

Thank you for your attention!

For any information:

www.thyssenkrupp-uhde-chlorine-engineers.com
alessandro.delfrate@thyssenkrupp.com

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