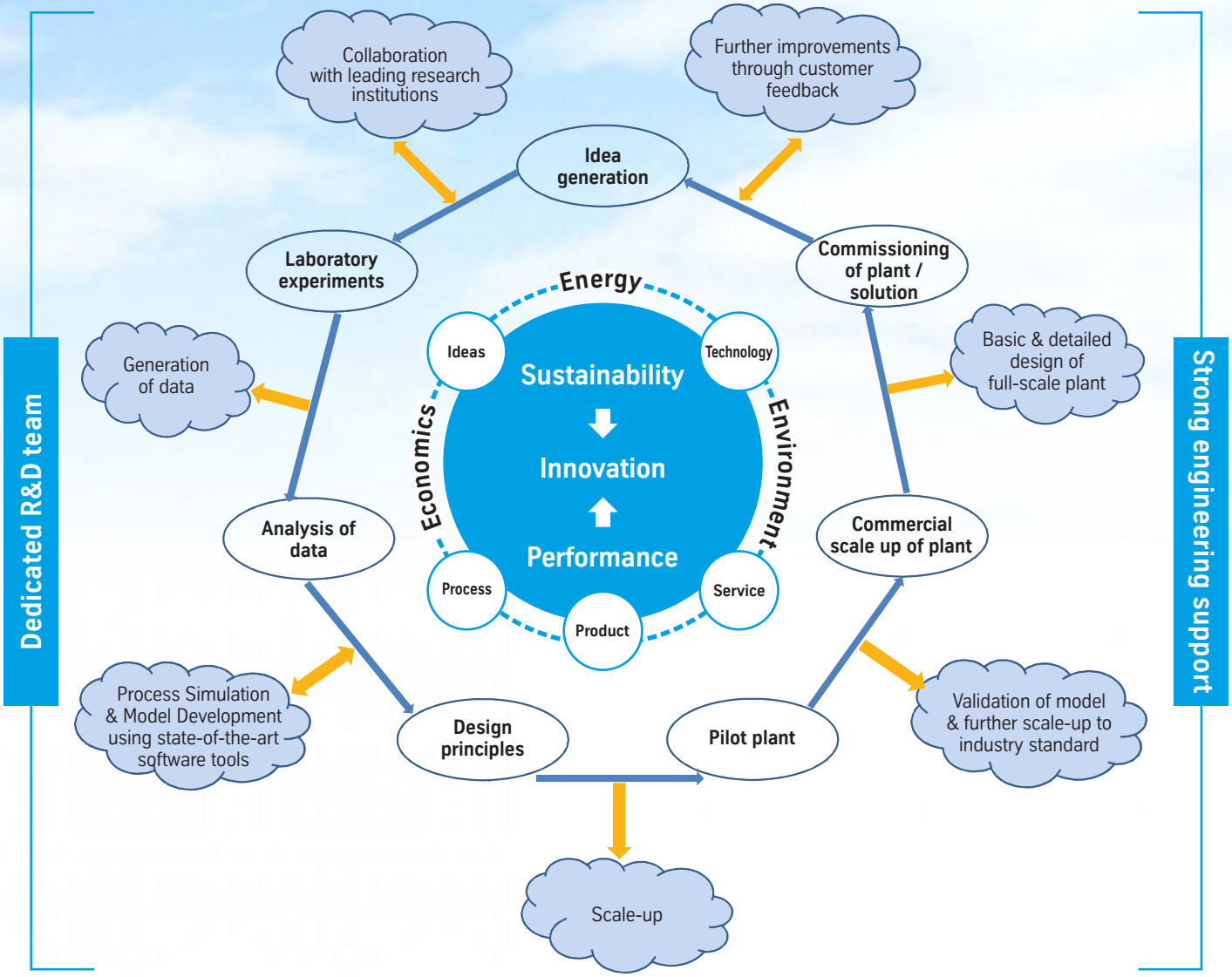
Industrial Solutions

Research & Development

Achieving Sustainability & Enhancing Plant Performance through Innovation

thyssenkrupp



About Us

Formed in 1977, thyssenkrupp Industrial Solutions (India) is amongst the leading engineering companies for the construction of chemical plants in India and abroad.

Based in Mumbai and Pune, our commitment to excellence is reflected in our quality certifications and 700-plus successfully-completed projects based on our proprietary and third party technologies.

Our global footprint, state-of-the-art plants and impressive customer list span the Who's Who of the global Chemical Industries.

Our commitment to sustainable solutions is founded in our constant endeavour to bring value to our customers' projects, through Research & Development.

We are a company in the Business Area Industrial Solutions of the thyssenkrupp AG Group, Germany.

700

Projects worldwide optimized for

- Process Improvements
- Value Generation
- Energy Efficiencies
- Environment Norms
- Resource Conservation
- Customer Plans & Budgets

Projects executed in

50

countries worldwide

Over

5

decades of service to the chemical industries worldwide

R&D - How it works for our Customers

The need for sustainable, more efficient and safer processes is a given. As project partner to the world's chemical industries, it is imperative that we continuously innovate to meet the challenges of current requirements and future needs.

We have successfully put our commitment to test with our own proprietary technologies.

Our R&D activities in India are organized around a group of full-time researchers based in Mumbai and backed by our 100-plus Process Engineering team. Our experience spans over 20 years and involves many significant developments. We are supported by our group's full-fledged R&D centre in Germany.

Alongside our own R&D initiatives, we also engage with customers and their teams in their premises to develop technology for their needs. We start with a laboratory-scale prototype and pilot testing, before evolving to a commercial scale.

And how we go about it…

- Understanding our Customer's requirements
- Application of our technical knowhow
- Institution of the lab procedure
- Verification of laboratory data
- Optimisation of process conditions
- Process intensification
- Reduction of by-products
- Scale-up to pilot plant status
- Design of new process units
- Sustainability review
- Trouble-shooting
- Commercial scale application
- Management of Intellectual Property Rights (IPR)

Research & Development

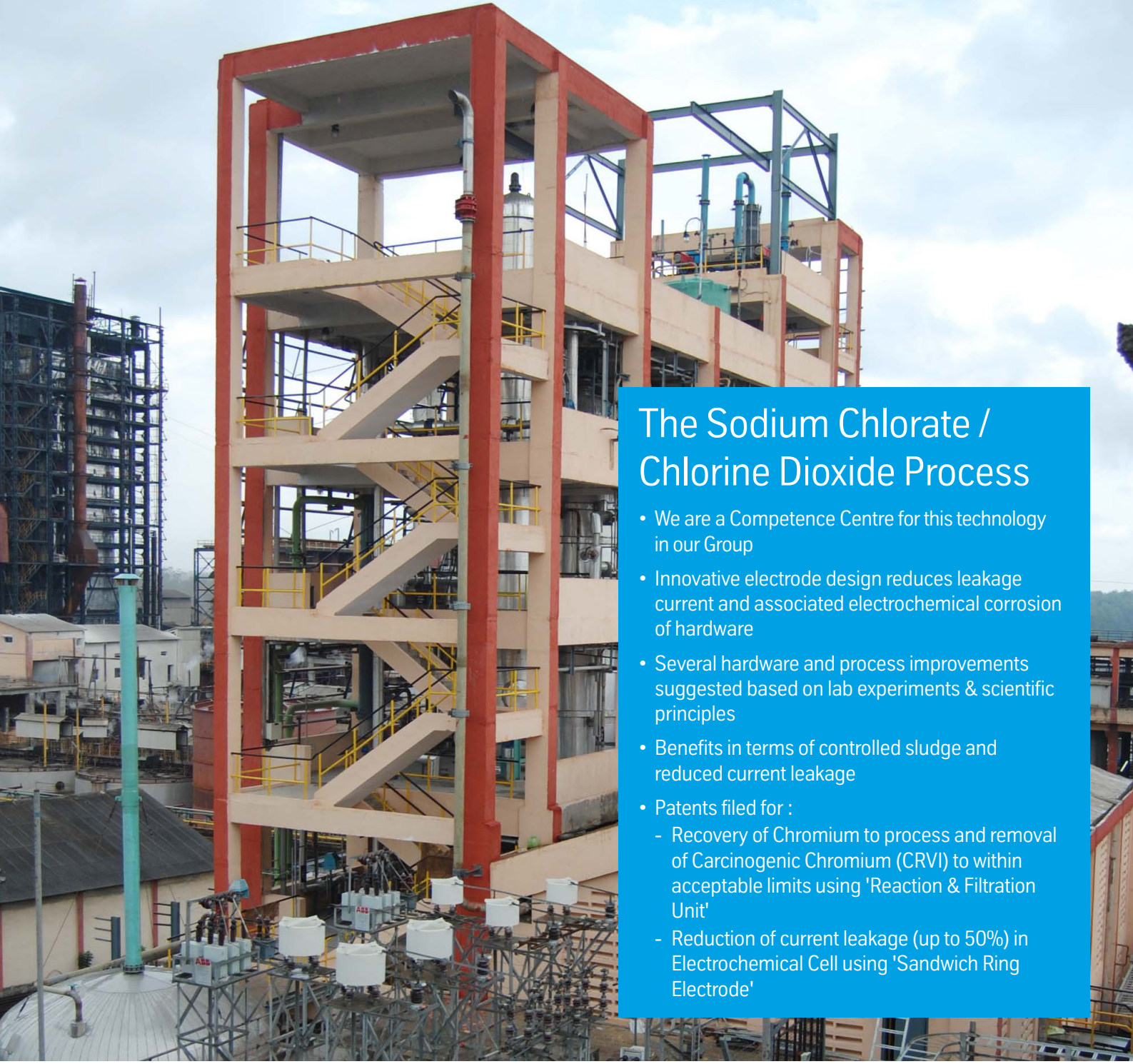
- Efficiencies, be they process, safety or environment are at the heart of the chemical processes that we deploy in our chemical plants.
- Lower capex and lower operating costs, environmental benefits, improved yields and higher efficiencies are amongst the many benefits that accrue from our investment in R&D.
- Sustainable investment in R&D enables us to continue offering cutting-edge technologies that translate into the sustainable solutions our customers deserve.

Activities of our R&D Group

- Supporting R&D activities of our group company in Germany
- Providing technical services to Process & Project teams
- Technology development activities for local market

R&D at Work - Adapting German technologies to Indian conditions

- First outside-Germany test facility installed for evaluating NaCl-ODC, a new technology for the production of Caustic Soda
- Assimilation of learnings of the effect of impurities in solar salt and fluctuating power conditions on NaCl-ODC
- Modifying internals of older Generation of Electrochemical Cells to achieve power consumption commensurate with results of those from latest Generation Membrane Cells for Caustic Soda production



The Sodium Chlorate / Chlorine Dioxide Process

- We are a Competence Centre for this technology in our Group
- Innovative electrode design reduces leakage current and associated electrochemical corrosion of hardware
- Several hardware and process improvements suggested based on lab experiments & scientific principles
- Benefits in terms of controlled sludge and reduced current leakage
- Patents filed for :
  - Recovery of Chromium to process and removal of Carcinogenic Chromium (CRVI) to within acceptable limits using 'Reaction & Filtration Unit'
  - Reduction of current leakage (up to 50%) in Electrochemical Cell using 'Sandwich Ring Electrode'

Indian Institute of Chemical Engineers

ESTABLISHED 1947

JUBILANT AWARD

FOR

OUTSTANDING CONTRIBUTION IN THE AREA OF CHEMICAL PROCESS DESIGN

For The Year

2017

Presented to

J P Soni, N Ranga Rao,Gopinath Pandhari, Milind Tete, Sanjay Dodiya, Randheer Yadav and P V Chepe

Dated the 27th December, 2017

P De

President

Award-winning Innovation

Our Research & Development activities in the field have received recognition from the Indian Institute of Chemical Engineers (IIChe) which conferred on our team the Jubilant Award for 'Outstanding Contribution in the area of Chemical Process Design'.

Large-area Electrochemical Cells for Sodium Chlorate

- Active area of the Electrochemical Cells in Sodium Chlorate production increased from $10m^2$ to $20m^2$
- Longevity of Cell life increased by deploying better material
- Significant reduction in pressure drops & resultant savings in energy by modifying entry to Cells
- New Cells occupy less floor space and less spare parts

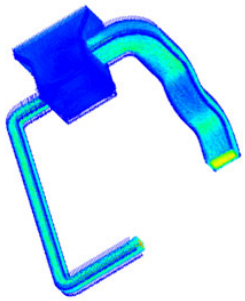
From $10m^2$ to $20m^2$

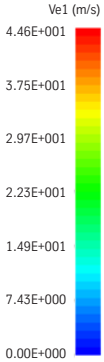
Laboratory Scale Simulator of Caustic-Chlorine Process

- 150 cm^2 membrane test Cell
- Operating parameters at site may be replicated
- Different membranes and electrodes may be tested
- Faster response to clients' queries

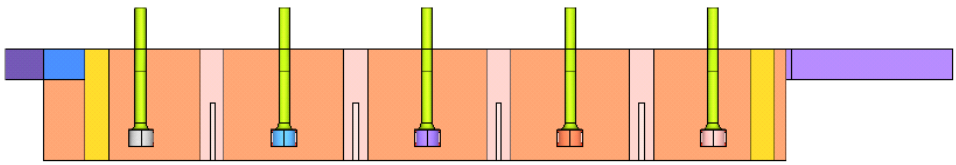
Computational Fluid Dynamics

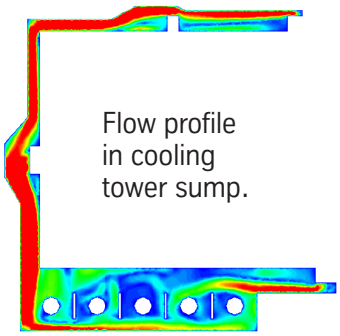
- Efficient analysis and control in hardware & operating conditions affecting process equipment performance.
- We cater to customers' requirements on flow, temperature and concentration or pressure profile in any process equipment.
- In-house expertise on Computational Fluid Dynamics (CFD) tools.





Flow and pressure distribution through different branches from a central header.





Flow profile in cooling tower sump.

All-round Services

- Evaluation of process / auxiliary equipment from vendors with a view to recommending those best-suited to customers' needs.
- Support to Project Task Force in terms of technical requirements.
- Providing customized services as per needs of local market and customers.
- Scale-up and optimization services for R&D work done by customers' in-house R&D teams.

The Road Ahead

Our R&D teams are geared to further enhance our customer experience. Reduced consumption of power during electrolysis is high on our agenda, as is value-added enhancements including by-product utilization and waste utilization / reduction in our existing processes and process equipment.

Our efforts, as always, are complemented by our group R&D experts, and our tie-ups with top R&D Institutes, Research Centres and laboratories in India and abroad.

Looking to engage customers for

- Improving energy efficiency
- Improvement in air quality - reduced SO_x and NO_x emissions
- Water quality improvement
- Renewable energy and storage
- Meeting environmental regulations
- Process development

Industrial Solutions

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