



CHEMETRY

measured change • lower energy • safer

REDEFINING HOW CHEMICALS ARE MADE





PROVEN TECHNOLOGY



CHEMETRY AT A GLANCE

Founded in 2008, Chemetry strives to be the industry leader in the development of safer, greener and lower cost chemical technologies. Our research team has dedicated hundreds of thousands of hours to develop, optimize and validate the **CHEMETRY eSHUTTLE™** platform in our state of the art laboratories and our integrated pilot plant.

- 35 employees with 20 PhDs and engineers along with a 24/7 operations staff
- World leading advisors in electrochemistry, membranes and catalysis
- 40+ patents allowed with an additional 40+ pending
- Funded by cleantech investors and the United States Department of Energy

WORLD CLASS LABORATORIES

In our laboratories, high throughput and batch electrochemical cells and reactors are used to screen and optimize process conditions, explore alternate chemistries, support operation of the pilot plant and validate critical components. We've also developed analytical instruments specific to our process streams with continuing efforts for optimization and new analytical discoveries.

CHEMETRY'S eSHUTTLE™ PLATFORM TECHNOLOGY

[learn more](#) →

THE CHALLENGE

Develop an economically feasible technology that reduces the carbon footprint and improves safety in the industry.

The chlor-alkali industry is over 100 years old with existing operations that utilize mercury and asbestos diaphragm cells to produce chlorine gas. Chlor-alkali is very energy intensive resulting in a significant carbon footprint. Without compelling technology alternatives, it's difficult to force change because the economics are not feasible - hence the challenge.

The high capital costs associated with converting a mercury, an asbestos diaphragm or an inefficient membrane cell plant to another chlor-alkali technology delays conversions and even closes plant operations in some regions. Further, chlorine gas is essential to the chemical industry, but chlorine gas also poses significant health risks. Chlorine gas is responsible for a number of recent deadly catastrophes and substantial resources are dedicated to mitigating chlorine exposure risks.

Electricity is a major feedstock to the chlor-alkali process leading to a significant carbon footprint with the associated greenhouse gas concerns. Energy costs determine the profitability of a chlor-alkali plant.

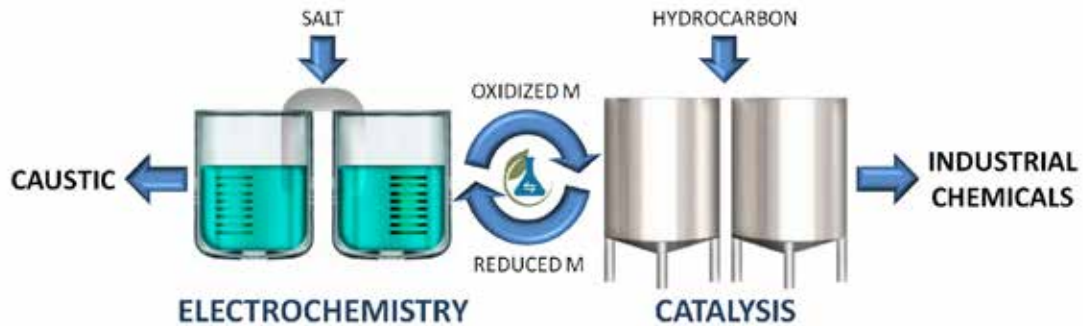
Lowering industry energy use is better for the environment and the bottom line.



WE ACCEPT THIS CHALLENGE

CHEMETRY eSHUTTLE™ PLATFORM

LOWER COST • LOWER ENERGY • NO MERCURY • NO ASBESTOS
NO CHLORINE GAS • SMALLER CARBON FOOTPRINT

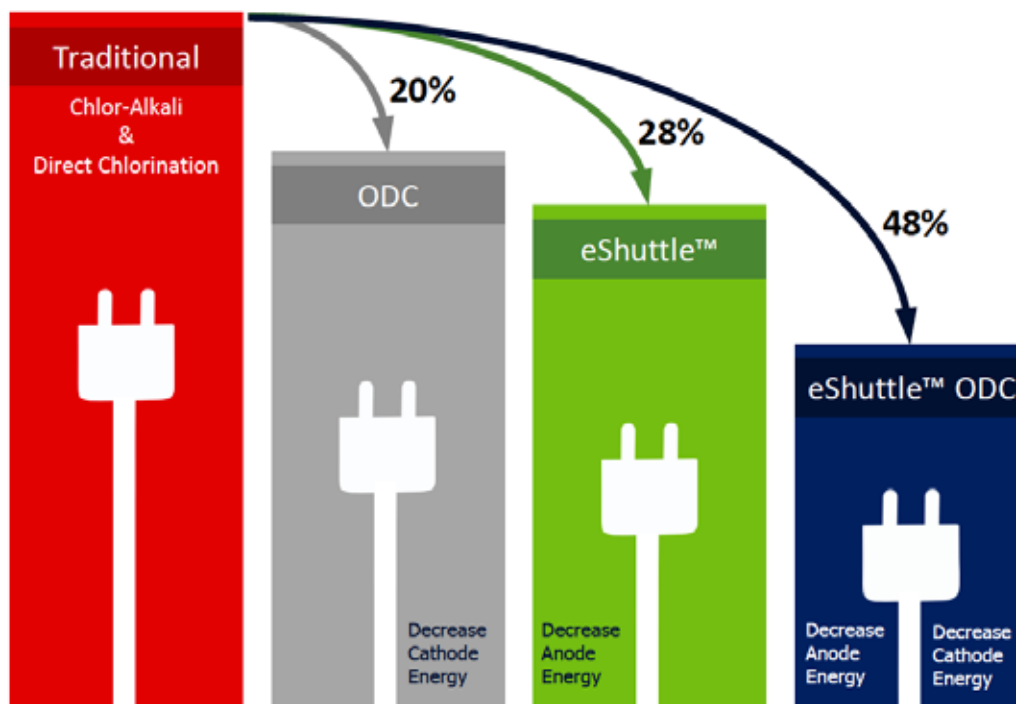


We've pioneered a new technology platform that combines electrochemical and catalytic processes to produce caustic soda and a suite of chlorinated chemicals. This membrane based technology avoids chloride gas with a metal chloride reaction between two integrated processes.

The initial focus of the eShuttle™ platform is the production of ethylene dichloride (EDC) with sodium hydroxide and hydrogen gas. Like chlor-alkali and direct chlorination, we use the same feedstocks to produce the same products, but with less energy.

eSHUTTLE™ ENERGY ADVANTAGES

The eShuttle™ platform is also compatible with Covestro's oxygen depolarized cathode (ODC) technology to further reduce the energy of the process. ODC experiments at the eShuttle™ Pilot Plant exemplified the synergies of both technologies in 2015.





AUTOMATED PILOT PLANT

Based on laboratory success, we engineered, constructed and operate a fully integrated and automated pilot plant to produce sodium hydroxide and ethylene dichloride in Moss Landing, California.

- Operational in 2013
- Utilizes a commercial height membrane cell
- Validated economics based on key performance indicators
- Qualified materials of construction and process control

eSHUTTLE™ PLATFORM POSITIONED FOR STRATEGIC PARTNERS AND SCALE-UP

PROVEN ECONOMICS



200 KTA EDC/167 KTA NaOH (DIAPHRAGM CHLOR-ALKALI) PLANT REVAMP WITH CHEMETRY'S eSHUTTLE™ PLATFORM IN EUROPE

CASE STUDY

- Increases plant capacity by 49% utilizing the same transformer and rectifier
- Eliminates the chlorine treatment system (compression, absorption & storage)
- Reduces power consumption by 720 kilowatt hours per tonne of EDC
- Membrane grade caustic quality
- Generates an additional \$26MM in revenue, saves \$16MM per year in utilities and reduces the CO₂ footprint by 85 KTA



BECAUSE THE ENVIRONMENT MATTERS



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