ZETON

REALIZE THE FUTURE

TECHNOLOGY HORIZONS

A publication by Zeton, the pilot plant specialists

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IN THIS ISSUE

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CELEBRATING OUR 25TH ANNIVERSARY

Zeton is proud to announce an important landmark in our company's history - a quarter-century in the pilot plant business! At events held at the company's Burlington, Ontario, Canada and Enschede, The Netherlands locations to mark the anniversary, Zeton's senior management thanked its employees, customers and suppliers for their contributions to the company's growth and success.

Twenty-five years ago, with the pilot plant supply business very much in its infancy, seven founding employees came together to form Zeton Inc. in Canada. In the same year, Zeton B.V. in The Netherlands opened for business under different ownership before joining the Zeton family in 1996.

"Looking back over Zeton's first 25 years in business, we would like to take this opportunity to thank our customers for entrusting Zeton with their unique pilot plant projects. We also extend our sincere appreciation to our employees, their families, and our suppliers for their dedication and resourcefulness, without which Zeton would not be the company it is today," said Mr. David Beckman, President and Chief Executive Officer of Zeton Inc.

From humble beginnings in 1986, Zeton has grown to over 200 people worldwide, the majority of whom are shareholders in the company.

"We are proud of what Zeton has achieved in its first 25 years in business, and with the support of our customers, employees and suppliers we are looking to the future with confidence. Special thanks and recognition must also go to the Cities of Enschede and Burlington for supporting and encouraging Zeton's growth as a significant employer in our communities," said Mr. Johan ter Harmsel, Managing Director of Zeton B.V.

"TRUE THANKS FOR THE VERY APPRECIATED COLLABORATION WE RECEIVED FROM YOU AND THE WHOLE ZETON TEAM!" CLAUDIO VOLPATO, ENI, ITALY

ENI-ZETON TEAM COMPLETES THREE HI-TECH PILOT PLANT PROJECTS

ENI of Italy chose Zeton B.V. in The Netherlands to design and build three hydrotreating and hydrocracking pilot plant projects. Each pilot plant fulfils a different, but specific, need in the Oil & Gas research conducted by ENI. In particular, for one of these projects, Zeton delivered a larger, more complex Chevron-Lummus Global (CLG) Isocracking pilot plant to ENI.

Each pilot plant fulfils a different, but specific, need

From the onset of the project, ENI and Zeton aligned their dedicated project teams to simplify communications and ensure strong cooperation. This led the creation of project-specific standards and specifications, and efficient, fast-track project execution. For project managers, Claudio Volpato (ENI) and Mark Damhuis (Zeton), this high level of cooperation between the project teams was key to the successful completion of all three projects.

Whereas the two multi-reactor hydrotreating pilot plants (both 6-fold parallel reactor systems) can be characterised as small scale flexible plants containing hi-tech process and automation solutions, the CLG Isocracking pilot plant was a much larger, non-standard, and fit-for-purpose plant. For the latter project, Zeton also completed a Phase I Basic Design phase.

Through Zeton's early involvement in the Basic Design phase of the CLG Isocracking pilot plant project, it was possible to create an optimal alignment between the demands of the process, the site characteristics and ENI's specific pilot plant process and automation requirements. A part of Zeton's scope included accommodating the very heavy feedstock used in this process.

The final result is a successfully-installed, fully-automated, robust and flexible outdoor pilot plant.

All projects have been designed, built and certified in line with ATEX requirements. Following a special design, one lab scale system was built to meet general purpose area classification. For the other two units, Zeton implemented specific Italian ATEX and ENI explosion proof requirements.

Zeton prides itself on taking a flexible and customer-oriented approach on every project. In one of three projects in particular, this flexible way of working was put to the test. At an advanced stage in the project, ENI requested Zeton to anticipate for a change in the final destination of the plant. Whereas originally the pilot plant was planned for indoor installation in a climate-controlled laboratory, now the pilot plant was to be installed in a hot summer, outdoor environment in Sicily. It is a credit to both project teams that such a change could be successfully accommodated so late in the project schedule.

The three completed projects have resulted in an increased awareness of the value that close cooperation between ENI and Zeton's can bring to such projects, and the hope is that this good understanding will bear fruit in future lab scale system, pilot plant and demonstration plant projects. ■

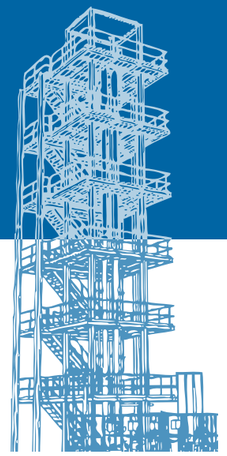
GLOBAL**OUTLOOK**

COMMENTARY ON TODAY'S GLOBAL PILOT PLANT DEVELOPMENT TRENDS

A review of the articles in this issue of Horizons, and the projects both Zeton Inc. in Canada and Zeton B.V. in the Netherlands have recently completed, shows that the development of new and improved alternative energy technologies continues to be a key R&D focus for our customers. This includes (natural) gas-to-liquids processes, coal to liquids, and the many different bioenergy technologies currently under development.

The development of alternative energy technologies is driven by the economics of higher petroleum costs, the desire for alternative liquid fuel sources, and environmental factors. Governments in North America and Europe have set targets for fossil fuel substitution. Increased funding from businesses, private investors and governments has made capital available for development of these innovative process technologies at the pilot and demonstration plant scale. Our experience in coal liquefaction and gasification and in biomass pyrolysis from the late 80s and early 90s, combined with our more recent gas-to-liquids/Fischer-Tropsch experience, has provided Zeton with a strong base of expertise from which to execute the alternative energy projects we have completed over the past few years. In many cases, Zeton has been fortunate enough to have worked on both the pilot and demonstration plant steps towards commercialization of these process technologies.

A key focus of the 2011 International Year of Chemistry (www.chemistry2011.org) is sustainable, or green, chemistry. As with the alternative energy projects described above, the chemical industry is actively developing new, sustainable chemistry technologies and processes. Zeton has recently completed several projects for customers whose process technology falls within this emerging branch of chemistry.



CASE **STUDY**

A BEHIND THE SCENES LOOK AT A RECENTLY COMPLETED PROJECT

AMMEL-LC AMMONIA REMOVAL SYSTEM

PROJECT DESCRIPTION

Zeton was contracted by Enpar Technologies Inc. to design and fabricate a production scale waste water treatment unit. Enpar had independently piloted their patented technology and approached Zeton to build a unit that would treat waste water in a mining application.

The system employs three fluidized bed ion exchange columns operated in series to remove ammonia from the water. Offline columns can be regenerated in parallel using a simple brine solution. Ammonia levels are monitored and switching between columns is automated for continuous operation. The brine used for regeneration is passed through an electrochemical reactor which converts the ammonia directly to nitrogen.

The unit was constructed in two modules for ease of transport and reassembly at site. Each module contained the equipment and necessary instrumentation for one of the two process steps - water treatment and brine regeneration.

DESIGN AND BUILD SUMMARY

Phase I - Basic Engineering was completed by Zeton, based on information provided by Enpar, to generate P&IDs, major equipment specifications, and a 3-dimensional plant layout. This led to a fixed price quotation and detailed Gantt chart schedule for Phase II - Detailed Design, Procurement, Fabrication and Factory Testing.

Detailed design started quickly, and within 16 weeks fabrication was complete. The system was factory tested with inert fluids at Zeton's facility with the customer's engineer present. Minor control system modifications were made during the factory acceptance test and the unit was emptied, dried, packaged and sent to site for installation. Following delivery to site, Zeton's engineer provided assistance to Enpar during Phase III – Installation and Start-Up.

A close working relationship between the project leads at both Enpar (Leonard Seed) and Zeton (Matthew Soucie) was crucial in successfully completing this project within a short time span.

Design and scope changes were managed efficiently by both parties and modifications were able to be incorporated with little to no schedule impact. The project was fast-tracked and took less than 6 months from basic engineering to site installation. Congratulations to Zeton's electrical and mechanical manufacturing teams led by Branka Matic and John Venuk on meeting this tight timeline.

TECHNICAL SPECIFICATIONS

- Water Treating Rate: 400 m3/day (278 litres/min)
- Inlet Feed Water Ammonia Concentration: Average of 35 mg/L
- Discharge Treated Water Ammonia Concentration: Less than 10 mg/L
- Ammonia Removal Rate: 476 g/hr
- Operating Pressure: 0.7 barg (10 psig) / Operating Temperature: 5-25°C
- Overall Dimensions (L x W x H): 24' X 24' X 28'
- Materials of Construction: PCV piping and valves, FRP and HDPE vessels
- Control System: Allen Bradley CompactLogix with a local 12" touch screen control panel

SPECIAL FEATURES

- Continuous unattended operation
- Remote monitoring capability
- Automated system for simultaneous water treatment and column regeneration
- Touch screen control display located on skid for process monitoring and operation

The Zeton team was pleased to receive a customer rating of "Excellent" based on post project survey criteria including quality of workmanship, overall design, and capability of the project team.

Enpar Technologies Inc. is an environmental water treatment company which specializes in patented technologies for water contaminant removal. They are located in Guelph, Ontario, Canada. ■

"It was great working with Matt and the group at Zeton. I agree that open communication helped the project run smoothly and meet the time constraints. We hope to be working with Zeton in the future."

— Leonard Seed, Vice-President, Product Development & Research, Enpar Technologies Inc.

SAFETY AND QUALITY LANDMARKS

Congratulations to Zeton's employees in Enschede and Burlington on recording a lost time injury-free year at the end of February, 2011. For Zeton B.V., this represents the fourth consecutive year without a lost time injury. Special thanks to Bob Hart, Safety Coordinator at Zeton Inc., and Rob van Dongen, SHE coordinator at Zeton B.V., for their dedication to workplace safety, and for their contribution towards Zeton realizing this important milestone. ■

Zeton is also pleased to announce that the quality management systems of both Zeton B.V. in The Netherlands and Zeton Inc. in Canada are now certified to the latest ISO 9001:2008 standards by Lloyds of London and SGS, respectively. Congratulations to the quality assurance teams led by Gary Chu in Burlington and Hennie Hofmeijer in Enschede on this important achievement. ■

ZETON EXECUTES PROJECT IN COLLABORATION WITH ISPT

NEW MEASURING AND CONTROL SKID CLARIFIES CRYSTALLIZATION IN PHARMACEUTICAL PRODUCTION

The process of crystallization to separate substances from each other is notoriously difficult to control and reproduce. A new measuring set-up (skid) – the result of collaboration between twelve companies and knowledge institutes connected to the Institute for Sustainable Process Technology (ISPT) - is intended to bring change. It will make the manufacturing of certain medicines even cheaper and more reliable.

THE CONSORTIUM

The system that has been designed and built by Zeton contains high quality equipment from a variety of companies and manufacturers. The collaboration between these companies was initiated by the Institute for Sustainable Process Technology (ISPT). This organization, which is financed in part by the Dutch government, was set up in 2005 to bring together companies and knowledge institutes with an interest in separation technology. They range from end users like FrieslandCampina, DSM and MSD, to several small, innovative technology suppliers, to knowledge institutes like Eindhoven and Delft Universities of Technology. Zeton is active in the ISPT platform to assist companies in developing the research tools they require for their projects.

CRYSTALLIZATION MEASURING AND CONTROL SKID

The measuring apparatus in the skid alone has been developed by four different companies. The concentration of the dissolved material is measured by

Integrating the requirements from several different companies presented an exciting challenge

an infrared absorption meter supplied by Bruker and a refractive index sensor from K-patents. An instrument from Sympatec determines the size of the crystals by transmitting sound with an extremely high frequency – five Megahertz – through the liquid. In order to make the data even more reliable, the shape of the crystals is measured using a microscope-based device supplied by Perdix Analytical Systems.

Zeton executed the process design and assembly of the unit. Zeton's role was to combine all requirements from a technological and technical point of view, and other influences like company standards, into one, fully-operational skid. Integrating the requirements from several different companies presented an exciting challenge, and required the flexibility and focus of all parties involved to reach this achievement. The collaboration has been technically and organizationally successful.

The skid, which has recently been commissioned at MSD, will supply data until mid-2011. Reactors will then also be connected at Albemarle and at a DSM plant. It is hoped that by the time the project has been completed in 2013, crystallization will be better understood and substantially easier to control.

DEMONSTRATING NEW CELLULOSIC ETHANOL PROCESS TECHNOLOGY

Coskata, Inc., a renewable energy company with a technology platform centered on the production of fuels and chemicals from a variety of input materials including biomass, agricultural and municipal wastes, and other carbonaceous material, announced in October 2009 that its demonstration plant, designed and manufactured by Zeton, was producing 40,000 gallons per year of ethanol from woodchips.

Coskata's cellulosic ethanol demonstration plant produces ethanol via a hybrid process consisting of gasification to syngas, fermentation of syngas to ethanol using proprietary microorganisms, and ethanol separation and purification via an exclusively-licensed vapor permeation process.

Coskata approached Zeton midway through the summer of 2007, and tasked us with the design and fabrication of the syngas fermentation and ethanol separation and purification sections of the demonstration plant.

Phase I - Preliminary Engineering and Basic Engineering started almost immediately, and this early collaboration gave Coskata access to Zeton's demonstration scale experience, and provided Zeton with the opportunity to become familiar with Coskata's process technology and specific project requirements.

The engineering team of Mark Moss, Pallavi Ray, Gloria Gao and Shoaib Nizami at Zeton were led by project manager Adam Whalley. The team worked closely with our customer contacts C.J. Buck, Steve Calderone and Rahul Basu throughout Phase II - Detailed Design, Procurement, Fabrication and Factory Testing. The mechanical and electrical teams, supervised by Mark Pulcine and Mike Frizzell, completed manufacturing in Zeton's shop.

Shipment to site was completed by April 2009, following which Zeton's team provided Phase III assistance to Coskata during mechanical and electrical on site reassembly, and provided control system engineering support during start up and commissioning.

Key features of the cellulosic demonstration plant included:

- An anaerobic fermentation system fabricated in part from 6" orbitally welded sanitary tubing;
- A vacuum distillation system;
- A proprietary membrane separation system;
- Two different bioreactor designs;
- Over 100 pieces of major equipment;
- Twelve (12) modular frame works that included three 72' tall towers;
- A total footprint for the assembled modular unit of 36' by 48';
- Emerson Delta V control system with approximately 500 I/O.

Zeton is proud to have had the opportunity to participate in Coskata's success as a pioneer in the development and commercialization of advanced cellulosic ethanol technology. ■

IN BRIEF

HIGHLIGHTING RECENT AND COMPLETED PROJECTS AND ENGINEERING STUDIES.

Gas-to-Liquids (GTL) demonstration plant for CompactGTL and Petrobras

Enclosed outdoor chemical demonstration plant

- Several ACE Technology® R+ units for Kayser Technology, Inc. (KTI)
- A microactivity test unit (MAT) and a 15 bbl/day demonstration plant for KiOR for biomass catalytic cracking
- A Mark IV Davison Circulating Riser (DCR) pilot unit for PetroChina (Lanzhou)
- A green chemistry demonstration plant located at a US refinery site
- A cyclic propylene steaming (CPS) pilot plant
- A bioalcohol demonstration plant
- A heavy oil processing plant
- An enclosed chemical demonstration plant
- Several basic engineering studies for pharmaceutical (continuous) kilo lab processing plants

Azeo-Sep™ membrane plant for KMX Membranes

Continuous distillation pilot plant for Ecopetrol in Colombia

CONTACT US

TO DISCUSS YOUR PILOT PLANT REQUIREMENTS, OR ITEMS IN THIS ISSUE OF HORIZONS, PLEASE CONTACT:

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