ZETON

REALIZE THE FUTURE

TECHNOLOGY HORIZONS

A publication by Zeton, the pilot plant specialists

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ZETON B.V. COMPLETES PHASE TWO FACILITY EXPANSION ON A FAST-TRACK SCHEDULE

Following the decision to invest in a new, state-of-the-art facility in 2009, and the unprecedented growth in business that has occurred since its opening in 2010, Zeton B.V. is pleased to announce that a substantial phase two building expansion was completed in late spring 2012. As a result, Zeton B.V.'s construction, machining and storage capabilities in Enschede have been significantly expanded by 40 per cent.

The expansion project was completed on an accelerated schedule following the same fast-track project execution approach that Zeton has applied to in-house pilot plant projects for over a quarter of a century. In fact, this was just-in-time delivery on a grand scale, with new skid modules ready to be installed on the floor in the new expansion bay the very moment the concrete had hardened!

With additional construction capacity now in place for the foreseeable future, Zeton B.V. has also recently added new, well trained and highly qualified staff, in line with our current and future anticipated project portfolio. And this recruitment campaign continues when a good fit exists between the aspirations of a qualified candidate and the company's needs.

Zeton B.V.'s management and staff would like to dedicate this expansion to our customers, both existing and new, for choosing Zeton for their pilot and modular plant projects in economically uncertain times. We are happy to repay this faith by expanding our facility and our staff, such that we can continue to serve in the future.

GLOBAL**OUTLOOK**

COMMENTARY ON TODAY'S GLOBAL PILOT PLANT DEVELOPMENT TRENDS

By considering the projects that Zeton has completed over the past year, an assessment can be made of the different commercial models that were applied to determine which work best for pilot and demonstration plant projects. The characteristics of projects involving the development of process technology are different than those involving established commercial technology. It is important to realize that technology development, through pilot and demonstration plant stages, and process innovation are parallel activities, and that at no time during these development stages is the process design fixed.

The approach applied to set up the basis for a contract can have a major impact on whether the project is successful and meets its intended goals. The conventional commercial model involves putting together a design basis and scope of work package. This is sent to multiple companies as an RFQ package with the intention of receiving multiple fixed price bids for a plant. However, there are typically process design issues that need to be resolved as the process develops and is scaled up. This leads to uncertainties in the initial design basis package and areas of the scope of work package that are not completely defined. The resulting contract can lead to a plant that doesn't meet its operating objectives, which could translate into significant, unanticipated costs and delays during startup and early operation.

Alternatively, the commercial model that we have seen to be most successful for process development projects is one where the end user selects the company to work with at an early stage in the design development cycle based on their experience and qualifications for the project. The end user and chosen designer-fabricator work together to develop the plant design during basic engineering. Cost estimates are presented in a progressive manner as the plant design is developed, so that all parties are aware of the costs that ultimately make up the fixed price for the plant. This approach also affords the opportunity to apply value engineering to the project at an early stage, where the greatest savings can be realized.

In Zeton's experience, selecting a commercial model that favours a collaborative approach between the end user and the designer-fabricator early in the project will result in a more successful outcome. I would welcome your input on this topic. You can reach me at **dbeckman@zeton.com**

David Beckman, President, Zeton Inc.

KTI-Zeton Alliance Delivers Two ACE-Model AP Units to Grace Germany

We are pleased to announce the delivery of two CE-compliant ACE-Model AP Units to Grace GmbH & Co. of Worms, Germany. The success of the project relied on the close cooperation of Kayser Technology, Inc. (KTI) of Houston, Texas, Zeton Inc. of Burlington, Ontario, and Zeton B.V. of Enschede, The Netherlands. Henk Naber of Zeton B.V. provided oversight of the project against the latest CE standards and practices, while the design was provided by John Kayser of KTI (process), George Hart of Zeton Inc. (electrical), and Sean Murray of Zeton Inc. (control systems). Henk Naber visited Canada for the factory acceptance test where CE plates were affixed to both units.

John Kayser, President of KTI: "The ACE-Model AP products directly benefited from the CE know-how of Zeton B.V. In addition, our 'easy' teamwork bodes well for future ACE projects destined for the CE marketplace." ■

"WE APPRECIATE ZETON'S DESIRE TO GET IT DONE RIGHT." GREG NUTTALL, PRESIDENT & CEO, WOODLAND BIOFUELS

ZETON DELIVERS CELLULOSIC ETHANOL DEMONSTRATION PLANT TO WOODLAND BIOFUELS






Zeton was contracted by Woodland Biofuels Inc. in late 2010 to design and build a state-of-the-art biofuels demonstration plant to be located in Sarnia, Ontario. The Woodland Catalytic Pressure Reduction (CPR™) technology includes the steam gasification of biomass to produce syngas followed by a series of proprietary catalytic reactions and separation steps ultimately generating fuels-grade ethanol as a product, and is protected by 29 patents.

The project began in Preliminary Engineering with a comprehensive review of the process flowsheet by the projects teams led by Doug Gray of Woodland Biofuels, and Paul Martin of Zeton. This quickly led to a rationalization of the demonstration plant scope to include only those key unit operations that needed to be piloted from a technology risk mitigation standpoint, while being cognizant of the project timeline and available budget. The approved scope was then carried through Basic Engineering to yield a firm price and scope of work for detailed design and fabrication of the demonstration-scale plant.

The approval for detailed design, procurement and fabrication was given in August 2011, whereupon the structural steel frames were fabricated and the long lead equipment items were ordered. Manufacturing began in earnest in January 2012, and completed modules were factory tested and shipped from Zeton's Burlington facility in two stages in July and August 2012. Following transportation to site by truck, reassembly of the process modules took approximately four weeks. In total, the fully-assembled plant consisted

of 11 process modules, with a module footprint of 1,500 square feet and an assembled height of almost 80 feet.

The project required several tall columns for reaction and separation steps. Gravity flow of solid feed materials also necessitated some tall structures. Zeton built stackable versions of its vertical modules which allowed these tall sections of the plant to be built side by side, ensuring perfect site fit-up of all interconnecting components. Reassembly of the stacked modules on site proceeded quickly and safely.

The project also required Zeton to design and fabricate several pieces of custom equipment not available commercially at the desired scale. By using novel materials and methods of construction, and by focusing only on what absolutely had to be piloted, Zeton and Woodland were able to deliver a high quality biofuels demonstration plant at a substantially lower cost than would otherwise have been the case, all on an accelerated project schedule.

Doug Gray, Vice President of Engineering, Construction and Project Implementation at Woodland Biofuels: "Zeton was instrumental in helping Woodland Biofuels scope its technology to a scale and capability that would be sufficient for future commercial work. It was critical that the pilot demonstration project focused on the absolute essential unit operations for proving the technology in an integrated manner. At the same time, the pilot plant had to be controlled and instrumented in such a way as to ensure the collection of meaningful scale-up data. Zeton was able to achieve both goals while maintaining a strict budget." ■

"Thank you to the entire Zeton team for all of your efforts over the course of the project. It's been a pleasure to work with you. Most important, we have very much appreciated your desire to get it done right."

Greg Nuttall, President & CEO, Woodland Biofuels.

BIOBASED FUTURE SYMPOSIUM A SUCCESS!

Following on from the success of our first symposium which focused on Process Intensification, Zeton B.V. was pleased to host our second symposium with the theme, Biobased Future, Right Here, Right Now, at the University of Twente in Enschede, The Netherlands on October 4, 2012.

Over 75 people from industry and academia across Europe and North America attended. Following opening remarks by Johan ter Harmsel of Zeton B.V., presentations were made by Arij van Berkel of TNO, Tom van Aken of Avantium and Gerhard Muggen of BTG Bioliquids B.V. on biobased chemicals manufacturing, and by David Beckman of Zeton Inc., Martin Dan Palis Sørensen of Haldor Topsøe, and Michael Luyben and Benjamin Fuchs of KRL on pilot and demonstration scale biofuels plants and projects.

Network opportunities were available to delegates throughout the symposium, which also included a tour of Zeton B.V.'s manufacturing facility. Delegates shared ideas, experiences and potential future developments and cooperation. Feedback from delegates included: "An inspiring symposium! Biobased and technology developments are often a joint effort. Zeton, please continue organizing these events, it is important for the future!"

Thanks are extended to our speakers and delegates, and to the staff at the University of Twente, for their help in making the Biobased Future, Right Here, Right Now symposium an unqualified success. ■

NOVEL LAB SCALE EBULLATED BED REACTOR SYSTEM FOR PNNL

Zeton was contacted by the Battelle Memorial Institute, operators of Department of Energy's Pacific Northwest National Laboratory (PNNL), to design and build a novel lab scale ebullated bed reactor system for the upgrading of bio-oil, the liquid fuel produced from the pyrolysis of biomass. In the first stage of the project, an acrylic mock-up of the reactor system was created and tested by Zeton, to view the effectiveness of the bed ebullation with different types of catalysts. Following successful prototype testing on actual process catalyst, the metal alloy ebullated bed reactor was fabricated, along with the balance of the fully-automated lab scale system, including liquid and gas (hydrogen) feeds, gas-liquid separation and product collection.

The novel aspect of the ebullated bed reactor designed by Zeton is the internal recirculation profile imposed on the entrained gas and liquid inside the reactor, as opposed to external recirculation which is the more common arrangement at the pilot scale. Bio-oil is very susceptible to degradation at temperatures as low as 45 C. The feed is kept cool until it mixes with an internal recirculating stream just before entering the catalyst bed. Using a unique internal recirculation system, the entrained liquid and gas mixture ebullates, or fluidizes, the catalyst bed, providing an even gas-liquid-solid dispersion. An internal disengagement zone above the catalyst bed separates recirculating liquid from exiting gas and upgraded bio-oil. The reactor is heated externally using an electric split-type furnace. At the time of writing, Battelle had been upgrading bio-oil using the ebullated bed reactor system for approximately one year. ■

TEAM **SPIRIT** HIGHLIGHTING THE ACCOMPLISHMENTS OF OUR TEAM IN THE DUTCH AND CANADIAN OPERATIONS

CROSS-EXCHANGE DELIVERS THE BEST OF BOTH WORLDS

Zeton designs and builds pilot plants from two locations in Enschede, The Netherlands and Burlington, Canada with identical project execution methodologies and equivalent quality standards. A closer look reveals that each has developed their own innovative techniques and know-how in such areas as the design approach for large modular skid structures, and safe and efficient working practices in the fabrication shop.

In the latest in a series of staff exchanges, Senior Lead Technicians, Eugene Ruel and Michel Koebrugge of Zeton B.V. visited our Canadian division to experience and discuss the safe working practices and innovative fabrication techniques employed in Burlington and Enschede. The free exchange of information and ideas ensured that staff from both organizations benefited from this cross-training event.

In addition to accelerating the implementation of new developments, intercompany visits also improve team spirit and cooperation between colleagues.

IN BRIEF

HIGHLIGHTING RECENT AND COMPLETED PROJECTS AND ENGINEERING STUDIES

A catalytic reformer pilot plant

A high viscosity polymer blending skid

- A smart-scale hazardous chemical satellite production plant
- An oxidation pilot plant
- A hazardous area-rated Davison Circulating Riser (DCR) pilot plant
- A rapid thermal processing (RTP™) integrated biorefinery demonstration plant
- A control system upgrade for a lab scale polyolefin reactor system
- An adiabatic reactor pilot plant
- A laboratory flow-through reactor system for a petroleum visbreaking application
- A biofuels demonstration plant converting wood to green gasoline via synthesis gas in a multi-step gasification process
- A basic engineering study for an integrated hydropyrolysis-hydrocracking (IH2) demonstration plant

A hydrocracker and hydrotreater pilot plant

A shale oil upgrader demonstration plant

CONTACT US

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