



REALIZE THE FUTURE™



THE PILOT PLANT SPECIALISTS

Bring your process technology to market - faster, with less risk and lower cost. For pilot and demonstration plants, lab scale systems and modular production plant projects, trust the experts.

Realize the Future, with Zeton.



As the **world's leading designer and builder** of innovative lab scale systems, pilot plants, demonstration plants and small modular production plants, Zeton has completed **more than 750 projects** in over 45 countries across 6 continents. Our **unique solutions** at the laboratory, pilot and demonstration plant scales provide **exceptional value** in the most challenging process development niches – **innovation** through early market development.

With state-of-the-art, integrated design-build facilities conveniently located in Burlington, Ontario, Canada and Enschede, The Netherlands, Zeton's engineers and craft technicians take pride in translating our customers' process technology into fully automated, working plants. We provide customized equipment, control and instrumentation solutions tailored to the unique requirements of each individual project.

Zeton's expertise in the scale-up of process technology consistently reduces time to market for our customers, shortening the path to process technology commercialization.

Customers benefit from exceptional quality and value that includes:

- Scale- specific, specialized engineering expertise
- Enhanced productivity, reduced project schedule and superior workmanship
- Project-specific and ISO 9001-certified documentation, training and QA/QC
- Streamlined project organization and communications through a single point of contact
- Demonstrated equipment functionality following Factory Acceptance Testing (FAT)
- Design-build on a fixed-price, lump-sum basis, reducing the risk of project overruns

CAPABILITIES, PRODUCTS, SERVICES AND INDUSTRIES SERVED

By working closely with our customers Zeton has earned a reputation for superior craftsmanship, fast-track project execution leading to reduced project schedules, demonstrated equipment functionality following extensive factory testing, and delivering exceptional value through innovative scale-specific engineering.

CAPABILITIES

With state-of-the-art, integrated design-build facilities in Enschede, The Netherlands, and Burlington, Ontario, Canada, Zeton provides:

- Modular design and fabrication of complete process plants across a broad range of industries and applications
- Comprehensive factory testing and training of our customers' operators
- Packing, crating and preparation for transportation to final destination

INDUSTRIES SERVED

Zeton has completed projects for customers in the following industries:

- Oil & Gas
- Polymers
- Chemicals
- Gas to Liquids/Synfuels
- Bioenergy/Biofuels
- Pharma/Biotech
- Mining/Hydromet
- Fine Chemicals
- Environmental
- Sustainable Chemistry
- Process Intensification

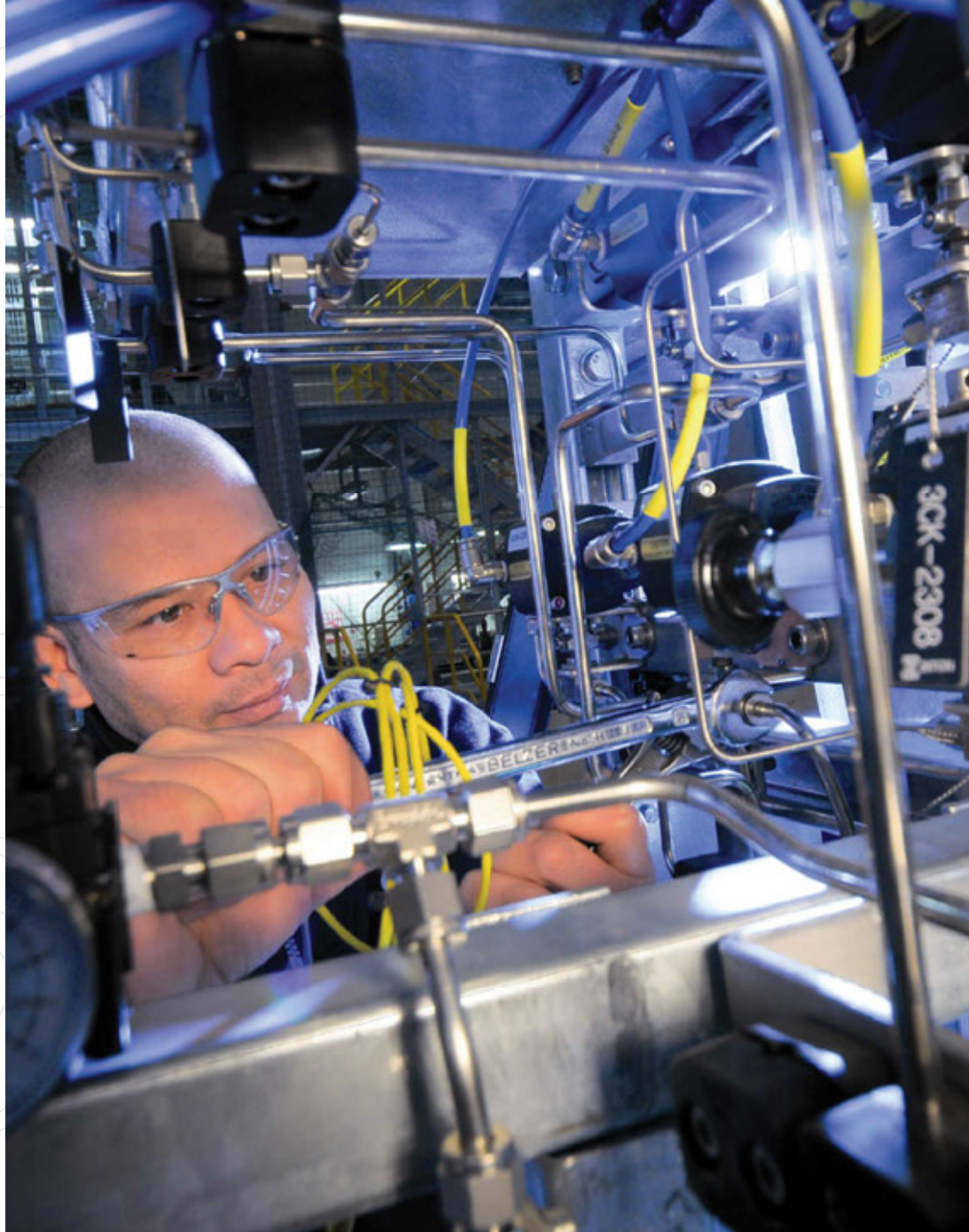
CUSTOM-ENGINEERED PRODUCTS

Zeton specializes in the design and fabrication of custom-engineered products, including:

- Lab scale systems
- Pilot plants
- Demonstration plants
- Small modular production plants

We have experience with process lines ranging typically in size from 1/8" (3mm) OD tubing up to 18" NPS (DN 450) piping systems, across a broad spectrum of temperatures, pressures and materials of construction.





ENGINEERING AND FIELD SERVICES

Zeton provides engineering and field services to our customers in support of their new plant projects, including:

- Pre-engineering consulting & conceptual engineering
- Cost estimation and feasibility studies
- Basic (front-end) engineering design
- Value engineering (scale-specific)
- On-site installation and start-up support

Zeton's multi-disciplined engineering capabilities include process, project, mechanical, control and electrical engineers. A comprehensive 3D computer model of the plant is created to show the structural steel and the major process equipment. On larger pilot, demonstration, and small modular production plants, our engineers use this model to complete mechanical piping design and pipe stress analysis, as well as conduit and cable tray routing to meet the instrumentation and electrical requirements.

CONTROL SYSTEM UPGRADES

Control system upgrades can greatly increase the value of an operating process plant, improving the quality of the data obtained by the customer, while at the same time extending its useful life.

For existing plants control system upgrade projects are completed in several stages including specification, cabinet and panel fabrication, retrofit and on-site start-up support.

Zeton's dedicated control systems groups are familiar with many of the commercially available control systems and are available to assist customers with the specification, fabrication and installation of both new and retrofit control systems. For projects where our customer has a preferred control system, we work closely with our customer's automation team to implement the final control solution. Alternatively, where no preferred control system has been specified Zeton can recommend a solution based on the requirements of the plant and our experience with projects of similar scale and complexity.

LAB SCALE SYSTEMS

Zeton understands the critical importance of lab scale systems in process development. Such systems require a flexible and multi-skilled approach to design, fabrication and operation. Zeton's attention to detail on lab scale system projects ensures that delivered systems meet or exceed our customers' expectations.

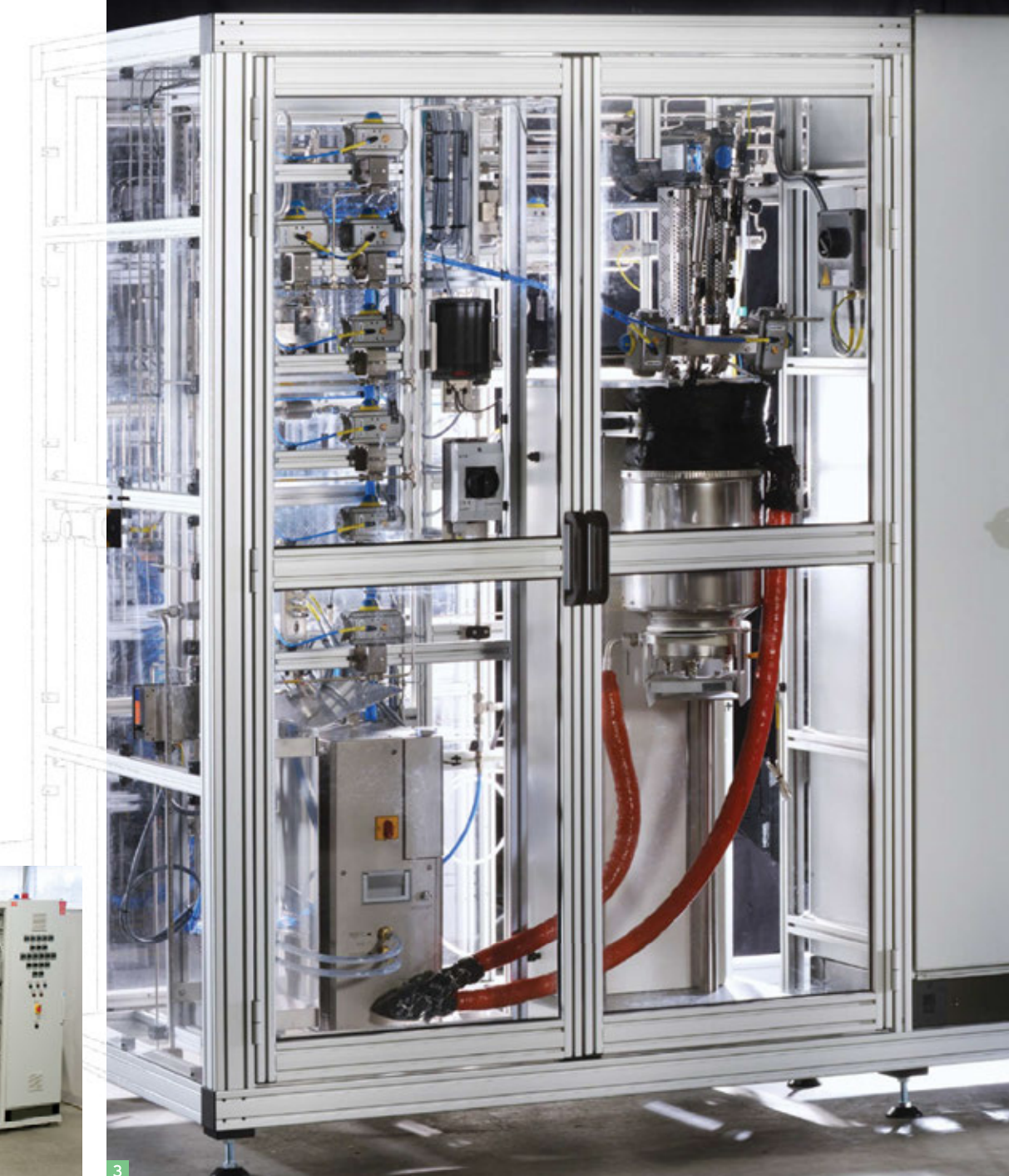
LAB SCALE SYSTEMS

Microreactor and small laboratory-scale systems can be designed and built with fixed bed reactors, fluidized bed reactors and continuous stirred-tank reactors. From single to multi-reactor configurations Zeton's custom-built lab scale systems have been designed for less than 10 gram catalyst loadings, with fractionation/recycle and integrated analytical capabilities. Fully automated with the latest in control system technology, Zeton's lab scale systems are delivered ready-to-run with complete engineering and operational documentation.



PROJECTS INCLUDE:

- ACE Technology® units for FCC catalyst testing
- Activated carbon test unit
- Adsorption/desorption
- Amine CSTR reactor system
- Autothermal Reforming (ATR) unit
- Catalyst activation
- Catalytic reforming (multiple reactor)
- Chemical reactor test stand, fixed-CSTR and Berty reactors
- Cyclic metals impregnation (CMI) of fresh FCC catalyst
- Cyclic propylene steaming (CPS) of FCC catalyst
- Diesel hydrogenation
- Distillation units
- Dual de-NO_x reaction
- FCC catalyst deactivation
- Fischer-Tropsch catalyst testing unit
- Fuel cell feed reformer systems
- Gas purification
- Heavy oil upgrading/hydroprocessing
- High throughput experimentation (HTE)
- Hydrocracking (HCU)
- Hydrodesulphurisation (HDS)
- Hydrogenation systems
- Hydrotreating
- Ketone dewaxing
- Metathesis catalyst testing unit
- Micro Activity Testing (MAT) of FCC catalyst
- Microreactor units
- NMR-MRI catalyst testing plant
- Polyolefins catalyst test unit
- Portable batch polymer catalyst testing
- Process Intensification Systems
- Resid hydrotreating with autosampler
- Steam deactivation unit
- Tritium capture system
- Water-gas shift catalyst testing plant



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Hydrosulphurisation catalyst testing system

3

ACE Technology® units for FCC catalyst testing in production

4

Double reactor polypropylene pilot plant

5

Close-up of parallel lab scale reactor systems

6

12-fold catalyst testing high throughput experimentation plant

7

Four reactor hydrotreater lab scale system

Close-up of lab scale glass and stainless steel vessel detail



PILOT PLANTS

Pilot plants are the preferred tool for companies developing process technology and are invariably on the critical path to technology commercialization. Zeton designs and builds pilot plants that bridge the gap between bench-scale chemistry and commercial manufacturing.

PILOT PLANTS

Working together with our customers, Zeton's engineers and craft technicians expertly translate fundamental process requirements into fully automated, safe, working pilot plants. Drawing on our extensive pilot plant experience, as well as our knowledge of non-proprietary equipment, control and instrumentation solutions across a wide variety of industries, each pilot plant is custom-engineered to meet our customers' specific research objectives.



PROJECTS INCLUDE:

- Alkoxylation pilot plant
- Biobased acid leaching pilot plant
- Biobased chemicals oxidation pilot plant
- Biochemical hydrotreater pilot plant
- Biomonomer recovery pilot plant
- Biomass catalytic cracking pilot plant
- Crystallisation pilot plant
- Coal gasification pilot plant
- Coal liquefaction / heavy oil co-processor
- Continuous solution phase polyethylene (PE) double loop unit
- Distillation units
- Ebullated bed hydrocracking pilot plant
- Electrocoagulation fines removal pilot plant
- Emulsion polymers pilot plant
- Fischer-Tropsch (FT) pilot plants
- Gas phase polyethylene (PE) polymerization (CTSR and fluidized bed)
- Grace Davison Circulating Riser (DCR) for FCC catalyst evaluation
- Gas-to-liquids (GTL) pilot plants
- High-density polyethylene (HDPE) pilot plant
- High pressure emulsion polymerization pilot plant
- Heavy oil hydroprocessing and upgrading pilot plants
- High pressure acid leach (HPAL) pilot plants
- Hydraulic wash column pilot plant
- Ketone/solvent dewaxing
- Oil desalting pilot plant
- Pharma and chemicals flow chemistry pilot plants
- Pharmaceutical intermediates mini-plant
- Phosgene pilot plant
- Polycarbonates (PC) pilot plant
- Polyurethanes pilot plant
- Polypropylene (PP) pilot plant with gas phase reactor
- Pressure oxidative leach pilot plants
- Slurry hydrocracking pilot plants
- Solution / slurry phase PE polymerization pilot plants
- Syndiotactic polystyrene pilot plant
- Synthetic rubber pilot plant

1 Hydraulic wash column pilot plant

2 Tritium capture unit

3 Dual reactor high throughput Fischer-Tropsch pilot plant

4 Ebullated bed pilot plant with H₂ feed module

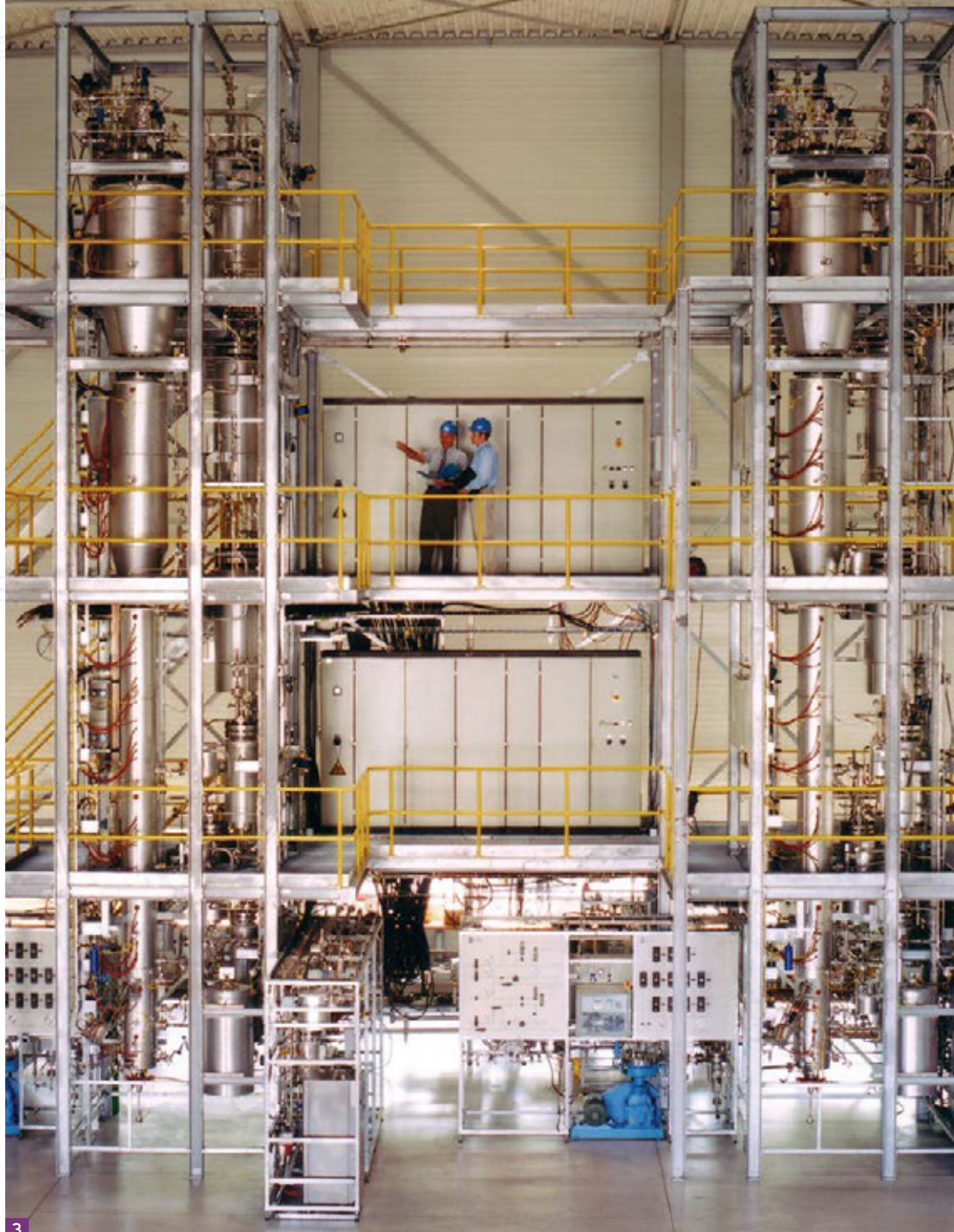
5 Coal gasification liquor filtration pilot plant

6 Distillation pilot plant

7 Biogas upgrading pilot plant

8 Close-up of a polypropylene pilot plant gas blowdown system

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DEMONSTRATION PLANTS

DEMONSTRATION PLANTS

Zeton has extensive experience and expertise in the development and implementation of demonstration plant projects, delivering over 50 world-class plants since the mid-1990s to meet our customers' process technology requirements.

Working from three modern high bay construction workshops in Burlington, Oakville and Enschede, Zeton is able to design and build large horizontal and vertical (multi)modular demonstration plants to meet the specific requirements of our customers' process technology.

Demonstration plants can generate significant quantities of product for market testing, and are often used together with pilot plants to support the ongoing operation and optimization of commercial plants. As a consequence of their size, demonstration plants are often installed at the future commercial plant site, and generally must meet the prevailing industrial site standards and specifications.

PROJECTS INCLUDE:

- Biobased food additive-monomer chemical demo plant
- Biomass Gasification To Ethanol Demonstration Plant
- Biomass-to-ethanol demonstration plant
- Biomass catalytic cracking demonstration plant
- Biobutanol demonstration plant
- Combi-Cracking Process Demonstration Unit
- Ethylene styrene interpolymer demonstration plant
- Fischer-Tropsch demonstration plants
- Green chemistry demonstration plant
- Gas-to-liquids (GTL) demonstration plants
- Heavy oil upgrading demonstration plants
- Hydrogen Production Demonstration Plant
- Multi-reactor polystyrene (PS) demonstration plant
- PE/PP (CSTR/ Loop) semi-works plant
- Pressure oxidative leach demonstration plant
- Polyvinyl Chloride (PVC) semi-works plant with monomer recovery
- Shale oil upgrading demonstration plant
- Synthetic Natural Gas (SNG) demo plant

SMALL MODULAR PRODUCTION PLANTS

SMALL MODULAR PRODUCTION PLANTS

Modular fabrication is often faster and more economical for small commercial plants than a traditional stick-built approach. This is especially true where the plant is to be operated in a remote location, or where the plant is relatively small because the product is only required in limited quantities.



PROJECTS INCLUDE:

- Biodiesel production plant
- Biomass-to-food additives and biomass-to-liquid fuels pyrolysis plants
- Electronic chemicals manufacturing plant
- Modular continuous Active Pharmaceutical Ingredient (API) plant
- Modular transformer oil production plant
- Multi-purpose industrial microreactor plant for fine chemical and pharmaceuticals production
- Resin production plant
- Satellite fluorine production plant

- 1 In-situ fluorine production plant
- 2 One hundred kg/hr copolymer semi-works plant
- 3 Thirty bbl/day shale oil upgrader demonstration plant
- 4 Sixty million litres/yr biodiesel production plant
- 5 GTL demonstration plant on-site
- 6 One hundred and twenty t/day poly-generation pyrolysis oil production plant on site
- 7 Close-up of demonstration plant piping system



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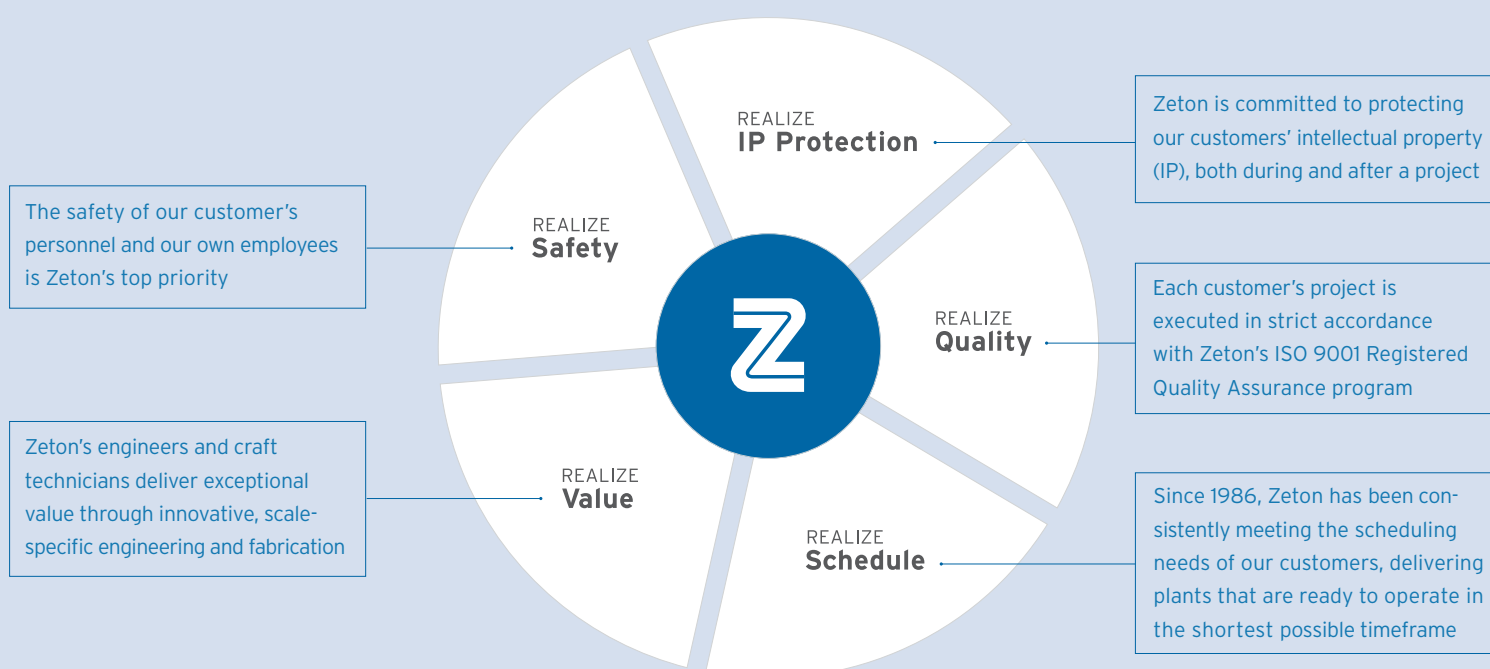
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CUSTOMER PROMISE AND EXTERNAL ACCREDITATIONS

Zeton designs and builds custom pilot plant projects that help our customers commercialize their process technology. For each project, we focus on five key elements which define our commitment, and our promise, to our customers.



EXTERNAL ACCREDITATIONS

Canada

- ISO 9001 Registered certified
- Authorized to manufacture ASME pressure vessels
- Authorized to apply the "NB" mark and register pressure vessels
- TSSA - Certificate of Authorization, CSA B51 (Manufacture of Pressure Vessels in Ontario)
- TSSA - Certificate of Authorization, Repair and Alteration of Pressure Vessels, Piping and Category A, B, & H Type Fittings
- TSSA - Certificate of Authorization, Fabrication and Assembly of Process Piping (B31.3)
- TSSA - Certificate of Authorization, Fabrication and Assembly of Power Piping (B31.1)
- CWB - CSA W47.1 Division 1, Certificate of Authorization, Fusion Welding of Structural Steel
- AWS Welding Procedures

Control system integration certificates:

- *Emerson DeltaV*
- *Honeywell ISP - Industrial Solutions Provider*
- *GE Proficy iFIX*
- *Rockwell Automation*

Netherlands

- ISO 9001 Registered certified
- OHSAS 18001
- Experience with following control systems:
 - *Emerson*
 - *Honeywell*
 - *Rockwell*
 - *Yokogawa*
 - *Siemens*
 - *ABB*
 - *And others*

ADVANTAGES OF WORKING WITH ZETON

Since 1986 Zeton has been a leader in the design and fabrication of lab scale systems, pilot plants, demonstration plants, and small modular production plants. Customers trust Zeton to help them bring their unique process technologies to market efficiently and cost effectively. Advantages Zeton offers to customers include:

INTEGRATED DESIGN-BUILD FACILITIES

World-class integrated design-build facilities in Burlington, Oakville and Enschede provide improved efficiency and minimized cost and scheduling risk for our customers.



SCALE-APPROPRIATE SOLUTIONS

Pilot plants demand a scale-specific approach to design, specification, project execution, fabrication and factory testing methodology that Zeton has developed and implemented.



State-of-the-art, world-class integrated design-build facilities in Canada and The Netherlands.

MODULAR DESIGN AND FABRICATION

Zeton's engineers optimize each design to permit safe operator access to equipment and efficient process equipment layout within the available footprint. We look for ways to reduce capital cost, while ensuring we meet any international shipping requirements for the finished plant modules.

UNIQUE FAST-TRACK PROJECT EXECUTION METHODOLOGY

Zeton has developed a unique, scale-specific fast-track project execution approach. For example, we execute detailed design, procurement and fabrication in parallel to compress the overall project schedule.

FLEXIBILITY

Zeton aims to provide custom plants and project flexibility, all while working within our customers' specifications and timelines.

RETAINED KNOWLEDGE AND SKILL

Zeton has a very high staff retention rate. Our multi-discipline engineers and craft technicians have unrivalled knowledge and skill in their field to complement the know-how and experience of our customers.

VERTICAL INTEGRATION

To meet schedule commitments, and to protect key customer intellectual property (IP), Zeton maintains the flexibility to complete work in-house or to use our trusted network of experienced, pre-qualified suppliers.

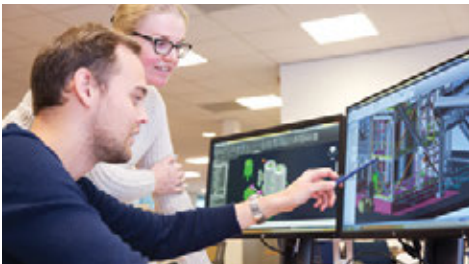
CREATIVITY AND INNOVATION

Zeton has a history of providing unique solutions that combine creativity and innovation to solve our customers' technology development challenges.

PROJECT METHODOLOGY

Zeton has developed a project execution approach that is as unique and scale-specific as our finished plants themselves. Designed to assist our customers in navigating the various stages of project approval and to ensure their plants are designed and built as efficiently and cost effectively as possible, it has culminated in a 3-step process. It's *Engineered Thinking* in action!

PHASE I



BASIC ENGINEERING DESIGN

Customers choose to take advantage of Zeton's specialized, scale-specific knowledge and experience by involving us early in the design process for lab scale, pilot plant, demonstration plant and small modular production plant projects. Zeton's engineers work closely with our customer's project team in the early-stage development of the plant. Engineering services for new plant projects include pre-engineering, consulting and conceptual engineering, cost estimation and feasibility studies and basic (front-end) engineering design studies.

PHASE II



DETAILED DESIGN, PROCUREMENT, FABRICATION AND FACTORY TESTING

Detailed design, procurement and fabrication are executed in parallel on a fixed-price, lump-sum basis. This minimizes the risk of cost overruns for our customers and allows Zeton to optimize manpower allocation and compress the overall project schedule. The final activity in this phase is a comprehensive customer-witnessed factory acceptance test (FAT) in Zeton's shop.

PHASE III



SHIPPING, INSTALLATION AND START-UP SUPPORT

Following shipping to the customer's site by road, rail, water or air, Zeton's engineers and craft technicians are available to provide on-site installation and start-up support as required by our customers. Once the plant is operational, Zeton can provide ongoing technical support to help our customers meet the objectives of their research and development programs.

This 3-step project execution methodology continues to evolve through the experience gained on every project we complete. As part of Zeton's ISO 9001 Quality Assurance program, we actively seek customer feedback on our performance and incorporate any learning points and recommendations.

Bringing novel process technology to market takes the experience and proven approach you only get by choosing the world's leading pilot plant specialist. Trust Zeton to help your company Realize the Future.

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