Gasification Engineering
for Fuel, Power and
Petrochemical Applications
Gasification: Clean Energy Conversion

Increasing demand for energy is exhausting the easy-to-access conventional sources, thereby increasing the competition, cost and environmental impact of supply. Gasification addresses energy security and environmental impact by converting renewable and stranded assets (waste, coal, residuals, etc.) into a variety of high value chemicals and fuels. Energy security can be improved through the conversion of locally available feedstock to offset energy imports. Gasification processes facilitate reductions in the environmental impact of energy supply particularly when the feedstock is renewable.

Optimal selection and configuration of proven technologies is required to ensure reliable and economic performance. Sometimes financial sensitivities necessitate analysis to prove that robust economics are in place to carry the project through a gated development process. At times, the process may hold great promise but requires the development of a reliable reactor to ensure high availability performance.

Solutions with Hatch

Hatch has considerable experience in gasification and syngas processing technologies, providing clients the capability to address these issues through cost-effective, customized, and reliable solutions.

Our value is demonstrated through our extensive experience in process design and engineering, thermo-mechanical reactor engineering, total plant engineering, construction management and commissioning. And while many engineering, procurement and construction management (EPCM) providers have aligned with individual gasification technology licensors, Hatch remains technology neutral to allow for the facilitation of independent review and unbiased technology selection advice.

Our experience with high-temperature processes, feed, slag granulation and power generation systems comes from our mining, metallurgy and energy projects around the world. This invaluable knowledge-sharing between sectors allows for Hatch to do what we do best – provide our clients with innovative and cost-effective solutions. We provide an entire suite of services designed for gasification and syngas chemistry applications including custom equipment design and whole plant engineering – all from concept to construction and commissioning.
Process Design and Engineering

Given the wide range of choices, early evaluation of gasification and syngas processing technologies is important and needs to suit the feedstock, final product, water availability and emissions constraints. Evaluation begins with process definition and typically starts with a search for a technology to process the feedstock available. An upfront market study may be required to evaluate the right product(s) for the target market.

Syngas produced by the gasification of feedstock such as coal, municipal waste or biomass can be used for power generation directly or to synthesize chemicals or fuels such as methane, naphtha, diesel, liquefied petroleum gas (LPG), dimethyl ether (DME), gasoline, hydrogen, synthetic natural gas (SNG) and ammonia.

Our dedicated gasification team has considerable experience in gasifier selection and the design of processes for the synthesis of chemicals and fuels. Using Aspen Plus™ software, a powerful tool for the simulation and optimization of various chemical processes, Hatch has developed numerous custom designs for processes specific to client needs. Such advanced methodologies permit Hatch to compare technologies from various licensors to maximize process efficiencies and minimize costs.

Biomass/GTL Facility
AP Fuels Inc., Canada

AP Fuels Inc. commissioned Hatch to study a biomass and natural gas-to-liquids facility. The work established the design and integration of major processes and equipment packages to determine the technical feasibility of producing 11,000 bbl/day of diesel and naphtha from the gasification of forestry products, supplemented by natural gas, for sale into the consumer market.

Synergies between CO-rich syngas from biomass gasification and H₂-rich syngas from steam methane reforming were utilized to improve yields and increase the scale beyond what was practical from biomass alone.
Gasification Engineering

Thermo-Mechanical Reactor Engineering

With gasification occurring at extreme temperatures and pressures, containing the process in a reliable and robust reactor is critical to the performance of an operating plant. It is vital to ensure the gas has enough residence time to complete the reactions and produce a desired syngas quality. Flowing solids and liquids into and out of a gasifier requires special consideration. Novel processes may require a pilot or demonstration prototype whereas established processes may require refinement to adapt to changes in feed, or achieve reliability improvements.

Hatch has assisted gasification technology licensors in the commercialization and improvement of proprietary technologies, applying more than 50 years of experience in high-temperature reactor design gained through our work in the metallurgical sector. Hatch provides services ranging from planning to the detailed design of gasification reactors including gas and particle flow modeling (for entrained flows and fluidized beds) as well as pressure vessel, molten material handling, refractory and cooling systems design.

Gasifier Detailed Engineering

Alter NRG, United Kingdom

Hatch engineered improvements to Alter NRG’s pilot US plant which employs Westinghouse’s plasma gasification technology. Subsequently, Hatch completed the detailed engineering for two of Alter NRG’s next-generation commercial plasma gasifiers – one of which is being constructed for the Tees Valley project in the United Kingdom. The plasma gasifiers will convert municipal wastes into power supplied to the grid.

Mongolian CTL Facility

POSCO and Energy Resources, Mongolia

POSCO and Energy Resources (ER) investigated the technical and economical feasibility of a coal-to-liquids (CTL) plant in Mongolia, producing 600,000 to 1,100,000 tonnes per year (tpy) of diesel, naphtha, LPG and DME.

Hatch was commissioned to undertake a conceptual study of this CTL plant inclusive of process engineering calculations, capital and operating cost estimates, and a financial model.

Hatch’s ability to quickly model and compare the process performance for several configurations helped POSCO and ER choose the most appropriate set of plant parameters and achieve optimal results.

▼ Hatch’s conceptual study chose the appropriate plant parameters and helped POSCO and ER achieve optimal results
Hatch leveraged our considerable experience in high-temperature pressure vessel design to enhance performance and reduce costs for Sasol.

Sasol Licensor’s Engineer
Sasol Technology (Pty) Ltd., South Africa

Hatch provides engineering services including materials-handling design, machine design and pressure-vessel design to assist Sasol Technology (Pty) Ltd. of South Africa with its ambitious plans to improve and proliferate the Sasol® FBDB™ gasification technology in support of growing and improving its syngas generation and coal-to-liquids business over the next decade.

Hatch’s mandate covers the upstream aspects of the Sasol® FBDB™ gasification technology, including coal delivery, gasification proprietary equipment and ash handling.

Our considerable experience in high-temperature pressure vessel design was leveraged to analyze process and equipment performance and identify design changes to enhance performance and reduce costs.
Total Plant Engineering

Developing a technology project from early concept through to the realization of a commercially successful plant requires a very wide range of skills. Sourcing these inputs from many different companies can be time-consuming and inefficient.

Our experts can provide a full suite of services spanning the entire operation of the gasification to end product facility. Hatch provides full engineering, procurement and construction management services to take your project from concept to reality.

Hatch’s capabilities are complemented by our in-house teams dedicated specifically to:

- Thermal power generation
- Coal mining
- Syngas chemistry
- Solid and molten materials handling
- Metallurgical process integration
- Transmission and distribution
- Water treatment.

Mesorini IGCC Facility
Industrial Development Corporation, South Africa

The Industrial Development Corporation (IDC) appointed Hatch to conduct a prefeasibility study for the use of low-grade South African coal in an integrated coal gasification combined cycle (IGCC) facility to produce both fuel gas and power required by an iron and steel plant.

The scope included an initial coal study to determine the properties of the available coals and to enable proper entrained flow gasification technology screening. A concept design enabled the development of specifications for budget quotations.

Hatch’s parallel involvement in the detailed design of the iron and steel making plant resulted in a more integrated solution that met the specific needs of the metallurgical facility. Addressing the requirements of a captive power plant and the availability requirements for a high capacity metallurgical plant were greatly assisted by Hatch’s understanding of both fields.
Process Design Package
Alter NRG, United Kingdom

Air Products and Chemicals Inc. is constructing and will operate a waste-to-energy facility located at Tees Valley, United Kingdom that employs Alter NRG’s Plasma Gasification System (APGS). The plasma gasifier will process 950 tonnes per day of sorted municipal solid waste producing syngas. Cleaned syngas will be used as fuel in a combined-cycle power plant to produce 49 MW of electricity. Power generated qualifies for Renewable Obligation Certificates in the UK since it offsets the use of fossil fuels for power generation.

Hatch prepared the engineering deliverables for the process design package (PDP) for Alter NRG based on process stream tables and a preliminary design basis developed by Alter NRG. This facility is the first full-scale PDP provided by Alter NRG.

Hatch worked closely with Alter NRG to define project process parameters for this first-of-scale project. The scale-up of the gasifier was realized through practical high-temperature reactor experience, finite element analysis and computational fluid dynamic studies.
Hatch is an employee-owned, multidisciplinary professional services firm that delivers a comprehensive array of technical and strategic services, including consulting, information technology, engineering, process development, and project and construction management to the Mining, Metallurgical, Energy, and Infrastructure sectors. Hatch has served clients for over 80 years and has project experience in more than 150 countries around the world. With 11,000 people in over 65 offices, Hatch has more than $35 billion in projects currently under management.

Contacts

Kerry McKenna
North America
+1 905 403 3960
KMckenna@hatch.ca

Vijendra Beepath
Africa
+27 (0)11 844 1307
VBeepath@hatch.co.za

Steve Bond
Australia
+61 7 3166 6204
SBond@hatch.com.au

To learn more about Hatch, visit us at www.hatch.ca.

This publication contains information in summary form, current as of the date of publication, and is intended for general guidance only. We make no guarantees, representations or warranties of any kind, expressed or implied, regarding the information including, but not limited to, warranties of content, accuracy and reliability. Any interested party should undertake their own inquiries as to the accuracy of the information. Hatch Ltd. excludes unequivocally all inferred or implied terms, conditions and warranties arising out of this document and excludes all liability for loss and damages arising therefrom. This publication is the copyrighted property of Hatch Ltd. © 2012. All rights reserved.