

STATEMENT OF QUALIFICATIONS

LOWER-EMISSION FUELS



WHO WE ARE



WHO WE ARE

Our firm

WSP provides technical expertise and strategic advisory services to a wide range of clients. We are multi-disciplinary specialists who provide integrated, value-added solutions in the environmental; real estate and buildings; transportation and infrastructure; and ERI (energy, resources and industry) markets.

We are committed to our local communities and distinguish ourselves through our collective international knowledge. Our teams consist of technical experts, strategic advisors, engineers, consultants, scientists, planners, surveyors, architects and environmental specialists.

WSP helps clients assess and define their objectives and the technical, environmental and business realities and challenges they face. Coupled with our integrated service offerings, we build strategic relationships with our clients, working with them throughout the planning, design, construction and commissioning stages of their projects.

Our philosophy

At WSP, we firmly believe that great teams make great projects and that our clients' success is the true measure of our contribution and joint accomplishments. We believe in open and honest collaboration with our clients and their partners. We are committed to fostering and maintaining an environment where teamwork and collaboration are essential for each activity we perform.

Our belief

For societies to thrive, we believe that we must all hold ourselves accountable for tomorrow. As Canada continues its energy transition, lower-emission fuels are emerging as an energy resource that has the potential to replace carbon-intensive fuels both here and abroad.

Our purpose

Our purpose is to integrate lower-emission fuel production into the Canadian energy mix by guiding our clients to understand where they can be produced, transported and used.

Our role

By applying our engineering expertise and understanding of lower-emission projects, we support our clients in identifying risks, opportunities and options for developing projects in their energy portfolios.



**WE AIM TO SHAPE COMMUNITIES AND
ADVANCE HUMANITY**

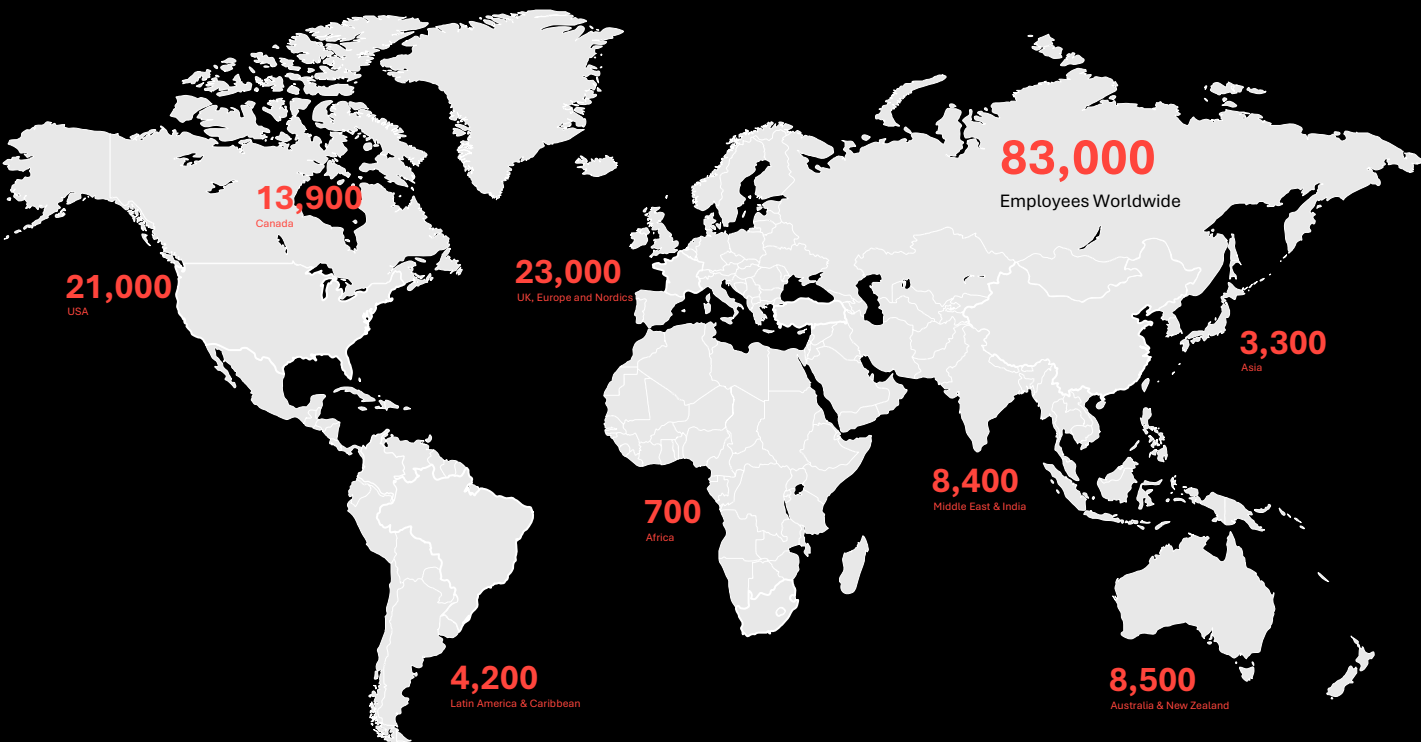
WE HAVE THE PEOPLE AND THE REPUTATION



WE FOSTER
COLLABORATION IN
EVERYTHING WE DO

We are a Canadian company headquartered in Montreal with a reputation for delivering practical and long-lasting solutions for our clients and communities.

WSP has a local and global network of hydrogen experts who are ready to support organizations around the world in their efforts to decarbonize assets and make progress toward net-zero objectives.



Figures as of February 2026

*Includes Golder employees, Wood E&I employees, and Louis Berger International.



LOCALLY DEDICATED WITH INTERNATIONAL SCALE

WSP is a leading international engineering and design consultancy at the forefront of delivering multi-disciplinary services.

WSP has the in-house expertise to deliver a wide range of lower-emission fuel projects including hydrogen, ammonia, renewable natural gas and biofuels project. We offer services in the following disciplines:

- Earth & Environment
- Energy & Process
- Power & Renewables
- Ports & Marine
- Energy Storage
- Water & Wastewater
- Land & Municipal
- Transmission & Distribution
- Transportation
- Advisory
- Digital Transformation
- Buildings



LOWER-EMISSION PROJECT DEVELOPMENT



Scoping

Develop the concept

- Power
- Export options
- Available land
- Water supply
- Conceptual facility design
- LCOE/LCOH/LCOX models
- AACE class 5 estimate
- Market studies



Prefeasibility

Identify and address risks

- Indigenous engagement
- Power connection
- Secure land
- Stakeholder agreements
- Begin environmental assessment process
- Update cost models
- Advance technical design
- AACE class 4 estimate
- Develop procurement, contracting and construction strategies



Feasibility/FEED

Support financial decisions

- Design to 60% (FEED)
- Major contracts tendered
- Early works
- Tendering
- Risk mitigations in place
- Technology qualifications complete for key elements
- AACE class 3 estimate



Detailed engineering

Complete engineering design

- Design to 100%
- Major contracts awarded
- Modularization complete
- Process safety finalized
- Final permitting complete



Construction

Support construction

- Mobilize on-site resources
- Technical and construction management for facility completion
- Monitoring of Environmental Protection Plans



Commissioning

Facilitate overall implementation

- Final on-site testing and start-up readiness trouble shooting and reviews
- Assistance with transfer to operations
- Final documentation handovers and as-building
- Post-construction wildlife monitoring



WE ARE FUTURE-FOCUSED AND CHALLENGE THE STATUS QUO

In addition to our engineering expertise, we provide advisory solutions to support the project development process and performance of lower-emission projects globally.

WSP advisory teams are positioned to understand the global picture while providing local solutions.

Technology assessment

Complete robust technology evaluations and recommend best-fit solutions.

Leverage our understanding of global supply chain trends to mitigate risks and highlight opportunities.

Business case development

Support the financial performance by combining economic modeling with engineering solutions.

Identify and incorporate various incentive programs and funding into detailed financial modeling.

Execution strategy

Support the development of execution plans to provide guidance on contracting, procurement and construction strategies throughout projects.

Energy optimization

Develop and optimize detailed energy models, to verify designs are in line with energy costs to maximize the financial and operating performance.

Quantitative project risk analysis

Identify and assess schedule, cost and event risk through quantitative modeling, leading to mitigation planning and contingency provisions.

Owner's engineer

Provide project management and technical support during the asset life-cycle as an advocate of the project owner.





WHAT WE DO



SOLVING CHALLENGES OF LOW-EMISSION FUEL PROJECT DEVELOPMENT

What barriers can WSP remove for you to allow your energy portfolio to include Future Ready solutions? Our team will implement strategies to support your growth in the **make it, move it and use it** industries.



HYDROGEN: MAKE IT, MOVE IT, USE IT



Make it

Our experience spans from traditional power generation technologies to emerging renewable technologies and their associated systems.

Our dedicated energy specialists rely on our internal network of engineering subject matter experts when considering the viability of a low-emission project.



Move it

WSP is a global leader in the engineering and design of the infrastructure and the transportation of Energy. WSP has a 40+ year history of designing pipelines, storage terminals, ports and jetties related to energy transmission.

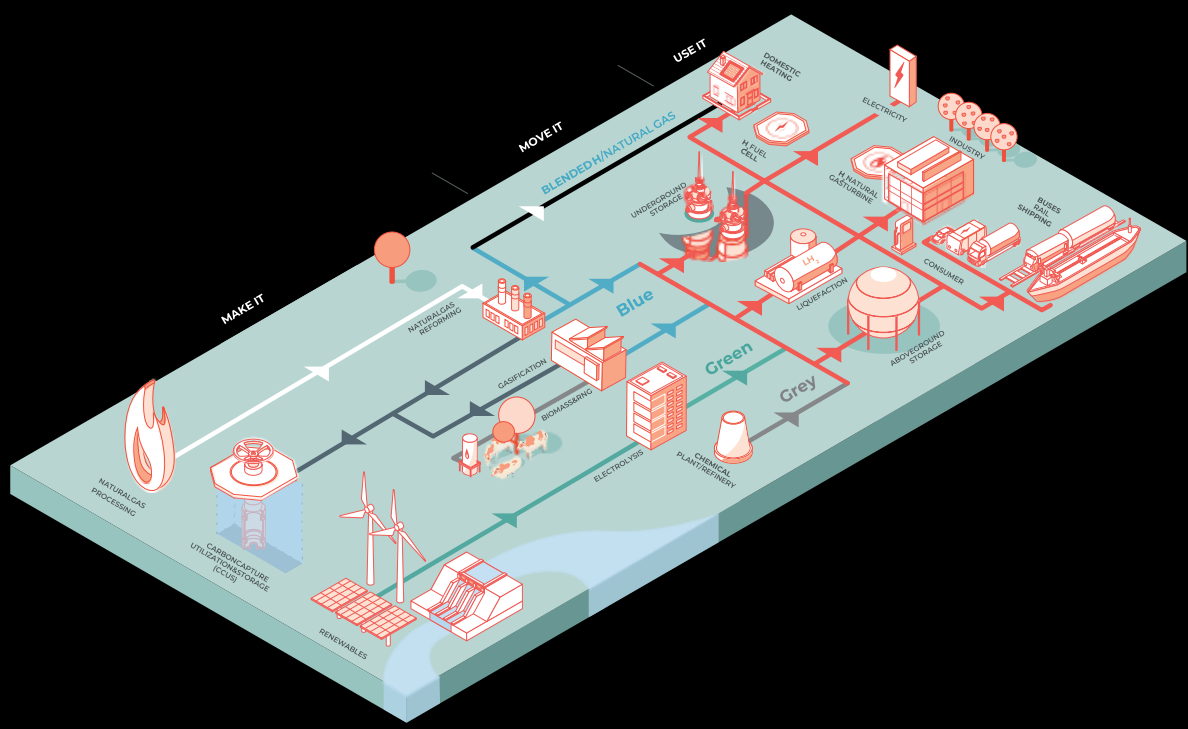
The global mobility of produced low-emission fuel is an emerging engineering field. Worldwide advancements are progressing ground-breaking projects to pilot e-fuel cars, trucks, planes and ships to move the product to market.



Use it

Leveraging our experience in domestic, commercial and industrial heating systems, WSP has been supporting efforts to decarbonize heating by using alternative energy sources, including e-fuels.

WSP has supported public transportation organizations as they prepare to shift their fleets to zero emission vehicles (ZEVs), including fuel cell electric vehicles (FCEVs) powered by hydrogen.



A photograph of an industrial facility, likely a refinery or chemical plant, featuring large, dark, curved pipes and tall, cylindrical towers. The scene is set against a clear blue sky. The image is framed by a red border with a stylized 'V' shape on the left and a red triangle on the right.

FULL PROJECT LIFE CYCLE SOLUTIONS

Low-emission fuels has emerged as a key component in the energy transition to meet net-zero goals around the world. WSP has developed and applied an execution strategy to determine the economic viability of low-emission fuel production and export in Canada.

Development of low-emission projects is complex and fast-moving. Consideration must be given to not only the hydrogen production design, but also access to power, land, water, transmission, distribution and environmental regulations. WSP is uniquely positioned to support our clients in understanding and assessing low-emission opportunities as they relate to their specific needs.

Our engineering teams encompass experts from all these specialized areas to determine project viability and associated risks and opportunities quickly and efficiently.

We design and deliver lasting solutions in the **make it, move it and use it** spaces.



PROVEN EXPERIENCE MAKE IT

Production – we evaluate lower-emission fuels and their derivatives to support OEM selection with overall balance of plant design.

Hydrogen facility – we leverage decades of facility design experience to deliver lower-emission fuel solutions with global expertise.

Economic – we develop project models including context definitions, inputs, assumptions, LCOH/LCOA/LCOE, risk assessment and sensitivity analysis.

Power – we calculate the optimal power for the project to analyze hydrogen generation capacity and determine the energy certification process.

Energy network – we evaluate the locations with the best connections to existing distribution and transmission networks for base load power and energy feedstocks.

Land – we consider environmental features and plot size for project suitability.

Source water – we analyze sea water, surface water and ground water availability and suitability.

Environmental – we develop regulatory roadmaps specific to each project location to identify critical path engagement requirements.





PROVEN EXPERIENCE MOVE IT

Export viability – we identify suitable and available waterways for berth and overall navigation.

Transport – we complete due diligence reviews of technology and assess key risks and economic drivers.

Recovery systems – we design systems to reconvert P-to-X products back to hydrogen for end-use applications.

Storage – we assess, design and develop underground and above ground storage systems including salt caverns.

Marine – we design import and export facilities for hydrogen and P-to-X products (ammonia, methanol, e-fuels, etc.).

Rail – we design rail load out, mainline, switches and related infrastructure for hauling P-to-X products safely to destinations.

Pipeline – we evaluate existing infrastructure and the design of new pipeline systems for the movement of hydrogen.

Logistic planning – we evaluate the routing of hydrogen products through distribution networks.

Specification development – we develop and audit existing specifications to support the safe deployment of lower-emission fuels within existing and new systems.





PROVEN EXPERIENCE USE IT

Mobility – we evaluate the applicability and the design of energy systems for different modes of mobility (road transportation, rail, marine and aviation) using lower-emission fuels in different forms. Examples include fuel cell electric vehicles or as hydrogen-based fuels.

Hydrogen dispensing – we design and develop lower-emission fuel hubs and fueling stations.

Hydrogen blending – we evaluate the maximum volumes of hydrogen that can be safely introduced into existing and new infrastructure.

Hydrogen fuel cells – we assess technologies to determine viability of hydrogen replacing conventional energy.

Power – we assess technologies to determine the viability of lower-emission fuels for power generation and long duration energy storage solutions.

Buildings – we assess the viability of lower-emissions fueled infrastructure on existing or new builds either as a blended energy source, 100% hydrogen, or synthetic methane from hydrogen.

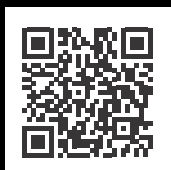
Industrial – we understand and evaluate conventional industrial processes to use lower-emission fuels and reduce greenhouse gases.





WSP is one of the world's leading professional services consulting firms. We are technical experts and strategic advisors including engineers, technicians, scientists, architects, planners, surveyors and environmental specialists, as well as other design, program and construction management professionals. We design lasting solutions in the Transportation & Infrastructure, Property & Buildings, Earth & Environment, Power & Energy, Resources and Industry sectors, as well as offer strategic advisory services. Our talented people around the globe engineer projects that will help societies grow for lifetimes to come.

Learn more about
our services



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**OUR
EXPERIENCE**

Enerkem Varennes Carbon Recycling (VCR) Detailed Engineering



Client	VCR
Location	Varennes, Quebec
Project Value	\$1.1B
Status	Completed

Project description

The Varennes Carbon Recycling (VCR) facility will turn non-recyclable institutional, commercial and industrial waste into biofuels and renewable chemicals. They are the first company in the world to produce renewable methanol and ethanol from non-recyclable, non-compostable municipal solid waste at a commercial scale.

WSP services

WSP was awarded the contract to provide detailed engineering and procurement services for the construction of the facility. WSP's scope included geotechnical, civil, structural, piping, mechanical and process engineering for plant utilities and field support during construction. WSP had over 130 resources across 4 business lines contributing to the project.

Features/scope and objectives

Modularization approach, including super modules (largest in Canada). 95% of fabrication being off-shored in emerging markets with transportation from Asia to Quebec via sea freight and barge.

Approximately 80 FTEs during the project peak.

AGR Chilled Methanol System syncs gas treating to condition the gas to optimize the production of methanol.

Strong partnership: ECOPLANTA FEL2 in Spain and Rotterdam (FEL3)

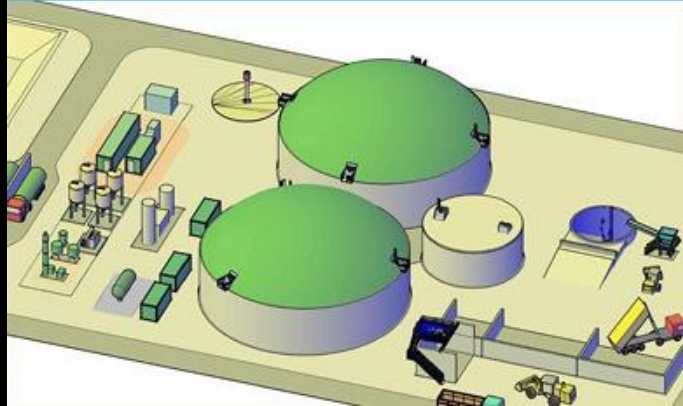
Value proposition

Collaboration: As part of our scope, WSP collaborated with complex construction and owner's teams to complete project management and project controls of all engineering scopes. This included the modularization design of 19 separate core processes and balance of plant areas

Integrated team: WSP leveraged project expertise from our Montreal and Calgary offices to allow for fit for purpose and integrated application of subject matter experts for the project. The integrated team allowed the client to benefit from WSP's diversity and engineering knowledge. The team jointly executed all design reviews, including vendor squad checks and regular weekly meetings.

First of its kind: The new \$1.1 billion facility will convert non-recyclable commercial and industrial waste, as well as forestry waste, to biofuels and renewables chemicals, representing more than 200,000 tonnes of waste into an annual production of nearly 130 million litres of biofuels. The plant will produce one of the lowest carbon-intensity fuels by diverting non-recyclable and non-compostable waste from landfills and by accessing green hydrogen and oxygen produced through electrolysis leveraging Quebec's excess hydroelectricity capacity.

Ontario Clean Water Agency Biogas Feasibility Study



Client	Ontario Clean Water Agency
Location	Timmins, Ontario
Status	Completed

Project description

WSP conducted the technical and financial assessment on Mattagami WPCP treatment capacity. We assessed digester performance for co-digestion feedstock, CHP and existing infrastructure. The biosolids process was evaluated to recommend its capacity to accept additional sources and volumes of food waste.

WSP services

The assessment also included the introduction of new innovative technology and the beneficial usage of biogas. WSP recommended multiple options for various new scenarios. These scenarios included considerations for cost, payback, volume of organics, digestate and biogas. Additionally, we evaluated the potential for RNG and electricity production.

Features/scope and objectives

Maximize usage of existing wastewater treatment infrastructure resulting in reduced GHG emissions.

Develop sustainable energy products (electricity/renewable natural gas/vehicle fuel)

Use waste to create renewable energy.

Divert organic waste from landfills.

Create economic value.

Value proposition

Collaboration: As part of our scope, WSP is assisting the City of Timmins as they evaluate options to reduce their greenhouse gas emissions by 5%, below 2017 levels, by 2027.

Lessons learned: We leveraged key learnings from previous renewable natural gas projects to enhance our approach and outcomes. These insights were instrumental in optimizing our processes and implementing innovative solutions. By applying the knowledge gained from past experiences, we were able to anticipate potential challenges, streamline operations and maximize the efficiency of our resources. This proactive utilization of prior learnings significantly contributed to the project's overall success and has set a strong foundation for future initiatives.

Commercial LNG to Confidential Ammonia Export Pipeline



Client	Confidential
Location	North America
Project Value	Confidential
Status	Completed

Project description

Our client is looking to develop a commercial liquefied natural gas (LNG) to ammonia production facility in Malaysia. Our client required an initial inquiry around the import of LNG, pipeline transport of natural gas to Malaysia and pipeline transport of ammonia back to a port for export.

WSP services

WSP was hired to provide options and cost estimates for ways to deliver the natural gas to a proposed ammonia production plant. WSP is required to explore two scenarios: first a pipeline that will tie-in to existing natural gas infrastructure and second, a pipeline from an LNG terminal and vaporisation facility. WSP will use actual data from other similar projects to size, select and estimate the project components.

Features/scope and objectives

- Identify all equipment and utilities needed to support the production of 2,050 metric tonnes of ammonia per day, which will be converted to urea (fertiliser).
- Provide an option to expand the facility to include an export terminal with connecting pipeline, adding an additional 4,000 MTPD of ammonia production.
- Evaluate cost and capacity of multiple pipeline options to support the security and supply of natural gas to the facility.
- Provide a preliminary economic analysis (PEA) for the proposed facilities including estimated capital and operating costs.

Value proposition

Collaboration: WSP collaborated with various industry OEMs to integrate their specialized technologies into the overall plant design. Partnering with OEMs that have a proven track record in delivering large ammonia production plants contributed to cost certainty in the capital cost estimates provided for the project.

Lessons learned: WSP used data from previous in-house projects to provide a strategic approach to validate the success of this project. By analyzing historical data, our team identified patterns, best practice, and potential pitfalls. This information allowed us to make informed decisions, optimize processes and anticipate challenges that would apply to this new project.

Future expansion: Planning for a future export terminal involved considering market demand, logistics, transportation, regulatory compliance, infrastructure, capacity, environmental impact, economic viability, stakeholder engagement and risk management. These factors were analysed in house and provided to our client.

Project Coyote Green Hydrogen & Ammonia Project



Client	Fortescue Energy
Location	British Columbia
Project Value	Confidential
Status	Completed

Project description

WSP has advanced scoping and pre-feasibility engineering studies for a confidential large-scale 1,000 MW green hydrogen project located in Western Canada. The green hydrogen/ammonia project will produce 800,000 tonnes of liquid ammonia per year to be exported via rail/port. Ammonia storage of 100,000 m³ will allow for the required shipping storage capacity.

WSP has supported this project from its inception. A detailed scoping study was completed, considering market access, power and water availability and suitability of candidate properties and surrounding regions for six candidate locations, with the optimal site reflecting the lowest levelized cost of hydrogen (LCOH) and of ammonia (LCOA). Additional due diligence on the selected site, including the evaluation of rail transport, as well as initial conceptual design and site layout, provided confidence in the project’s go-forward strategy.

WSP next completed a pre-feasibility engineering study to advance the conceptual design. Leveraging WSP’s full suite of engineering disciplines, scientists and cost analysts, the entire facility’s design (including electrolysis, ammonia synthesis and downstream shipping/logistics) was advanced, generating an AACE Class 4 estimate and significantly reducing project risks.

Our approach

WSP’s client-centric strategy has driven tight integration between WSP and its client since the project’s initiation. Relationships between WSP and the client, from the executive level to their respective project engineers, have brought the alignment needed to quickly address key questions, navigate complexity and meet the client’s core objectives and timelines consistently.

Value proposition

- Agile Project Execution:** Entering the emerging hydrogen market, the client required responsiveness and flexibility with regards to completion of the project mandates as their organization pivoted into this space. Significantly, this has aided the client in engaging with provincial and federal leadership, including at the Prime Minister’s provincial Premiers’ levels.
- Project Delivery:** Given the competitiveness of the hydrogen market, the client further required an ambitious focus on project delivery to capture key opportunities ahead of their competitors.
- Innovation:** Project delivery of a green hydrogen product of this scale has not been achieved worldwide to date. Adapting its experience in billion-dollar project execution, WSP developed key design criteria, technology evaluation methodologies and risk management techniques as part of the project. The client has since utilized these criteria more broadly with WSP and within their own project portfolio.
- Stakeholder Engagement:** Supported our client in their effort to accelerate project development and initiate stakeholder engagement at an early stage of the project. This allowed the client to pursue funding application and advance discussion with relevant levels of government.

Commercial LNG to Ammonia Production Facility



Client	Confidential
Location	Malaysia
Project Value	Confidential
Status	Completed

Project description

A North American energy company is considering the production and export of ammonia to serve the carbon free fuel demand. Strategic placement of multiple ammonia production facilities was required to achieve the target ammonia export volumes such that an extensive pipeline network is required.

WSP services

WSP was hired to provide pre-FEED engineering services to design the transport infrastructure comprising 1,200 km of pipelines up to a 30-inch diameter. WSP supported route development, geotechnical/hyrotechnical assessment of the pipeline corridor, field survey of the route and design of the pipeline infrastructure from ammonia production facilities to the export terminal. Key engineering deliverables were also developed to support initial permitting efforts as well as community engagement.

Features/scope and objectives

- Development of a reliable pipeline route, design and cost estimate with the support of environmental and landowner teams (by client) to determine project viability.
- Development of a 1,200-kilometer ammonia transport pipeline including route selection and facility engineering to the export terminal.
- Preparation of a risk matrix for the transport of large ammonia volumes including preliminary dispersion modeling to determine impact of a pipeline leak.
- Close collaboration of internal WSP engineering teams with client-supplied environmental, social and land-owner teams to develop a pipeline right-of-way with high confidence of procuring the eventual easements.

Value proposition

Collaboration: WSP collaborated with multiple client teams to develop an integrated solution. Additionally, close collaboration with ammonia production and export terminal engineering contractors contributed to a fully integrated system design including a planned production ramp up over many years.

Lessons learned: There are operating ammonia pipelines of similar length. However, the quantities of ammonia to be transported by the proposed pipeline far exceed that of operating systems. While no significant technical challenges were encountered, a strong risk identification/risk mitigation process was key to design development.

Future phases: WSP is continuing to support the project development, including the evaluation of various project configurations. Preliminary permitting packages will be submitted to acquire regulator support for the project and the safety systems developed for the project.

Blue Hydrogen to Ammonia



Client	Westlake
Location	Western Canada
Project Value	Confidential
Status	Completed

Project description

WSP was contracted by West Lake Energy to complete a pre-FEED design of a new ‘blue’ ammonia/hydrogen facility. The planned design targeted 0.75 Mtpa (2,050 tonnes per day (“tpd”)) of ammonia using an auto-thermal reformer (“ATR”) or steam methane reformer (“SMR”) process with a target of 95% CO₂ capture rate. Additional hydrogen is produced to supply the local hydrogen market. The liquid ammonia produced will be transported by rail to market, with on-site storage and rail spurs/loading included in the design. The facility includes carbon capture, compression, dehydration and pipelining for sequestration.

WSP services

WSP completed a full pre-FEED engineering study of the proposed West Lake Energy Blue Ammonia project, including core ammonia production technology evaluation and selection, balance of plant engineering, onsite rail infrastructure and connection to neighboring rail carrier network, as well as Class 4 cost estimation.

This included:

- Developing a preliminary facility design and defining key requirements for major equipment.
- Reviewing and comparing ammonia production proposals from technology licensors.
- Defining the project’s regulatory requirements and key risks.
- Assessing the project’s overall capital cost and economics per AACE Class 4 guidelines.

Value proposition

Brownfield integration: The proposed ammonia production facility was to be sited at an existing gas plant facility. WSP’s team carefully balanced the design of the ammonia plant with the present condition and needs of the existing plant site to develop an optimized layout.

Water mitigation: The proposed site was in a water-stressed region with limited surface water availability. WSP approached this challenge through a two-pronged approach; first, WSP completed a high-level hydrogeological assessment of ground water resources in the area; second, WSP focused the plant’s design to minimize the facility’s use of water through evaluation of process cooling methods.

Project execution: WSP leveraged its expertise in pre-FEED and FEED level studies and its extensive historical database to expedite key components of this study. This allowed WSP to focus on the most consequential facets of the project (i.e., high CAPEX equipment, plant integration, etc.) while leveraging industry-standard estimating methodologies and design assumptions to deliver the cost estimate and project certainty required.

Coal to Hydrogen to Ammonia Production Facility



Client	Glencore
Location	Australia
Project Value	Confidential
Status	Completed

Project description

Glencore is evaluating the option to convert coal at their Surat site in Australia to hydrogen. The project considers process technology by specialty vendors to produce hydrogen and carbon dioxide. The CO₂ will be delivered to sequestration and the hydrogen converted ammonia for pipeline transport to export facilities.

WSP services

WSP was hired to provide engineering services to support integration of multiple process technologies from vendors into the project site including all required utility infrastructure. In addition, WSP designed the overland CO₂ and ammonia transportation pipelines as well as the export terminal. CO₂ sequestration was to be completed by others. WSP then developed capital and operating cost estimates for the project to allow evaluation.

This included:

- Identification of all on-site process equipment and utilities needed to support production of 1.4 million metric tonnes of ammonia per annum.
- Development of a 300+ kilometer ammonia transport pipeline including route selection and facility engineering to the export terminal.
- Development of a 200+ kilometer carbon dioxide (dense phase) pipeline including route selection and facility engineering to the sequestration site (sequestration by others).
- Development of a 1.4 million metric tonnes per annum ammonia export terminal including all facility engineering (onshore and offshore infrastructure).

Value proposition

Collaboration: WSP collaborated with specialty process vendors and the Glencore team to develop a process facility fully integrated with coal mining operations. Global subject matter experts were integrated into the WSP Australia project team to support pipeline and marine terminal design development, bringing best practices from the global project experience to the local team.

Lessons learned: Working with the Glencore mining team to develop the project required extensive team conversations to align project expectations. In part, the project was within reasonable commercially proven benchmarks but represented a unique combination of infrastructure for Glencore. The connection with WSP global experts was instrumental in supporting project definition.

Future phases: WSP is continuing to support the project development, including the evaluation of various project configurations. For example, third party ownership (build, own, operate) of the transport pipelines is being evaluated as a configuration alternative. WSP is providing input as well as cost modelling to determine the optimum overall configuration.

WOODFIBRE LNG Marine Terminal Substructures Basic Design

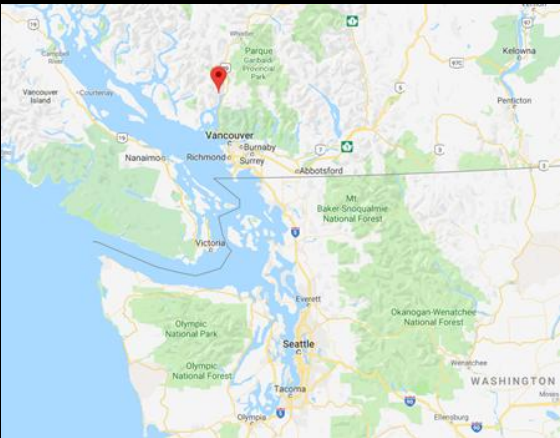


Client	McDermott International
Location	Squamish, British Columbia, Canada
Project Value	Contract Price (Design): \$1M
Status	Completed

Project description

Woodfibre LNG Limited (WLNG) is proposing to construct and operate a liquefied natural gas (LNG) export facility on the former Woodfibre Pulp and Paper Mill site in Átl'ka7sem (Howe Sound) approximately seven kilometers south of Skwxwú7mesh (Squamish). The project is located on the historical location of a Skwxwú7mesh Úxwumixw (Squamish Nation) village known as Swiyat. The project includes land based natural gas processing and liquefaction facility; the floating storage and offloading unit; and supporting infrastructure.

The WLNG Marine Terminal is located on the steep coastal slope of Howe Sound just east of the WLNG plant. The marine terminal consists of one floating storage tank (FST) transfer platform with supporting jacket and four FST mooring jackets for two permanently moored FSTs. Two LNG sister vessels will be converted to FSTs by removing the bow and stern sections of both vessels. LNG carrier (LNGC) will be moored alongside the FSTs with loading platform as part of one of the FST cantilevers, which will facilitate ship-to-ship LNG transfer.



LNG Facility Location

The goal of the Basic Design Phase has been to conduct a review of the studies and engineering completed to date and to validate the proposed design, changing where required, utilizing jacketed support structures for the floating storage units with integrated mooring and berthing. WSP undertook the following distinct scopes to validate the design and review of the overall constructability of the structures:

- Geotechnical data review and gap analysis
- Metocean and vessel motion data review
- Design validation and alternative layouts
- Geotechnical analysis and interpretive report
- Design basis and detailed design scope of work
- Basic structural design
- Installation methodology
- Project management and support

Our approach

Based on the review and evaluation, WSP proposed a list of detailed recommendations, including design revision to the terminal arrangement to reduce construction risks and costs, while increasing operational safety of the terminal. This included design changes to adopt a strut mooring system. Additionally, as part of the basic design WSP has been providing technical design services including:

- Structural design of the mooring struts and load absorption and damping system;
- Design of substructure foundations for the loading platforms and mooring structures;
- Geotechnical design of the piling and other foundations;
- Coordination with the client's vessel conversions contractor (floating storage tanks);
- Coordination with classification society (ABS) to provide guidance on the classing of the storage tank foundations during detailed design;
- Providing active direction to the ongoing dynamic mooring analysis undertaken by a third party;
- Providing guidance to the client on the installation practices and methodologies for the marine foundations and other structures related to the marine facilities; and,
- Providing guidance for the upcoming physical modeling work by a third party

ATCO EnPower Hydrogen Production Refuelling Stations



Client	ATCO
Location	Western Canada
Project Value	Confidential
Status	Ongoing

Project description

WSP is supporting ATCO EnPower with detailed design deliverables for two different hydrogen production and refuelling facilities that will be used as a pilot project for CPKC to trial hydrogen fuel cells for use with their locomotives. Detailed design deliverables along with project implementation activities are currently being progressed at two locations in Calgary and Edmonton. For each location, a hydrogen production package will be installed along with hydrogen compression, storage and dispensing equipment that will be used to refuel the hydrogen fuel cells on the pilot locomotives. Both pilot locations will use electrolysis technology for the generation of hydrogen.

WSP Services

WSP's capabilities in hydrogen plant design were utilized, covering geotechnical and civil design including site grading, structural design, process engineering, mechanical and piping engineering design, automation and controls, electrical engineering and design. WSP further provided technical review of major equipment design including the electrolyzer package, compression, storage and dispensing equipment.

Value Provided by WSP

Working with suppliers with limited experience in Canadian regulations proved to be challenging as support required to meet or exceed Canadian standards was difficult to obtain. WSP and the client worked closely with the vendor to ensure they were aware of Canadian regulations and that all deliverables that required P. Eng. certification were produced according to the regulating body. Supply chain issues and new technology introduced additional schedule risks, while specialized materials and high-pressure piping caused delivery delays. The project team worked diligently with vendors and the client to meet timelines.

Value proposition

Innovation: This project is North America's first hydrogen production and dispensing facility for hydrogen fuel cell powered locomotives. Completion of this project will pave the way for future development in the space of hydrogen production and dispensing for use in hydrogen powered locomotives and freight vehicles.

Client strategy: WSP's strategy has driven tight integration between WSP and its client since the project's initiation through FEED and detailed engineering. Having a core team of project managers and project engineers on both the client and WSP side has brought alignment needed to quickly address key questions, navigate complexity and meet the client's core objectives and timelines consistently.

Communication: By committing to open and consistent project communication, WSP and ATCO's project teams have been able to work together effectively to overcome both technical and logistical challenges through the project design and execution phases.

Life cycle approach: A deep understanding of project cycles—from conceptual scope to construction—allows WSP to highlight risks and potential gains early in the development to allow for positive outcomes for our client.

Confidential Green Hydrogen & Methanation Scoping Study



Client	Confidential
Location	Confidential
Project Value	Confidential
Status	Completed

Project description

A leading developer of green hydrogen projects globally, our client is developing a green hydrogen and green methane project in Canada. The project will generate up to 1,000 MW of its own renewable power via combined wind and solar, which is used to produce 70,000 tonnes per year of green hydrogen. This hydrogen is combined with biologically sourced carbon dioxide to produce renewable natural gas—enough to supply over 100,000 homes per year with net-zero energy.

As its first project in Canada, this flagship project will cement our client’s reputation in Canada as a responsible developer and community partner giving special consideration to water conservation, hydrogen safety and demonstration of bona-fide reduction in greenhouse gas emissions. This project’s unique assemblage of technologies—never deployed together at this scale—will be a model for rapid deployment of hydrogen in Canada.

WSP services

WSP was engaged by our client to provide engineering services to its projects since its initiation. WSP’s capabilities in both renewable power project development and hydrogen plant design were utilized, covering geotechnical and environmental assessment; wind and solar resource assessment; generating facility engineering (mechanical, electrical and civil engineering); production facility engineering (process, mechanical, electrical, piping, civil/structural); procurement; project controls; and project management. WSP further provided strategic advisory services concerning project financial analysis, lifecycle analysis, optioneering and technical strategy as well as project execution.

Value provided by WSP

As the global leader in large-scale hydrogen infrastructure, WSP has provided our client with industry-leading expertise. WSP began work early to identify and mitigate key project risks and shape the overall project strategy to maximize value. WSP has been able to help our client understand and assess opportunities concerning combined heat and power (CHP), intermittent operation of electrolysis with renewables and project construction staging and planning for future expansion. WSP has further streamlined project efforts by leveraging its integrated teams to coordinate the design of both generation and hydrogen production facilities. This provides both simplicity to our client’s management of the project’s engineering and consistency in the engineering delivered. Lastly, WSP and our client have collaborated closely together throughout engineering to ensure the project meet’s our clients’ requirements.

Our value propositions

Global approach: Regional knowledge combined with global expertise to advance the project scope and mitigate project risk.

Expertise: WSP combined industry knowledge and in-house expertise to develop a unique application of hydrogen to methane process, combining knowledge components to make an overall effective solution for our client.

Local industry connections: WSP is working with our client to identify local opportunities for collaboration and connection creating added value for not only our client but the project region.

Life cycle approach: WSP leveraged decades of experience in completing large scale projects to identify risks and opportunities in this new industry. A deep understanding of project cycles—from conceptual scope to construction—allows WSP to highlight risks and potential gains early in the development to allow for positive outcomes for our client.

Hydrogen Refueling Stations with Supply of Sodium Chlorate Process Hydrogen



Client	ENGIE Impact
Location	Brazil
Project Value	Confidential
Status	Ongoing

Project description

Engie Impact is working for CMPC in the plant located in Guaíba, Porto Alegre, Brazil. For this, Engie Impact is evaluating taking a residual hydrogen product of the creation of sodium chlorate. Sodium chlorate and chlorine soda are inputs for the manufacturing process of CMPC's products.

The hydrogen capacity available at the plant is equivalent to 6,000 kgH₂/day, where in the first stage, it is expected to use 2,600 kgH₂/day to purify it, store it and dispose of it in 58 trucks per day that have bi-fuel engines.

For this reason, Engie Impact needs to know the minimum technical requirements of the project to subsequently tender the engineering. They hired WSP to determine the minimum technical requirements in the first stage and then move forward with the engineering.

WSP services

WSP's services included delivering a list and definitions of the technical minimums necessary for a plant of these characteristics, considering all the elements that are incorporated, such as tie-in, pre-purified compression, hydrogen purification, compression for storage and finally, the supply to trucks through 3 dispensers. We considered civil, electrical, mechanical, instrumentation, risk and constructive requirements.

Value provided by WSP

Brazil does not currently have clear legislation or regulations regarding hydrogen projects, so our direct client was able to give a clear guide in the development of this project, through our experience and support from other offices in HRS implementation.

Our value propositions

Innovation: This project allows us to start using hydrogen at the CMPC company level. This type of project is feasible in almost all of its 46 plants. Additionally, it sets a precedent at the national level and can be considered as a benchmark for the future development of standards and regulations related to green hydrogen in Latin America.

Client strategy: The client's strategy is to generate information for management decision-making to obtain financing and economic evaluations that allow these projects to be scaled in all CMPC plants.

Communication: For the development of the project, it was necessary to have very fluid communication between Engie Impact, CMPC (Guaíba) and WSP. We began with a field visit to get to know the facilities and conditions of the pilot project, meet the key CMPC personnel and collect the necessary information. After the visit, it has been a continuous communication process to adapt the conditions to the client's specific requirements.

Life cycle approach: For the project life cycle, it is essential to understand the steps and critical processes to size CAPEX and OPEX for the implementation/operation of the project. In this way, the end customer will present the project at the management level and be able to take a step toward implementing other plants at the corporate level.