



Transforming Energy with Hydrogen

HELPING OUR CLIENTS STAY AHEAD IN THE
ENERGY TRANSITION



Our Rankings

#1

Ranked most sustainable corporation among industry peers

2023 Corporate Knights Global 100

1%

Ranked among top 1% in the world on sustainable performance

2023 Corporate Knights Global 100

Net Zero

Carbon neutral for 2022 emissions, then net zero

Our Operational Pledge

2

Top 10 International Design Firms by Market - Water

ENR August 2023

5

Top 5 Green Design Firms by Sector - Manufacturing & Industrial

ENR September 2023

7

Top 10 International Design Firms by Market - Power

ENR August 2023

11

Top 150 Global Design Firms

ENR August 2023

14

Top 200 Environmental Firms

ENR July 2023

26

Top 50 Program Management Firms

ENR July 2023

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With your reading experience in mind, we have built in easy ways for you to navigate this document.

Use the top menu and the table of contents to flip to different sections. Watch for arrows, buttons, and underlined hyperlinks throughout the document; they will lead you to more information.

Our Business Operating Units

WITH OUR FIVE BUSINESS UNITS, WE ARE ABLE TO OFFER OUR CLIENTS A FULL-SERVICE CONSULTING AND ENGINEERING FIRM.

At Stantec, our team includes a global network of more than 28,000 employees located across 400 locations worldwide. Whether you need one service or many, we have specialists who can work with you and your team at every stage of your project's life cycle.

We help clients stay ahead of changes in their industries—working together to deliver innovative solutions for the longterm, with

solutions that are creative, custom, and cost-effective. We bring specialized industry experience that can save millions of dollars in cost, cut waste, increase production, and improve safety. Whether designing a facility, processing plant, or a pipeline, we provide efficient, reliable, and flexible solutions at a price that maintains your competitive advantage.

STANTEC'S BUSINESS LINES AND SERVICES



- Renewable Energy
- Power Delivery
- Mining
- Oil & Gas
- Dams & Hydroelectricity
- Load Balancing
- Fuel Conversion
- Battery Storage

- Airports & Aviation
- Civic/Municipal
- Commercial
- Education
- Geomatics
- Healthcare
- Industrial
- Science & Technology

- Permitting & Planning
- Regulatory Strategy
- Assessment & Remediation
- Brownfield Surveys
- Geotechnical
- Mitigation & Monitoring
- Construction

- Ports and Marine
- Bridges
- Community Development
- Roadways
- Transit & Rail

- Conveyance
- Storm Water Pollution Prevention
- Operations
- Water Supply
- Surface and Groundwater
- Planning & Management
- Water/Wastewater



Energy Transition

The Energy Transition is a global phenomenon. It is the simultaneous rapid evolution of multiple markets at a pace not seen since the Industrial Revolution over 200 years ago. It is revolutionizing how energy and resources are developed and consumed across markets. The Energy Transition is changing the nature of what infrastructure can do, mitigating our environmental impact, and unlocking potential for a cleaner, more efficient way of life.

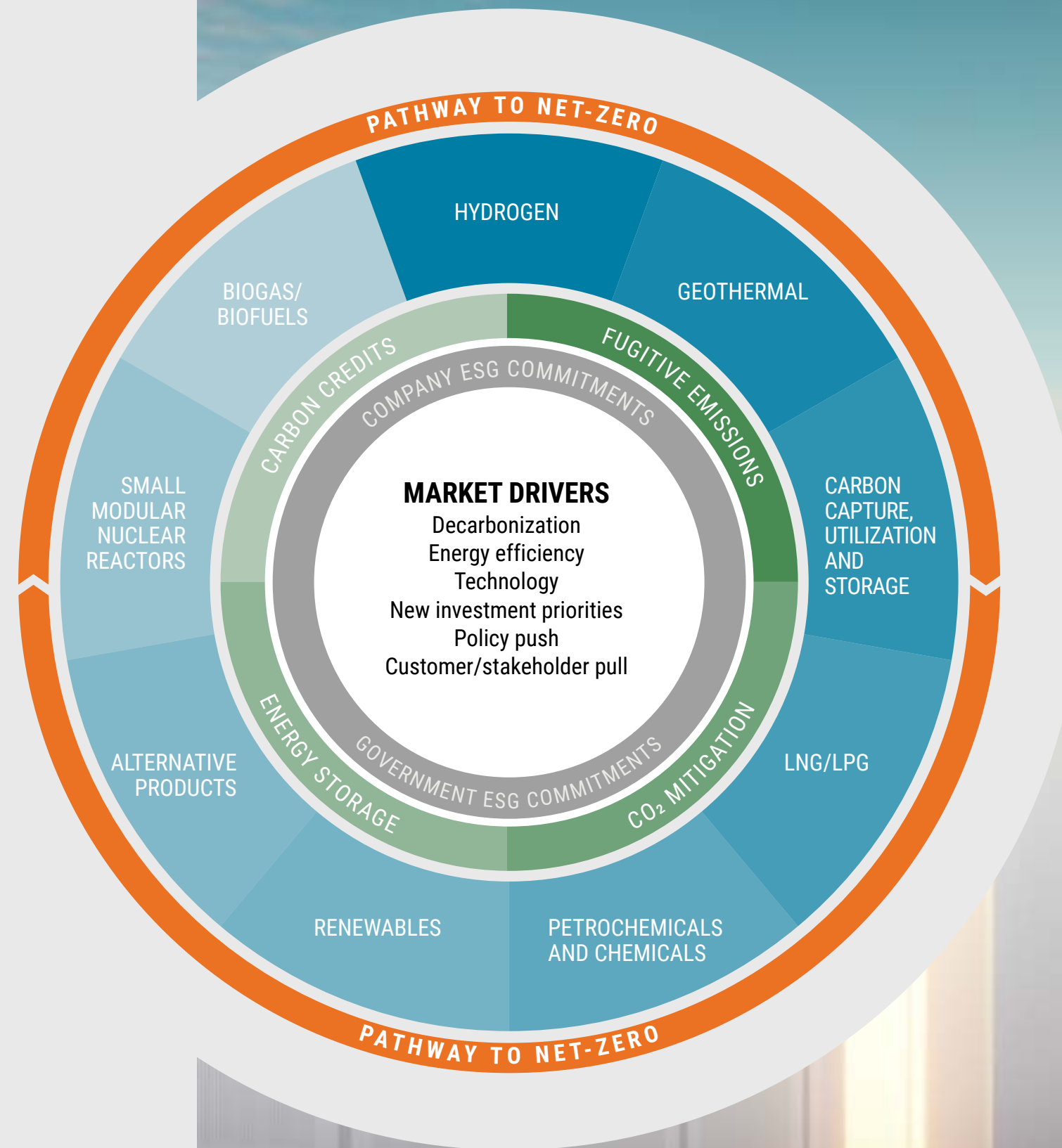
An important way that Stantec is advancing the Energy Transition globally is by helping

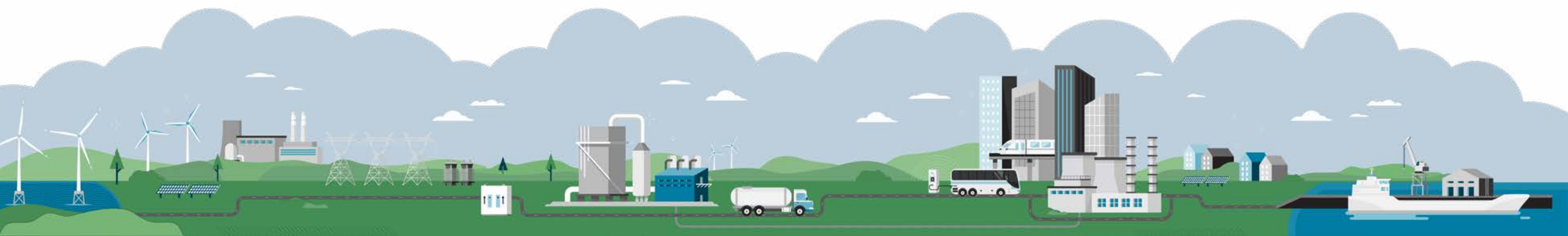
our clients to combat global climate change and achieve their environmental, social and governance (ESG) goals. We are working together to take action now to reduce Greenhouse Gas (GHG) emissions and strive towards a more sustainable future.

We help our clients with large scale decarbonization strategies and renewable energy schemes that will be necessary to achieve carbon neutrality.

Learn more

[Stantec ERA Issue 04: The Energy Transition Issue](#)





RENEWABLE ENERGY GENERATION → POWER DELIVERY → PRODUCTION → STORAGE AND DISTRIBUTION → END USE → PORTS
 NATURAL GAS AND CARBON CAPTURE

Hydrogen in the Energy Transition

HYDROGEN PLAYS A CRITICAL ROLE IN THE TRANSITION, WITH POTENTIAL FOR LOWER GHG EMISSIONS THAN NATURAL GAS.

We can implement cost effective and reliable ways to help you with production, storage, transport, and use of hydrogen.

With our history and diverse background in energy and natural resources, process engineering, water supply, infrastructure, and environmental services, our team can support expanding hydrogen infrastructure through each step in the process.

Learn more

[What is hydrogen's place in the energy transition](#)

[Understanding the Opportunity and Challenges of Hydrogen](#)

[Why is everyone talking about hydrogen?](#)

Hydrogen Production & Distribution

Hydrogen can be produced using different factor inputs and production technologies. These dictate the best green or blue hydrogen process deployment. We have project and design experience with all forms of hydrogen production processes from standalone packages to an integrated approach across the value chain.

Our diverse expertise includes:
→

FACTOR INPUTS

WATER

- Sourcing
- Intake
- Treatment

POWER

- Wind/Solar/Hydropower
- High voltage
- Transformer
- E-house
- Transmission lines
- Terminal stations
- Load balancing

PRODUCTION

ELECTROLYSIS (GREEN)

- Technology/supplier selection
- Modularization
- Control systems
- Balance of Plant (BoP)

NATURAL GAS PROCESSES (GRAY/BLUE)

- Steam methane reforming (SMR)
- Auto-thermal reforming (ATR)
- Partial oxidation (POX)

TRANSFORMATION

- Ammonia
- Liquid Organic Hydrogen Carrier
- Methanol
- Liquefaction

TRANSPORTATION AND STORAGE

CARBON CAPTURE (BLUE)

- Technology selection
- Design
- Subsurface storage
- Carbon dioxide monetization and monitoring

HYDROGEN STORAGE AND DISTRIBUTION

- Above and below ground
- Process safety
- Terminals
- Piping & valving
- Metering
- Fire detection

COMPRESSION

- Compressor
- Controls

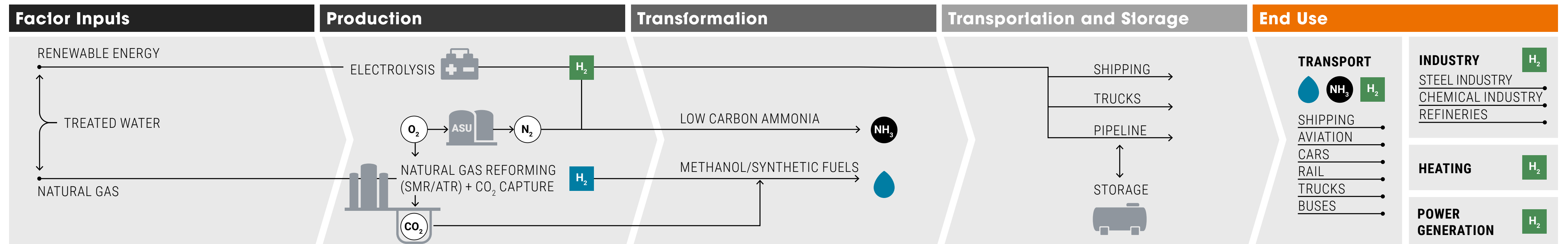
END USE

FUEL CELLS

- Mobile (Transportation)
- Stationary (Power Production)
- Large-scale electrification

HYDROGEN APPLICATIONS

- Pipelines
- HENG pipelines interface
- Steel, refining, petrochemical, and ammonia industries
- Mobility and process efficiency
- Lower GHG emissions
- Meet state and federal mandates





Gray Hydrogen

Gray hydrogen is derived from fossil fuels, such as natural gas or coal by using Steam methane reforming (SMR) and gasification, respectively. These energy-intensive processes generate a great deal of greenhouse gases, which are released to the environment. Currently this is the primary source of industrial hydrogen. However, in search of more sustainable fuel sources, markets are now moving toward blue and green hydrogen.

Blue Hydrogen

Over 95% of the world's hydrogen is produced using fossil fuels known as gray hydrogen, however, through the use of carbon capture technologies, gray hydrogen is labeled blue hydrogen. To certify and meet decarbonization targets, we can assist our clients in understanding the use and/or sequestration of captured CO₂.

Stantec has expertise in the key elements of blue hydrogen production using steam methane and auto-thermal reforming, partial oxidation units, and coupling the appropriate carbon capture and purification technologies to meet downstream needs. We can also model and develop hydrogen caverns and CO₂ storage reservoirs.

Green Hydrogen

With a global focus on decarbonization, there is growing interest in the production of green hydrogen to replace fossil fuels. To meet GHG compliance mandates, lower GHG footprints or meet market demands, we are at the forefront of the economics behind this conversion technology.

Key elements for developing a successful green hydrogen transition include; leveraging reliable and affordable renewable power, access to conditioned water supply, applying electrolyzer technology and integrating site ancillaries correctly. With these elements in mind, hydroelectric dams and wind and solar farms are ideal locations to install new green hydrogen production plants.

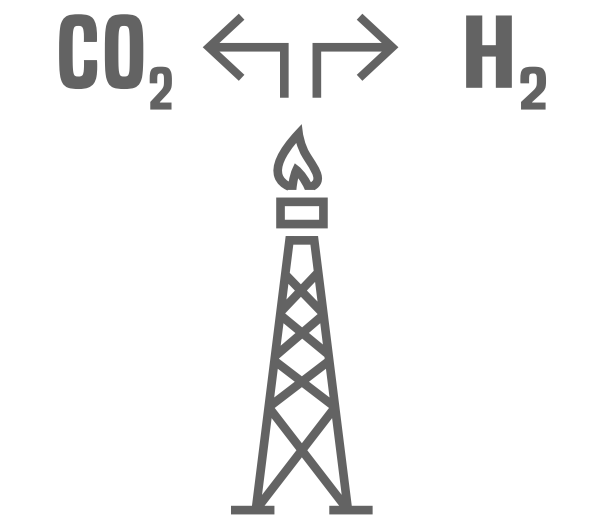
With Stantec's background in electricity production, distribution and conditioning; water intake, conveyance and treatment; process industries; and gas distribution and storage, we can support your projects throughout the entire value chain of green hydrogen development and production.

Learn more:

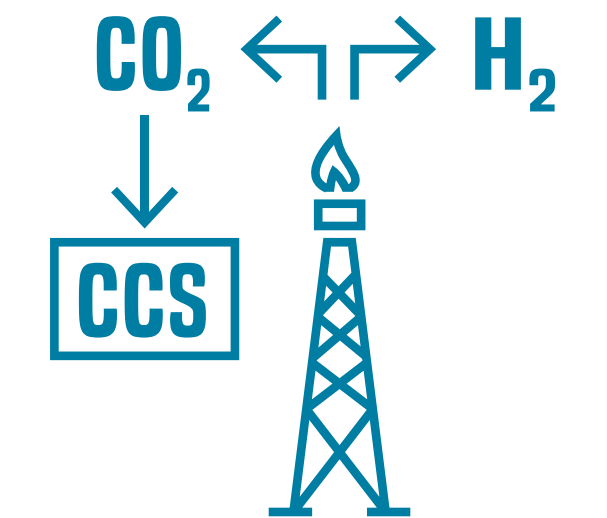
[Producing Hydrogen using Hydropower in the US](#)

[Eastern Promise: The compelling case for green hydrogen in Atlantic Canada](#)

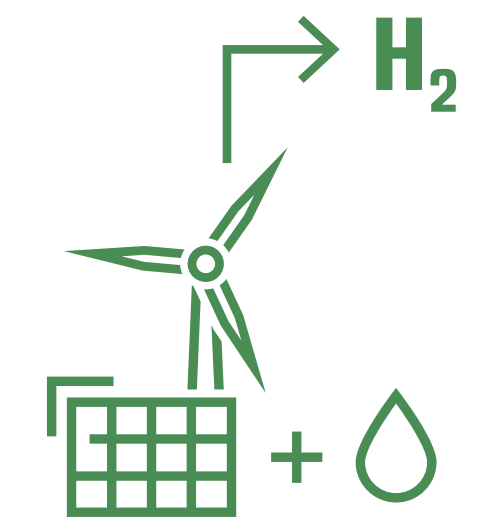
GRAY



BLUE

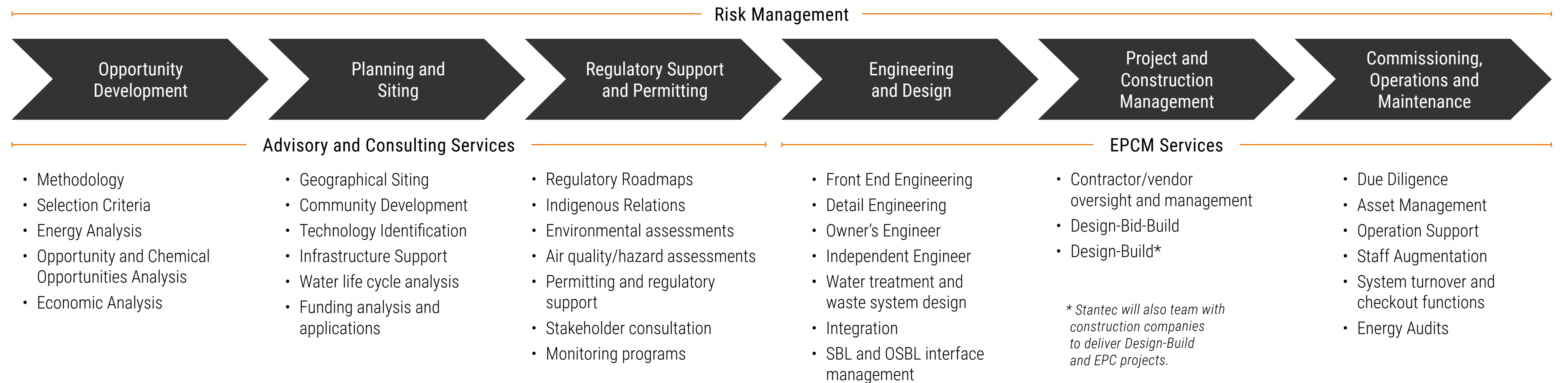


GREEN





Our Services



Advisory and Consulting Services

Recognizing the fundamental shift occurring across energy markets, businesses are accelerating plans to diversify by expanding their low carbon energy portfolios. But how do you determine which fuel supply is right for your business? What factors enable conversion and implementation? And how do you make projects viable that can sustain human and biological ecosystems?

Stantec is leading the way by helping our client's stay ahead of the changing energy landscape. Our team of experts evaluate macro and microeconomic issues to develop a path forward with you. We bring together business, economic, and technical experts to provide turnkey services in project development for green/blue hydrogen market applications.

Learn more:

[Solving for H: 4 challenges hydrogen experts are working to resolve](#)

HIGHLIGHTED SERVICES INCLUDE:

- Opportunity development
- Regulatory strategy, compliance, and permitting
- Market applications and assessments
- Factor input evaluation and technology selection
- Water Life Cycle Analysis
- Risk management
- Capital planning
- Process safety
- Unit integrity
- Innovating industrial processes
- Siting
- Internal and external stakeholder consideration and outreach
- Industrial water applications
- Evaluating electricity needs
- Supply contract negotiations
- Mapping/tracking future legislative changes and mandates
- Funding opportunities



Regulatory Compliance and Permitting

Stantec has vast experience delivering a wide variety of environmental resources documentation. We prepare technical environmental reports, such as constraints assessments, existing conditions reports, and environmental analysis compliant documents in conformance with local, state, and federal guidelines for hydrogen. Our team members have received project approvals in the most challenging regulatory environments. Our approach is to prepare environmental documentation that meets our client's needs, while cost effectively complying with local, state, and federal standards.

Our team members have in-depth knowledge of state and federal regulations protecting natural resources. We conduct agency and stakeholder consultation; prepare and implement technical resource studies that meet agency requirements; evaluate construction, operation and maintenance activities; and develop

minimization and avoidance measures, monitoring and reporting plans, and permit conditions.

As part of discretionary project review, we evaluate the regulations to determine exemptions and special conditions that may apply, and work with our clients to develop strategic permitting and regulatory compliance approaches. We prepare permit applications and supporting materials, facilitate contact and coordination with the permitting agencies, conduct stakeholder outreach and community engagement to identify issues early in the process.

Our contacts and working relationships with key agency personnel and knowledge of agency procedures are vital inputs to permit planning.

HIGHLIGHTED SERVICES INCLUDE:

- Representing clients at public hearings, meetings and workshops, internal department meetings, and coordinating with permitting agencies
- Preparing environmental analysis compliant project and alternative descriptions to support decision-makers' approval process (permitting strategy suggest incorporation of minimization measures to expedite environmental review and permitting)
- Evaluating policies for consistency and preparing cumulative impact analyses
- Preparing findings and participating in decision-maker hearings



Public Involvement, Outreach, and Stakeholder Consensus Programs

Many of our projects require implementation of a strong public involvement component. Our approach to public outreach involves constructively engaging stakeholders in a project dialogue that incorporates actions to develop better projects with local support, addressing stakeholder concerns, and resulting in increased approvals and successful project implementation. We have experienced staff working and collaborating with resource and regulatory agencies, non-governmental organizations (NGOs) and the public for infrastructure development projects. We maintain strong working relationships with agencies throughout the US and are familiar with their regulatory authority, preferred protocols and outreach methodologies, procedural timeframes, and understand how to determine public involvement and communication preferences.

HIGHLIGHTED SERVICES INCLUDE:

- Representing clients at public hearings, meetings and workshops, internal department meetings, and coordinating with local, state, and federal permitting agencies
- Preparing environmental analysis compliant project and alternative descriptions to support decision-makers' approval process (permitting strategy suggest incorporation of minimization measures to expedite environmental review and permitting)
- Evaluating policies for consistency and preparing cumulative impact analyses
- Preparing findings and participating in decision-maker hearings



Program Management

Program Management represents owners and provides independent program and project management solutions to public and private sector clients undertaking multi-project capital programs or a single, stand-alone capital project. We specialize in providing project planning, implementation, management, and control solutions for all types of projects in the following markets buildings, energy and resources, environmental, infrastructure, and water.

Our services are consistent with the best practices established in the industry and endorsed by the Project Management Institute. Our offering goes well beyond the scope of basic service delivery. We focus on delivering comprehensive services to our clients, recognizing that true value is measured in adaptability to need, comprehensiveness, and quality of service delivery.

CERTIFIED MANAGEMENT SYSTEMS

Stantec's Integrated Management System covers our business processes and is certified to internationally recognized standards.

ISO 14001:2015 ENVIRONMENTAL MANAGEMENT SYSTEM

Mitigates environmental risk, manages and monitors environmental performance, and is accountable for meeting emission-reduction targets

ISO 45001:2018 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM

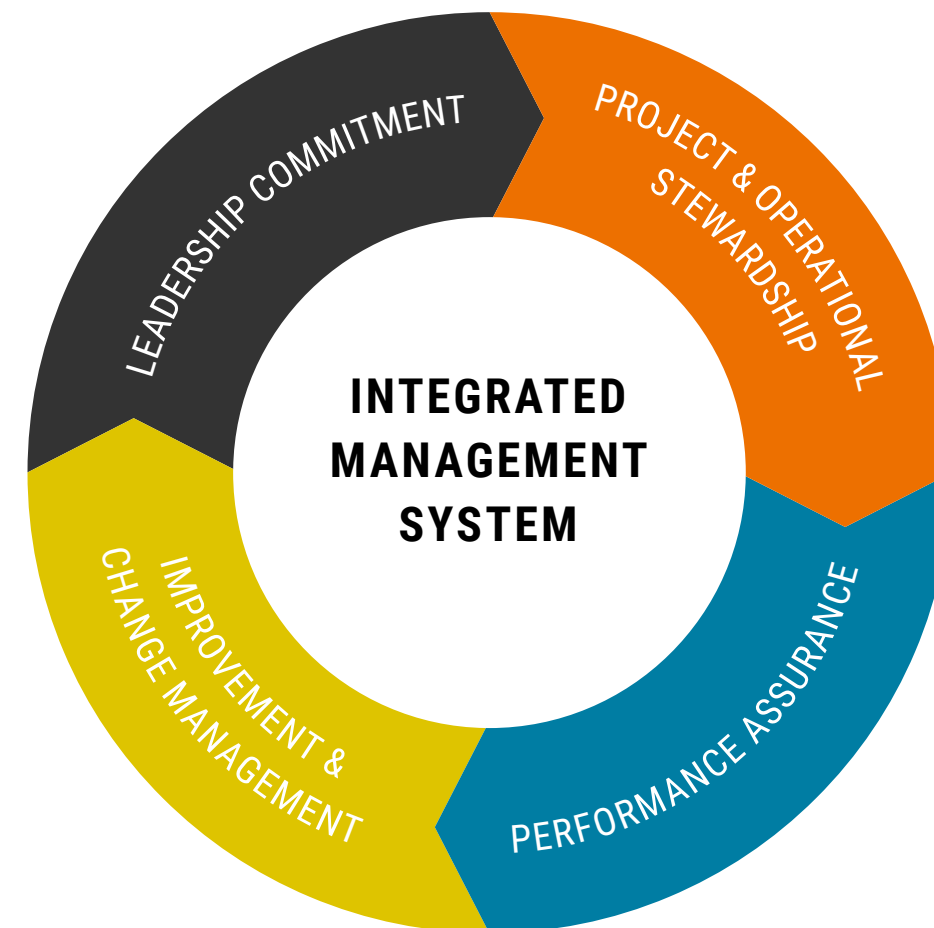
Aligns work processes, systems and behaviors to protect employees from injury and prevent property loss and environmental damage

ISO 9001:2015 QUALITY MANAGEMENT SYSTEM

Identifies and promotes consistent practices for our project teams, thereby improving productivity and efficiency, managing project risks, and promoting client satisfaction

ISO 20000-1:2018 MANAGEMENT STANDARD

Maintains data confidentiality, integrity, and availability



Renewable Energy Project Development

Renewables are the necessary power input for producing green hydrogen. We use an interdisciplinary approach to solve problems that integrate the work of our engineering scientific, economic, and regulatory experts to support energy transition and create effective solutions for complex environmental and natural resource management issues. Our understanding of the requirements associated with all phases of siting, permitting, constructing and monitoring for solar, on-and-off-shore wind, and other renewable projects, combined with natural resource economic principles, contributes to our success in assisting clients through the planning, permitting, construction, and operational processes. We create customized approaches and provide high quality service and outstanding sustainable business solutions.

Our staff is uniquely equipped to tackle the most complex environmental and natural resources management challenges—and provide inspiring outcomes.

HIGHLIGHTED SERVICES INCLUDE:

- Planning & siting
- Critical Issues Analyses
- Regulatory support & permitting
- Biological & cultural monitoring
- Phase I Environmental Assessments
- Engineering design
- Construction management
- Startup commissioning & testing
- Operations & maintenance



Water Supply and Treatment

As hydrogen becomes a key sector for energy transition, water sourcing, treatment, and wastewater disposal are becoming critical. Each hydrogen generation process requires varying levels of water, with green hydrogen generated from water electrolysis requiring the most. The blue hydrogen process utilizes water for carbon capture and cooling needs, where gray hydrogen generated from Steam methane reformation (SMR) requires high purity boiler feed water (BFW) to generate steam and cooling water to meet the evaporating needs.

We carefully consider how to realistically meet demand by identifying viable, sustainable, and socially acceptable water sources. In some cases, this may be alternate water sources such as industrial wastewater or seawater, which require additional treatment to

meet hydrogen plant water quality requirements. Hydrogen plant wastewater streams also need to be treated and disposed of in an environmentally and socially responsible manner.

Understanding the key role water plays in the hydrogen value chain, we provide strategic guidance and integrated services that not only support sound management choices but also assist in addressing future water demands, identifying feasible water sources, forecasting regulatory issues, supporting stakeholder integration, and developing balanced water portfolios.

WATER AND GREEN HYDROGEN

The electrolysis process requires purified water to generate hydrogen. Production of ~1kg of H₂ needs ~9kg of reagent water. The reagent water quality requirements are based on ASTM D1193:

- Type I (ultrapure) is recommended
- Type II (deionized) is required at a minimum

See table to right.

HIGHLIGHTED SERVICES INCLUDE:

- Conveyance and treatment design and engineering
- Surface and groundwater modeling
- Regulatory compliance
- Remediation
- Planning and Permitting
- Wastewater treatment
- Economic evaluations
- Water life cycle evaluation for hydrogen



ASTM STANDARDS FOR REAGENT WATER

Measurement (Unit)	Type I	Type II	Type III	Type IV
Resistivity (MΩ-cm) at 25°C	>18	>1	>4	>0.2
Sodium (ppb)	<1	<5	<10	<50
Chloride (ppb)	<1	<5	<10	<50
Total Organic Carbon	<50	<50	<200	N/A
Total Silica (ppb)	<3	<3	<500	N/A
pH Value	-	-	-	5-8

Natural Gas to Hydrogen

With over 230,000 MW of power generation projects completed, we have the knowledge and experience with a variety of fuel conversion applications. Our experience also includes working with major boiler and burner suppliers to integrate upgrades into existing power plants.

HIGHLIGHTED SERVICES INCLUDE:

- Process engineering
- Safety
- System Hazard Analysis
- Steam methane reformation (SMR)
- Autothermal reformation (ATR)
- Carbon capture technology evaluation
- Code review

- Third-party review and authentication
- Environmental assessment and permitting
- OEM interface/performance review
- Heat balance and thermodynamic modeling
- Existing BOP systems integration
- Controls interface
- Existing electrical system integration
- Review material compatibilities
- Construction and operation
- Commissioning/start-up/testing
- Compliance monitoring and reporting



Safe Hydrogen Design and Operation

Our focus on safety starts at the inception of a project, where we consider the human element of constructibility, operations, and maintenance along with system performance and best price options, using these priorities to guide our designs and recommend the best option.

Guiding innovation in North America, we can provide guidance and support through lessons-learned and evaluation of industry best practices executing hydrogen projects, working with technology providers, and by providing construction and operation management support. Leveraging our innovative technological experience, we can guide client choices with:

- Hydrogen industry recommendations
- Risk management
- Development of specifications and standards
- Compliance with with legislative mandates

The application of standards and specifications for water, conversion and electrical systems, plant layout, and piping, compression, storage, asset integrity, and safety interlocks will be followed.

HIGHLIGHTED SERVICES INCLUDE:

- Equipment and personnel safety
- Operational safety documentation
- Separation of gas classified areas from arc-producing electrical equipment
- Adequate grounding for static charge
- Mitigation of on- and off-site safety concerns
- Leakage evaluation



HENG Hydrogen-Blended Natural Gas Pipelines

Many of our clients are exploring the move to hydrogen-blended natural gas pipelines, and new emission regulations are encouraging hydrogen use. We see the value HENG would have on Brownfield and Greenfield pipelines to create a reliable infrastructure. There is a near-term opportunity to move hydrogen through pipelines by blending it with natural gas. However, safety and economics will dictate studies and design options to create viable and sustainable transportation options.

Stantec is a leader in pipeline and facility integrity management. We know how to provide world-class risk management services to meet local, state, and national requirements for facilities that process and transfer natural gas and hydrogen. For design, inspection and mitigation, our professionals can provide full life-cycle guidance on natural gas, hydrogen, hydrogen-blend, and CO₂ infrastructure.

We apply a holistic approach to evaluating hydrogen blends in pipelines and can advise our clients on how to anticipate, prevent, manage, and mitigate potentially dangerous and costly conditions associated with hydrogen transportation.

HIGHLIGHTED SERVICES INCLUDE:

- Facility and pipeline integrity
- Internal and external corrosion
- Cathodic protection
- Materials (including metallurgy, welding and fracture mechanics)
- In-line inspection
- Engineering assessments
- Third party audits
- AC/DC interference mitigation
- SCADA
- Blending and de-blending evaluation

Learn more:

[Asset integrity: Key considerations for blending hydrogen in your pipeline](#)



Carbon Capture, Utilization, and Storage

CCUS is the key to what makes blue hydrogen blue. By capturing and storing (or using) the resulting carbon, the resulting carbon footprint is lower. Whether our clients are looking for support with permitting, planning, regulatory strategy, feasibility studies, technology selection, or a detailed design and long-term monitoring, Stantec has proven in-house carbon capture and utilization capabilities to help maximize production using existing assets. Through efficient energy audits and employing jurisdictional and industry best practices, our team helps clients meet local, national, and global regulatory and sustainability goals and mandates.

PROJECT PLANNING

- Feasibility Studies (FEED, FEL, etc.)
- Technology review and selection
- Opinion on probable cost
- Conceptual design and component re-use
- Economic and risk evaluations
- HAZOP and HAZID reviews
- Reservoir evaluation
- Underground injection
- Pilot plant planning

ENVIRONMENTAL

- Regulatory strategy
- Due diligence
- Natural resource and water quality
- Regulatory and permitting
- UIC well permitting & monitoring
- Permit compliance
- Air Quality & GHG emissions
- Stakeholder consensus
- Public outreach

ENGINEERING

- Conceptual design and engineering
- Mechanical
- Electrical
- Process/Chemical
- Process and performance modeling
- Civil
- Structural
- Instrumentation & Controls
- Facility, worker, and offsite impact safety controls

INTEGRATION

- Merging technology developers with emission emitters
- Developing relationships between compatible industries
- Maintaining community and stakeholder support



Fueling and Terminal Infrastructure

Stantec leads the industry in providing design, consulting, and engineering services for vehicle/fleet fueling infrastructure, serving 200+ fleet clients with 300+ projects. Our hydrogen facility experience includes assessing feasibility of alternate delivery modes—such as onsite generation from water electrolysis and steam-methane reforming—as well as considering fueling infrastructure using traditional systems that use or can be retrofitted to use liquid hydrogen. In addition to early-phase analysis projects, Stantec is experienced with permitting, design, and engineering for hydrogen fueling infrastructure.

ZEVDDECIDE™

We use ZEVDdecide™, a modeling tool composed of multiple modules, to provide solutions tailored to your needs. Using ZEVDdecide™, we can predict the performance of zero-emission vehicle fleets, including hydrogen-based ones. We can project total fuel demand, determine charging schedules, and

access fueling/charging station recommendations and power requirements.

HIGHLIGHTED SERVICES INCLUDE:

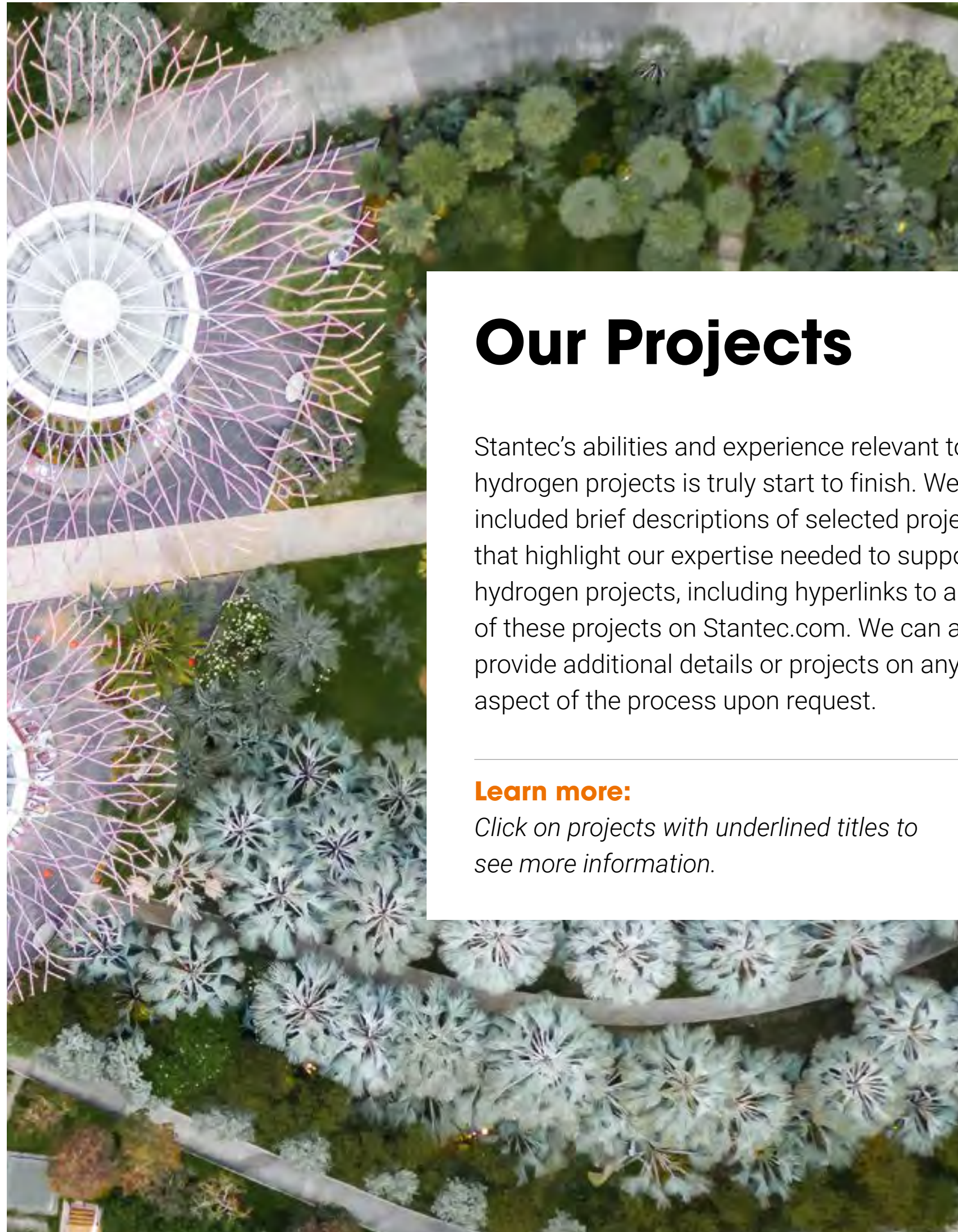
- Programming and investigation for market-specific applications and facilities
- Construction-cost estimating and feasibility analyses
- Obtaining building and safety plan-check approval
- Recommending fueling-equipment packages
- Construction-phase assistance for contractor compliance with the project requirements
- Testing during commissioning and operations

Learn more:

[Demystifying Hydrogen Fueling for Transit Fleets](#)

[ZEVDdecide™](#)





Our Projects

Stantec's abilities and experience relevant to hydrogen projects is truly start to finish. We've included brief descriptions of selected projects that highlight our expertise needed to support hydrogen projects, including hyperlinks to a few of these projects on Stantec.com. We can also provide additional details or projects on any aspect of the process upon request.

Learn more:

Click on projects with underlined titles to see more information.

Green/Blue Hydrogen

GREEN HYDROGEN

BIOMASS TO HYDROGEN PROJECT

California

Stantec is supporting Tule River Economic Development Corporation (TREDC) and Kore Infrastructure with the development of the conceptual engineering for a modular, forest biomass-to-carbon-negative hydrogen production facility. The project will generate two to four tons/day of fuel cell-quality hydrogen per day and the carbon will be trapped as biochar. Partial funding is through the California Department of Conservation Grant under the Forest Biomass to Carbon-Negative Biofuels Pilot Program. Stantec will continue with Front-End Engineering Design. If the project is funded, construction is expected to begin by mid-2024, and the facility should be operational by the second half of 2025.

GREEN HYDROGEN USE POTENTIAL STUDY (WORLD BANK)

South Asia

With only 10% of their hydropower being used, Stantec completed a study for a South Asian country to improve their hydrogen potential. The study looked at increasing hydrogen production through the use of hydropower as well as GHG reduction

strategies. Our team assessed the mobility sector, energy use, and the opportunity for converting the sector to hydrogen. We also assessed power requirements for the country to generate hydrogen, to convert all residential cooking to hydrogen, and for a 1000 tonne a day ammonia plant for export. In conclusion, our team found that the potential is adequate for the country's future vision.

GREEN HYDROGEN MARKET STUDY FOR MAJOR UTILITY

Ontario, Canada

Stantec completed several hydrogen studies for a power producer in Ontario. The first study was a presentation on the hydrogen market in North America which was followed up by a study detailing the hydrogen market in Ontario including government funding and incentives. Stantec also completed a zero-emissions bus (ZEB) analysis and assessment which included the suitability for hydrogen infrastructure.

GREEN 4 MW HYDROGEN PRODUCTION PLANT

Europe

Stantec supported the development of a 4 MW hydrogen production plant in Europe. Our scope of work included reviewing the production site, geotechnical and environmental assessments, factor inputs,

and permitting. Future work will include scoping and engineering expertise on the electrolyzer integration as well as reviewing and making a recommendation for the hydrogen distribution (pipeline and truck).

CONFIDENTIAL 5 GW OFFSHORE WIND TO HYDROGEN AND AMMONIA PRODUCTION

Nova Scotia, Canada

Stantec supported the development of 5 GW offshore wind to hydrogen and ammonia production facility for domestic and potential export use. Our scope of work included power production, distribution, framework development, and offtakes assessments for international markets.

2GW WIND TO HYDROGEN AMMONIA PROJECT

Newfoundland & Labrador, Canada

Stantec has completed project environmental registration and subsequent comprehensive environmental impact assessment with supporting flora/fauna field studies for World Energy GH2. Additional services have included concept electrical engineering and power system studies, concept water supply and water disposal, with assessment of existing water supply infrastructure at the former paper mill site.

BLUE HYDROGEN

CONFIDENTIAL BLUE HYDROGEN FACILITY

Louisiana

Stantec is providing due diligence and preliminary engineering services to support a confidential oil & gas client's acquisition of several parcels in Louisiana and planned development of a blue hydrogen facility which will support a nearby refinery. Stantec's services include critical issues analysis and evaluation of the properties for environmental considerations including Phase I, wetlands, T&E species, cultural resources, and air discharge.; civil requirements such as geotechnical, ALTA surveying, traffic, and utility planning; development of a permitting matrix; and a preliminary engineering evaluation for the facility including sizing and siting of equipment, block flow diagrams, and piping under a major river.

BLUE/GREEN HYDROGEN AND AMMONIA OPPORTUNITIES EVALUATION

North America

Stantec provided advisory services to an international resource development company on green/blue hydrogen and ammonia opportunities in North America. Our team provided technology and

commercial evaluations, preliminary siting for projects, CO₂ capture and sequestration technology and commercial evaluations, and CO₂ regulatory overview for North America.

ALBERTA POWER LIMITED (HEARTLAND)

Alberta, Canada

Our client decided they wanted to increase the volume of hydrogen produced by using auto thermal reforming. Stantec was engaged to verify information received from the technology licensor as well as provide advisory and technical services on implementation and commercial and technical decisions. We also evaluated processes to recover and sequester the CO₂, provided OSBL engineering support, and provided a Class IV cost estimate.

SCOPING STUDY FOR DEMONSTRATION PLANT, PROTON TECHNOLOGIES

Alberta, Canada

Stantec completed a study in 2020 to assess oxygen needs and hydrogen production, purification, safety and handling options using in-situ reforming and gasification. We are the ongoing selected service provider providing technical and economic specialist services for the commercial phase.

BLUE HYDROGEN (SMR) FEASIBILITY STUDY

Canada

Stantec advised a client on the CO₂ abatement opportunities with a 25 MMSCFD blue hydrogen plant to support steam and heat demands of a seed crushing refinery. Consultation included CapEx/OpEx estimates, material balance flowsheets, and economic viability of two different blue hydrogen plant configurations.

BLUE HYDROGEN (SMR) FEASIBILITY STUDY

Canada

Stantec advised a client on the CO₂ abatement opportunities with a 95 MMSCFD blue hydrogen plant to support steam and heat demands of methanol plant. Consultation included CapEx/OpEx estimates, material balance flowsheets, and economic viability of the process.

Compression and Storage

ENERGY STORAGE SYSTEM FOR MICROGRID

Southern California

Stantec completed a feasibility study to improve reliability of the power supply to a town in California. We worked closely with our utility client to evaluate historical data to

determine power requirements, outages duration, future growth projection, and impact of an existing solar EV and battery storage system. We evaluated sizing of units for hydrogen energy storage system (HESS) and battery energy storage system (BESS); equipment CapEx estimates for a dozen capacity cases, calculated in consultation with equipment suppliers; and comparison of different hydrogen storage options. The study concluded with the CapEx comparison of HESS versus BESS for a range of storage times from 12 hours to 48 hours, with HESS cases having the lower equipment CapEx cost. The HESS main process units include hydrogen production (electrolysis), compression, storage, and power conversion (fuel cell). The work completed will provide key information to the utility to continue definition of the best HESS to increase the power supply and microgrid reliability for the community.

Pipelines and Integrity

NATURAL GAS/HYDROGEN PIPELINE ASSESSMENT FOR CONFIDENTIAL CLIENT

Alberta, Canada

Stantec prepared a hydrogen analysis for existing infrastructure and considerations for building new gas pipelines for future hydrogen transport.

LARGE-SCALE HYDROGEN DE-BLENDING STUDY, PHASE I

Canada to United States

Stantec supported the first phase of a large-scale hydrogen/natural gas de-blending feasibility study with a major pipeline operator. The de-blending plant was evaluated to process 1.6 billion standard cubic feet per day (BCFD) of a blended hydrogen and natural gas composition. The objective was to determine the technical and commercial viability of a hydrogen recovery process at this scale. Two blend cases were explored: 5% and 20% volume hydrogen into the natural gas stream, with hydrogen volumes up to 320 MMSCFD.

Phase I of the study involved a qualitative evaluation of hydrogen extraction technologies, estimation of high-level capital and operating costs, preliminary equipment lists, process schematics, and potential downstream impacts on natural gas and natural gas liquids (NGLs) customers.

Fueling and Terminal Infrastructure

HYDROGEN FUELING STATION DESIGN, ENGINEERING, AND PERMITTING SERVICES

California

Stantec is currently assisting a major retail fuel client with design, engineering, and permitting for the development of hydrogen fueling at up to 30 new and existing service station sites across California. Stantec's services include design for hydrogen delivery, storage, and dispensing at the selected properties. We evaluate future vehicle circulation for fuel deliveries, confirm adequate electrical power, and are assisting with the installation of dispensing equipment and associated canopies. We are providing up front site research and assessments to aid with site selection, preliminary site layout and design consisting of site plan and layout for H2 compound and dispensers, architectural renderings, landscaping, site plans, and construction documentation. We are also currently providing permitting support for gaining approval from the cities with jurisdiction at each proposed location.

SHELL HYDROGEN FUELING FACILITY FEASIBILITY STUDIES

California

Stantec conducted a feasibility review of five proposed hydrogen fueling facilities in California. The feasibility study consisted of a review of planning & zoning requirements for each site; entitlements, permitting requirements, and timeline; utility availability, sizing and connection capabilities; site layout/accessibility for potential site demolition, construction and future H2 fuel deliveries.

LIVERMORE-AMADOR VALLEY TRANSIT AUTHORITY

Livermore, California

Stantec is providing design engineering for hydrogen fueling infrastructure for 68 FCE Buses. Leading the technical development of a hydrogen fueling facility that is planned to support two quantities of FCE buses. Project scope includes preparation of 60% complete design documents, with the selected contractor scoped to complete the drawings. The Phase 1 design will accommodate up to 40 initial FCE buses and will include a 15,000-gallon cryogenic-hydrogen storage tank, three high-pressure H2 liquid pumps (any two of which can operate at a time with the third as a rotating spare), two heat exchanger an integrated high-pressure storage buffer and valve panel

and two hydrogen dispensers for providing H35 fills to FCE buses in the existing service lanes. One of the fueling lanes will also be equipped with an H70 dispenser fueling for light-duty FCE vehicles. For Phase 2, the facility is planned to add a second 15,000-gallon hydrogen tank, which will be connected to the LH2- header supply that feeds the three cryogenic pumps.

TRIDELTA TRANSIT

Contra Costa County, California

Stantec is leading the technical development of a hydrogen fueling facility that is planned to support two quantities of FCE buses. Project scope includes preparation of 100% complete design documents, including plan-check approval. The Phase 1 design will accommodate up to 45 initial FCE buses and will include a 15,000-gallon cryogenic-hydrogen storage tank, two high-pressure H2 liquid pumps (of which can serve both dispensers, with the other as a spare), two heat exchanger an integrated high-pressure storage buffer and valve panel and two hydrogen dispensers for providing H35 fills to FCE buses in line with the two existing service lanes.

RTC OF SOUTHERN NEVADA HYDROGEN FUEL CELL BUS FUELING FACILITY

Southern Nevada

Stantec is providing comprehensive planning and design engineering for a hydrogen fueling facility suitable to support 50 FCE buses. Our scope includes assessment of options for supplying the facility with cryogenic-liquid hydrogen or producing hydrogen gas onsite. This assessment includes consideration of CapEx, and OpEx factors such as equipment, construction, utility upgrades, electrical energy and demand, and contracted maintenance. Selected hydrogen-delivery method will be the basis for 100% design engineering for the fueling facility, which is planned to include two high-flow dispensers in the service lanes providing 'H35' fills and connection to the existing fuel management system. Due to the accelerated delivery of initial FCE buses, the project also includes design engineering for a temporary hydrogen-fueling facility that will be sized to fuel up to four FCE buses nightly, using gaseous tube-trailer delivery of hydrogen.

Regulatory and Permitting

B.C. HYDROGEN REGULATORY MAPPING STUDY

British Columbia, Canada

Stantec prepared the B.C. Hydrogen Regulatory Mapping Study to identify the current gaps, opportunities, and barriers to establishing an efficient and effective regulatory framework for advancing clean hydrogen projects in British Columbia. To illustrate how different regulatory approvals may apply, the study examines six representative low carbon hydrogen projects with different production pathways. Additionally, the study identifies the key stakeholders who may be involved in the regulation of hydrogen in B.C. This study will help to advance a key objective of the government's BC Hydrogen Strategy—the blueprint for using low-carbon hydrogen to help decarbonize sectors of the economy, achieve climate goals, and support an emerging clean technology sector.

SOUTH SAN FRANCISCO HYDROGEN PROJECT, ENVIRONMENTAL PERMITTING SERVICES

South San Francisco, California

Stantec recently provided environmental and permitting services to a confidential client for the construction and operation of a

proposed grey hydrogen project in the San Francisco Bay area. The project would include construction and operation of a steam methane reformer unit on an idle industrial property. The project would also include construction of a hydrogen fueling station to serve light and heavy-duty vehicles. Stantec completed an environmental site assessment, permitting services through the local agency and air permitting services with the Bay Area Air Quality Management District. Key environmental issues analyzed as part of the project's environmental impact assessment included construction and operations-related air emissions, public safety considerations, airport safety, noise impacts, lighting, and traffic impacts to surrounding roadways.

WASHINGTON GREEN HYDROGEN PROJECT, ENVIRONMENTAL PERMITTING SERVICES

Washington

Stantec is currently preparing a permitting strategy and permitting schedule for a proposed green hydrogen facility and pipeline project within the State of Washington. Stantec permitting strategy will emphasize the permitting process through the Washington Energy Facility Site Evaluation Council (EFSEC). The proposed green hydrogen facility would provide a foundation for the development of a Pacific

Northwest green hydrogen hub. Stantec's experience with siting energy projects in Washington, strong relationships with key regulatory agencies, and depth of local resources will make Stantec a valuable partner in successfully permitting this important green hydrogen project. Stantec's team has in-depth knowledge of green hydrogen manufacturing and transport, permitting requirements, energy facility siting, Washington EFSEC review process, and Washington State Environmental Policy Act (SEPA) and National Environmental Policy Act (NEPA) requirements.

Water Supply and Treatment

UK WATER INDUSTRY RESEARCH (UKWIR) INTEGRATING AND PRODUCING HYDROGEN

United Kingdom

The UK Hydrogen Strategy outlines the journey towards a low-carbon hydrogen sector in the UK—delivering an ambitious 10GW of low-carbon energy by 2030, while supporting net zero emissions by 2050. Stantec led this project which explored the impacts and opportunities relating to these ambitions on the water sector. The project provides an industry-level understanding of how water utilities can contribute within the

hydrogen value chain and the current sector ambition in relation to the UK Hydrogen Strategy. The project reviewed the various technology options available, their associated water demand and impacts both regionally and nationally. It also considered integration with energy and infrastructure requirements, and a high-level appraisal of economics, business models, and commercial viability to develop and operate facilities.





We are where you are.

WE'RE ACTIVE MEMBERS OF THE COMMUNITIES WE SERVE. That's why at Stantec, we always design with community in mind. We collaborate across disciplines and industries to bring buildings, energy and resource, and infrastructure projects to life. Our work—professional consulting in planning, engineering, architecture, interior design, landscape architecture, surveying, environmental sciences, project management, and project economics— begins at the intersection of community, creativity, and client relationships.

Since 1954, our local strength, knowledge, and relationships, coupled with our world class expertise, have allowed us to go anywhere to meet our clients' needs in more creative and personalized ways. With a longterm commitment to the people and places we serve, Stantec has the unique ability to connect to projects on a personal level and advance the quality of life in communities across the globe.

28k

Employees

400+

Locations globally

6

Continents

