

---

# Leading Energy Transition with Biogas Utilization



# About Stantec

**28k** Employees  
**400+** Locations globally  
**6** Continents

**#1** Architecture Engineering Firms, BD&C August 2023  
**#4** Top 10 Design Firms in Power - Hydro Plants ENR December 2022  
**#5** Design Firms by Sector - Manufacturing & Industrial, ENR September 2023

**#2** International Design Firms by Region - United States, ENR August 2023  
**#7** Top 225 International Design Firms, ENR August 2023  
**#2** Industrial Sector Architecture + AE Firms, BD&C September 2022

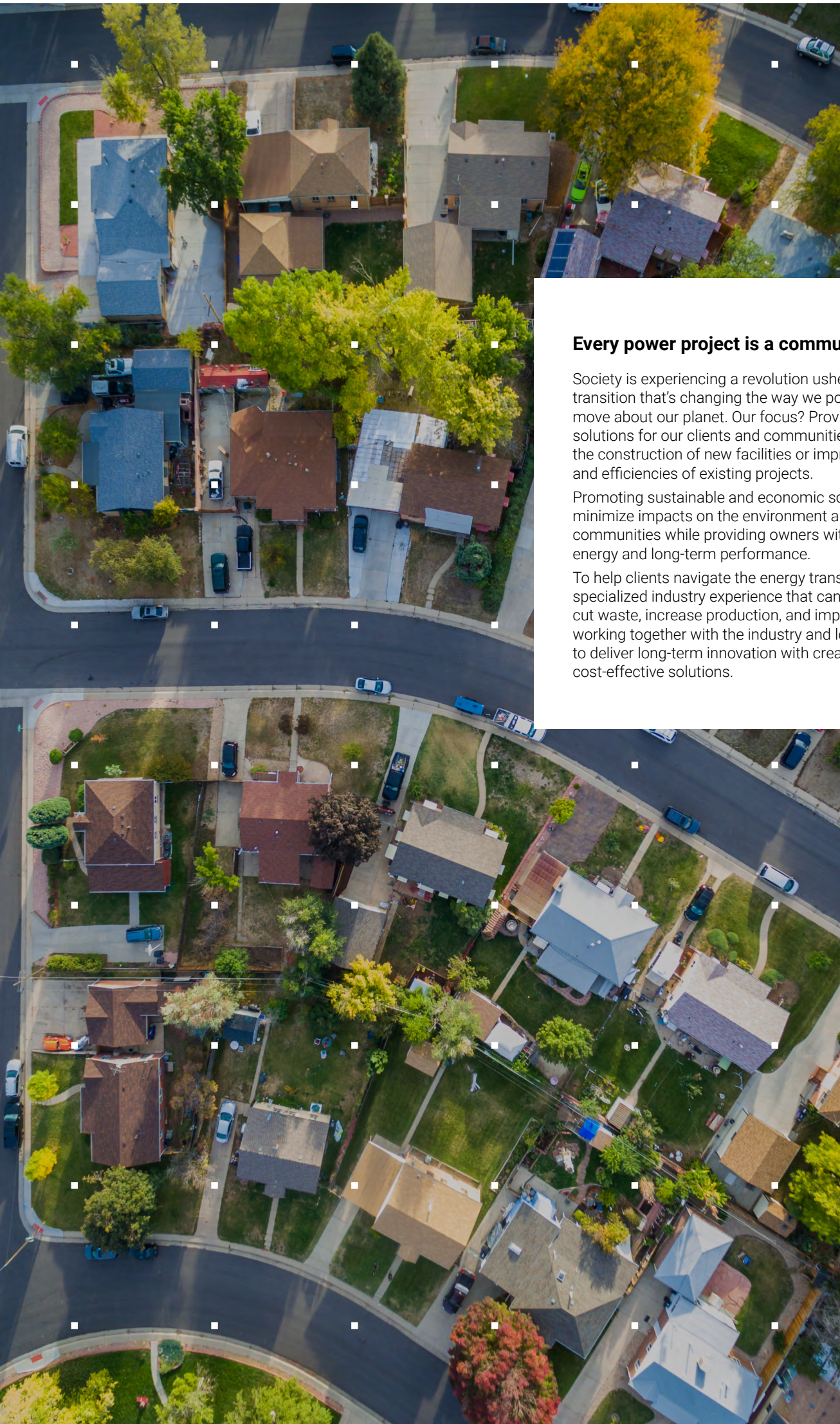
**#6** Environmental Firms by Type of Work - Consulting/Studies ENR July 2022  
**#3** Hydro Plants ENR July 2022  
**#8** Environment - Water Treatment, Desalination Plants ENR July 2023



With your reading experience in mind, we have built interactive material into this document. Watch for buttons and underlined hyperlinks throughout the document, they will lead you to more information.

# Table of Contents

<b>OUR BUSINESS OFFERINGS</b>	<b>3</b>
<b>ENERGY TRANSITION</b>	<b>4</b>
<b>OUR SERVICES</b>	<b>6</b>
WASTE TO ENERGY	7
PROJECT ADVISORY AND CONSULTING SERVICES	8
BIOGAS PRODUCTION & UTILIZATION	8
HYDROGEN PROJECT COMPONENTS	9
CARBON CAPTURE, UTILIZATION AND STORAGE	9
RENEWABLE ENERGY PROJECT DEVELOPMENT AND PERMITTING	10
REGULATORY COMPLIANCE AND PERMITTING	10
PUBLIC INVOLVEMENT, OUTREACH, AND STAKEHOLDER CONSENSUS PROGRAMS	11
PROGRAM MANAGEMENT	11
<b>OUR RELEVANT EXPERIENCE</b>	<b>12</b>



**Every power project is a community project.**

Society is experiencing a revolution ushered in by an energy transition that's changing the way we power, live on, and move about our planet. Our focus? Providing sustainable solutions for our clients and communities, whether through the construction of new facilities or improving the safety and efficiencies of existing projects.

Promoting sustainable and economic solutions, we minimize impacts on the environment and surrounding communities while providing owners with clean, reliable energy and long-term performance.

To help clients navigate the energy transition, we bring specialized industry experience that can save millions, cut waste, increase production, and improve safety. We're working together with the industry and local communities to deliver long-term innovation with creative, custom, and cost-effective solutions.

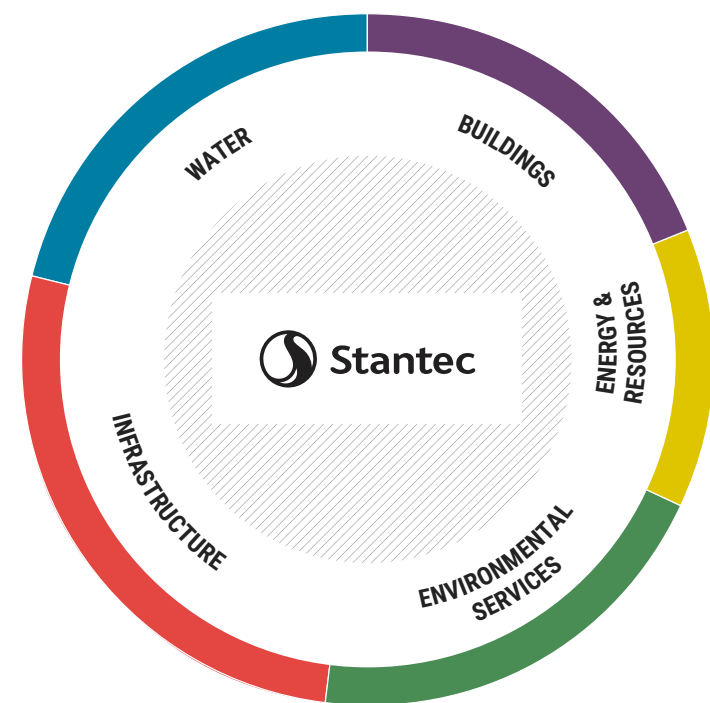
# Our Business Offerings

**With our five business units that operate seamlessly together, we are able to offer our clients turnkey environmental and engineering consulting services.**

At Stantec, our Energy Team includes over 2,000 professionals to support and guide our clients through the energy transition. This team is part of our global network of 28,000+ employees located across 400 locations worldwide. We help clients stay ahead of changes in their industries—working together to deliver innovation for the long-term, with solutions that are creative, custom, and cost-effective. We bring specialized industry experience that can save money, cut waste, increase production, and improve safety. Whether permitting, engineering, constructing, or managing a project, we provide efficient, reliable, and flexible solutions while considering cost and schedule, and maintaining your competitive advantage.



**Stantec's Business Lines and Services**



**BUILDINGS**

- Airports
- Civic
- Commercial
- Education
- Health
- Industrial**
- Science & Technology
- Workplace

**ENERGY & RESOURCES**

- Energy**
- Mining, Minerals, and Metals

**ENVIRONMENTAL SERVICES**

- Buildings
- Community Development
- Mining
- Oil & Gas
- Power**
- Transportation
- Water

**INFRASTRUCTURE**

- Airports
- Bridges & Structures
- Land Development
- Municipal
- Parks & Open Spaces
- Ports & Marine Terminals
- Roadways
- Smart(ER) Mobility
- Transit & Rail
- Urban Places

**WATER**

- Conveyance
- Industrial Water
- Management & Technology Consulting
- Waste Management
- Wastewater Treatment
- Water Resources
- Water Treatment
- Wet Weather Flow & Urban Stormwater



# Energy Transition

Energy Transition is a global phenomenon. It is the rapid evolution of multiple markets at a pace not seen since the Industrial Revolution. It is not only the evolution from conventional to renewable generation, it is driving fundamental changes across energy and energy-dependent markets to lower carbon emissions. Impacting much more than the shift in energy sources and production, the Energy Transition is revolutionizing how energy and resources are developed and consumed across markets. It is changing the nature of what infrastructure can do, mitigating social and environmental impacts, and unlocking potential for a cleaner, more efficient and sustainable way of life.

At Stantec, we're advancing the Energy Transition globally through helping our clients achieve their goals in:

- Safety
- Biogas production and upgrading
- Biogas to combined heat and power
- Energy conversion
- Carbon capture, utilization, and sequestration
- Technology assessment and selection
- Renewable portfolio standards
- Renewable Fuel Standard Credits (RIN Credits)
- Low Carbon Fuel Standard Credits
- Alternative fuel development
- Distributed energy resources
- Environmental, social, and governance action planning
- Sustainability
- Climate action
- Electrification
- Resilience
- Master planning
- Stakeholder Consensus
- Community Acceptance



CH<sub>4</sub>

# Biogas in the Energy Transition

**Biogas plays a critical role in the transition. As a drop-in replacement for fossil fuels, biogas permits seamless transition for end users.**

With our history and diverse background in energy, natural resources, and renewables, we can support expanding RNG infrastructure development through:

- Feedstock identification and characterization
- Front end engineering and process selection
- Capital cost estimating
- Grant identification and application
- Digester design and biogas refining technology
- Natural gas pipeline interconnects
- Nutrient densification and distribution

## Thought Leadership

As leaders in the rapidly growing field of hydrogen, Stantec's experts are sharing their knowledge at conferences, in peer-reviewed journals, and technical publications. Below are a few examples of our Stantec.com-hosted content including blogs and a Webinar about the opportunities and challenges of hydrogen. From production to end use, Stantec has the experts and knowledge to complete any type of biogas project.



The potential of biogas in the energy transition.



Click topics for more details.

### Continuing Advances in Wastewater to Energy Technology

How thermal hydrolysis accelerates digestion to efficiently process wastewater while recovering valuable resources.



Full Steam Ahead with Thermal Hydrolysis Process (THP)

### Water and Energy: A symbiotic relationship

Water and energy are critical to human life. They are intrinsically tied together, and innovation, demand, and limited resources affect both.



### The Future of Resource Recovery

How can we implement nutrient and energy recover technologies while maintaining fiscal responsibility?



Atlanta Metro Integrated Biosolids and Zero Waste Program Webinar.

Integrating biogas into our energy infrastructure can reduce greenhouse gas emissions while also combating the global water and landfill crisis.

**How can biogas power our communities more sustainably?**

# Biogas

Our experience includes production of biogas through collection, gasification, and anaerobic digestion to generate energy. With projects ranging from major capital projects to controls upgrades to existing plants, our experts also provide services related to Gas Storage and Processing (RNG) and Heat and Power Generation.

## CONSULTING/APPLICATIONS

- Project Development Support—Flow diagrams;
- Site Layouts and General Arrangements
- Heat & Mass Balance
- Optimization Studies
- Studies and Economic Analysis
- Power System Modeling(short circuit/coordination analysis)

## ELECTRICAL, CONTROLS & INSTRUMENTATION

- PLC/Distributed Process Control Systems
- PLC/Computer Programming
- Burner Management/Boiler Control Systems
- Equipment/Instrumentation Specification
- Boiler Control
- High Voltage Power Transmission Systems
- Vibration Monitoring Systems
- VF Drive Retrofits
- Main Power Output Systems (generator exciters, stepup transformers)
- Station Service System (transformers, motor controlcenters and cabling)
- SCADA Systems
- Communications Systems
- Electrical System Protection
- Control and Metering Design

## MECHANICAL

- Facility Layout
- Equipment Specification
- Material Handling/Storage Systems
- General Building Heating/Ventilating/Air Conditioning
- Electric Room/Test Lab/Control Room Air Systems
- High Temperature/Pressure Piping Systems
- Fuel Transport Piping Systems
- Electrical Switchgear and Transmission Systems
- Plant/Potable Water Systems
- Air/Vacuum Piping Systems
- Chemical Piping Systems
- Feed water Treatment Systems
- Pipe Stress Analysis and Support Design
- Pressure Vessel Design to ASME Codes
- Fire Protection System
- Fresh Water and Sea Water Cooling Systems

## CIVIL/STRUCTURAL

- Civil/Siteworks
- Boiler Building Structures/Foundations
- Sea Water Cooling Pumphouse Structures/Foundations
- Electric/Control Rooms
- Equipment Foundations
- Conveying System Structures/Foundation
- Foundations for Stacks/Tower Structures
- Flue Gas Ductwork and Supports
- Boiler/Precipitator/Scrubber Support Steel
- Turbine/Engine/Boiler
- Vibration Analysis
- Site Survey
- Construction Monitoring

## PROCESS/ENVIRONMENTAL

- Air Pollution Controls
- Spill Containment Systems
- Stack Emission Testing/Monitoring
- Hazardous Waste Handling/Storage/Disposal
- Combustion Source Retrofits
- Environmental Assessments and Audits
- Permitting/Licensing/BACT Analysis
- Waste Audit/Waste Reduction Plans
- Process Modeling (Mass & Energy)
- Recycling/Landfill Facilities
- Process Safety Management/Lockout Tagout
- Training/Start-up Support
- Leachate Treatment Systems and Settling Ponds
- Flue Gas Desulphurization Building Structures/ Foundations
- Selective Catalytic Reactor Building Structures/ Foundations

## SYSTEM & FUEL TYPES

- Simple cycle
- Combined cycle
- Cogeneration/CHP
- Repowering
- Hybrid systems
- Wood pellet
- Anaerobic digestion and digestate management
- Biomass
- Biogas
- Feedstock management (wastewater residuals, food waste, food and beverage waste, and co-processing)

## STARTUP & OPERATIONS OR PLANT SERVICES

- Training/Start-up Support
- Construction Monitoring
- Training/Commissioning/Start-up SupportWaste





## Biogas Production & Utilization

Biogas can be produced using different inputs and production technologies. These dictate the best process deployment. We have project and design experience with all forms of production processes from standalone packages to an integrated approach across the value chain. Our diverse expertise includes:

### FEEDSTOCK SOURCING AND CHARACTERIZATION

- Food Waste
- Municipal Waste Solids
- Industrial Wastes
- Distilleries
- Crop Residues
- Energy Crops

### BIOGAS/RNG STORAGE

- Low-pressure dome storage
- Compressed natural gas (CNG)
- CNG dispensing

### BIOGAS APPLICATIONS

- Home and office heating
- Industrial processes
- Transportation fuel
- Power generation

### PROCESS UNIT OPERATIONS

- Feedstock receiving and storage
- Pretreatment
- Anaerobic Digestion
- Biogas refining
- Nutrient densification
- Biogas storage

### PIPELINE INTERFACE

- Metering
- Analysis
- Compressor
- Controls

### CARBON CAPTURE

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

### INSIDE BATTERY LIMITS OUTSIDE BATTERY LIMITS INTERFACE

- Process/water/utility interface
- Infrastructure management
- Power
- Emissions
- Offsite infrastructure management
- Permitting & Regulatory Strategy
- Due diligence
- CEQA/NEPA
- Regulatory permitting
- Natural resource assessment
- Permit compliance

## Project 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.

Whether you need support with environmental permitting, regulatory strategy, economics, risk management, capital planning or require expertise on digestion, biogas refining, process safety, or unit integrity, we have the specialists available to recommend the best economic and technical options for RNG. From innovating industrial processes or evaluating conventional hydrogen applications, we can support your journey from opportunity development, factor input design and technology selection, siting, design, regulatory compliance, public outreach, and permitting to construction, operation, and beyond.

### PROJECT ADVISORY SERVICES INCLUDE:

- Market assessments
- Project development and design
- Technology assessment and selection
- Project economics and risk recognition
- Supply contract negotiations support
- Regulatory strategy, compliance, and permitting
- Internal and external stakeholder consideration
- Future legislative changes and mandates
- Influence of public opinion and customer demands

### PROJECT ROLES AND SERVICE MODELS

Part of being where and when you need us is our ability to be there in the role we're needed. Our project roles include:

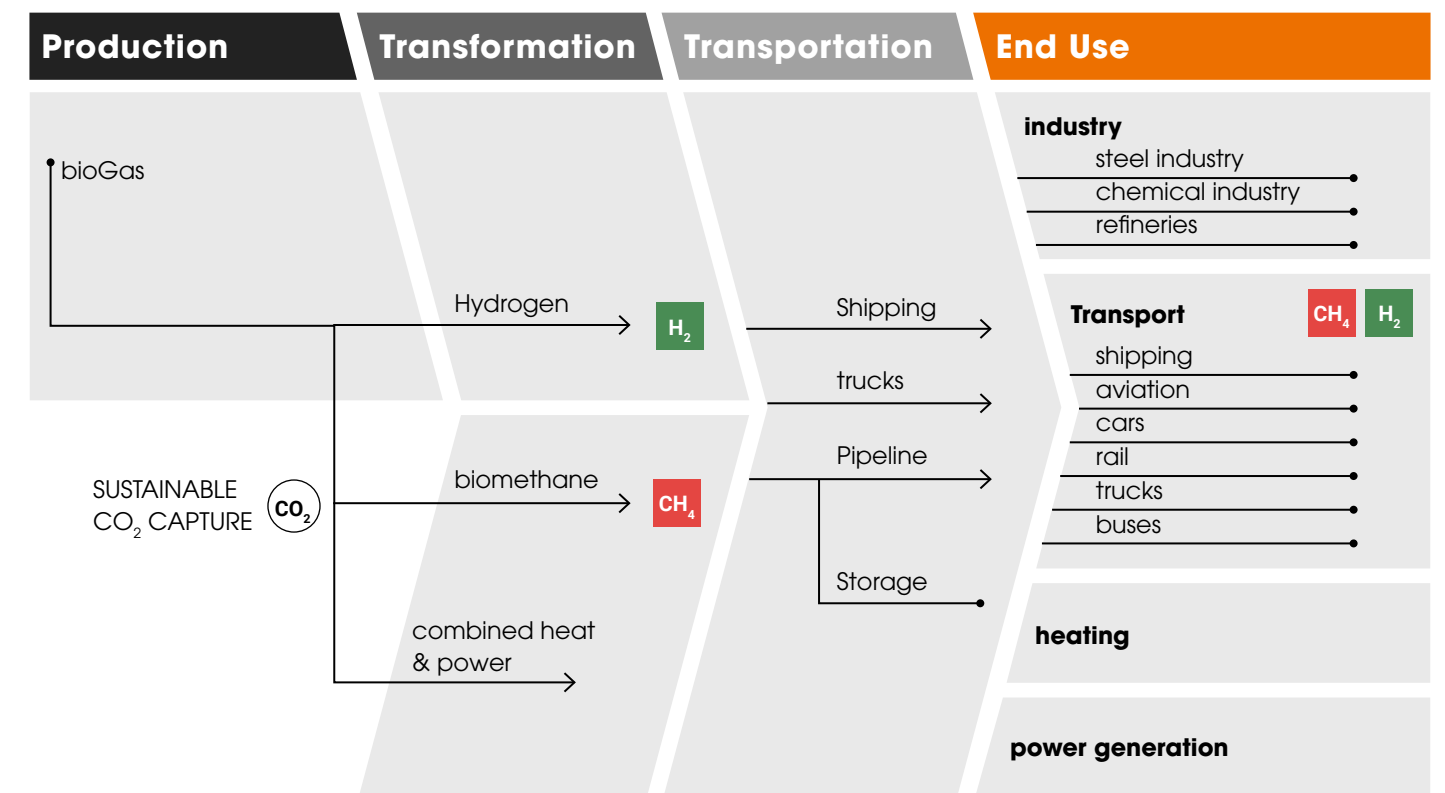
- Front End Engineering and Design
- Owner's engineer
- Detailed engineering and design
- Independent engineering review
- Expert testimony
- Operating plant support

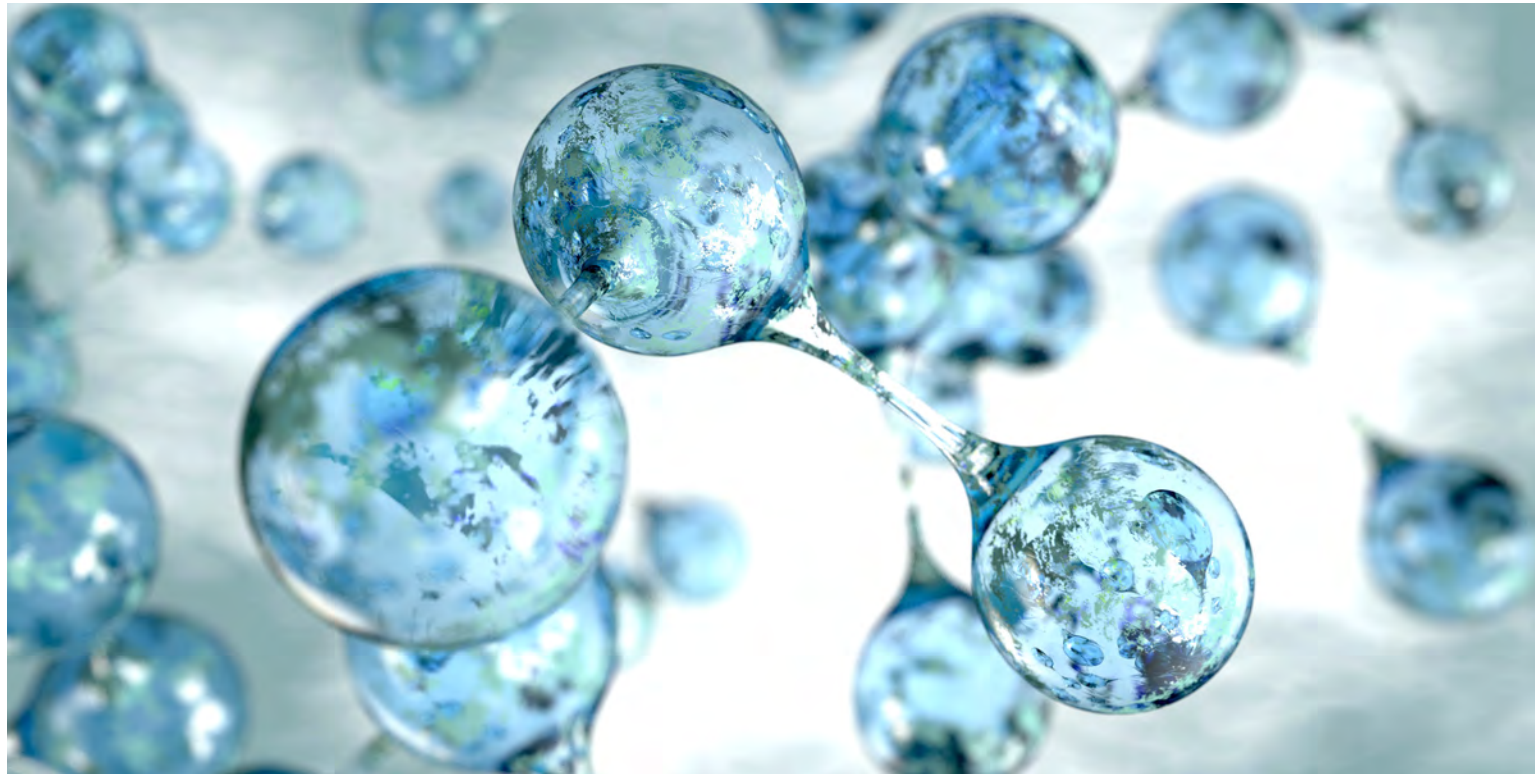
### PROJECT DELIVERY METHODS

The roots of our project delivery innovation and flexibility start in our ability to engage in diverse project delivery models.

- Engineering, Procurement, Construction (EPC)
- Engineering, Procurement, Construction Management (EPCM)
- Design, Bid, Build (DBB)

## Biogas Value Chain





## Biogas makes Biomass Energy Practical

Biogas refined to pipeline quality RNG makes biomass readily transportable and usable as a drop-in replacement for fossil natural gas. Many biomass energy sources are geographically dispersed and remote from end users.

Crop residue, for example, could be a significant energy source but its low bulk density makes it impractical to transport. Even if it could be delivered to an end user, the user has no way to use it. RNG resolves both of those problems.

As a drop in replacement, RNG takes biomass into industries, processes, homes, and offices that biomass alone could never enter.

## RNG and Hydrogen

RNG provides an opportunity to build on existing technologies and processes to provide unified solutions including hydrogen.

Stantec has expertise in 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 carbon dioxide storage reservoirs.

### RNG AND CARBON CAPTURE

Coupled with carbon capture technologies at the digester, RNG becomes carbon negative. To certify and meet decarbonization targets, we can assist our clients in understanding the use and/or sequestration of captured CO<sub>2</sub>.

## HENG Pipelines

Many of our clients are exploring moving to hydrogen through Hydrogen Enriched National Gas (HENG) 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, and CO<sub>2</sub> infrastructure.

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

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

## Safe Hydrogen Design and Operation

Our focus on safety starts at the design stage of a project, where we consider the human element of constructability, 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. These 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







## Carbon Capture, Utilization, and Storage

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
- CEQA/NEPA
- 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

## Biogas Power Generation

Stantec's experience covers all thermal-based generation with projects ranging in size from less than 100 kW to 1,300 MW. 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. Our specific fuel conversion expertise includes:

- Process engineering
- Safety
- System Hazard Analysis
- 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

## 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. We are well-versed with alternative fuels such as hydrogen, compressed natural gas (CNG), and electric-vehicle charging. Our transportation group includes a dedicated team providing planning and design services for Zero Emission Vehicles (electric and hydrogen). 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 infrastructure. Our 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





## 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 CEQA/NEPA-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 CEQA/NEPA process 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.

Our services include:

- Representing clients at public hearings, meetings and workshops, internal department meetings, and coordinating with local, state, and federal permitting agencies
- Preparing CEQA/NEPA-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

## Renewable Energy Project Development

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.

The scope of services for our projects includes:

- Planning & siting
- Critical Issues Analyses
- Regulatory support & permitting
- Biological & cultural monitoring
- Phase I Environmental Assessments
- Public Utilities Commission (PUC) application assistance
- Engineering design
- Construction management
- Startup commissioning & testing
- Operations & maintenance





## 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.

Our collaborative approach to public involvement is based on the following principles:

- Leverage our knowledge of client and public stakeholder concerns to allow for early identification of potential issues to help ensure that schedules meet expectations
- Accept regulatory and stakeholder challenges, understand their rationale for opposition and create project-specific approaches for each unique situation
- Build trust through applying our technical expertise relying on scientific competence and respect for others, thus maximizing the efficient execution of tasks and creating confidence in the scientific validity of applicable studies
- Listen actively to understand stakeholders' interests and concerns by asking key questions, as necessary
- Collaborate with stakeholders to jointly solve problems
- Competently demonstrate that potential solutions may require balancing environmental, social, economic, and political challenges to satisfy the interests of all parties while meeting client policies, protocols, and expectations and protecting human and natural resource ecosystems

## 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.



# Biogas Project Components



## FEEDSTOCK FLEXIBILITY RECEIPT, STORAGE, AND USE OF MULTIPLE FEEDSTOCKS BIOGAS POTENTIAL

- Site Civil & Environmental
- Development
- Community Engagement



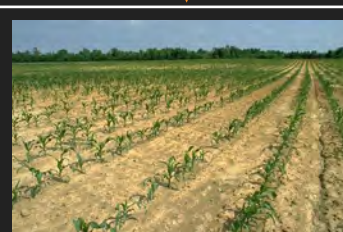
## TECHNOLOGY ASSESSMENT + PROJECT SUPPORT

- Anaerobic Digestion
- Combined Heat and Power Production
- Renewable Natural Gas Production



## STORAGE

- Layout
- Design
- Safety
- Integrity



## DIGESTATE HANDLING

- Technology Assessment
- Dewatering
- Beneficial Reuse
- Agronomic Loading
- System Integration
- Design



## RNG SERVICES

- Technology Assessment
- Heat Recovery
- System Integration
- Design



## RNG HANDLING AND COMPRESSION

- Engineering Design
- Technology Assessment
- Natural Gas Utility Interface



## DISTRIBUTION PIPELINES + TRAILERS/TRUCKS

- Markets & Offtake Agreements
- Design
- Safety / outreach
- Integrity



## FILLING STATIONS

- Layout
- Design
- Safety

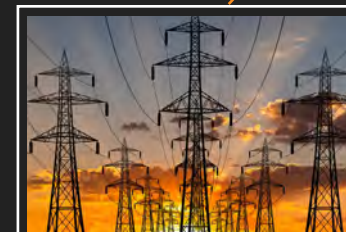
## INCENTIVE ASSESSMENTS

- RIN trading
- LCFS trading
- IRA Funding



## COMBINED HEAT AND POWER SERVICES

- Technology Assessment
- Heat Recovery Design Services
- CHP Prime Mover Design



## POWER ENGINEERING INTEGRATION

- Electrical Engineering
- Power Utility Interface
- Internal System Power Supply

# Our relevant experience

We combine technical excellence with local knowledge for insightful project experience.



## Stantec's Projects in Biogas and Renewable Energy

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

### **CAVENDISH FARMS BIOGAS FACILITY** New Annan, Prince Edward Island

As the principal consultant, Stantec's knowledge of food processing and biomass waste management was key to the successful planning, detailed design, and construction of a showcase biogas generation facility.

Stantec provided civil, mechanical, electrical, instrumentation and control design and construction support services to build a bio-gas facility. Using potato waste, this process provided an alternate supply of fuel to the client's boiler, decreasing consumption of fossil fuels and significantly reducing greenhouse gases. The project commenced with preliminary design including general arrangements to establish the project's capital budget and schedule for the Owner. Scope included site work, storage tanks (Hydrolysis, Digesters, and Secondary Digesters), buildings, specialized material handling and process equipment, gas system, and modifications to the existing boiler plant.

The project meets significant sustainable objectives for the facility. In a year, the facility is expected to realize a 30-35 per cent reduction in its overall carbon footprint— equivalent to 35 kilotonnes— through diversion of fossil fuels (10 million litres), reduced trucking requirements (more than 500,000 kilometres), and creation of an organic, natural fertilizer that will be used on the potato fields.

This project received the Award for Technical Excellence (2009) at the Association of Canadian Engineering Companies - New Brunswick Annual Showcase Awards, and the Award of Excellence, Natural Resources and Energy (2009) at the Canadian Consulting Engineering Awards.

### **SUSTAINABLE LANDFILL BIO-CELL** Calgary, Alberta

Stantec has developed a unique landfill for The City of Calgary that converts municipal solid waste into power.

Stantec designed a 100-by-100-metre (109-by-109-yard) landfill bio-cell (LBC) lined to prevent seepage, which was filled it with 55,000 tonnes (60,627 tons) of residential municipal solid waste, and capped with a geosynthetic, and soil and compost mixture.

Waste in the LBC, in operation since 2006, is kept moist with recirculated leachate and stormwater from on-site detention ponds during a four-year anaerobic phase until it is biologically stabilized by microbes. The methane produced is piped to a nearby internal combustion engine that generates 275 kilowatts of continuous power. Purchased by energy company ENMAX, the electricity is helping to run Calgary's light rail transit system.

In addition to generating electricity, the LBC cuts emissions, giving The City of Calgary valuable offset credits and a reduction to its environmental footprint. Once gas collection is no longer economical, air will be pumped into the cell until the waste can be mined for recyclables, which, along with compost, will be sold.

#### **Awards:**

2009: Association of Professionals in Engineering and Geoscience in Alberta (APEGGA) - Environment and Sustainability Award

2006: Consulting Engineers of Alberta Showcase Awards - Award of Excellence

2008: Shell/ASTECH Award for Environmental Innovation,

2007: Alberta Emerald Award for the Best Environmental Project



City of Merced WWTF Phase V  
Solids Handling Upgrade  
Merced, California



**CITY OF MERCED WWTF PHASE V SOLIDS HANDLING UPGRADE**  
Merced, California

Using the largest active solar dryers in the United States to support local farms and earn money for the community—we can't think of a better project.

To the City of Merced, the solids waste generated by their wastewater treatment facility was just something that required disposal. To us, the waste had untapped potential.

Stantec started with a review of their current waste handling and disposal system. The City was using unlined drying beds, which have an increased potential to contaminate the underlying groundwater, to decant and dry digested solids from the existing digesters. We determined the existing beds could continue to be used only if reconstructed with a double liner to meet current landfill standards, a very expensive option. Even with the double liner, reliability during heavy rainfall periods is highly uncertain, and an additional disposal area would be required to accommodate future growth. A less costly and more effective alternative was needed.

Working closely with the City, we developed a solids handling facility design that stops groundwater pollution, preserves the agricultural buffer, and replaces typical off-site disposal expenses with a new revenue source.

The biogas generated from the digestion process is used for heating the digesters, reducing fuel costs. The new system includes a covered solids holding tank, a digester gas holder, and a dewatering facility with centrifuges, solids feed pump station, and the largest active solar dryers in the United States.

**HYPERION TREATMENT PLANT SOLIDS HANDLING AND PROCESS UPGRADES**

Los Angeles, California

Over the last three decades, Stantec has provided technical services for the City of Los Angeles, Department of Public Works for biosolids processing and management at the City's four wastewater treatment plants ranging in size from the 25 mgd Terminal Island Treatment Plant to the 400 mgd Hyperion Treatment Plant.

Our work started with the detailed design and construction management of the 265 dry ton per day Hyperion Energy Recovery System. This project involved the design of biosolids dewatering, drying and combustion facilities, and digester gas cleaning and energy recovery facilities. Also included in the project was a unique digester cleaning facility that employed static screens to remove grit from the biosolids prior to dewatering and a vanadium-based digester gas cleaning process to remove hydrogen sulfide and other impurities from the produced digester gas. As part of the Hyperion Energy Recovery System, the team designed a truck loading station to move dewatered biosolids

into trucks for transport to off-site reuse options. This facility included quick operating doors to help keep odors contained within the truck bay and shaftless screw conveyors to move dewatered biosolids cake long distances with minimum maintenance.

Value engineering and cost control measures saved \$160M on this large-scale biosolids project.

Following this project, the City moved to a strategy of offsite beneficial reuse of biosolids, and Stantec was engaged to support the Solids Handling Program. Under this contract, we provided planning, design and construction management services for upgrades to the biosolids dewatering system, the dewatered biosolids cake storage system, truck loading and odor control.



Hyperion Treatment Plant Solids Handling and Process Upgrades  
Los Angeles, California





**NORTHERN TREATMENT PLANT POST AEROBIC DIGESTION**  
Denver, Colorado

The Denver Metro Wastewater Reclamation District (Metro) Northern Treatment Plant is one of the most advanced facilities in the western United States and will eventually serve up to 750,000 customers. The North plant has a recently installed a post aerobic digestion (PAD) system that takes anaerobically digested sludge back through a conventional aerobic system.

PAD and anaerobic ammonium oxidation (Anammox) are both sidestream treatment technologies which are excellent options for reducing and recycling nitrogen back into the liquid stream requiring supplemental carbon or alkalinity. However, PAD is different from Anammox because PAD is advanced digestion that follows after anaerobic digestion. This provides benefits that include volatile solids reduction, odor reduction, and struvite formation reduction.

Through PAD, Metro is taking advantage of the reduction of Nitrogen without the use of chemicals.

**MICROGY INC. - HUCKABAY RIDGE FACILITY**  
Stephenville, TX

Microgy Inc.'s Huckabay Ridge Facility was designed and constructed by Stantec using licensed biogas technology to handle the methane gas produced by manure from 10,000 cattle along with food processing waste.

Microgy Inc. needed a facility to handle the 650,000 MMBTU of methane gas produced yearly by the conversion of manure from 10,000 head of cattle along with food processing waste. The detailed engineering design required the use of licensed biogas technology from the client.

Stantec used the biogas technology to provide services from concept to start-up to construct a pipeline-quality methane facility. The facility has eight million gallons of anaerobic digesters which work to convert manure and food waste into methane.

The facility was completed in 2006 and has since cut down methane emissions to the Stephenville community.

**NEW HOPE DAIRY BIOGAS PRODUCTION**  
Galt, California

MT-Energie wanted to build a facility to support its mission to cut down on methane emissions to the environment and contracted Stantec to provide design and engineering for the biogas production building.

MT-Energie needed a new facility for a dairy farm that could use cow manure to produce biogas to cut down on methane emissions to the environment. The project required design and engineering services, as well as permitting assistance and code review.

Stantec was able to provide basic process and mechanical engineering and detailed electrical design for equipment such as solids handling, pumping systems, reciprocating gensets, gas upgrade, and heat exchangers. We also assisted the client with permitting and code review to facilitate the start-up of the facility on time.

The facility constructed based on Stantec's designs is able to handle 180,000 MMTBU of methane per year.

**PISCATAWAY WASTEWATER TREATMENT PLANT (WWTP) BIO-ENERGY PROJECT**  
Accokeek, Maryland

Stantec is the lead design engineer for this new bioenergy facility at the Piscataway Water Resource Recovery Facility (WRRF). This \$270M project represents one of the largest and most innovative bioenergy microgrid projects in the country, incorporating long-term biosolids treatment and management. It provides a holistic approach to improving reliability, operational efficiency, integration, and risk management for the Facility.

This waste-to-energy project will produce Class A biosolids from five of the Washington Suburban Sanitary Commission's (WSSC) facilities, along with biogas, which will be treated to pipeline quality and injected into the Washington Gas pipeline. The biosolids will be utilized as a soil additive for surrounding communities.

Stantec assisted with permitting, developed pilot studies, and provided complete design services for the project. The project includes imported sludge receiving, pre-dewatering, a thermal hydrolysis process (THP), anaerobic digestion, final-dewatering, and cake loadout. The energy recovery system includes biogas, renewable natural gas systems, and a combined heat and power (CHP) system. Stantec led the design of the gravity thickening, solids screening and pre-dewatering, pre- and post-dewatered cake receiving and storage, THP, anaerobic digestion facilities, gas storage facilities, CHP system, sidestream treatment, odor control, fats, oils, and grease receiving, and process controls.

The biogas produced in the digesters will be upgraded to pipeline-quality renewable natural gas. Renewable natural gas will be fed to the facility's CHP plant consisting of three 1.5 MW generators and two heat recovery steam generators, which will produce process steam to feed the THP process. The CHP plant will operate in a microgrid arrangement providing electricity and steam to the WRRF.

The facility is currently under construction and expected to be substantially complete by November 2024. Additionally, the project is expected to receive credits and grants for achieving an overall 65% energy efficiency.





**ROBERT O. PICKARD ENVIRONMENTAL CENTRE - DIGESTER EXPANSION**  
Ottawa, Ontario

Stantec was key partner in the detailed design and implementation of a \$345 million expansion to the Anaerobic Digester Facility in the City of Ottawa.

Working closely with another consultant, Stantec participated in the design development and construction of the anaerobic digester expansion for the Robert O. Pickard Environmental Centre (ROPEC). Our project team included civil, mechanical, electrical, environmental, and process engineers that provided engineering design and construction services support as well as start-up and commissioning services.

Rated at 545,000 m<sup>3</sup>/d, ROPEC consisted of a Raw Sewage Pumping Station, Headworks, primary, aeration, secondary clarifiers, anaerobic digesters, and a dewatering/unloading facility. The expansion included two "tall-tank" type mesophilic anaerobic digesters (designed to operate in thermophilic mode in the future), modifications to the existing anaerobic digestion biogas handling system, and a new biogas handling system.

The biogas emitted by the digesters is used in boilers for plant and process heating, and a cogeneration system producing hot water and electricity. The preliminary and detailed designs were completed in 2004, and the final commissioning of the facility was completed in 2009.

**SURREY BIOFUEL PROCESSING FACILITY**  
Surrey, British Columbia, Canada

With a mandate for a cleaner city, Surrey's new biofuel processing facility collects food scraps from the community and converts it into biofuel for the trucks collecting waste.

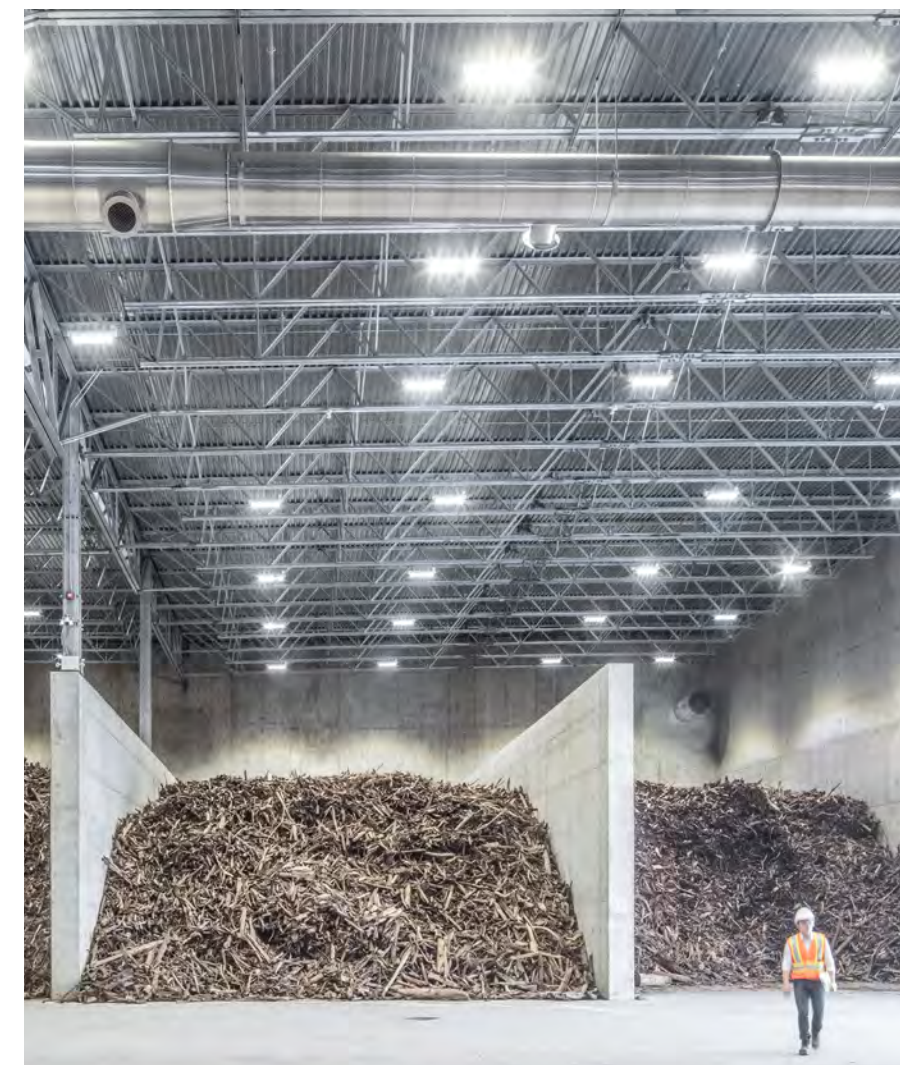
The City of Surrey Biofuel Organic Waste Processing Facility is one part of their larger Rethink Waste program that allows residents and businesses to separate waste in garbage, recycling, and organic waste.

The facility converts the City's collected kitchen and yard waste, along with commercial waste from across the region, into 100% renewable natural gas and compost. Odors from the processing activity are controlled by enclosing the facility's critical areas and treating exhaust through biofilters and air scrubbers to remove odor and dust before the air is discharged into the atmosphere. The natural gas is used to fuel the City's natural gas waste collection trucks, and any excess is sold back to the natural gas utility. The facility also produces a compost product that is suitable for landscaping and agricultural applications.

As a public-private partnership, Stantec partnered with Orgaworld Canada, a leading organics waste treatment company, and SBW, for construction. Stantec provided architectural, structural, mechanical, electrical, and civil design services.

The facility is designed to receive and process 115,000 tonnes of organic waste annually. At capacity, it is able to process 100% of the City's organic waste over the 25-year contract term, along with commercial organic waste. It is estimated that this diversion of waste from the landfill will amount to approximately 25,000 tonnes of CO<sub>2</sub>e reduction per year, equivalent to taking 5,200 passenger vehicles off the road per year.

Online in March 2018, the facility is the largest of its kind in Canada and the first closed-loop fully-integrated organics waste management system in North America.





Communities are fundamental. Whether around the corner or across the globe, they provide a foundation, a sense of place and of belonging. That's why at Stantec, we always design with community in mind.

We care about the communities we serve—because they're our communities too. This allows us to assess what's needed and connect our expertise, to appreciate nuances and envision what's never been considered, to bring together diverse perspectives so we can collaborate toward a shared success.

We're designers, engineers, scientists, and project managers, innovating together at the intersection of community, creativity, and client relationships. Balancing these priorities results in projects that advance the quality of life in communities across the globe.

Stantec trades on the TSX and the NYSE under the symbol STN. Visit us at [stantec.com](http://stantec.com) or find us on social media.

Lee Finlay,  
BC Practice Leader  
(763) 252-6989  
[lee.finlay@stantec.com](mailto:lee.finlay@stantec.com)

Mark Griffiths, PL Eng.  
Senior Principal, Energy & Resources,  
Saskatchewan  
(587) 702-6634  
[mark.griffiths@stantec.com](mailto:mark.griffiths@stantec.com)

Design with community in mind

