Annual Report

2021–22

net-zero atlantic

Contents

Get in Touch:

netzeroatlantic.ca

nperry@netzeroatlantic.ca
902.406.7015

1209 Marginal Road
Halifax, Nova Scotia B3H 4P8

From the Executive Director

OUR LAUNCH AS NET ZERO ATLANTIC took place at the end of our fiscal year in March 2022. It's a shift that aligns with the growing global focus on the energy transition and the ambitious actions that will be required to reach net zero emissions by 2050. Our team is driven to use our skills and experience to respond to climate change.

Net Zero Atlantic grew out of the Offshore Energy Research Association, broadly known as OERA. In many respects, Net Zero Atlantic's work is the same as what we did at OERA for close to a decade: our team of scientists, engineers and program managers lead applied research and contribute to projects focusing on energy.

Today, our work focuses on cleantech initiatives and renewable energy technologies. Our team is producing the credible and objective data the Atlantic region needs to decarbonize and move toward a more sustainable and inclusive economy.

In recent months, we've been leading projects and applied research in critical topics related to the energy transition, including:

Developing an open-source energy system model for Atlantic Canada — a first-in-Canada interactive online tool that will enable policymakers, industry and researchers to evaluate the cost and opportunities of alternative pathways to a carbon-neutral future.

Evaluating the full hydrogen value chain for Atlantic Canada through comprehensive studies and by acting as Secretariat for the recently launched Atlantic Hydrogen Alliance that will create an Atlantic Hydrogen Roadmap.

Exploring offshore wind's potential for Nova Scotia by determining the economic and policy conditions needed for the province to create a successful industry, attract direct investment, build local capacity while minimizing risk.

Evaluating Nova Scotia's geothermal energy potential by creating a resource atlas and modelling the economics of viable projects to serve the agriculture and aquaculture industries.

The shift in approach that is implicit in the energy transition is also reflected in our work as we see through to completion existing projects we've been working on for years. Research being carried out as part of the Offshore Growth Strategy (OGS) — originally created to build geoscience knowledge related to Nova Scotia's onshore and offshore oil and gas potential — will conclude once current contracts have been fulfilled.

We recognize that reaching net-zero emissions by 2050 will be a team effort involving collaboration by many organizations and individuals. With that in mind, having partnered with government and academia for many years, we're now accepting applications for membership from private sector companies and other organizations that support our mission. Our members' insights, perspectives, and experiences are shaping our priorities and approach.

Since the change to Net Zero Atlantic, we've already seen the exciting potential that exists as we work together to achieve a carbon-neutral future. I'm pleased to provide an overview of our progress in this annual report.

Alisdair McLean
Executive Director, Net Zero Atlantic

Our Work

WE ARE CONTINUING to fulfill our mandate to support the energy transition through focused projects and applied research with an Atlantic Canadian focus. In 2021–22, we produced credible and objective data to inform sound policies and decisions related to critical topics including, but not limited to:

- Energy system modeling
- Hydrogen
- Offshore wind
- Geothermal energy
- Decarbonization strategies
- Tidal energy

Vision

Net Zero Atlantic is a leading energy research organization advancing Canada's transition to a carbon-neutral future.

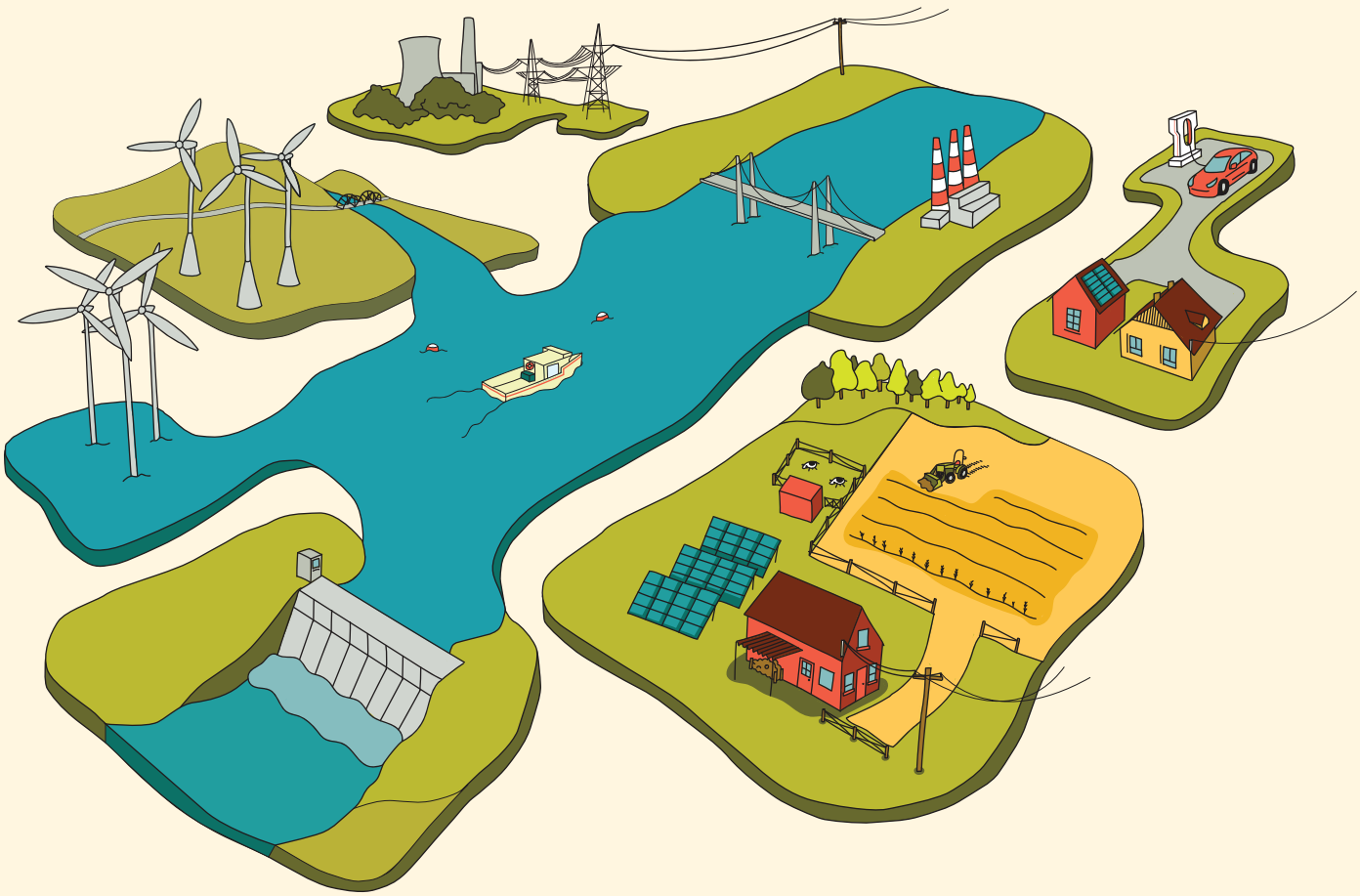
Mission

Lead applied research and contribute to projects that enable the transition of Atlantic Canada's energy system to a carbon-neutral future through collaboration with academia, governments, private sector, Indigenous Peoples and other non-government organizations.

Purpose

Advance a sustainable and inclusive transition to a carbon-neutral Atlantic Canada through the provision of credible and objective data and support services.

Atlantic Canada Energy System (ACES) Model



Our energy system model is a tool that enables users to analyze different climate change mitigation options and compare their relative cost and effectiveness against other approaches. The cost and complexity of standard energy system models has so far limited their use to well-resourced energy system stakeholders, specialized consultants, and select research communities. This comes at a cost to our collective capacity to reduce GHG emissions.

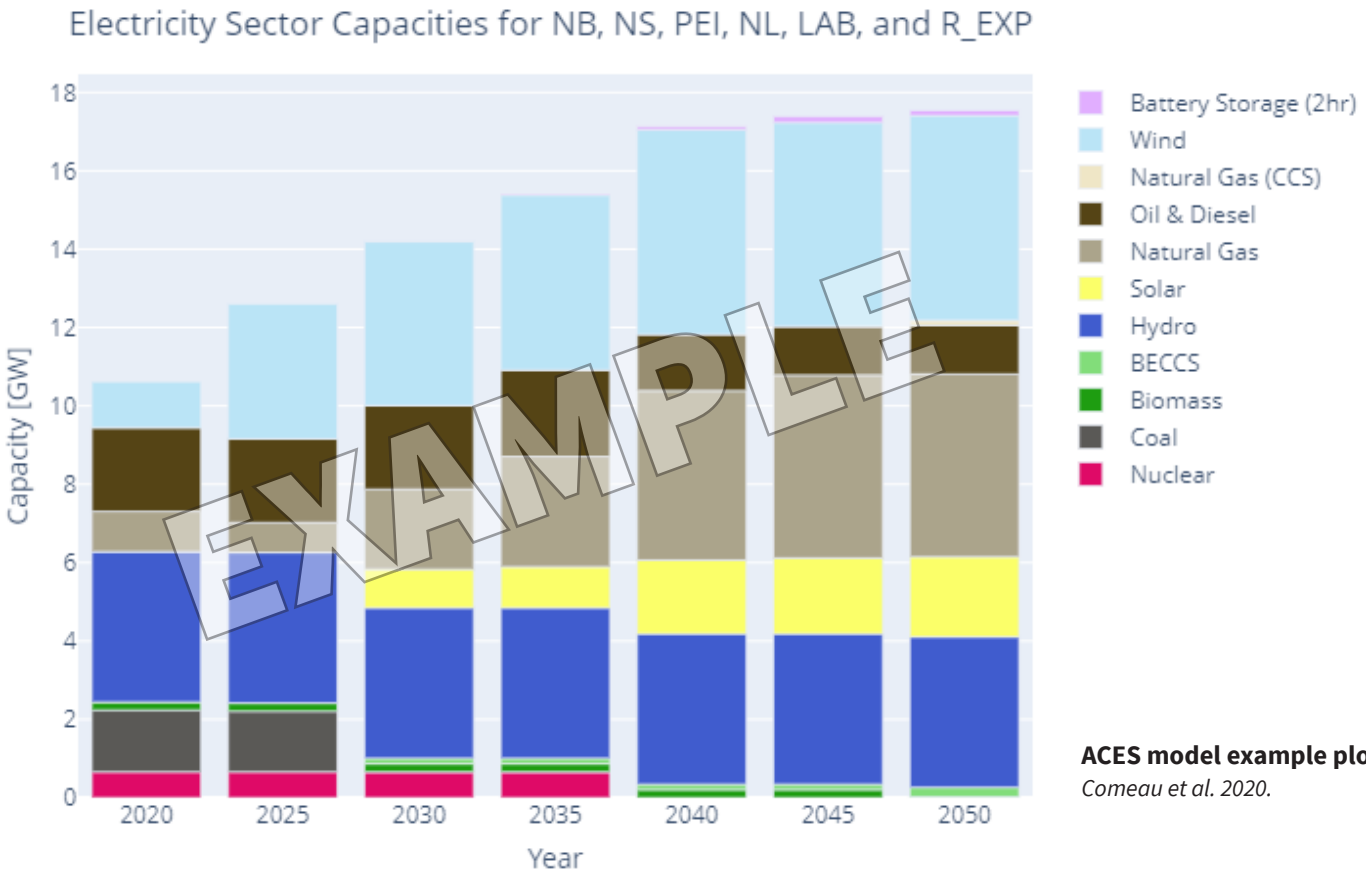
MOTIVATED BY THESE circumstances, the team at Net Zero Atlantic created the ACES model — an open-source energy system model for Atlantic Canada. Our goals are to:

- increase accessibility of energy system modelling in the region,
- provide a shared tool to analyze different possible pathways to net zero emissions, and
- promote data sharing and increase transparency and inclusion in decision-making related to the future of the energy system.

The ACES model encompasses technologies that could satisfy forecasted long-term energy demands for all four Atlantic provinces across all greenhouse gas (GHG)-emitting sectors of the economy: electricity, buildings, transportation, agriculture, waste, and industry. An open-source tool, the ACES model will be continuously improved through user feedback. Since releasing the first version of the model to stakeholders in November 2021, our team has already made several updates to better meet user needs and more accurately reflect on-the-ground realities of the region's energy system.

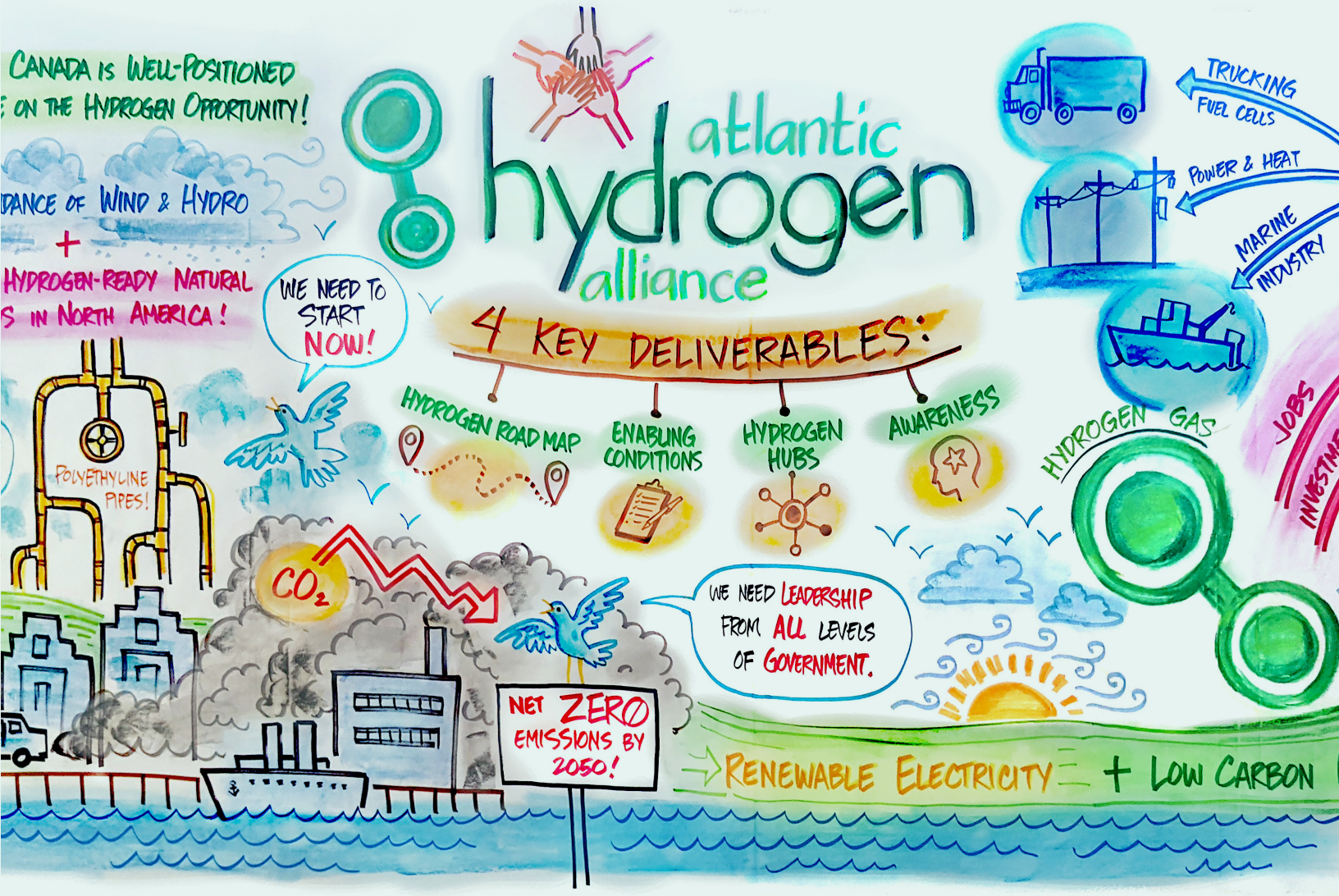
We're carrying out a significant education and outreach program to advance local modelling expertise and promote continuous model improvement. Through one-on-one engagement sessions, we're training and seeking input from organizations representing various economic sectors across the region. We also provide educational resources on the ACES model website, where users can access a web-based version of the tool.

We plan to continue to expand the application of the model by exploring key technologies including small modular reactors, hydrogen, and onshore wind, and by providing modeling services to clients.



ACES model example plot.
Comeau et al. 2020.

Hydrogen



We're continuing to build knowledge and stimulate discussions on where hydrogen fits in Atlantic Canada's future energy system. In 2021-2022, Net Zero Atlantic conducted two feasibility studies to analyze the role hydrogen could play in the transition to a regional net zero economy in and recommended the next steps that could be taken in Atlantic Canada.

IN 2021-2022, Net Zero Atlantic conducted two feasibility studies to analyze the role hydrogen could play in the transition to a regional net zero economy in and recommended the next steps that could be taken in Atlantic Canada. Building upon these recommendations, the Atlantic Hydrogen Alliance (AHA) was formed under the leadership of Net Zero Atlantic. This volunteer-driven organization has 56 active member organizations representing all four Atlantic provinces and the entire hydrogen value chain.

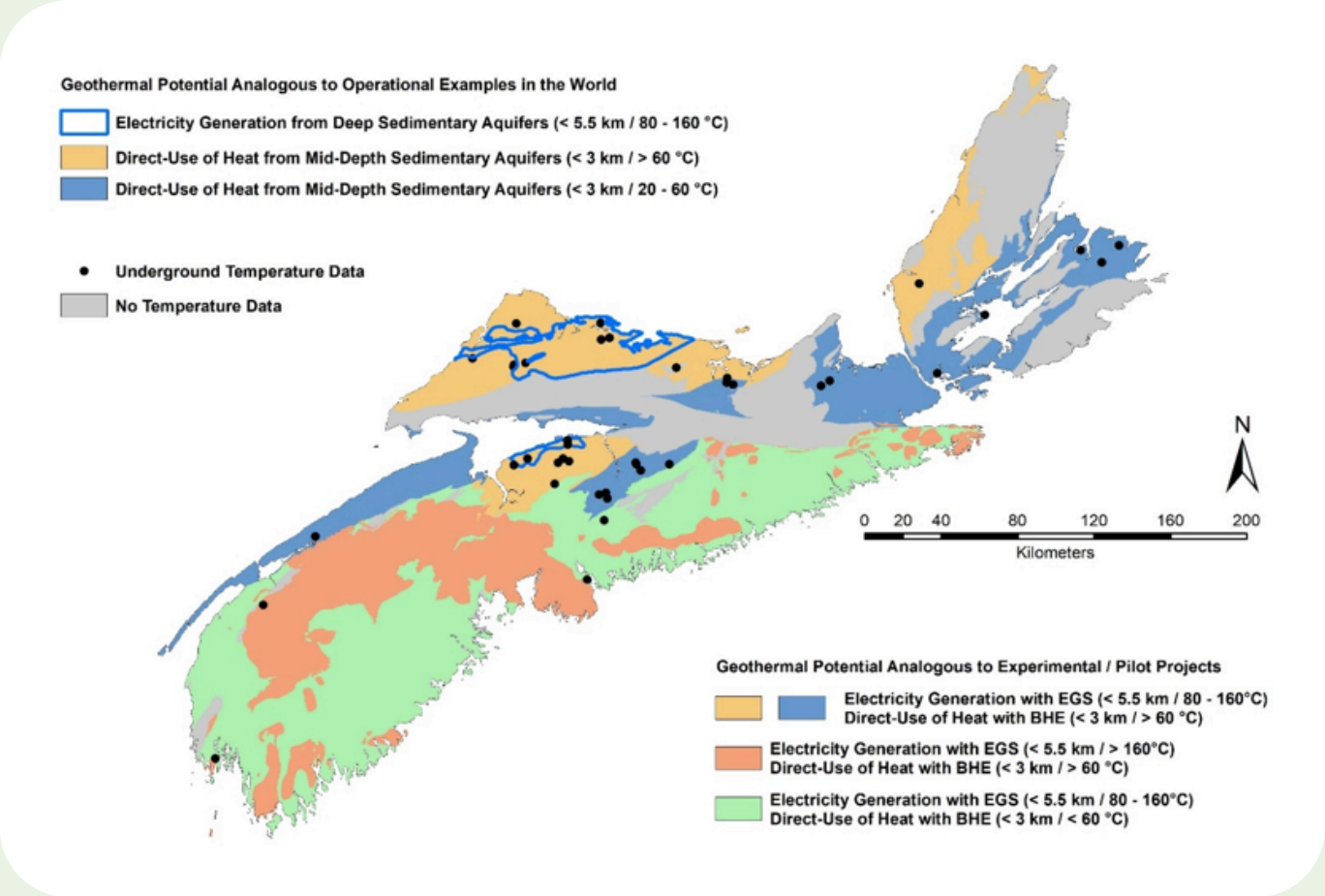
As the secretariat for AHA, Net Zero Atlantic manages four working groups that aim to:

1. **Complete an Atlantic Hydrogen Strategy/ Roadmap** that describes the optimal low-carbon hydrogen production methods, distribution systems, and end-uses for the development and deployment of hydrogen in Atlantic Canada.
2. **Develop draft policies, regulations, codes, and standards** to enable hydrogen development in Atlantic Canada.
3. **Facilitate the creation of one or more hydrogen 'hubs' in Atlantic Canada** to develop and deploy local hydrogen projects across the full hydrogen value chain.
4. **Develop and execute a communications, engagement, and advocacy plan** to promote the development of the hydrogen sector in Atlantic Canada and raise awareness of the economic and environmental potential for hydrogen in the region.

Our work to realize hydrogen's full potential for Atlantic Canada will continue in the months ahead.

Atlantic Hydrogen Alliance launch event.

Geothermal



Nova Scotia's geothermal resource potential.

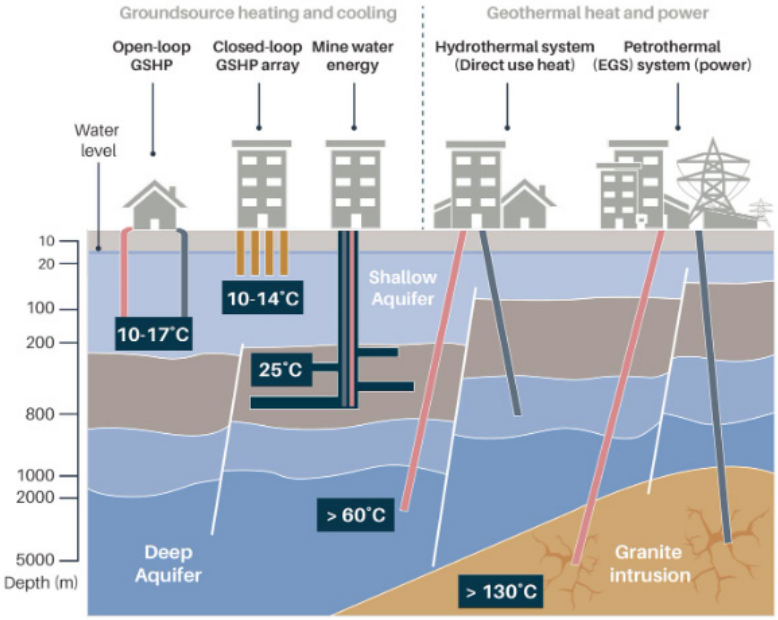
We're building a greater understanding of the potential geothermal energy holds for electricity generation and heat production for Nova Scotia. We've compiled data showing the best areas for geothermal resource development in the province — both for conventional geothermal technology and for new technologies that can exploit more marginal resources, allowing consideration of the entire province for geothermal resource development.

WE'RE ASSESSING THE technical and financial suitability of mid-depth geothermal systems for specific heating applications: greenhouses, aquaculture facilities and community district heating in three geological regions of Nova Scotia: the Stellarton Sub-Basin, the Cumberland Sub-Basin and the Windsor-Kennetcook Sub-Basin. Sensitivity analyses to determine if these geothermal systems would prove cost effective under varied geological and financial conditions have also been carried out.

The objective of our latest study is to help Nova Scotians understand the economic hurdles and opportunities to developing direct use of heat geothermal projects in the province. We've identified economic constraints that affect project feasibility and makes recommendations that would enhance project viability. We've found that economic viability for geothermal resource development requires stable, year-round heating demand and the availability of shallow depth-high temperature basins. Larger facilities with higher heating requirements currently serviced by expensive heating oil also enhance viability.

We've also commissioned another study — an assessment of the strategic opportunities and limitations of geothermal energy in Nova Scotia, along with an operational roadmap describing concrete next steps to advance the sector in Nova Scotia. And, we're planning a 3D subsurface model to help better locate and describe prospective geothermal reservoirs. This work is expected to be complete later in 2022 and it will help inform next steps with geothermal.

Another initiative — *the Community Geothermal Resource — Capacity Assessment and Training program (GeoCAT) project* — will build mid-depth geothermal project development capacity in 12 rural Nova Scotia communities, including five Mi'kmaw communities. The program will create awareness of local geothermal resources in local community representatives and, working with these representatives, assess community-specific interest and opportunities for economically viable geothermal project development. Next, community representatives will present these opportunities to decisionmakers and interested citizens and the community representatives with supporting project development expertise will learn and teach interested residents how such projects can be achieved in their community.



Geothermal project types.
British Geological Survey 2022.

Offshore Wind

Offshore wind is an untapped resource for Atlantic Canada which, if developed, has the potential to enable energy exports, stimulate the regional economy, and contribute to displacing carbon-intensive electricity generation and meeting ambitious GHG emission reduction targets.

WE'RE CURRENTLY SCOPING offshore wind projects to help create a foundation for an offshore wind sector. We've also initiated a three-year capacity building project to build sector knowledge in rural and Indigenous communities that may participate in future offshore wind projects. Funded by Natural Resources Canada's Smart Renewables and Electrification Pathways Program (SREP), Capacity Building Stream, the *Capacity Building for the Sustainable and Inclusive Development of Nova Scotia's Offshore Wind Resource* project will build on partnerships created with the Confederacy of Mainland Mi'kmaq and the Unima'ki Institute of Natural Resources. Together with our project partners, we will collectively facilitate educational forums and workshops to introduce the subject of offshore wind in coastal communities, build relationships, and create community outreach plans tailored to the expressed interests of each community. The second project phase will execute the outreach plan, furthering offshore wind knowledge in rural, Mi'kmaw, and other equity-deserving communities.

Additionally, in 2021, we completed studies to evaluate how to stimulate offshore wind development in Nova Scotia and to assess the economic impacts of developing the Port of Sheet Harbour into an offshore wind hub. Moving forward, we'll work with provincial and private sector partners to understand the grid integration limitations and opportunities presented by the offshore wind industry as it emerges in Nova Scotia, New Brunswick, and Prince Edward Island. And we'll use our Atlantic Canada Energy System (ACES) model to assess the economic effects of different offshore wind development scenarios, providing decision makers with insights to possible project development effects and opportunities.

Decarbonization Strategies

Under the Sustainable Development Goals Act, Nova Scotia has legislated a net zero GHG emission economy by 2050. To achieve this important milestone, a portfolio of decarbonization strategies must be adopted by the private and public sectors.

DEMAND-FOCUSED STRATEGIES include energy efficiency, energy conservation and end-use electrification, while supply-focused strategies include low-carbon fuels and low-carbon electricity generation. How these strategies are implemented will present different economic opportunities for regional companies.

Our team facilitated the creation of a report analyzing the economic and workforce implications for Nova Scotia of three decarbonization scenarios outlined in Nova Scotia Power's 2020 Integrated Resource Plan, and provided recommendations for an equitable transition to a low carbon economy.

The report concludes that the job creation potential and economic benefits for Nova Scotia are greatest in a rapid electrification scenario. Job creations and GDP growth are significant in all analyzed scenarios and special attention is drawn to Nova Scotia's increasingly tight labour market. Further, the report highlights that Nova Scotia has strong research, design, and development capabilities for many decarbonization technologies, but has limited availability of skilled construction and engineering personnel relative to their demand.

The report's recommendations focus on enabling strategies that would stimulate investment in preparing the workforce to deliver the province's decarbonization strategy.

Tidal Energy

Pathway Program

TO ADDRESS ECONOMIC and regulatory barriers to the commercialization of the tidal industry in Nova Scotia, we led the *Pathway Program*: a collaborative, $3-million, multi-year initiative to define, test and validate an environmental effects monitoring solution for tidal energy devices.

The many interconnected research initiatives carried out under the program have successfully defined and evaluated a variety of methods and technologies to monitor and report on interactions between marine animals and tidal turbines. Completed in March 2022, the Pathway Program has made substantial contributions to the state of the science in environmental effects monitoring for instream tidal devices.

Intellectual property (Echofilter software tool) created by Nova Scotian researchers through this work will help regional and global tidal developers reduce their regulatory compliance costs, while the data automation enhances regulator confidence in monitoring results.

This applied research program was undertaken in collaboration with academic partners, regional technology suppliers, tidal energy companies, regulators, and the Fundy Ocean Research Centre for Energy (FORCE).

Vectron Project

TIDAL TURBINE DEVELOPERS require the best possible current velocity data to inform turbine durability and power performance design. The Vectron Project is providing not only the highest resolution velocity data to turbine developers, but also data analysis and software tailored to their needs. This will directly add value to their turbines and to their operations in Nova Scotia.

The objective of the Vectron Project is to build and field test to industry standards an autonomous undersea instrument platform to measure turbulence at tidal turbine hub height. The project is also developing proprietary software and expertise to analyze turbulence data and develop local proficiency in marine operations needed for platform deployment. This new sensor will help tidal turbine developers understand the impact of turbulence on turbine durability and power conversion efficiency.

The project team from Dalhousie University and the Fundy Ocean Research Centre for Energy (FORCE) has now completed testing and implementation of enhancements and the Vectron is ready for continuous, commercial operation.

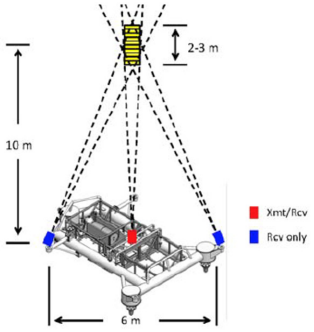


***Photo:* Work on developing the Vectron (Phase I).**
Used with permission from Fundy Ocean Research Centre for Energy (FORCE).

***Diagram:* A schematic of the Vectron platform. The Vectron remotely samples turbulence at 10 m above the seabed.**
Fundy Ocean Research Centre for Energy (FORCE) 2020.

2021–22 Facts & Figures

64 active projects throughout the year

51 projects completed on time
(average 80% on time for the year)

Value of projects completed or in works:

$6,288,399

Social Media Presence:

1,488 Twitter Followers

1,770 LinkedIn Followers

More than **4,600** Email subscribers

Met with **190** representatives of government, industry, and academia

Engaged **72** organizations through ACES model outreach

Monthly Webinar Series

13 webinars
presented to a total audience of more than **1,900 viewers** from **47 countries**

Trained 34 individuals
from **19 organizations**
in the use of the ACES model

46 opportunities
for highly qualified personnel (HQPs) and/or students