net-zero atlantic

# APPLICANT GUIDE

## FALL 2025

**September 29 - November 3**









**Net Zero Emerging Concepts & Technologies - Nova Scotia (ECT-NS) Research Program**

netzeroatlantic.ca/ect-ns
info@netzeroatlantic.ca

# Applicant Guide

## Net Zero Emerging Concepts and Technologies – Nova Scotia (ECT-NS) Research Program

Call Opens: 29 September 2025
**Proposals due: November 3, 2025 (3:00 pm AST)**

## Contents



### 1. Program Rationale

Nova Scotia won't get to net-zero by 2050 with proven renewable energy and energy efficiency technologies. There are still significant knowledge and technology gaps that must be identified and addressed to tackle the most hard-to-abate greenhouse gas emissions (GHG) in the 2030-2050 period.

Many of the solutions needed to achieve 2050 net-zero goals will need to be invented, proven and scaled up to achieve further reductions in GHG emissions. Bringing critical, emerging technologies and concepts from the laboratory to the market may take decades to achieve. Given the critical importance of action during the next 10 years and the time that it typically takes for emerging technologies to get

from the laboratory to market, Nova Scotia cannot afford to wait for market incentives to deliver the level of change required.

The **Net Zero Emerging Concepts and Technologies (ECT) Research Program** will help to expedite this process. The ECT Research Program seeks to identify gaps in GHG emissions reduction pathways for hard-to-abate emissions and prioritize made-in-Nova Scotia solutions to reduce GHG in the post 2030-period.

The ECT Research Program is a minimum **three-year recurring** Open Call program. The Fall 2025 open research call is call number five (5) for the program, which aims to support research and development (R&D) investments in two areas:

1. Fostering conceptual, early-stage genesis of novel technologies, and concepts in Nova Scotia, and

2. Evaluating the suitability of technologies, and concepts emerging in other jurisdictions for Nova Scotia.

Net Zero Atlantic, the ECT Research Program administrator, is a leading energy research organization advancing Atlantic Canada's transition to a low-carbon future. Our focus is on advancing research that will help decarbonize our region's economy, mitigate climate change impacts, and move Atlantic Canada toward net-zero emissions by 2050. As a member of the 50-30 Challenge, we are committed to increasing workforce diversity in the energy sector.

The Nova Scotia Department of Environment and Climate Change (DECC), the Program funder, encourages growth of the clean economy and works to support all Nova Scotians in benefiting from its growth as stipulated in the *Environmental Goals and Climate Change Reduction Act*. Through Nova Scotia's Climate Change Plan for Clean Growth, DECC has invested $3,000,000 in the ECT Research Program to support early-stage research needed to develop new clean technologies and practices to help Nova Scotians meet their net-zero by 2050 target.

## 2. Program Objectives and Expected Outcomes

The primary objective of the ECT Research Program is encourage and fund the Nova Scotia research and innovation community (both private and academic sectors) to identify and develop a suite of promising, emerging clean technologies, approaches and practices that warrant continued funding from Nova Scotia's technology incubation ecosystem.

The ECT Research Program has the following objectives:

1. Identify knowledge gaps to eliminate or offset the final 20% of GHG emissions.

2. Advance promising technologies and approaches that can address the gaps to net zero.

3. Encourage collaborative research among Nova Scotia's universities, community colleges, indigenous led institutions, the private sector and others.

4. Create intellectual property and/or business opportunities for low-carbon solutions in Nova Scotia that are exportable globally, thus creating economic opportunities for Nova Scotians.

5. Build collaborative thematic research networks that can attract national and foreign investment.

Expected ECT Research Program outcomes are:

- A suite of promising made-in-Nova Scotia clean technologies, approaches and practices that can address the gaps to net zero and that warrant continued funding from the province's incubation ecosystem.

- NZA recommendations to the province to support advanced studies, field work or pilot projects for promising technologies or methods that should be introduced to Nova Scotia from other jurisdictions.

- New knowledge, exportable intellectual property, patents and publications that demonstrate progress in advancing concept level projects to early technology readiness levels that has the potential to address global demands for low-carbon solutions thus creating economic opportunities for Nova Scotians.

- Collaborative research among Nova Scotia's universities and colleges, First Nations-led institutions such as the Confederacy of Mainland Mi'kmaq (CMM), Mi'kmaw Conservation Group (MCG), and the Unama'ki Institute of Natural Resources (UINR), the private sector and others.

- Collaborative thematic research networks that can attract national and foreign investment.

## 3. Eligible Applicants

To be eligible to receive funding through the ECT Research Program, the Lead Proponent must be incorporated, registered or based in Nova Scotia. Partner organizations may be registered or based elsewhere in Canada or internationally. Proposals will be accepted from:

a. For-profit and not-for-profit organizations such as academic institutions, companies including sole proprietors, industry associations, research associations, utilities, electricity system operators, transmission system owners and operators

b. Indigenous organizations and groups

c. Community groups

The ECT Research Program encourages collaborative research within and between institutions and between academic, private sector and Indigenous organisations.

The following entities are not eligible to receive this funding: federal, provincial, territorial, regional, and municipal governments and their departments and agencies.

## 4. Funding by Research Stream

A total of $3,000,000 is available for the three-year ECT Research Program, not including contributions by Mitacs, which will be approved on a project-by-project basis as described in Section 7.2. Funding is provided by NSDECC ($3,000,000) with matching funding provided by Natural Resources Canada through the Energy Innovation Program for a total of $6,000,000 in funding for the program.

The ECT Research Program has two research streams, as outlined below. Applicants must clearly identify what stream their application fall under. Additionally, applicants must clearly articulate the knowledge gap being addressed by their project in alignment with a clearly identified priority research theme (PRT).

**Stream 1 Technology & Methods *Development* in Nova Scotia**

Stream 1 targets early-stage (pre-commercial) conceptual projects that create made-in-Nova Scotia solutions for GHG emissions reductions. Stream 1 funding is intended to support innovation and IP/economic development in Nova Scotia. The objective of this funding stream is to develop and advance novel technologies, and/or methods that target hard-to-abate GHG within the province.

Projects under this stream will be funded to $50,000[1] (excluding taxes, not including Mitacs funding) for conceptual-level studies of not more than 12 months. The projects must aim to solve an identifiable GHG reduction or mitigation problems in the province and must clearly demonstrate how the target technology, and/or method would be applied in Nova Scotia.

Completed Stream 1 projects that advance Nova Scotia's progress to net zero by 2050 and describe an achievable path to IP and/or economic development may be eligible for follow-on funding up to $250,000[1] over an additional 1 to 2 years (provided they finish within the program funding window) to further advance their proof of concepts to a point where they can attract private sector or additional public sector funding. This will be based on available funding and can not be guaranteed for all research calls.

**Stream 2 Technology & Methods *Adoption* from Elsewhere**

Stream 2 projects target emerging GHG reduction technologies and approaches under development outside of Nova Scotia. Stream 2 will fund technoeconomic and/or feasibility type studies that evaluate how technologies, methods, and/or practices demonstrated elsewhere can be imported and deployed, with or without modification, in the Nova Scotia context.

Stream 2 will fund up to $130,000 per project (excluding taxes, not including Mitacs funding) for projects of not longer than **12 months duration**. Completed Stream 2 projects must aim to obtain additional funding from Nova Scotia's technology incubation ecosystem for follow on work.

[1] Not including Mitacs funding (see Section 7.2).

## 5. Priority Research Themes

Priority Research Themes include the subjects listed below. These Themes are described in more detail in **Appendix 1**. The Priority Research Themes will evolve over the course of the three-year Program; subsequent calls may seek research projects under different themes.

Theme 1: Fishing and Ferry Fleets

Theme 2: Nature-Based Solutions for Carbon Sequestration

Theme 3: Agricultural Emissions

Theme 4: Carbon Capture & Utilization (CCU)

Theme 5: Long-Term Energy Storage

Theme 6: Electricity System Challenges Post 2030

Theme 7: Hydrogen as an Alternative Fuel

Theme 8: Biomass use for energy

For projects that touch on more than one Theme, Applicants are asked to pick the primary Theme that is most applicable or relevant to their project. Applicants will be expected to identify the GHG reduction gap their research is intended to address, then describe project objectives, methodology and outcomes.

## 6. Eligible Activities

The ECT Research program seeks to identify and develop a suite of promising, emerging clean technologies, approaches and practices that warrant continued funding from Nova Scotia's technology incubation ecosystem. The Program aims to fund early-stage projects that are difficult to fund through other funding sources. Economic development opportunities in Nova Scotia and the creation of intellectual property are related core objectives of the Program.

The following eligible activities may be undertaken during the course of a project.

1. Research, development, assessment, data gathering, testing and integration of novel and innovative equipment, software, methodologies or approaches, for example:

    a. Proof of concept of technologies where there is a significant technical risk, including field trials, bench-scale testing, pilot plants, and prototypes.

    b. Research and/or development of new or iterative methodologies.

    c. Analytical tools and modelling software.

d. Other.

2. Pre-demonstration field testing – limited duration tests designed to develop the knowledge and understanding of the technology or approach including the development of monitoring and verification technologies and methodologies.

3. The installation of a pre-commercial technology; installation of equipment and/or infrastructure to support a demonstration or multiple demonstrations.

4. Modification of existing processes, equipment, or systems to accommodate an innovative technology or processes.

5. Cost assessments for the engineering, design and permitting of an installation as described above, including engineering and design costs if supported or required as part of a demonstration.

6. Operation, performance testing, and analysis of pre-commercial equipment in its intended environment to assess performance of an innovation.

## 7. Process and Funding

### 7.1 Timing

The ECT program is currently in its third and final year. The Fall 2025 research call is the fifth and final research call under the current ECT funding program. All projects selected for funding within the Fall 2025 cohort will be required to follow the below funding structure and timeline:

- Projects will be selected for award by the end of 2025 calendar year
- Stream 1 projects will be awarded a maximum of $50,000 for the execution of their work scope, exclusive of tax and Mitacs matching funds.
- Stream 2 projects will be awarded a maximum of $130,000 for the execution of their work scope, exclusive of tax and Mitacs matching funds.
- Project start date no later then March 1st, 2026.
- Project completion date not later then February 28th, 2027. **This is a 12-month maximum duration for both Stream 1 and 2 projects.**
- No follow-on funding is eligible for Fall 2025 projects unless the program is extended. In this case NZA will inform selected project leads of this change.

All costs exclude taxes, which will be paid by NZA in addition to the funding amount listed above.

Table 1: ECT Research Program Milestone Dates

| Item | Date |
|---|---|
| **Fall 2025 Research Call Opens** | 29 September |
| Question Period Closes | 24 October 2025 |
| **Research Call Closes** | 03 November 2025 |
| Proposal Review and Selection | 20 December 2025 |
| Contracting | January 2026 |
| Mandatory Project Start Date | 01 March 2026 |

### 7.2 Mitacs Accelerate Umbrella Grant Funding

All submitted proposals are potentially eligible for additional (matching) funding through a pre-approved Mitacs Accelerate Umbrella grant established for this program[2]. Mitacs funding is available for students at the undergraduate, post-graduate levels as well as new graduates who are within two years of the date of their graduation. The Applicant should consider ECT Program timelines (12 months) when selecting student grant opportunities. Net Zero Atlantic (NZA) qualifies as a partner organization. Please list NZA as well as any other partner organization who will contribute to the Mitacs sponsorship.

The proposal submission template includes a section related to Mitacs applications. Inters must already be secured at the time the proposal is submitted to the ECT Program. Proposals that seek Mitacs funding will go through a two-step approval process: review by the ECT Program Proposal Review Committee with all other proposals, and if selected for funding, a three-weeks review by Mitacs (Table 1).

### 7.3 Eligible Costs

The ECT Research Program will fund up to 100% of eligible projects costs, up to the maximum award allocation. Eligible project expenditures can begin once the Applicant has been notified that they have been selected for funding under the ECT Research Program, but no payments will be made until NZA, and the successful proponent have completed the contracting phase.

Eligible costs are described below. Funds can be used for research, proof-of-concept or prototype development, technology design and technology optimization, intellectual property development, and assessment of market potential. Funds can cover cost of researchers, contractors, technicians, students and post-doctoral researchers.

Equipment and other costs that are difficult to attribute directly to an individual project are generally ineligible but may be considered.

<u>Eligible Expenditures</u>

A. Salaries and Benefits

Eligible

- For employees on the payroll of the Lead Proponent for the actual time spent by employees on the project.
- Labour stipends for students (undergrad, Masters, PhD candidate) or recent graduates.
- A reasonable prorated share of benefits such as the employer's portion of Canada Pension Plan and Employment Insurance, health plan and insurance, Worker's Compensation, sick leave and vacation plus any other employer paid payroll related expenses.

[2] To apply for matching Mitacs funding, the Applicant would use all or a portion of the funding requested from NZA or the Applicant's own cash contribution. Please see the 'Budget Submission Template' for instructions on how to show this in the submission.

Not Eligible

- Salary bonuses, performance pay, shares, stocks, stock options and the like.
- Incentives such as vehicle use and gym memberships.
- Salaries and benefits that have been reimbursed under other funding arrangements.

B. Contracting Services

Eligible

- Professional, technical, and scientific contracting services provided by partners, sub-contractors and consultants (i.e. not employees on the Lead Proponent's payroll).

Not Eligible

- Contractual services from a Lead Proponent's inter-related company.
- Items which have no relationship to the project, or which have been charged on an indirect basis in Overhead.
- Contracting services that have been reimbursed under other funding arrangements.

C. Capital Expenditures

Eligible

- Purchase, installation, testing and commissioning of qualifying equipment, materials and products, including diagnostic, testing tools and instruments.
- Materials consumed in carrying out the project, including those utilized in the production and operation of models, prototypes and pilot plants.

Not Eligible

- Items which have no relationship to the project, or which have been charged on an indirect basis in Overhead.
- Capital Expenditures that have been reimbursed under other funding arrangements.

D. Results Dissemination/Travel

Eligible

- Expenditures including meals and accommodation.
- Reasonable travel costs, including meals and accommodation necessary for project activities e.g. field trials and demonstrations at locations away from the Proponent's usual location.
- Conferences costs including travel, meals and accommodation **where project results are presented.**

Not Eligible

- Alcohol, entertainment and gifts.

E. Other Expenses

Eligible

- Printing services and translation.
- Data collection services, including processing, analysis and management.
- Elder Honoraria.

Not Eligible

- Education and outreach programs, training, workshops.

F. Overhead

Overhead expenditures which are directly related to the conduct of the project, and which can be attributed to it. Overhead expenditures cannot exceed a maximum of 15% of eligible expenditures[3]. Overhead expenditures include:

- Administrative and corporate support provided directly to the project by the Recipient's employee(s), including audit and similar professional fees.
- Routine laboratory and field equipment maintenance, based on the actual expenditure by a Recipient.
- Office operating expenses directly related to the conduct of the project (e.g. faxes, telephone, photocopies, and office equipment).

Not Eligible

- Utilities (electricity, fuel, internet), rent.

A predetermined overhead percentage (based on evidence provided by the recipient of expected overhead expenditures at the time of CA negotiation), may be set and subsequently applied to each claim, in order to avoid unnecessary administrative burden to funding recipients.

G. Taxes

GST, PST and HST minus of any tax rebate to which the recipient is entitled. NZA will pay applicable taxes in addition to the funding amounts listed in section 7.1 to ensure the full funding amount is available for the project.

**7.4 Leveraging Funds and In-Kind**

Leveraging ECT Program funds with funds obtained elsewhere is encouraged and will be included among the evaluation criteria. Preference will be given to projects that leverage funding from non-government sources and projects that include participation by or inclusion of Indigenous partner organisations.

[3] The overhead calculation excludes funding paid to Mitacs

Cash and/or in-kind funding from other sources are not required to qualify for ECT Program. In-kind costs are ineligible for reimbursement.

In recognition that both private sector and academic researchers are competing for funding, NZA takes a restrictive view of in-kind contributions. In-kind support must be reportable by the proponent and easily verifiable, directly support the project, and fall into the same cost categories as identified for Eligible Expenditures.

Note that only one contract will be issued per project; it is the Lead Proponent's responsibility to contract with and disburse funds to their research collaborators.

## 8. How to Apply

The **deadline** for the Fall 2024 call submissions is **Monday, November 03, 2025, at 3:00 pm AST**.

Applicants are asked to download our *Proposal Submission* and *Budget Submission Templates* from the ECT website and fill out the project description and budget sections. Submissions are made online by uploading the proposal form to the link below

*https://netzeroatlantic.sharefile.com/i/ib83802bfd044e519*

Proponents will receive a return email acknowledging receipt of submission.

Submissions are to include the following three (3) files:

A. One (1) completed Proposal Submission in word format.

B. One (1) completed Budget Submission Template in excel format.

C. One (1) pdf compiling both the A and B.

All files must use the following naming structure:

- APPLICANT LAST NAME_Proposal_ECT_NS_ FALL_2025_ YYMMDD
- APPLICANT LAST NAME_Budget_ECT_NS_FALL_2025_YYMMDD
- APPLICANT LAST NAME_COMPLET PDF SUBMISSION_ECT_NS_FALL_2025_YYMMDD

## 9. Questions and Clarifications

Net Zero Atlantic will accept questions from interested Applicants on an ongoing basis until 5 pm AST, Friday October 24, 2025. Questioners will receive a direct email response from NZA, and all questions and answers will be posted anonymously on the NZA website FAQ.

Please submit your questions by email (no phone calls please) to the NZA Program Coordinator at info@netzeroatlantic.ca. Please do not contact the DECC with questions.

## 10. Proposal Contents

As outlined in the Proposal Submission Template, all proposals must include:

1. Project Summary: An outline of the Starting TRL and target TRL at project completion and brief descriptions of the knowledge gap being addressed, the GHG emissions reduction path and the development of the proposed solution towards economic development after the ECT project completion.

2. Project Overview: A non-confidential description of the proposed research/work including a statement of the project's research objective(s) and expected outcomes.

3. ECT Program Alignment: A description of the project's alignment with the selected stream (technology creation/development or adoption/adaptation) and PRT.

4. Project Research Objectives: A description of the proposed research objective(s) and how they will address the knowledge gap(s) in GHG emissions reduction in the selected PRT.

5. Economic Benefits: A description of how the project will lead to economic development and benefits to Nova Scotia

6. Work scope: A description of the research methodology by task including the expected time needed to complete each task This section will be used in the contract with successful Applicants, so Applicants must use a structured approach that lists, for example, tasks or work packages, their duration and expected outcomes.

7. Risk: A description of perceived risks to project success, such as risk in securing needed personnel and/or additional funding or leverage, risks to project timing, safety or environmental-related risks, along with how the Applicants will manage these risks should they arise.

8. Team: A summary of key research team members' expertise and their roles in the project (CVs not required).

9. Budget: A budget presented on the template provided.

10. Planned Outcomes: A description of project outcomes and a plan to implement the proposed solution or progress the project towards commercialization.

11. EDIA: A statement regarding how the ECT Research Program's Equality, Diversity, Inclusion and Accessibility (EDIA) expectations will be met (Section 11).

12. Rural and Remote Application: A description outlining how the project concept or technology may be implemented and or modified for use in rural and/or remote applications.

In fairness to other Applicants, a winning proponent is expected to complete the project as proposed in their original application. Once a project commences, NZA reserves the right to decline any modifications to the project budget, schedule or tasks requested. In addition, Applicants that commit to securing funds/in-kind leverage from other agencies, programs, etc. are expected to follow through with such plans. NZA reserves the right to cancel the contract in the event pledged funding or leverage cannot be obtained.

## 11. Equity, Diversity, Inclusion and Accessibility Framework

The ECT Research Program seeks to support an inclusive and equitable transition to net zero emissions. Research carried out under the program must therefore support the pursuit of equity, diversity, inclusion, and accessibility (EDIA) in both research practice and in research project design. To support EDIA in research *practice*, proponents must take steps to consider EDIA in the hiring of and management of their research teams. To support EDIA in research *design*, proponents must ensure that they have taken relevant EDIA concerns (i.e., potential impacts of a project on equity-seeking communities) into account in the design of their research projects. Proponents will further be expected to report on EDIA outcomes at project close.

The Program administrators will use the following definitions in the evaluation of proposals.

> **Equity:** the removal of systemic barriers and biases that have contributed and currently contribute to disparities in opportunities and outcomes for diverse communities.
>
> **Equity-Seeking Groups:** communities that, due to historical and contemporary injustices, experience and seek to address barriers to equal access of resources and opportunities. These communities include Indigenous peoples, racialized minorities, LGBTQ2S+ people, people with disabilities, and women in STEM fields.
>
> **Diversity:** the presence of individuals, organizations, and communities with varying attributes including, but not limited to, race, ancestry, culture, language, gender identity, religion, sexual orientation, and ability.
>
> **Inclusion:** the creation of an environment in which all individuals, particularly those identifying as belonging to an equity-seeking group, feel valued for their contributions and supported to fully participate.
>
> **Accessibility:** the provision of conditions required to enable the participation of all individuals, particularly those identifying as belonging to an equity-seeking group.

Within the Proposal Submission Template, proponents will be asked to respond to the following questions, which will be scored during the evaluation process as described in Section 13.

*Questions to be completed in the Proposal Submission Template*

**EDIA in Research Practice**

1. Do you or any of your co-applicants identify as belonging to an equity-seeking group?

   -Yes
   -No
   -Do not know
   -Prefer not to answer

2. If you plan to hire additional team members to work on the proposed project, what measures will you take to ensure that a diverse pool of candidates can access and apply for positions?

3. In the management of your team, how will you ensure that all team members have the support needed to fully participate in the research program and to access opportunities for networking and skill development?

**EDIA in Research Design**

1. If any of your research activities will be carried out at an offsite location and/or will require the participation of community members, what measures will you take to ensure that community needs and/or concerns are accounted for in the design and execution of your research project?

2. Could the outcomes of your research project impact (positively or negatively) equity-seeking groups? If so, what measures will you take to avoid any negative impacts and enhance benefits to those equity-seeking groups?

Note: This Framework assumes that EDIA in Research *Practice* will apply to all projects. However, EDIA in Research *Design* may not apply to all projects (i.e., if the research activities will not be conducted offsite and/or if the research activities and/or outcomes will have no significant impact on equity-seeking groups). In this case, the proponent will be asked at the proposal submission stage to explain and justify why EDIA in Research Design does not apply to their project.

## 12. Rural and Remote Considerations

As the energy transition advances, considerations need to be made for the 41% of Nova Scotians that live in rural communities. As industries work on advancing large scale technologies, considerations into implementation practices and infrastructure costs must be made for rural, remote, low density and/or underrepresented communities.

Within the Proposal Submission Template, proponents will be asked to outline how their project may impact rural and/or remote communities. Rural applications are not a requirement of the ECT program, but considerations will be given to projects that demonstrate the potential positive impact for these communities.

## 13. Proposal Evaluation

Proposal evaluation panels will be managed by the Program Administrator and will include external subject matter experts as applicable. External reviewers will be asked to sign a Non-Disclosure Agreement (NDA) to protect commercially sensitive information and ideas. The following criteria will be used to evaluate proposals:

| **Factor** | **Weight** |
|---|---|
| **1. Project Need and Responsiveness to the Applicant Guide (AG):** a. Research objective clearly stated; b. Project aligns with stated stream and Priority Research Theme; c. Proponent has articulated a real knowledge gap(s) to GHG reduction and economic benefits to Nova Scotia. | 30% |
| **2. Approach and Methodology:** a. Proponent has outlined a clear and effective workplan that will achieve the stated objectives, and a sound approach in undertaking this project; b. Communication format and frequency are described; c. Proponent describes an achievable schedule with well-defined milestones and deliverables. d. Proposal includes a clear direction or preliminary plan to progress towards economic development | 35% |
| **3. Qualifications, Capabilities and Management:** a. Experience and capabilities of the lead proponent and delivery team; b. Collaboration, team organisation and scale are appropriate for this project; c. Risks have been sufficiently assessed and managed. | 15% |
| **4. Budget, Leverage and Value:** a. The budget is clear and complete and well described; b. The Team will offer leverage and good value for the proposed budget. | 10% |
| **5. EDIA:** a. Proposal articulates measures to include EDIA in Research Practice; c. Proposal articulates measures to include EDIA in Research Design. | 10% |
| Total: | 100% |

***Confidentiality:*** *The successful Applicant herein authorizes Net Zero Atlantic to reveal the Applicant's name, title, affiliate institution, title and lay summary of the project, duration of support, and approved funding amount. Please indicate if the application contains any information, apart from rates and prices, that cannot be shared.*

**Appendix 1: Priority Research Themes**

# Emerging Concepts and Technologies (ECT) Research Program

## Priority Research Themes

version. 10 October 2024

This document describes current Priority Research Themes of the ECT Research Program. This list is current as of the date given above and may be updated with new or expanded Themes for subsequent calls. The research subjects and key issues listed below are not intended to be exhaustive nor restrict Applicants to consideration of these issues alone; other subjects proposed by the Applicant will be considered as long as they broadly fall within a Priority Research Theme.

All projects submitted to the ECT Research Program must align with one of these Themes. For projects that touch on more than one Theme, Applicants are asked to pick the one Theme that is most representative of their project. Applicants must identify the particular knowledge gap(s) within a Theme that will be addressed by their project. Applicants should consider the following points when designing their projects and address these points, as applicable, in their application:

1. For the 2030-2050 period, what are the expected sources of greenhouse gas (GHG) emissions in this sector in Nova Scotia?

2. What are the gaps between what's currently being done and what needs to be done to ensure decarbonization targets are reached in this sector?

3. In what way(s) will your proposed project address these knowledge gap(s) and ultimately reduce GHG emissions in the province?

4. What economic benefits to Nova Scotia will result by addressing the identified knowledge gap(s)?

### Fishing and Ferry Fleets

The marine industry is core to the provincial economy, culture, and identity. Net-zero enabling technologies, such as advanced batteries and alternative fuels for marine transportation, remain at an early stage of development.

Some key issues when it comes to managing emissions include:

- Vessel/equipment upgrades to reduce fuel use.
- Adoption of fishing techniques, sensors and other equipment that reduce or replace bottom trawling.

- Adoption of best practices to improve resource harvest efficiency and thus achieve emissions reductions (e.g., better planning, use of science-based decision making, improving rule enforcement, implementing better monitoring programs, etc.).

## Nature-Based Solutions for Carbon Sequestration

Nature-based solutions include a variety of approaches to protect, manage and restore forests and timberlands, wetlands, croplands, grasslands and grazing lands so that these ecosystems can store carbon. An understanding of the carbon sequestration potential in Nova Scotia may include collaboration with Mi'kmaw communities so that Indigenous knowledge systems and approaches can be included in any solutions adopted.

Some key issues in this sector include:

- There is a lack of knowledge and quality data regarding soil nutrient cycling and storage within forest, wetland, and agricultural soils and throughout riverine and estuary ecosystems.

- New or improved analytical methods and remote sensing approaches are required to better assess soil quality, evaluate the nutrient cycling potential and monitor trends.

- Proxy indicators are needed for carbon stocks and subsequent sequestration rates. Other indicators for adaptation and mitigation successes and failures are also needed.

- Centralized databases and regional inventories of forest, wetland and agricultural soils are required. These databases must be established with incentives to share data and must be accessible in a barrier-free way to small landowners. Data privacy issues and other impediments to data access must be resolved so that existing, privately owned datasets can be used as for baselines.

- The carbon credits/offsets regime is difficult for most potential users to understand or utilize. Understanding how to assess and value sequestration potential as it relates to offsets, credits, insurance, market access, and the monetization of woodlots and wetlands is a necessary step for incentivising private owners to participate in the carbon market.

## Agricultural Emissions

Agricultural emissions, largely generated through non-combustion activities, defy easy abatement using standard mitigation strategies such as electrification and fuel-switching. Research and development are needed to accelerate the development of solutions that prevent and or/capture emissions from agricultural processes and scale-up their adoption in Nova Scotia.

The main sources of emissions in this sector include:

- Enteric (ruminant) fermentation.

- Manure management.

- Liberation of $N_20$ from soils.
- 'Indirect emissions'.

Some of the main issues when it comes to managing emissions in this sector include:

- Development of zero-emissions farm machinery and equipment.
- Enhancing carbon sinks (e.g., through reduction in tillage, restoring degraded land, improving pasture management, reducing fallow periods, managing residues, etc.).
- Reducing methane emissions (e.g., through extending lactation periods of dairy cows, using more efficient breeds, feed additives, improving reproductive performance, etc.).
- Reducing nitrous oxide emissions (e.g., through better measurements of $N_20$ loss, improvements to fertilizer management and application practices; greater use of legumes as a nitrogen source; use of cover crops to remove excess available nitrogen; adjusting tillage intensity, etc.).

### Carbon Capture & Utilization Technologies

There will be certain emissions that cannot be prevented or captured upon point of release. Though nature-based solutions can counteract some of these residual emissions, their scope will be constrained by geographic and ecological boundaries. Carbon Capture and Utilization technology will thus likely be required in Nova Scotia and the world at large to reach net-zero emissions. Research on this subject would expand work already undertaken by the province in past years and focus on adapting technologies developed elsewhere for use in Nova Scotia.

Innovation will be central to reducing the cost of CCU technologies and supporting accelerated commercialisation. Priority innovation needs for CCU include but are not limited to:

- Reducing the energy consumption needed to separate $CO_2$ through emerging sorbent technologies and innovative approaches able to regenerate the solvent at low to medium temperatures.
- Reducing the cost of carbon sorbents and/or making them more durable (increasing their lifespans).
- New air contactor designs and processes to reduce energy use.

## Long-Term Energy Storage

Nova Scotia is a winter-peaking, cold climate jurisdiction that will transition to a low-carbon electricity generation system powered by variable-output renewable energy (i.e., wind and solar). This makes Nova Scotia vulnerable to supply interruptions during periods of limited solar and wind availability, which in turn necessitates the use of both short-term and long-term energy storage. Cost-effective long-term energy storage solutions are not yet commercially available. In addition, the technical and regulatory integration of long-term energy storage into the province's energy grid is still unexplored.

Some of the main issues with resulting implications for future GHG reduction include:

- Understanding the value that energy storage can provide in energy systems with large penetrations of variable renewables.
- Improving the capacity and longevity of lithium ion and other battery types.
- Assessing the technoeconomic system impacts of adopting compressed air or other storage opportunities.
- Understanding the applicability of thermal energy storage in residential, commercial and industrial buildings.

## Electricity System Challenges Post 2030

While it is agreed upon that fossil-fuel-based electricity generation capacity will be reduced in Nova Scotia, many questions about the electricity system post 2030 are unanswered. How can variable renewables replace the firm capacity that natural gas provides to the electricity generation system? What are the regulatory barriers (and pathways) for community renewable energy projects? How can the reliability of the electricity grid be maintained with an increased number of severe weather events? What impact does a widespread adoption of heat pumps have on the peak electricity demand and consequently on the required electricity generation capacity? How valuable is peak shaving in Nova Scotia's future energy system? These are a number of example questions that would benefit from further investigation.

Addressing these knowledge gaps would allow Nova Scotia to minimize curtailment, better integrate community and private sector wind and solar power into the grid and strategically upgrade different sectors of the electricity grid in response to emerging projects.

Some of the main issues related to this sector include:

- Resource adequacy and seasonal energy use and energy production imbalances.
- Network adequacy, cost and efficiency.
- Managing system stability and dispatch, and resource adequacy in the face of increased renewable energy coming from rural locations.
- Improving grid efficiency
- Circular economy addressing new supply chain challenges

## Hydrogen as an Alternative Fuel

Hydrogen is an energy carrier that has the potential to contribute to the reduction of GHG emissions in Atlantic Canada. For hydrogen to be accepted and widely used as an alternative fuel after 2030, work is required to further our knowledge on production techniques and applications that are reliable, economically feasible, and safe.

Areas that require innovation and investigation include:

- End use applications.
- Small scale production of hydrogen for use on site.
- Transportation and storage of hydrogen.
- Monitoring of equipment and transportation methods.

### Biomass use for energy

The use of biomass to replace hydrocarbon sources of energy can reduce the net GHG emissions related to electricity generation, transportation, heating and processing. Biomass sources include municipal waste, residual waste from forestry, agriculture and other organic materials that can be converted into high value sources of energy. Many methods of biomass conversion to alternative energy sources exist, yet new innovations are still required to optimize processes and have alternative fuels more commonly available and used. Areas of research and development that will benefit from investment and investigation include:

- Optimizing available Nova Scotia feedstocks for biogas or other renewable fuels
- Adoption of existing technologies from other jurisdictions to address Nova Scotia's energy needs
- Testing of new feedstocks, methods or processes for generation of renewable fuels

END