REQUEST FOR INFORMATION (RFI)

CANADIAN COAST GUARD – MARINE VESSEL FLEET GREENING

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PART 1 – PURPOSE AND NATURE OF THE RFI

1.1 Context

The Government of Canada (Canada) has committed to transition to low-carbon and climate-resilient operations while also reducing environmental impacts beyond carbon. The Greening Government Strategy (GGS) and Federal Sustainable Development Strategy (FSDS) articulates ambitious sets of goals and commitments to ensure that Canada is a global leader in government operations that are low-carbon, resilient to climate change, and green.

The GGS includes provisions for reducing greenhouse gas (GHG) emissions from Canada's National Safety and Security (NS&S) fleets, which includes the Canadian Coast Guard (CCG).

The GGS mandates reduction of fleet and facility operations GHGs by at least 90% below 2005 levels by 2050 (with an aspiration to be carbon neutral). Additionally, by 2023, NS&S fleet departments are expected to develop and regularly update Operational Fleet Decarbonization Plans that outline how they will reduce their emissions from operations in line with the overall 2050 target.

A combination of permanent carbon dioxide removal and operational measures will contribute to net-zero emissions from NS&S fleets. NS&S departments will adopt best practices to improve efficiency and reduce emissions and environmental impacts in the areas of:

- fuel procurement, including low-carbon fuels
- fleet procurement, including purchasing energy-efficient platforms, equipment and machinery
- operational efficiency and net-zero research and innovation

1.2 Purpose of the RFI

Natural Resources Canada (NRCan) is launching this Request for Information (RFI) in order to seek information and feedback from industry on practical guidance and viable options in marine fleet greening that could contribute to the reduction of GHG emissions within CCG's fleet of marine vessels.

This RFI invites industry to provide information with respect to the following:

a) Data collection and insight solutions capable of measuring, recording, integrating, and analyzing data derived from the operation of marine vessels.

   Data collection applications to track performance metrics related to marine vessel energy efficiency, including, but not limited to shaft power and torque, fuel consumption, GHG emissions, variations in drafts/displacements, distance travelled, average speed and speed profile, weather and environmental conditions, time at sea, time at port/anchor, etc..

   Data insight solutions of interest would make use of collected operational data to perform comprehensive and strategic analyses on CCG fleet operation in support of overall marine vessel decarbonization and energy efficiency improvements, including, but not limited to: characterization and quantification of operational profiles, development of data-based prediction tools to support optimization (e.g. fuel consumption prediction modelling), quantification of performance variation subsequent to implementation of energy saving device/s, anomaly reporting (e.g. high fuel consumption instances), detection of performance degradation of machinery or equipment (e.g. predictive maintenance) etc..

b) Technologies, devices, and solutions for marine vessel decarbonization, including, but not limited to, electrification and/or hybridization, on-shore charging infrastructure, machinery and/or hydrodynamic and operational measures that could lead to GHG emission reductions, improved energy efficiency, vessel optimizations, etc..

Respondents are requested to provide answers and feedback related to Part 5 - Questions to Industry - which contains questions for specific information being sought by Canada.

1.3 Nature of the RFI

This is not a bid solicitation. This RFI will not result in issuance of a solicitation or the award of any contract. As a result, interested suppliers of any goods or services described in this RFI should not reserve stock or facilities, nor allocate resources, as a result of any information contained in this RFI. Nor will this RFI result in the creation of any source list. Therefore, whether or not any interested supplier responds to this RFI, this will not preclude that supplier from participating in any future procurement. Also, the procurement of any of the goods and services described in the RFI will not necessarily follow this RFI. This RFI is simply intended to solicit information and feedback from industry with respect to the matters described in this RFI. Canada assumes no responsibility or obligation with respect to the cost of preparing a response to this RFI. Any and all expenses incurred by industry in pursuing this opportunity are at industry's sole risk and expense.

NRCan may use non-proprietary information provided in this review and/or in the preparation of any formal solicitation document. Respondents are encouraged to identify, in the information they share with Canada, any information that is to be considered as either proprietary or third party. Canada may be obligated by law (e.g. in response to a request under the *Access of Information and Privacy Act*) to disclose proprietary or commercially-sensitive information concerning a respondent. For more information, please see http://laws-lois.justice.gc.ca/eng/acts/a-1/.

NRCan will not be bound by anything stated herein and reserves the right to change at any time, any or all parts of the requirement, as it deems necessary. NRCan also reserves the right to revise its marine fleet greening and procurement approaches, as it considers appropriate, either based upon information submitted in response to this RFI or for any other reason it deems appropriate.

PART 2 – INSTRUCTIONS TO RESPONDENTS

2.1 Nature and Format of Responses Requested

The Department's current view of its requirement for CCG marine fleet greening, the characteristics of the current CCG marine fleet, and the technical requirements for marine vessel greening and decarbonization are all detailed in Part 3 and Part 4 of this RFI.

The Department is also seeking input and responses to specific questions (refer to Part 5 – Questions to Industry) covering important elements of the requirement prior to proceeding with finalizing CCG's marine vessel fleet greening strategy and any procurement initiatives.

Respondents are invited to provide comments regarding the content of Part 3 and Part 4 included in this RFI, and to complete and return the electronic format of Part 5 – Questions to Industry. Respondents should explain any assumptions they make in their interpretation of the RFI's stated requirements.

2.2 Response Costs

NRCan will not reimburse any respondent for expenses incurred in responding to this RFI.

2.3 Treatment of Responses

2.3.1 Use of Responses

Responses will not be formally evaluated. The responses received may be used by NRCan and CCG to develop or modify procurement strategies or any draft documents contained in this RFI. NRCan will review all responses received by the RFI closing date. NRCan and CCG may, at their discretion, review responses received after the RFI closing date.

2.3.2 Review Team

A review team composed of representatives of NRCan, CCG, and the National Research Council (NRC) will review the responses. NRCan, CCG, and NRC reserve the right to hire any independent consultant, or use any Government resources considered necessary to review any response. Not all members of the review team will necessarily review all responses.

2.3.3 Confidentiality

Respondents should indicate and mark any portions of their response that they consider proprietary or confidential. NRCan, CCG, and NRC will handle these portions in a confidential manner in accordance with the *Access to Information Act* of Canada.

2.3.4 Follow-up Activity

NRCan, CCG, and/or NRC may, at their discretion, contact any respondents to follow up with additional questions or for clarification of any aspect of a response. NRCan, CCG, and/or NRC may, at their discretion agree to meet with respondents to provide respondents with the opportunity to present and/or demonstrate their capabilities in relation to this RFI. Respondents' presentations are at no obligation to NRCan, CCG, or NRC, and respondents will be responsible for all costs associated with NRCan, CCG, or NRC's invitation to make a presentation.

2.5 Format of Responses

2.5.1 Response content

The first page of each document of the response provided should contain:

a) The RFI number
b) The name of the company that the respondent represents;
c) The title, name and contact information of the respondent; and,
d) The date of submission of documents.

All pages should be identified with the company's name and numbered.

2.6 Submission of Responses

Respondents are requested to submit their responses only by e-mail to:

Serge.tshimanga@nrcan-rncan.gc.ca

Canada requests that responses to the RFI be submitted in a searchable, digital format. Please note that due to limitation on the size of our network capability we request that each email not exceed 5MB. Respondents may want to provide separate emails identifying the number of emails.

2.6.1 Responsibility for Timely Delivery

Each respondent should ensure its response is delivered on time to the correct email address specified in section 2.6. An acknowledgement of receipt will be provided to each respondent following the submission of their response

2.7 Enquiries

All enquiries and other communications related to this RFI must be directed exclusively to:

Serge.tshimanga@nrcan-rncan.gc.ca

Since this is not a bid solicitation, Canada will not necessarily respond to enquiries in writing or by circulating answers to all respondents.

2.8 Changes to the RFI

Changes to this RFI may occur and will be published on the Government Electronic Tendering System (GETS). Canada asks respondents to visit www.buyandsell.gc.ca regularly to check for changes, if any. Respondents may also subscribe to receive notifications whenever there is an amendment or update related to this RFI.

2.9 Security Requirements

There are no security requirements associated with responding to this RFI.

2.10 Official Languages

Responses to this RFI are requested to be presented in either of the official languages of Canada (English or French).

PART 3 – DRAFT DEPARTMENTAL AND PROCUREMENT STRATEGY

3.1 Introduction

In order to meet the GGS's GHG emissions reduction mandate for the federal government's NS&S fleets, as well as inform CCG's forthcoming Operational Fleet Decarbonization Plan, NRCan is soliciting information from industry and other interested participants that may contribute to the greening of marine vessel fleets and promote decarbonization and fleet modernization within the maritime sector.

This RFI will inform the following users:

1. **Canadian Coast Guard (CCG)** – CCG currently owns and manages an active fleet of 123 marine vessels that are stationed in home ports across Canada and which serve to ensure the safety, accessibility, and security of Canadian waters, and protect Canada's marine environment. CCG is responsible for ensuring all maintenance requirements and capital expenditures associated with its marine fleet vessels are met, as well as its transition toward low-carbon mobility and responsibility for GHG emission reductions.

2. **Natural Resources Canada (NRCan)** – Through its Greening Government Operations (GGO) Fleets team, NRCan provides support to participating government departments and agencies with modernizing their fleet vehicles and achieving GHG emission reduction targets specified under the GGS mandate. NRCan works with these fleets to find strategic and sustainable mobility solutions tailored to their operational needs.

3. **National Research Council (NRC)** – NRC is Canada's largest research and development organization. As part of its Departmental Sustainable Development Strategy (2020 to 2023), NRC will contribute directly to federal sustainable development goals that will support effective action on climate change, clean growth and the usage of clean energy. This will enable a cleaner, more sustainable future for Canadians and help position the country to achieve a net-zero emissions economy by 2050.

4. **Royal Canadian Navy (RCN)** – The RCN serves as the naval force of Canada, which seeks to protect Canadian sovereignty and interests at sea, at home, and abroad. The RCN marine vessel fleet is made up of numerous classes of ships, submarines, support vessels, and specialized units. The RCN is committed to achieving the energy and environmental objectives required to meet its commitments under the Defence Energy and Environment Strategy (DEES), which promotes environmental stewardship and effective action on climate change.

5. **Transport Canada (TC)** –TC is responsible for the development and oversight of responsible transportation policies and programs across Canada, including within the marine sector. In its support of green transportation systems, TC leads a suite of regulatory and voluntary measures to reduce greenhouse gas emissions within the marine sector and provides testing services for clean transportation technologies so that they may be introduced in a safe, effective, and timely manner for Canadians. Additionally, TC operates a fleet of four ferries, which provide inter-provincial passenger ferry services in Atlantic Canada and Eastern Quebec.

While responses to this RFI should be tailored specifically to the overall profiles and characteristics of CCG marine vessels and their operational requirements, as specified within this RFI, responses may be used by any of the other identified users as contributions to a shared knowledge resource base.

3.2 Background

CCG's marine vessel fleet comprises 125 active vessels, with vessel lengths ranging from 12 m to 119.6 m, and gross tonnage ranging from 13.3t to 11,345t. These vessels service a wide range of regional locations, cruising ranges, and vessel and voyage classes in accordance with the varying operational requirements managed and directed by the CCG.

CCG seeks solutions to help eliminate GHG emissions from its operations, in support of Canada's Paris Agreement commitment to fight global warming and climate change. This will require a process of 'decarbonizing,' which refers to an accelerating reduction of operational GHGs through time.

As part of its mandate to protect the marine environment and meet the Canadian public's expectations of clean and healthy waters and coastlines, CCG is actively seeking information related to applications, technologies, devices, and solutions that could contribute to greening its marine vessel fleet and its transition to low-carbon mobility.

3.3 Greening Strategy and Procurement

Due to the large variance in usage profiles and operational needs within the CCG marine fleet, for the purposes of this RFI, the vessels have been split into two broad categories to enable more specialized and targeted approaches to decarbonization planning within participants' responses.

The two established categories of vessel groupings are presented in Table 1 alongside their generalized vessel properties and expected targeted approach to fleet greening. It should be noted that there may be exceptions for certain vessels within their corresponding category, as usage profiles have been consolidated for ease of categorization within this RFI.

Table 1: Vessel Categories for Purposes of RFI No. **NRCan-174590**

	Smaller Vessels	**Larger Vessels**
Number of vessels within CCG fleet	72 (58% of fleet by number of vessels)	53 (42% of fleet by number of vessels)
Length of Vessel (m)	12 to 20	20 to 120
Gross Tonnage (t)	15 to 100	200 to 11,345
Cruising Range (nm)	200 to 300	400 to 35,000
Fuel Capacity (m^3)	1 to 7	15 to 3,500
Vessel Class	Channel Survey and Sounding Vessel, SAR Lifeboat, Specialty Vessel	Nearshore Fishery Research Vessel, Offshore Fishery Science Vessel, Midshore/Offshore Patrol Vessel, Medium/Heavy Icebreaker, Medium/High Endurance Multi-Tasked Vessel, Air Cushion Vehicle, Special Navaids Vessel, Offshore Oceanographic Science Vessel, Specialty Vessel
Propulsion Type	Geared Diesel	Geared Diesel, Diesel Electric
Endurance (days)	1 to 2	8 to 205

Smaller Vessels generally have low cruising ranges, remain near coastal areas, and require frequent refuelling. They may be ideal candidates to explore electrification and/or hybridization

powertrains as well as other operational hybridization measures, within the context of this RFI, as their usage profile could allow for more frequent contact with on-shore electric charging equipment relative to larger vessels.

Larger Vessels generally have much longer cruising ranges, have larger fuel capacity and may be employed over several consecutive weeks or months at sea in active duty. While more time at sea and less frequent contact with on-shore charging equipment may preclude certain electrification/hybridization powertrains for these vessels, there still exist several measures and technologies which may permit hybridization, through energy storage systems, within these vessels for certain operational processes.

Within both smaller and larger vessels there are opportunities to explore vessel infrastructure upgrades/modifications (i.e. hydrodynamic and machinery measures), as well as data collection and insight solutions that may reduce GHG emissions.

Further information and resources on CCG's active marine vessel fleet can be found on their website: https://www.ccg-gcc.gc.ca/fleet-flotte/index-eng.html.

Following the RFI closing date, CCG, NRCan, and NRC will review the submissions provided by the respondents and will strategize accordingly the most appropriate actions needed to facilitate decarbonization of the CCG marine vessel fleet in association with CCG's operational requirements, fleet service life, and future procurement needs.

Any bid solicitations for equipment, infrastructure, or associated accessories resulting from information presented as part of this RFI will be conducted according to NRCan policy.

3.4 Technical Documents

Draft Annex A – Definitions and Requirements outlines the definitions and technical requirements for marine vessel electrification/hybridization, on-shore charging infrastructure, machinery and hydrodynamic measures, as well as marine vessel data collection and insight applications. The specification criteria is based on the operational roles of the applications, technologies, devices, solutions, and our best knowledge of the industry. Industry is invited to suggest changes and improvements to these criteria which Canada will consider with a view to improve capabilities and enhance competition.

3.5 Questions to industry

Respondents responding to this RFI are requested to answer the questions listed in "Part 5 – Questions to Industry" as well as to provide any additional comments regarding any part of the procurement strategy outlined in the RFI.

PART 4 – DRAFT DOCUMENTS

DRAFT ANNEX A – DEFINITIONS AND REQUIREMENTS

4.1 Definitions:

Greening: Process through which the overall environmental impact of an application, system, or technology is reduced.

Decarbonization: Process through which carbon emitted via greenhouse gas emissions is reduced or halted entirely.

Data Collection: Active tracking of marine vessel utilization data during operational duty cycles in order to establish performance metrics of a given vessel and contribute to data insight solutions. Performance metrics may include parameters such as fuel consumption, GHG and other emissions, average voyage speed and distance, time at port/anchor etc.

Shore Power Charging Equipment (SPCE): A complete assembly consisting of on-shore conductors, connectors, devices, apparatus, and fittings installed specifically for the purpose of power transfer and information exchange between the branch circuit and an electric vessel.

Manual Charging System: Conventional cable connection between the SPCE and an adjoining vessel by an experienced operator to facilitate charging of on-board batteries.

Wireless Charging System: Contactless connection between the SPCE and an adjoining vessel, whereby electrical current passes through an inductive sending coil to a receiver coil installed within the vessel. The high frequency current passing through the coil is converted to DC power and can be used to facilitate charging of on-board batteries. Wireless charging is less labour intensive and time-consuming than manual charging systems.

Automated Charging System: Conventional cable connection or wireless connection between the SPCE and an adjoining vessel that does not require presence or action from an operator. The vessel is positioned and charging initiated/completed automatically, via utilization of proximity sensors.

Endurance: The duration a marine vessel can continue in its operational capacity without needing to refuel or recharge critical machinery.

Hydrodynamic Measures: Vessel design properties, apparatuses, and techniques that directly affect the resistance between the moving vessel and the surrounding water during motion.

Underwater radiated noise (URN): Predominately low-frequency sound waves that are propagated by marine vessels through surrounding water during their operation. URN may threaten marine fauna that are dependent upon hearing and sound for navigation, communication, finding food, reproduction, and hazard detection.

Machinery Measures: Internal design elements, components, and devices that affect the overall propulsion of the vessel and its energy consumption during operation.

Diesel-Electric Drive: Mechanical output from the vessel's diesel internal combustion engine(s) is converted into electrical energy, which supplies the electric motors connected to the propeller(s) and auxiliary loads within the vessel.

Hybrid Drive: A combination of battery energy system and internal combustion engine powering the electric motors connected to the propeller(s) and auxiliary loads within the vessel. The battery energy

system stores surplus energy generated from the internal combustion engine and/or via regeneration from alternative vessel processes. The battery may or may not be chargeable using SPCE. The vessel may be powered solely from electricity for a period of time, depending on the performance and size of the battery energy system.

Fully Electric Drive: The electric motors connected to the propeller(s) and auxiliary loads within the vessel are powered solely by batteries. There is no internal combustion engine on board the vessel. The battery must be charged at regular intervals using SPCE in order to use the vessel.

Variable Frequency Shaft Generator (VFSG): Shaft generators are used to convey energy from the main engine to drive auxiliary loading. This, in turn, decreases dependence on auxiliary engines and motors to support the on-board operational loading within the vessel.

As the main engine generally supplies power with a variable output (due to changing propulsion needs, sea conditions etc.) and auxiliary loading has a more constant usage profile, the installation of a Variable Frequency Shaft Generator with a frequency converter to supply voltage at a constant current, can improve energy efficiency as well as reduce GHG emissions and maintenance costs.

Propeller: Mechanical system with a rotating hub and radiating blades that generate thrust to move the vessel through the surrounding water, powered via an engine or motor t.

Rudder System: Mechanical system with a directed control surface near the vessel's stern, that permits controlled steering of the vessel through the surrounding water.

Waste Heat Recovery System (WHRS): An energy recovery heat exchanger that recovers heat from the exhaust stream that would normally be lost from select mechanisms, such as the main and auxiliary engines, as a thermal energy power source. This thermal energy may be used to power systems such as absorption chillers, as well as for steam or hot water generation and/or air heating systems. This recovery of exhaust heat can decrease GHG emissions and improve overall energy efficiency for operation of the vessel.

Air Lubrication System: A system through which small bubbles can be created and propagated along the bottom of a vessel's hull in order to reduce frictional resistance between the vessel and the surrounding water during operation. This can reduce energy consumption when the vessel is in motion. The air lubrication system generally includes installation of air release units (ARUs), compressors, piping, valves, and control and automation systems. Not to be confused with an air bubbling system used in icebreaking operations.

Antifouling Paint: Paint coating applied directly to the hull of a vessel that can control or prevent the adhesion of organisms to the surface of the hull. This can help reduce the frictional resistance between the vessel and the surrounding water and increase vessel cruising efficiency.

Energy storage systems – Combinations of energy storage systems, such as supercapacitors, batteries, and flywheels.

Supercapacitors – Energy storage devices that use an electric field to electrostatically store energy between two terminals which are separated by a dielectric. Supercapacitors differ from electrolytic capacitors due to their higher capacitance value and lower voltage limits which allows more energy per unit volume or mass than electrolytic capacitors. Supercapacitors can deliver charge faster and tolerate more discharge and recharge cycles relative to batteries.

Micro-grid – A local, independent electrical grid that services an area with defined electrical boundaries. Micro-grids may operate either in grid-connected mode or island-mode depending on if they are connected to a wider electric power system or not. Micro-grids that can only operate in island-mode are known as isolated micro-grids. Micro-grids generate electricity on-site typically from renewable or thermal energy sources and are supplemented with an energy storage system.

Mission Modularity – Standardized mounting platforms for a variety of module types, where modules can be self-contained or serviced by shipboard capabilities, including electricity, hydraulics, and/or water.

Modularity also allows for containerized packaging for smaller-type cargoes, where the program task limited to product transport. Modules can be pre-staged for pickup allowing for reduced turnaround time.

Economical Transit Mode – A vessel transit speed wherein delivery of normal operations is unaffected by the operation of one or two gensets at optimal loading, to ensure the lowest fuel consumption and decreased GHG emissions.

4.2 Requirements:

Data Collection and Insight Solutions

The proposed data collection solution should be viable across the entirety of the CCG vessel fleet. The data collection solution, however, may require a multi-pronged approach due to the variance in age and communication technologies associated with CCG's fleet of marine vessels. Newer CCG vessels contain more modern communication technologies (e.g. TCP/IP, serial communication) relative to older vessels (i.e. vessels first launched in the 1960's, 70's, and 80's) which have communication technologies more closely associated with the time-periods in which they were built (e.g. twisted pair cabling).

Older vessels within the CCG fleet generally do not have a central computer where all data may be shared. Some information stored on one piece of equipment is not transmitted outside of the specific local control unit. For example, navigational data such as GPS and speed log would be stored in the wheelhouse electronics suite, whereas engine hours and clutching engines in/out would be monitored in the Alarm and Monitoring system and analog logbooks.

It is thus imperative that participants, through this multi-pronged approach, provide data collection solutions capable of capturing operational data in a highly granular, consistent, and reliable fashion across the CCG marine vessel fleet. This multi-pronged approach may include, for example, installation of acquisition systems such as data loggers, and/or use of fleet management software/hardware, communication infrastructure to support multiple data feeds, etc..

The proposed data collection application must also be capable of real-time connectivity using appropriate satellite networks. An additional connected device or backup system with accessible internal memory is also required to store data during temporary losses in connectivity.

All information collected through the application must be stored and safeguarded according to standard Canadian data security requirements contained within the Contract Security Manual (https://www.tpsgc-pwgsc.gc.ca/esc-src/msc-csm/index-eng.html). Data transmission to a centralized database or cloud-based storage system must be performed using a secure network.

Permissions to access and share data via an API or web platform must be coordinated directly with the designated vessel operator. Information must be accessible in a single and secure web-based platform that meets Canadian data security requirements. APIs must allow for integration of all data captured within third party systems. APIs must also provide vessel-specific dashboards for fleet overview during the data collection period to designated individuals at CCG.

Shore Power Charging Equipment (SPCE)

The proposed SPCE is required to function in operating temperature of between -30°C to +40°C. It must have bilingual (English/French) interface and labelling.

The SPCE must be capable of tracking usage for reporting purposes. The collected data should be transmitted automatically to a central system. The SPCE should also be able to store the data locally in the event of a network connection failure.

The SPCE is required to be approved for use in Canada, meaning equipment has been certified by a certification organization accredited by the Standards Council of Canada in accordance with the applicable standards e.g.: CSA, cUL, cETL etc.

On-Board Batteries

On-board batteries are required to be approved for use in Canada, and must meet all relevant Canadian and international standards and certifications e.g.: IEC, CSA, cUL, cETL etc.

On-board batteries must be controlled using a battery management system (BMS). The purpose of the BMS is to calculate the state of charge of the batteries, balance the individual cell charge levels, perform fault detection and management, and display overall state of health of the batteries.

Adequate fire protection systems, fire and gas detection systems, emergency shutdown mechanisms, cooling systems, control, monitoring, alarm, and safety systems should all be implemented as part of the battery management system, in order to minimize the risk and hazard associated with battery associated malfunction and failure and ensure the safety of persons located on board the vessel.