CANADA-NEWFOUNDLAND & LABRADOR

C-NLOPB

OFFSHORE PETROLEUM BOARD

2023

ANNUAL EMISSIONS REDUCTION INITIATIVE REPORT

TABLE OF CONTENTS

INTRODUCTION

The Government of Canada and the Government of Newfoundland and Labrador are committed to achieving net zero emissions by 2050. In 2021, the federal government created the **Canadian Net Zero Emissions Accountability Act.** The Act establishes a legally binding process to set five-year national emissions reduction targets as well as develop credible, science-based emissions reduction plans to achieve each target. [1] In 2022, the Government of Canada published the **2030 Emissions Reduction Plan.** The plan outlines how Canada will meet its enhanced Paris Agreement target to reduce Greenhouse Gas (GHG) emissions by 40-45 per cent from 2005 levels by 2030.[2] The Newfoundland and Labrador government has committed to interim targets to achieve a reduction of ten per cent from 1990 GHG emission levels by 2020 and a 30 per cent reduction from 2005 levels by 2030.[3] In December 2023, the federal government released its **Regulatory Framework for and Oil and Gas Sector Greenhouse Gas Emissions Cap** which proposes a cap-and-trade system to limit emissions for the oil and gas sector in an effort to reach net-zero by 2050. Public engagement is now underway with a target date of mid-2024 for the publication of draft regulations of the oil and gas emissions cap.

In 2021, Canada's total emissions were 670 Megatonnes of Carbon Dioxide Equivalent (Mt CO_2e), with 189 Mt CO_2e or 28 per cent from the oil and gas sector. This included natural gas, conventional oil and oil sands production but excluded midstream and downstream emissions.[4] In 2021, Newfoundland and Labrador's offshore upstream oil and gas production accounted for 1.5 Mt CO_2e, 0.22 per cent of Canada's total and 16 per cent of the province's 9.5 Mt CO_2e total.[5] At the time of publication, the federal government had not updated Canada's total emissions numbers for 2022.

In 2021, oil and gas production in the Newfoundland and Labrador Offshore Area (Offshore Area) accounted for one per cent of Canada's upstream oil and gas sector emissions.[6]

THE ROLE OF THE C-NLOPB

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is responsible for collecting and reviewing emission reports as per the Administration of the **Management of Greenhouse Gas Act** Memorandum of Understanding between the C-NLOPB and the Newfoundland and Labrador provincial government. C-NLOPB staff also collect quarterly emission data in order to benchmark performance with yearly targets. Environmental Protection Plans are reviewed to ensure operators have included a periodic review of the management strategy and technology associated with emissions from offshore activities. Development Plan submissions are reviewed for proposed offshore installation emissions, along with the proposed management approach and technology to be implemented to reduce emissions to the lowest amounts achievable, without compromising safety of operations. Flaring and venting limits are set and approved for offshore production facilities. C-NLOPB staff participate in the Newfoundland and Labrador Oil and Gas Task Force - Energy Transition Working

[1] Canadian Net-Zero Emissions Accountability Act
[2] 2030 Emissions Reduction Plan – Canada's Next Steps for Clean Air and a Strong Economy

[3] ClimateChangeActionPlan_MidtermUpdate.pdf (gov.nl.ca)
[4] Greenhouse gas emissions - Canada.ca
[5] CER – Provincial and Territorial Energy Profiles – Newfoundland and Labrador (cer-rec.gc.ca)
[6] Data derived from Canada National Inventory Report – https://data-donnees.az.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/

Group which is responsible for publishing a report on how the Newfoundland and Labrador oil and gas industry can optimize the use of technology and innovation to meet current energy needs, while at the same time improving safety, reducing carbon emissions and remaining competitive in a net zero future.

In 2022, the Newfoundland and Labrador Minister of Industry, Energy and Technology and the Minister of Natural Resources Canada (NRCan) requested that the C-NLOPB compile an annual report describing work that the oil and gas industry has undertaken in the Offshore Area to reduce GHG emissions and reach net zero. The information in this report was provided by local operators, industry associations and research entities in the fall of 2023 in response to a request made by the C-NLOPB. This report outlines their commitments and goals to reduce emissions, highlights progress made to date and describes ongoing Research and Development (R&D) projects that may further reduce emissions from the Offshore Area. That information and the text contained herein have been compiled and edited by C-NLOPB staff for clarity and consistency of scope.

For more information about the C-NLOPB, please visit www.cnlopb.ca, email information@cnlopb.ca, X @CNLOPB, or phone (709) 778-1400.

CENOVUS ENERGY INC.

Cenovus Energy Inc. (Cenovus) operates the **SeaRose** Floating, Production, Storage and Offloading (FPSO) vessel producing from the White Rose and North Amethyst fields. These fields are located 350 kilometers (km) east of St. John's, Newfoundland and Labrador. After the White Rose Field discovery in 1984, production began in 2005. Cumulative production from the **SeaRose** FPSO has reached 323.76 million barrels (MMbbl) of oil and 478.66 billion standard cubic feet (Bscf) of natural gas as of March 31, 2023. The cumulative gas disposition to March 31, 2023 for this facility includes 46.10 Bscf flared, 61.95 Bscf used as fuel, 361.11 Bscf injected and 234.94 Bscf used for gas lift. The annual emissions from the **SeaRose** FPSO from 2018-22 are outlined in Table 1 and include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

Table 1: SeaRose FPSO Annual Emissions

YEAR	GREENHOUSE GAS TONNES OF CARBON DIOXIDE EQUIVALENT (t CO_2e)			
	CO_2	CH_4	N_2O	TOTAL
2018	332 733	21 639	2 185	**356 556**
2019	242 550	14 846	2 049	**259 445**
2020	343 084	17 047	2 232	**362 362**
2021	311 297	18 223	1 965	**331 484**
2022	299 399	17 238	1 860	**318 497**

Source: NL-Industrial-Facilities-Provincial-GHG-Data-for-Website-2016-2022.pdf (gov.nl.ca) at time of publication

Cenovus' initiatives and operational improvements completed in 2022-23 include:

- Creation of a bespoke GHG dashboard for the **SeaRose** FPSO as part of the Performance and Trip Reporting System (PTRS). The dashboard converts fuel consumption and flare volume data in real-time to GHG emissions as carbon dioxide equivalent (CO_2e), giving onshore and offshore operations the ability to track emissions based on their source and determine the effects of operational conditions on emissions. By integrating with the PTRS, the consequences of plant interruptions on emissions can be readily evaluated.

- Implementation of *emissions.AI*, a third-party software that gathers real-time data and investigates the **SeaRose** FPSO's emission profile to reduce carbon intensity and increase energy efficiency. This digital tool analyzes data from thousands of instruments in the integrated control and safety system. The software uses Artificial Intelligence (AI) and process engineering calculations to determine valuable metrics such as emissions deltas and efficiency changes of rotating equipment. These metrics are monitored regularly and optimization opportunities are highlighted for Cenovus Engineering and Operations personnel to act upon. Since its inception, this new means of tracking emissions has helped the team identify sticking fuel control valves, degrading compression bundles and other operations issues that, when resolved, have enabled the **SeaRose** FPSO to reduce its emissions profile further.

- Building on previous study work, the company has started upgrades to the **SeaRose** FPSO Main Power Generators (MPG). As of November 2023, the power turbine upgrades were completed on all three units (MPG A, B and C).
- In 2023, two Fugitive Emissions Management Program (FEMP) surveys were completed. The FEMP has proven effective in identifying fugitive emission sources and has enabled Cenovus to prioritize maintenance activities to reduce or eliminate fugitive emissions. Since implementing the FEMP on the **SeaRose** FPSO, Cenovus has repaired all 2020 and 2021 identified emission sources within the federal regulation requirement of 730 days through planned turn-around campaigns and planned maintenance outages.

Cenovus continues to participate in several Joint Industry Projects through Energy Research and Innovation NL (ERINL), including the Ocean Supercluster's Digital Offshore Canada Project and the Open Offshore Program.

EXXONMOBIL CANADA PROPERTIES

ExxonMobil Canada Properties (EMCP) operates the **Hebron** Platform producing from the Hebron Field. The Hebron Field is located approximately 340 km southeast of St. John's, Newfoundland and Labrador. The Field was discovered in 1980, with production starting in 2017. Cumulative production from the **Hebron** Platform has reached 227.86 MMbbl of oil and 91.88 Bscf of natural gas as of March 31, 2023. The cumulative gas disposition to March 31, 2023 for this facility includes 10.45 Bscf flared, 28.20 Bscf used as fuel, 53.21 Bscf injected and 87.64 Bscf used for gas lift. The annual emissions from the **Hebron** Platform from 2018-22 are outlined in Table 2 and include CO_2, CH_4 and N_2O.

Table 2: Hebron Platform Annual Emissions

YEAR	GREENHOUSE GAS (t CO_2e)			
	CO_2	CH_4	N_2O	TOTAL
2018	400 088	78 210	3 151	**481 449**
2019	517 219	85 621	2 805	**605 645**
2020	481 622	26 099	3 032	**510 753**
2021	437 227	14 113	3 302	**454 643**
2022	418 124	10 446	3 015	**431 586**

Source: NL-Industrial-Facilities-Provincial-GHG-Data-for-Website-2016-2022.pdf (gov.nl.ca) at time of publication

EMCP is a direct, wholly-owned subsidiary of ExxonMobil Corporation. As an affiliate of ExxonMobil Corporation, EMCP can leverage core capabilities and strategies of advantages in scale, integration, technology, functional excellence and people to build globally competitive businesses to meet society's need for products essential to modern life, while addressing the challenge of climate change. EMCP can also leverage the experience and expertise of the other Hebron owners in evaluating potential emissions reduction opportunities for the Hebron Project.

The **Hebron** Platform managed Scope 1 GHG emissions throughout the 2022 reporting year by operating reliably and efficiently. Operational changes throughout the year include improvements in gas compression reliability, gas injection strategy updates and operational practice refinements. These initiatives have been effective in reducing GHG emissions from flaring. Hebron also employs a routine optical imaging Leak Detection and Repair (LDAR) program to help identify and mitigate fugitive emissions. In 2023, EMCP continued to focus on reducing emissions further, the team assessed the **Hebron** Platform's ability to route seal gas to flare to help reduce emissions from compressor seals. This upgrade is planned for 2024.

EMCP continuously evaluates opportunities for R&D, including emissions reduction opportunities. Two of these key early-stage potential R&D project initiatives are to assess:

- the potential wind resource and the feasibility of using wind-generated power to supplement current power generation, including design basis review and subsea risk assessment; and
- the potential for a brownfield design and installation of an amine-based carbon capture process unit. The study will evaluate the feasibility of adapting technologies suited for onshore generation systems for installation and operation on the **Hebron** Platform.

HIBERNIA MANAGEMENT AND DEVELOPMENT COMPANY LTD.

Hibernia Management and Development Company Ltd. (HMDC) operates the **Hibernia** Platform producing from the Hibernia Field. The Hibernia Field was discovered in 1979 and is located approximately 315 km east-southeast of St. John's, Newfoundland and Labrador. HMDC declared first oil in 1997 and has produced 1,245.83 MMbbl of oil and 2,198.24 Bscf of natural gas as of March 31, 2023. The cumulative gas disposition to March 31, 2023 for this facility includes 105.09 Bscf flared, 133.73 Bscf used as fuel, 1,959.34 Bscf injected and 65.10 Bscf used for gas lift. The annual emissions from the **Hibernia** Platform from 2018-22 are outlined in Table 3 below and include CO_2, CH_4 and N_2O.

Table 3: Hibernia Platform Annual Emissions

YEAR	GREENHOUSE GAS (t CO_2e)			
	CO_2	CH_4	N_2O	TOTAL
2018	494 123	54 777	3 067	**551 968**
2019	456 146	44 239	3 137	**503 522**
2020	540 919	17 003	3 012	**560 933**
2021	509 770	15 701	2 907	**528 379**
2022	441 204	11 772	2 798	**455 774**

Source: NL-Industrial-Facilities-Provincial-GHG-Data-for-Website-2016-2022.pdf (gov.nl.ca) at time of publication

HMDC is committed to reducing GHG emissions. The **Hibernia** Platform managed Scope 1 GHG emissions throughout the 2022 reporting year by operating reliably and efficiently. Prevention, control and mitigation of environmental risks have been emphasized from the beginning of the Hibernia Project, starting with the Environmental Impact Statement, continuing through production facilities design and development of operating procedures and inspections or audits of environmental performance. To ensure compliance, environmental staff work alongside the planning and design teams and participate in the specification and procurement of major equipment. Sound operating procedures and good housekeeping practices improve effective prevention, control and mitigation of effects on the surrounding environment. HMDC is exploring new and alternative technologies that can further reduce emissions and investing in innovative solutions that may impact the industry broadly.

The Hibernia Project focuses on operational efficiencies to reduce GHG emissions and emissions intensity, leveraging investments made in well work, rig upgrades and enhancements to offshore wireless connectivity.

HMDC continuously evaluates opportunities for R&D, including emissions reduction opportunities. Two potential R&D project initiatives are to assess:

- the potential wind resource and the feasibility of using wind-generated power to supplement current power generation, including design basis review and subsea risk assessment; and
- alternatives to flaring with lower environmental impacts.

SUNCOR ENERGY INC.

Suncor Energy Inc. (Suncor) is the Operator of the **Terra Nova** FPSO vessel producing from the Terra Nova Field. The Terra Nova Field was discovered in 1984 and is located 350 km east-southeast of St. John's, Newfoundland and Labrador. Production began on the **Terra Nova** FPSO in 2002 and has produced 425.03 MMbbl of oil and 842.35 Bscf of natural gas as of March 31, 2023. The cumulative gas disposition to March 31, 2023 for this facility includes 64.65 Bscf flared, 75.27 Bscf used as fuel, 702.43 Bscf injected and 144.52 Bscf used for gas lift. The annual emissions from the **Terra Nova** FPSO from 2018-22 are outlined in Table 4 below and include CO_2, CH_4 and N_2O. The **Terra Nova** FPSO was off-site for the majority of 2020 and all of 2021-22 while undergoing upgrades to the facility, resulting in lower or zero emissions reported for those years.

Table 4: Terra Nova FPSO Annual Emissions

YEAR	GREENHOUSE GAS (t CO_2e)			
	CO_2	CH_4	N_2O	TOTAL
2018	559 216	28 917	3 849	**591 982**
2019	468 435	21 619	3 776	**493 830**
2020	59 768	121	2 671	**62 560**
2021	0	0	0	**0**
2022	0	0	0	**0**

Source: NL-Industrial-Facilities-Provincial-GHG-Data-for-Website-2016-2022.pdf (gov.nl.ca) at time of publication

Suncor has a corporate GHG emissions goal of reducing their emissions by 10Mt by 2030 across their value chain. Their long-term objective is to achieve net zero emissions by 2050. Suncor's strategy is to be Canada's leading energy company by growing their business in low GHG fuels, electricity and hydrogen while sustaining and optimizing their existing hydrocarbon business and transforming their GHG footprint. Suncor's expertise, long-life resources, integrated business model, stronger customer connection, and leading environment, social and governance performance enables this strategy. To achieve this goal, Suncor is focusing on:

- reducing Scope 1 and 2 emissions through base business improvements;
- growing low-emissions energy businesses in renewable fuels, electricity and hydrogen to address Scope 2 and 3 emissions; and
- working with others to reduce value chain emissions, including Scope 3.

In 2022 and 2023, as part of the Terra Nova Asset Life Extension (ALE) project, the **Terra Nova** FPSO underwent several improvements to the facility to increase vessel reliability. Specifically, the ALE project included the following scopes:

- mitigation for corrosion, improvements to reduce process upsets, losses of containment and flaring when the FPSO is in production;
- upgrades to gas compression units, resulting in possible annual GHG reductions of up to one per cent of CO_2e. This included upgrades to gas compression bundles that would increase gas throughput capacity by approximately 20 per cent. There are four compressors in the system and there were upgrades to the ancillary equipment, process and heat exchangers;

- replacing pipe spools, upgrading metallurgy, renewal of pipe coatings and replacing or refurbishing passing valves should contribute to an overall reduction in fugitive emissions and losses of containment. This should result in possible annual GHG reductions of up to one per cent of CO_2e; and
- double block and bleed valves were installed on select pressure safety valves to allow isolation for future replacement without causing a production outage on the FPSO, reducing the need for flaring during this maintenance activity.

Suncor is actively working to identify GHG emissions reduction opportunities in its base business assets, including the Terra Nova Project and within its supply chain. They continue to monitor technology enhancements and support R&D opportunities that could reduce GHG emissions in the Offshore Area. Listed below are Suncor's anticipated projects:

- **Suncor Leak Detection and Repair Program**
  Suncor plans to develop a LDAR program in 2024-25. The program will include the systematic detection and repair of fugitive emissions leaks from equipment. The program will include using specialized equipment for detection of leaks on the **Terra Nova** FPSO and mitigations for any leaks that are detected.

- **Suncor/Enaimco Subsea Digital Twin Project (Phase 2)**
  Suncor introduced the subsea digital twin project with their partner Enaimco in 2022 and completed Phase 1. The vision for this project is to provide a single source of truth for all subsea assets in the Terra Nova Field, from the spider buoy to the subsea wellhead equipment, including flowlines, risers and electrical and hydraulic systems. In 2022, this project was fully scoped, and some initial data collection had taken place. In 2023, the project entered the proof-of-concept phase and is currently being vetted with users. The vision for the "single source of truth" is to bring all the information to the subsea team needed for operational planning and decision-making. This includes all relevant hard copy data for construction and operational scopes of work. The AI software consists of an anomaly data set gathered from multiple sources and is now integrated within the software, further expanding the single source vision.

  AI software divides video files into usable information for the subsea teams to support operational decision-making. Once the historical operational data from inspections are integrated, AI will be trained to produce results that may reduce vessel time, personnel on board and other tooling requirements supporting the Subsea Inspection Campaign for the Terra Nova Field. The proof-of-concept phase will continue as the **Terra Nova** FPSO begins operations in late 2023 and over 2024. The data will be generated and analyzed in the fourth quarter of 2024 to confirm the results of this project phase. This will provide further information on the potential time and emissions savings.

- **Flaring Reduction While Well Testing**
  Suncor finalized the **Terra Nova** FPSO Flare Reduction Study in late 2022. A full description of the study and the two aspects assessed is below under **Terra Nova FPSO Flare Reduction Study**. One aspect of this study focused on reducing gas compression related flaring through the

modification of the Terra Nova gas injection well barrier testing strategy. This aspect involved studying the current protocol for routinely testing Terra Nova's well barrier elements. Barrier testing is a regulatory task performed in accordance with Suncor's well intervention and integrity management strategy. Since the start of the project, this practice required the gas compression train to be taken offline and to flare or burn all produced gas. The study examined developing a method to keep the gas compression train online during testing that will enable gas to be processed by the facility without flaring. By changing the barrier test procedure to use the annulus bleed system to bleed off tubing pressure above the downhole safety valves, there would be no need to shut down gas injection during the test.

This study confirmed it is possible to increase the flow through the annulus bleed with a larger restriction orifice, improving the chance for successful gas injection well barrier testing. Detailed engineering and risk assessment is required as per Suncor's Business Process for Management of Change (MOC) before making a final recommendation to increase the orifice size and proceed with modifications. Once detailed engineering and the MOC process are complete, Suncor will decide to complete a trial utilizing the annulus bleed testing philosophy with the existing orifice.

Suncor is a member of ERINL, which delivered the Offshore Research, Development and Demonstration (RD&D) component from NRCan's Emissions Reduction Fund (ERF). As part of a competitive call for proposals, Suncor submitted two proposals to investigate two discrete offshore emissions reduction opportunities, both of which successfully received funding. These proposals were the **Terra Nova** FPSO Flare Reduction Study and the Sustainable Emissions Reduction by Digital Integrity Management (SERDIM), or Copsys Intelligent Digital Skin (CIDS), outlined below:

- **Terra Nova FPSO Flare Reduction Study**
  Pressure relief and blowdown systems, along with their associated flare, play a key part in preventing and mitigating the effects of major accident hazards from hydrocarbon-producing facilities. Daily flaring results in approximately 25-30 per cent of Terra Nova's current GHG emissions. Flare gas is a by-product of oil production and processing during routine operations that is released from different sources in the process system. This gas is sent to flare to be burned off, resulting in GHG emissions. The purpose of this project is to complete front-end engineering and design studies focusing on reducing flaring on the **Terra Nova** FPSO. The study assessed two separate aspects, the technical feasibility of installing a closed flare system on the **Terra Nova** FPSO and reducing gas compression train-related flaring. The results from this study showed that implementing a closed flare system is not feasible on the **Terra Nova** FPSO; however, reducing gas compression related flaring through the modification of the Terra Nova gas injection well barrier testing strategy to reduce gas compression outages showed promise and will be further evaluated by Suncor as an option for implementation. More detail on this aspect is provided above under **Flaring Reduction While Well Testing.**

- **Sustainable Emissions Reduction by Digital Integrity Management (SERDIM)**
  CIDS is a new coating-based (paint) digital sensor technology that could transform existing corrosion and integrity management systems. Developed by Copsys Industries Inc. and led by Suncor, this project aims to test further and advance CIDS technology and its ability to replace

predominantly labour-intensive piping inspection processes to detect and manage corrosion under insulation with a persistent digital presence that will be able to detect corrosion hotspots before they occur and provide ongoing protection. This could improve process safety, facility integrity, reliability and environmental performance. CIDS has the potential to reduce GHG emissions by reducing the frequency of production upsets, which could result in a decrease in flaring and a significant reduction in the likelihood of fugitive emissions caused by corrosion. This technology could be used in oil and gas production, transportation and other process industries. This project targets taking the CIDS technology from a technical readiness level (TRL) of 4 (validated in a test environment) to a TRL of 8 (qualified for use).

Additionally, in 2022 and 2023, Suncor participated in the Digital Oceans Canada (DOC) Project and The Open Offshore Program through ERINL. Suncor is leading Use Case 4 titled, “Process Optimization with Asset Intelligence” in the DOC project.

BP CANADA ENERGY GROUP ULC

BP Canada Energy Group ULC (bp) is transforming to produce energy that is secure, affordable and increasingly lower carbon while continuing to produce the energy the world needs today. They aim to be a net zero company by 2050 or sooner.

bp's strategy includes the delivery of resilient hydrocarbons, convenience and mobility solutions to consumers and low-carbon energy. Resilient hydrocarbons will be delivered by a high-graded portfolio, lowering emissions and driving returns while maintaining an absolute focus on safety. In 2023, bp announced they would be investing more in energy security and affordability with an increased investment into resilient hydrocarbons and their transition growth engines.

By 2030, bp aims to have delivered significant progress towards becoming net zero by 2050 or sooner by:

- cutting emissions from operations by 50 per cent compared to 2019;
- reducing emissions associated with carbon in upstream oil and gas production by 20-30 per cent compared to 2019; and
- reducing the carbon intensity of the products they sell by 15-20 per cent compared to 2019.

bp has no operating assets in the Offshore Area. Any potential future developments will, in addition to meeting regulatory requirements, follow all bp requirements, including assessment of environmental and social impacts to allow for the implementation of appropriate mitigations and deliver on the above-mentioned aims.[7] Any potential future developments would assess emissions and seek to mitigate them during design based on available technologies. Further work would occur through the life-cycle of the asset to manage emissions.

bp conducts R&D within company operations and through partnerships with industry (e.g. Oil and Gas Climate Initiative), technology developers and academic institutions worldwide. Research into new technologies that improve operational efficiency or focus directly on emission abatement may be applied to future developments.

[7] bp getting to net zero

EQUINOR CANADA LTD.

Equinor Canada Ltd. (Equinor Canada) has completed several exploration drilling campaigns in the Offshore Area, most recently the Bay du Nord Field in the Flemish Pass Basin. This Field is located 450 km east-northeast of St. John's, Newfoundland and Labrador. Equinor ASA (Equinor) is the ultimate parent of Equinor Canada Ltd.

Equinor aims to be a leader in the energy transition. It has set a clear ambition to become a net zero company by 2050, including emissions from production and final consumption. Equinor's Energy Transition Plan[8] combines carbon-efficient oil and gas production with accelerated, value-driven expansion in renewables and low-carbon technologies. The strategy includes clear and measurable portfolio-level targets to ensure absolute reductions in global GHG emissions. By 2030, Equinor aims to:

- reduce GHG emissions by 50 per cent (2015 baseline);
- reduce the net carbon intensity by 20 per cent by 2030 (includes Scope 3 emissions from the use of their products);
- have 12-16 Gigawatts of installed renewable energy capacity globally;
- have five to 10 million tonnes CO_2 transport and storage capacity annually;
- allocate more than 50 per cent of annual gross capital expenditure towards renewables and low-carbon solutions; and
- supply hydrogen to three to five major industrial clusters by 2035.

Equinor Canada's offshore assets are a priority within Equinor's global portfolio. Since 2008, Equinor Canada has operated exploration programs in the Flemish Pass and the Jeanne d'Arc Basin and includes the Bay du Nord discovery in the Flemish Pass. Drilling and exploration work to appraise and mature the Flemish Pass Bay du Nord project is considered ongoing. The 2022 drilling campaign included drilling an exploration well at Cambriol and a wellhead retrieval at the Cappahayden drill site.

Equinor Canada considers carbon efficiency in their exploration drilling campaigns. Contractor performance monitoring includes optimizing emissions management. Equinor Canada's 2022 drilling and exploration campaign included the following:

- reusing materials whenever possible;
- relying on local inventories where available to reduce emissions associated with long-distance transportation;
- implementing an operations strategy to optimize fuel use for rigs and support vessels;
- utilizing contract structures that incentivize suppliers to reduce fuel consumption;
- tracking vessel and rig fuel daily to enable timely adjustments and improvements; and
- safe and efficient drilling execution to reduce overall operations time and resulting emissions.

Illustrative of Equinor Canada's commitment to continuous improvement, data collected in the 2022 drilling campaign will be used to optimize operations during the 2024 campaign. Continuous improvement is intrinsic to Equinor Canada's culture and is considered critical to meeting Bay du

[8] Equinor Energy Transition Plan

Nord's Environmental Assessment Decision Statement commitment to net zero GHG emissions by 2050.

Bay du Nord is a strategically important project for Equinor. Utilizing data and lessons learned from the 2022 drilling campaign, Equinor Canada will work with drilling and supply contractors to optimize operations to reduce emissions. This will include reusing materials, sourcing inventory locally, and managing vessel movement and crew rotations for maximum efficiency. Equinor Canada will monitor fuel usage to identify further operational efficiencies to reduce emissions over the length of the drilling campaign. These activites will help to facilitate a continued and open dialogue about optimization opportunities and enable the incorporation of global best practices wherever possible.

Bay du Nord remains an early-phase development in Equinor's portfolio and is aligned with Equinor's Energy Transition Plan. Following the 2023 postponement decision, Equinor Canada continues to work diligently on improvement opportunities and is encouraged about the future of the development. While the project may look different as optimization opportunities are incorporated, Equinor Canada remains committed to its low-carbon ambitions and will continue to assess new technologies and operational innovations to lower emissions and reduce the project's overall carbon footprint.

Equinor Canada actively invests in the local and Canadian R&D community. The company conducts its own R&D activities and is also a partner in Energy Research and Innovation Newfoundland and Labrador (ERINL) which conducts R&D on behalf of partners. Equinor's investment in strengthening additive manufacturing in Newfoundland and Labrador, with the ultimate goal of a digital warehouse of parts able to be made locally, is an example of technology investment with emissions reduction benefits. Building capacity in the local economy to supply parts to Bay du Nord would also reduce emissions associated with shipping parts from around the world while also boosting the local economy. Equinor plans to continue to progress and leverage experience with additive manufacturing, digitalization, robotics, drones, Artificial Intelligence and machine learning to increase efficiency, strengthen safety and reduce emissions.

Equinor's R&D investment in Newfoundland and Labrador would increase substantially should Bay du Nord be sanctioned, activating a commitment to material and ongoing investments in local R&D, education and training.

CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS

The Canadian Association of Petroleum Producers (CAPP) is an industry association representing companies that explore, develop and produce oil and natural gas in Canada.[9]

In 2023, CAPP released the **Collaborating for Safety and Environmental Sustainability: A Continuous Improvement Plan for 2023-2025** to enhance communication and collaboration amongst offshore operators. The Plan was developed by CAPP's Offshore Policy Group, comprised of senior leaders with CAPP's member companies who are active in the offshore.

While CAPP does not play a direct role in research or specific emissions-reduction efforts, facilitating collaboration and dialogue amongst local stakeholders and assessing opportunities for additional outreach to support emissions-reduction efforts are priorities.

In 2022-23, CAPP was involved in various GHG emission reduction awareness initiatives:

- Co-hosted and planned the Offshore Environmental Forum. Includes sessions on emissions reduction efforts to advance information sharing among industry, regulators, Indigenous groups, the fishing industry and others.
- Produced a series of eight videos focusing on research related to offshore emissions reduction opportunities.
- Held an offshore climate policy workshop for members to facilitate information sharing and gather input.
- Participated in various initiatives led by external groups to understand better net zero pathways and emissions reduction opportunities, including the work of The Net Zero Project (participation in its Pathways to Net Zero report, engagement on its Carbon Capture, Utilization, and Storage (CCUS) roadmap, etc.) and Net Zero Atlantic (presented on incentives to support emissions reduction opportunities).

CAPP has no operating assets in the Offshore Area. The organization recognizes the importance of delivering reliable information about reducing GHG emissions and participated in the following forums and committees:

- **2023 Offshore Environmental Forum**
  The forum included a session on emissions reduction opportunities and progress. CAPP sees its role in this space as facilitating information sharing and providing opportunities for collaboration.

- **International Association of Oil and Gas Producers (IOGP) Climate Committee**
  CAPP participated in the IOGP's climate committee to stay apprised of international learnings and provide local offshore members with any information or understandings that could be applicable.

[9] Canadian Association of Petroleum Producers - capp.ca

- **Conference of the Parties 28 (COP28)**
  CAPP participated in COP28 to share information about the Canadian oil and gas industry's efforts to reduce emissions and learn about best practices in other countries.

CAPP also participates in steering committees and advisory boards for various research organizations, including the Environmental Studies Research Fund and ERINL.

ENERGY RESEARCH AND INNOVATION NEWFOUNDLAND AND LABRADOR

ERINL is a not-for-profit organization that identifies collaborative RD&D opportunities and facilitates projects on behalf of Newfoundland and Labrador's oil and gas industry. The Government of Canada, through NRCan, provided funding for the ERF to discover more ways to reduce GHG emissions in the oil and gas industry. ERINL successfully executed the offshore RD&D segment of the fund, overseeing 18 projects initiated in 2021 that investigated offshore emissions reduction opportunities, ranging from feasibility and engineering studies to demonstration of major equipment and systems in current operating assets. The culmination of these projects occurred in 2022.

Seven of these projects were outlined by operators in previous sections. The remaining projects are described here. It is important to note that the estimates of potential reduction assumed in some cases are modelled on a full deployment in the Offshore Area (e.g. all assets/vessels) and that implementation of some solutions would reduce the CO_2 available to be reduced by other measures (e.g. full-scale electrification from one solution would reduce power generation emissions targeted by other technologies). The following projects under the ERF which were not addressed previously are below:

- **Atlantic Towing Ltd.**
  Atlantic Towing Ltd. delivered the Novel Battery Hybrid Retrofit of a Multi-Purpose Platform Supply Vessel project. This project is a first-in-kind integration of multiple battery technologies combining spinning reserve and all-electric transit on a platform supply vessel. Battery technology has enabled the carbon-free, all-electric operation of smaller vessels for short transits when power demand is low. Battery-hybrid drive train technology has also been used on North Sea supply vessels. This project combined these technologies under a single power management system and was demonstrated on the Atlantic Shrike platform supply vessel. Extended operating experience will enable actual emissions reductions to be calculated.

- **Cnergreen**
  A project completed by Cnergreen tested the ability to reduce GHG emissions offshore using Novel Nanoparticle-based Foam Technology. Cnergreen investigated the performance of its patent-pending ArmorFoam™ technology in laboratory-simulated offshore reservoir conditions. The studies showed that the innovative nanoparticle-based foam reduces the short-circuiting of injected gas/water and can potentially reduce fluid circulation and associated emissions. Reducing gas/water re-circulation minimizes the power required for gas separation, compression and injection, thereby reducing GHG emissions. A prototype equipment skid for a future field trial was also developed. If technology is successful and fully adopted across the region, the estimated GHG emission reduction could be significant.

- **Design By Analysis**
  Design By Analysis completed Phase 2 of their LUMENATE Wellbore Operations Monitoring System in 2022, a novel downhole monitoring system that provides measurements during phases of offshore drilling not covered by existing telemetry. Offshore operators could have live real-time downhole information needed to optimize wellbore operations, remove uncertainty and reduce well construction and workover time. This would shorten the time required to

produce a field and could reduce GHG emissions. Extended-reach drilling can potentially increase production from existing facilities, lowering emissions intensity.

Phase 3 of LUMENATE technology development commenced in 2023 and was aimed to prepare it for industry trials. Funding for this phase will be sourced from industry and other sources.

- **Duxion**
  Duxion developed Express Hybrid Electric Retrofit Solution for Offshore Vessels, the world's first 500 kilowatt hybrid diesel-electric propulsion system that can be retrofitted to the existing propulsion systems of in-service vessels without the need for costly dry docking or significant drive shaft modification. This offers traditionally-configured vessels a greener propulsion system with significant emissions reductions. This project investigated design challenges, manufacturing optimization, prototyping, testing and will deliver a physical prototype for future demonstration. If the technology is successful and fully adopted on vessels in the region, it could help GHG emission reduction efforts.

- **Growler Energy**
  Growler Energy investigated the feasibility of supplying renewable electrical energy for power generation for Newfoundland and Labrador's offshore oil and gas facilities, analyzing options such as electrification from shore, hydrogen and wind energy. The study adopted a risk-based approach that identified barriers, opportunities and knowledge gaps associated with using renewable energy to power offshore oil and gas platforms. If the projects outlined in this study were to be implemented, this could result in major emissions reductions.

- **M.A. Procense**
  M.A. Procense is developing a compact carbon capture system to remove CO_2 from the exhaust gas of offshore facilities' power generation systems, including dual-fueled gas turbines, diesel generators and steam generation systems. The system pressurizes the exhaust gas from turbines and routes it through an expansion cooling system comprised of specialized nozzles. The separated CO_2 can be further pressurized and made ready for storage. If the technology is successful and fully implemented across the region, this could result in significant emissions reductions.

  The initial ERF phase successfully validated the technology concept. Subsequent phases are expected to progress in 2023-25 to optimize designs and scale up for a demonstration, with funding from industry, and NRCan's CCUS RD&D Capture focus area.

- **Memorial University of Newfoundland**
  Memorial University of Newfoundland worked on a proof-of-concept project called Separation First Technology, which involved developing and demonstrating porous materials to reduce CO_2 in offshore oil production. Specifically, this project explores using Metal-Organic Frameworks (MOFs) to separate CO_2 from offshore oil and gas exhaust streams. MOFs are porous materials that can be designed at the atomic level for different applications. Having developed and pilot-tested a potential MOF porous material, this project focused on developing a small-scale filtration system to separate CO_2 from a simulated exhaust stream and was completed in 2022.

Future phases are projected to unfold in 2023-25, aiming to optimize the technology. These phases will involve examining various polymer host materials to embed the MOF, along with exploring diverse configurations to enhance filtration capabilities. Funding for this phase will be sourced from industry, and NRCan's CCUS RD&D Capture focus area.

- **Planetary Technologies**
  Planetary Technologies investigated the ability to use a novel electrochemical process using alkalinity generated from mine waste to capture carbon from the exhaust of offshore production facilities. The resulting bicarbonate is stored within seawater, helping to reduce ocean acidification. The project determined that the mild alkalinity proposed would not be optimal for a space-constrained offshore oil and gas platform, although direct ocean air capture has significant potential.

- **Intecsea**
  Intecsea performed a life-cycle study to examine the suitability of using offshore floating wind to power offshore facilities. The study examined the benefits to Canada through reduced emissions and the contribution of developing a workforce associated with floating wind concepts fabricated and assembled in Canada and safely operated offshore. The study's results indicated that using floating wind turbines offshore Newfoundland and Labrador is technically feasible and that major components could be constructed in Atlantic Canada. If the scenarios defined in this project were to be implemented, this could potentially reduce a significant percentage of baseline emissions for offshore platforms.

- **Waterford Energy Services Inc.**
  Globally, floating wind technology has advanced and prototypes tested. However, research regarding its applicability to the unique conditions in the Offshore Area is in the early stages. Therefore, Waterford Energy Services Inc. (WESI) performed a conceptual study applying floating wind as an alternate energy source for Mobile Offshore Drilling Unit (MODU) installations in the Offshore Area and examined mooring analysis, power cables, wind resource assessment, battery systems, ice effects, power modelling and electrical cable disconnection. The study concluded that Floating Offshore Wind Turbines are feasible in this region, and WESI is planning further studies to progress field trials in the future.

- **St. Francis Xavier University**
  St. Francis Xavier University's project measured methane emissions from oil and gas platforms in the Offshore Area by collecting aircraft-based measurements of methane around oil production facilities to quantify and verify methane emission levels. Results were compared to measured values of other offshore platforms in the North Sea and the Gulf of Mexico and Canadian onshore environments that were thought to have higher methane intensity. The study provided independent verification of offshore reported methane emissions and confirmed that Canada's offshore production is among the least methane-intensive in Canada and the United States.

- **Digital Oceans Canada**
  DOC is a project involving Ocean Supercluster, ERINL, Virtual Marine and GRi Simulations. This multi-phase project will see the development of a shared platform that will enable the creation and commercialization of digital twins and other digital products and services for a range of ocean industries. DOC will be built by developing a set of tangible, high-value digital twin use cases in the offshore sector to demonstrate benefits and deliver an initial viable platform. Future work will scale up and expand initial twins and applications, add new twins (including from other ocean sectors), and continually add data and analytical tools in the platform. At the end of the project, DOC will feature a proven development platform environment and a set of digital twins that multiple stakeholders can access to benefit from the interfaces, numerical and visual models, and data available in the platform.

  Future phases could:
  - expand the functionality and broaden the application of initial twins;
  - create new twins (including for direct application in other sectors);
  - expand ocean environmental data sets accessible to users;
  - continue to improve and build the analytical toolset within the platform; and
  - expand access to the platform, including through potential immersive simulators in relevant regional innovation hubs (such as the proposed "digital ocean innovation centre" in St. John's and the Centre for Ocean Ventures and Entrepreneurship in Dartmouth).

  Analysis by Accenture, in collaboration with the World Economic Forum, shows that digital technologies, if scaled across industries, could contribute to reductions needed to hit the International Energy Agency net zero trajectories in the energy, materials and mobility industries.

- **Advancement of Environmental Genomics and Ednatec**
  Advancement of Environmental Genomics and Ednatec is developing a set of methodologies and technologies that will facilitate the mainstream application of novel genomics-based technologies in environmental assessment and monitoring most relevant to the oil and gas industry. If implemented, this will require less ship time to complete the work compared to current methods and, therefore, reduce emissions from shipping. It is estimated that this methodology has the potential to be approximately seven to 10 times more efficient than traditional "catch and look" environmental assessment technologies. This work was ongoing in 2022.

ERINL is involved in the following future R&D projects:

- **Memorial University of Newfoundland**
  Memorial University of Newfoundland proposes a novel approach to carbon capture and utilization from point emission sources using biomass-based adsorbents. The proposed project will run from 2023-27 and investigate using biochar-based adsorbents that could be deployed offshore (platforms, ships) to capture carbon from point sources (stack, vent) and then use the CO_2-loaded biochar in construction materials. The project will produce biochars from forestry

and fishery waste, enhance its adsorption capacity for typical flue gas emissions and then test different types of biochar as additives to enhance cement properties, creating a circular approach to waste products.

- **Energy NL – The Net Zero Project**
  Under the Net Zero Project, a study is proposed to determine the feasibility of reutilizing existing Newfoundland and Labrador's offshore assets (infrastructure and reservoirs) for future CO_2 injection and storage.

- **CORSphere**
  CORSphere's innovative project addresses a critical challenge in the maritime industry: optimizing emissions, fuel usage and maintenance practices for environmental sustainability and operational efficiency. The project proposes developing an AI-powered, mobile-first SaaS platform seamlessly integrated with existing ship systems. This platform aims to minimize fuel consumption to reduce emissions directly, predict maintenance needs, and significantly enhance operational efficiencies. The proposed project is expected to begin in 2023 and run through 2025, with projections estimated at a five to 15 per cent reduction in fuel consumption and associated emissions.

- **Open Offshore Program**
  Funded predominantly by the Offshore Oil and Gas Industry Recovery Assistance Fund and Atlantic Canada Opportunities Agency in 2021, the Open Offshore Program aimed to help drive Newfoundland and Labrador's offshore recovery and enable long-term growth by increasing the momentum of the digital transformation of the offshore and sustaining human resource capacity and expertise in the industry. One of the key outcomes of the digitalization of the oil and gas industry is emissions reduction. The program comprises five inter-related initiatives:

    1. **Communications Infrastructure Strategy**
       Atlantic XL and their project partners Tampnet and Asea Brown Boveri reviewed the options for high bandwidth, low latency connectivity to offshore basins, including fibre, satellite and related technologies.

    2. **Integrated Offshore Metocean Network**
       Williams Sale Partnership (WSP) undertook to identify the value proposition and feasibility of an integrated regional metocean monitoring network. The technology review considers emerging remote sensing technologies, optimizing predictive models and forecasts, and developing a digital strategy for implementation and operation.

    3. **Offshore NL Open Data Framework, Implementation Plan and Pilot Activity**
       WSP developed an open standards data framework for physical environmental data and conducted a data demonstration.

    4. **Digital Technologies Roadmap**
       Aker Solutions developed a digitalization roadmap methodology that enables the oil and gas industry in the region to identify the most relevant digitalization products,

technologies, and services for the Newfoundland and Labrador region; practical use case scenarios that can be upgraded and modernized through digitalization; cost, benefit and emissions reduction data to provide timeline inputs to the economic analysis; and an economic/operational modelling tool.

5. **Cultivating Alignment of Digitalization Activities in the Industry Ecosystem**
ERI and Strategic Directions Inc. (Theresa Rahal) are advancing key relationships with stakeholders to optimize the digitalization activities which will support the industry. Several key outcomes from this initiative include the formation of the Offshore Energy Digitalization Forum with the C-NLOPB; planning, in collaboration with techNL, the first annual Digital Offshore ’23 conference held in November 2023 in St. John’s; and development of other key stakeholder relationships.

ERINL led the Open Offshore Program with partners Atlantic XL Inc., WSP, and the Oil and Gas Corporation of Newfoundland and Labrador (OilCo). The program concluded on December 31, 2023.

MEMORIAL UNIVERSITY OF NEWFOUNDLAND AND LABRADOR

Uniquely positioned in the harsh maritime environment of Newfoundland and Labrador, Memorial University boasts nationally and internationally leading research expertise in a range of areas including ocean engineering and science, technology, natural resources, health, innovation and entrepreneurship, and climate change. More than 40 per cent of Memorial's current research is ocean-related. That work is supported by world-class research facilities and strong public partnerships with industry and organizations.

Researchers from Memorial University have been active in the understanding and reduction of GHGs across multiple sectors. There have been several projects looking at flare reduction, methane emissions monitoring, CO_2 capture techniques, renewable energy and utilization/storage. A listing of projects from 2022 is as follows:

- **Department of Process Engineering, Faculty of Engineering and Applied Science**
    - Dr. Majid Abdi has been working on the use of compact process technology and process intensification for carbon capture technology including use of dual membrane contactors, centrifugal contactor systems and use of advance nozzle technology.

    - Dr. Lesley James and team at the Hibernia Research Group have been studying how captured CO_2 at offshore locations can be utilized for enhanced oil recovery. The focus has been on constrained CO_2 volumes possibly captured from existing facilities, the effect of less selective CO_2 capture techniques resulting in impurities in CO_2 and their impact on recovery efficiency, the effectiveness of injecting CO_2 in Water Alternating Gas (WAG), mixed CO_2-natural gas WAG, carbonated water injection and combinations including rates of CO_2 recycle/volume injected. The work has included the effect of different reservoir fluid and rock characteristics, along with their interactions, on oil recovery efficiency. These interactions are important to CO_2 storage with CO_2 storage evaluation a focus of future work.

    - Drs. Lesley James, Salim Ahmed and Kelly Hawboldt and students have helped evaluate a flare reduction strategy resulting in economic potential if there is a green source of energy.

    - Dr. Kelly Hawboldt and team study how adsorbents sourced from forestry and fishery waste can be used to capture CO_2. Work to date (TRL3) has shown the treated bioadasorbents have the capacity to adsorb CO_2 on par with existing commercial CO_2 adsorbents. Based on this proof of concept, Dr. Hawboldt, Dr. Kris Podsuka (Physics), and Dr. Stephanie MacQuarrie (Chemistry) are building on this work using a multidisciplinary approach to further develop bioadsorbents in carbon capture processes from material development to process design and scaling up. This study plans to demonstrate the proof-of-concept feasibility of a unique cradle-to-cradle approach to offshore carbon capture using biochar produced from Atlantic Canadian waste biomass. This clean-tech approach links renewable/waste energy, recovery of waste streams, and integration of local materials.

- Drs. Syed Imtiaz and Salim Ahmed are controlling greenhouse gas emissions by developing an energy efficient dynamic positioning controller to maintain ship position, showing potential to reduce ship thruster energy demand by 50%. They are also working with Beyond Energy on managed pressure drilling to better control drilling, decreasing both drilling energy and well clean up after drilling.

- Drs. Lesley James, Kim Welford, Alison Malcolm, Karem Azmy, David Lowe, Michael Babechuk, Steve Butt, Kelly Hawboldt, Kris Poduska, and Shegufa Shetranjiwalla-Merchant have created a multidisciplinary team with multiple industrial and government partners to evaluate and educate on carbon storage potential offshore Newfoundland and Labrador.

- **Department of Mechanical Engineering**
  - Drs. Kevin Pope, Greg Naterer and others of Mechanical Engineering are studying offshore wind and green hydrogen produced from water and wind.

- **Faculty of Business Administration**
  - Dr. Cooper continues to be interested in business processes and social enterprise models that could be deployed to reduce GHGs in the Offshore Area whilst still supporting economic growth and reduced reliance on government/public donations/support.

- **Faculty of Science**
  - Dr. Michael Katz and Heloise Therien-Aubin are working on the design and synthesis of mixed matrix membranes for carbon dioxide separation from exhaust streams and potential applications in direct air separation.

  - Dr. Talia Jane Stockman considers CO_2 reduction electrocatalysis to convert CO_2 at both ambient temperature/pressure as well as in supercritical CO_2 conditions.

THE NET ZERO PROJECT

The Net Zero Project is a collaborative partnership of Energy NL, econext, and OilCo, focused on the identification and development of clean growth projects, options and strategies for Canada's offshore energy industry to reach net zero. The three main objectives for The Net Zero Project are:

1. progress technical and economically viable pathways to achieve net zero in the Offshore Area;
2. advance policy solutions to facilitate these pathways; and
3. develop a network for sharing information on pathways that will help inform potential investors and decision-making in the offshore energy industry.

The Net Zero Project has been leading research and identifying a series of pathways for the offshore energy industry in the Offshore Area to achieve a reduction (or offsetting) of GHG emissions by 2050. Findings confirm that Canada's offshore oil carbon intensity is 30 per cent below the global average. This situation, combined with investment in transformational clean technologies, makes it possible to grow the offshore industry while maintaining net zero by 2050 standards. Technologies such as CCUS, electrification of offshore operations from floating wind turbines and carbon offsets can be attractive solutions for the Offshore Area.

The Net Zero Project conducted a CCUS Workshop in September 2022, as CCUS is a technology that can potentially have an important role in the future of the offshore oil and gas industry. A CCUS white paper was also initiated to provide information on the opportunity, future potential and challenges. Learning mission was undertaken in Norway to learn about the approaches and projects in that country. While prevalent in Western Canada, CCUS is relatively unknown within Newfoundland and Labrador and in an offshore oil and gas context in general. Newfoundland and Labrador has an opportunity to be an early developer in offshore CCUS technology with proper planning and collaboration amongst key stakeholders. The development of a CCUS Roadmap is now a priority for the project.

The Net Zero Project has provided guidance reports on carbon offsets, including a white paper. These define the regulatory system as-is and current options for future frameworks. A carbon offset framework can help to enable net zero, present opportunities for economic development and mitigate economic leakage. Development of a carbon offset roadmap is underway and can help Newfoundland and Labrador to realize potential related to carbon offsets.

As electrification of offshore assets can provide real reductions in GHG emissions, another priority will be developing a roadmap for electrification.

The Net Zero Project continues to yield several important efforts and benefits towards emission reductions in the oil and gas industry in the Offshore Area. These include:

- helping stakeholders to understand the feasibility of GHG emissions reduction opportunities;
- providing a net zero framework for the offshore from which further analysis can be undertaken;
- identifying enabling conditions and barriers for each net zero opportunity;

- focusing research, development and investment towards net zero in the Offshore Area;
- increasing collaboration within the industry;
- building capacity within the industry to pursue net zero by 2050; and
- communicating information through the life of the project and beyond.

This project was supported with funding from the Offshore Research, Development, and Demonstration component of NRCan's ERF, which was managed by ERINL; ACOA; and the Government of Newfoundland and Labrador.

APPENDIX: LIST OF ABBREVIATIONS, CHEMICAL ABBREVIATIONS AND UNITS

ABBREVIATIONS

ACOA (Atlantic Canada Opportunities Agency)
AI (Artificial Intelligence)
ALE (Asset Life Extension)
bp (BP Canada Energy Group ULC)
CAPP (Canadian Association of Petroleum Producers)
CCUS (Carbon Capture, Utilization and Storage)
Cenovus (Cenovus Energy Inc.)
CIDS (Copsys Intelligent Digital Skin)
C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board)
COP28 (Conference of the Parties 28)
DOC (Digital Oceans Canada)
EMCP (ExxonMobil Canada Properties)
ERINL (Energy Research and Innovation Newfoundland and Labrador)
ERF (Emissions Reduction Fund)
Equinor (Equinor Canada Ltd.)
FEMP (Fugitive Emissions Management Program)
FPSO (Floating, Production, Storage and Offloading)
GHG (greenhouse gas)
HMDC (Hibernia Management and Development Company Ltd.)
HP (High Pressure)
IOGP (International Association of Oil and Gas Producers)
LDAR (Leak Detection and Repair)
LP (Low Pressure)
MOC (Management of Change)
MODU (Mobile Offshore Drilling Unit)
MOF (Metal-Organic Framework)
MPG (Main Power Generation)
NRCan (Natural Resources Canada)
Offshore Area (Canada-Newfoundland and Labrador Offshore Area)
OGIRA (Oil and Gas Industry Recovery Assistance)
OilCo (Oil and Gas Corporation)
PTRS (Performance and Trip Reporting System)
R&D (Research and Development)
RD&D (Research, Development and Demonstration)
SERDIM (Sustainable Emissions Reduction by Digital Integrity)
Suncor (Suncor Energy Inc.)
TRL (Technology Readiness Level)
WESI (Waterford Energy Services Inc.)

UNITS

bbl (barrel)
Bscf (billion standard cubic feet)
km (kilometer)
kt (kilotonne)
MMbbl (million barrel)
Mt (megatonne)
t (tonne)

CHEMICAL ABBREVIATIONS

CH_4 (Methane)
CO_2 (Carbon Dioxide)
CO_2e (Carbon Dioxide Equivalent)

240 Waterford Bridge Road
The Tower Corporate Campus
West Campus Hall
Suite 7100
St. John's, NL
Canada A1E 1E2

t: 709–778–1400
f: 709–778–1473

Core Storage and Research Centre
30-32 Duffy Place
St. John's, NL
Canada A1B 4M5

t: 709–778–1500

CNLOPB.CA
@CNLOPB