Offshore Wind R&D Priorities Roadmap

NOVA SCOTIA OFFSHORE WIND R&D PROGRAM

AUGUST 11, 2025

NOVA SCOTIA

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Table of Contents

Introduction

Advancing sustainable and efficient offshore wind development in Nova Scotia requires a strategic and coordinated research and development (R&D) approach. The first step in this approach is identifying and prioritizing offshore wind R&D knowledge gaps and needs for the sector. This report presents the offshore wind R&D priorities identified by participants during the Nova Scotia offshore wind R&D roundtable and organizes the priorities into stages along the offshore wind development timeline. This report is intended to provide an additional opportunity for comment on the identified R&D priorities from experts in academic and applied research, Mi'kmaw communities, sector and industry knowledge, regulatory and policy backgrounds, traditional knowledge, and organizations with experience related to offshore wind development.

The R&D priorities identified at the roundtable and comments provided on this report will inform the future development of an offshore wind R&D plan for Nova Scotia.

Background

The development of offshore wind in Nova Scotia presents a generation-defining opportunity to develop a sector that can deliver sustainable economic growth, energy security, and climate resilience. A key step in realizing this opportunity is the provincial target for the issuance of licences for up to 5 gigawatts (GW) of offshore wind capacity by 2030. Following the announcement of the provincial target, the Regional Assessment for Offshore Wind Development in Nova Scotia was conducted and identified important knowledge gaps on a wide range of offshore wind topics. Recommendation T1-1 from the final regional assessment report was to develop a collaborative research initiative to address these pressing data gaps with respect to offshore wind development. To realize this recommendation and thus advance the sustainable development of the offshore wind industry, a strategic and coordinated R&D response is critical. Achieving this goal will require coordinated investment and a strong foundation of applied research and innovation across Atlantic Canada.

Offshore Wind R&D Roundtable

On Monday, June 9th, 2025, Net Zero Atlantic in partnership with the Nova Scotia Department of Energy hosted the Nova Scotia Offshore Wind R&D Roundtable to identify and prioritize offshore wind R&D knowledge gaps and needs. This event convened 63 representatives from academia, research organizations, provincial and federal governments, Indigenous organizations, offshore wind developers and industry associations, fisheries representatives, and community stakeholders.

The roundtable's primary purpose was to collaboratively develop a list of specific R&D priorities within broader research themes, which included environmental effects, impact assessment, Indigenous knowledge and research, socioeconomics, metocean and geological data, and technology, innovation, and upgrades.

Offshore Wind R&D Plan

The R&D priorities identified by roundtable participants are essential for laying the groundwork for a comprehensive and strategic offshore wind R&D plan, which will clarify research requirements, identify key contributors, and provide budget and timeline estimates for the R&D priorities. The offshore wind R&D plan will be an important tool for decision-makers and the offshore wind innovation ecosystem to align resources, reduce duplication, and direct investment toward the most critical knowledge gaps to support the efficient and sustainable development of Nova Scotia's offshore wind resource.

Approach to R&D Priorities Mapping

This report consolidates and organizes the R&D priorities identified during the offshore wind R&D roundtable. Notes and recordings from the roundtable showed overlap in R&D priorities within and between sessions; where possible, overlapping priorities were condensed into a single priority. All session topics and priorities were summarized by the Net Zero Atlantic-led project team. The R&D priorities contained in this report are informed by expertise of the offshore wind R&D roundtable participants and validated by research presented at the 2024 Offshore Wind R&D Forum. Priorities identified at the roundtable were situated into the offshore wind development timeline based on their impact on key stages of development (i.e., urgency) and their potential impact to the R&D workflow (i.e., relevance). **Figure 1** presents the urgency – relevance matrix used to organize the R&D priorities into the offshore wind R&D roadmap.

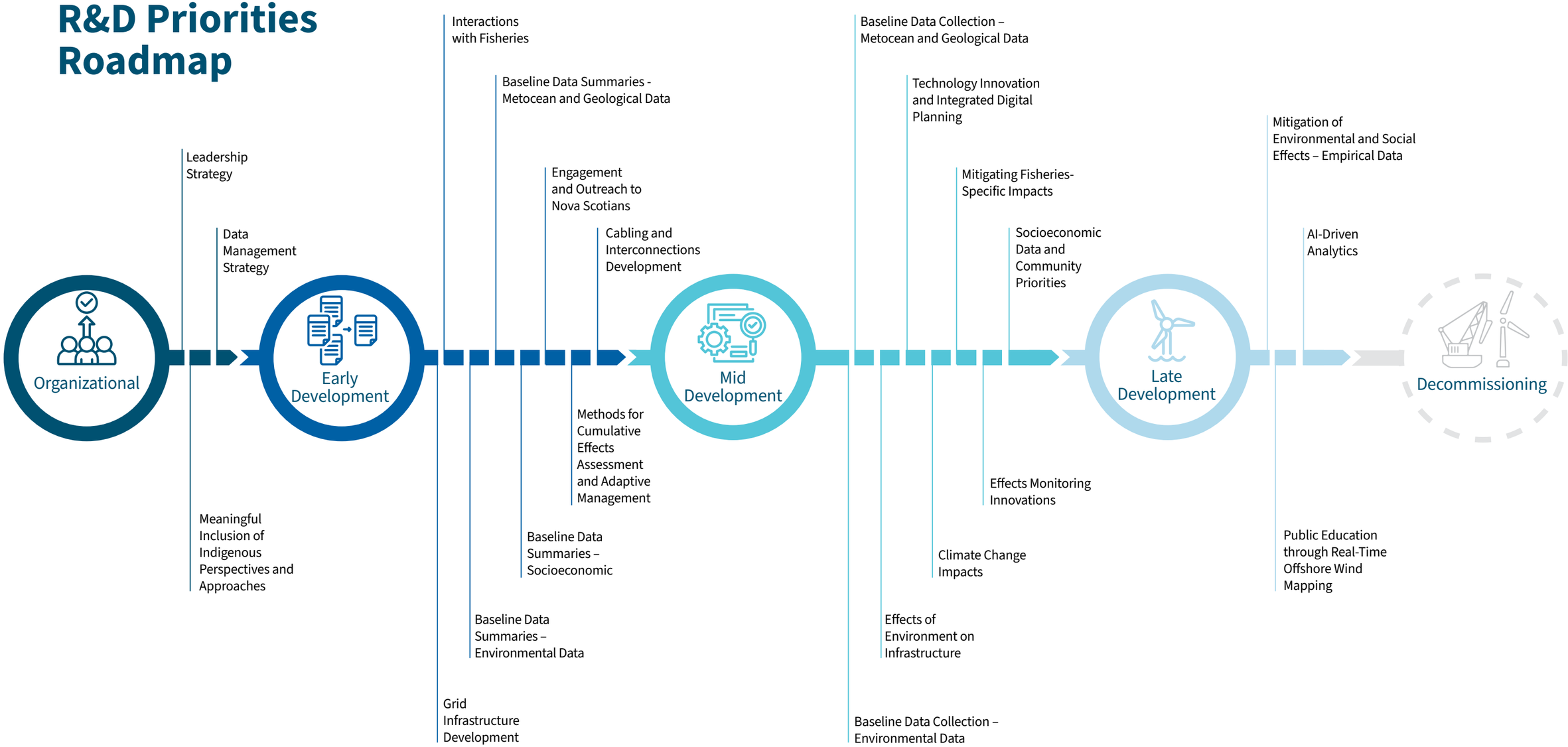
		Relevance		
		High Workflow Impact	Medium Workflow Impact	Low Workflow Impact
Urgency	Early Development	Highest Priority		
	Mid Development			
	Late Development			Lowest Priority

Figure 1. Urgency - relevance matrix for R&D priorities, where urgency relates to the offshore wind development timeline (development stages) and relevance relates to the impact to workflow (e.g., consolidation known of baseline data prior to data collection)

Considerations

The R&D priorities described in this report represent specific research questions, ongoing work, broader considerations and recommendations, and overarching questions that will set the stage for future work. Accordingly, further collaboration with stakeholders and rightsholders is needed to validate the outcomes from the R&D roundtable and inform the future development of the offshore wind R&D plan for Nova Scotia.

R&D Priorities Roadmap



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Organizational Phase

A coordinated R&D leadership strategy, meaningful inclusion of Indigenous perspectives and approaches, and clear data management are necessary to ensure productive engagement and collaboration across the sector. Focusing on the organizational phase prior to progressing the development timeline will enable a more efficient and effective approach to the R&D necessary to advance the sector.

Priority R&D Areas:

1. Leadership strategy
2. Meaningful inclusion of Indigenous perspectives and approaches
3. Data management strategy

Priority 1: Leadership Strategy

Establishing a leadership strategy for collaborative research efforts and stakeholder engagement initiatives was identified as a clear and foundational need for the effective development of the offshore wind sector. Roundtable participants noted that such a strategy would require the identification of a new or existing organization responsible for identifying data gaps, establishing research priorities, and determining available funding sources to instigate essential research and monitoring programs. An objective organization leading this effort is important to manage the expectations, objectives, and timelines between collaborators, funders, stakeholders, and rightsholders in the offshore wind sector. Identifying this organization and developing the required terms of reference to support its role is a crucial first step.

R&D Action:

1. Identify an organization to lead collaborative efforts and stakeholder engagement initiatives to identify data gaps, establish research priorities, and determine funding sources to instigate essential research and monitoring programs.

Priority 2: Meaningful Inclusion of Indigenous Perspectives and Approaches

Meaningful Indigenous involvement in all stages of R&D is necessary for a sustainable and inclusive offshore wind industry. Fair and inclusive processes must be established and implemented in decision-making at all stages of R&D. This includes embracing the concepts of Etuaptmumk (two-eyed seeing) and different ways of knowing beyond the conventions of western science that can inform adaptive management and decision-making processes. This integration requires early prioritization, commitment, and fostering meaningful relationships with both on- and off-reserve Mi'kmaw communities to be effective.

The Apoqnmatulti'k project involves a collaborative partnership that pairs Indigenous, local, and western scientific knowledge to better understand valued aquatic species in the Bay of Fundy and Bras d'Or Lake. It serves as a potential model for establishing a collaborative framework with Indigenous communities for co-generation of knowledge with potential applications for offshore wind R&D.

R&D Action:

1. Engage with Mi'kmaw communities to determine best approaches for meaningful inclusion of Indigenous knowledge and knowledge systems in Nova Scotia offshore wind R&D. This action would involve a review of jurisdictions where Indigenous knowledge and communities were involved in resource management R&D and decision-making processes. Recommendations would approach models for co-generation of knowledge and meaningful inclusion of Indigenous knowledge and participation within adaptive management frameworks and decision-making for communities' consideration.

   A meaningful first step could include funding for the participation of the Mi'kmaq of Nova Scotia in the leading organization identified in **Priority 1**.

Priority 3: Data Management Strategy

Empirical data that could support offshore wind development may be disparate and scattered, and there are often challenges with stakeholder data literacy related to how diverse data are aggregated, managed, and understood. Advancing an effective approach to data management requires the identification of an organization to manage and store publicly available and confidential data needed to support the offshore wind sector. Roundtable participants identified the centralization of data and clear guidelines surrounding data interpretation as important for the overall data management strategy.

Publicly available data were recommended to adhere to applicable data governance principles, such as: Findability, Accessibility, Interoperability, and Reusability (FAIR); Collective benefit, Authority to control, Responsibility, and Ethics (CARE); and Ownership, Control, Access, and Possession (OCAP). Publicly available data were also recommended to reflect the United Nations Educational, Scientific and Cultural Organization's (UNESCO) open science recommendations.

R&D Action:

1. Develop data management strategy through the identification of a lead organization to develop and maintain a data repository for publicly available and confidential offshore wind data.

Early Development Phase

The early development phase begins with the identification of wind energy areas proposed for development. This action will require a coordinated approach to synthesize all existing data on a variety of environmental, social, economic, and cultural factors for the designated wind energy areas. Identifying potential knowledge gaps, best practices, and standardized frameworks and terminology as this phase progresses will inform data collection in subsequent stages of development. Priorities identified in this section should be initiated with support from the organizations and initiatives described in the organizational phase (Priorities 1-3).

Priority R&D Areas:

4. Grid infrastructure development
5. Interactions with fisheries
6. Baseline data summaries – environmental data
7. Baseline data summaries – meteorologic, oceanographic, and geological data
8. Baseline data summaries – socioeconomic
9. Engagement and outreach to Nova Scotians
10. Methods for cumulative effects assessment and adaptive management
11. Cabling and interconnections development

Priority 4: Grid Infrastructure Development

Key topics related to the development of grid infrastructure include interregional transmission planning and market opportunities, identifying barriers, understanding how development timelines (e.g., equipment lead times) impact transmission planning, and determining suitable cost-sharing mechanisms for Nova Scotia. This priority involves evaluating infrastructure readiness for large-scale variable electricity generation, developing strategies for demand-response, energy storage, smart grids, and modelling future grid scenarios. Ultimately, the research could produce tools supporting grid flexibility, data-driven infrastructure investment insights, and grid modernization.

Findings from the Phase 1 report of the "Atlantic Canada Offshore Wind Grid Integration and Transmission Study" outlined the potential market and offtake opportunities for offshore wind; future scenarios were modelled in which offshore wind helps decarbonize domestic electricity consumption, export clean electricity to neighboring markets, and serve growing hydrogen demand. This enables the evaluation of offshore wind targets and their impact on energy system costs, reliability, and emissions.

R&D Action:

1. Advance interregional transmission planning for Nova Scotia by identifying key barriers, assessing the impact of development timelines, and exploring fair cost-sharing mechanisms. Evaluate infrastructure readiness for offshore wind, integrate strategies like demand-response and energy storage, and develop tools and policy recommendations for grid flexibility and modernization.

Priority 5: Interactions with Fisheries

Robust and geographically specific data on fishing activities, such as what is being fished, where fishing occurs, and methods used are needed for designated wind energy areas. Engagement with the harvesting sector is needed to fill gaps in existing fishing data and approaches to maintain data confidentiality. There are lessons to be learned from other jurisdictions to approach this topic and work through other key questions, including co-location and interactions between offshore wind equipment and fishing gear.

R&D Actions:

1. **Baseline Data Collection: Fisheries Activity in Wind Energy Areas**

   Objective: Work with the fisheries sector to compile geographically relevant data pertaining to fisheries activities in designated wind energy areas. This action aims to address existing data gaps (with support from the lead organizations in **Priorities 1 and 3**) and distinguish between genuine absences of fishing activities and temporary management measures for sustainability.

2. **Jurisdictional Scan on Co-Location, Mitigation, and Compensation Approaches**

   Objective: Identify applicable data and regulatory approaches from other offshore wind jurisdictions (e.g., North Sea, UK, US) through literature review and qualitative analysis, adapting them for Nova Scotia's unique fisheries, ecosystems, and regulatory frameworks.

Priority 6: Baseline Data Summaries – Environmental Data

A strong consensus emerged during the R&D roundtable on the importance of establishing a standardized framework and protocol for defining terminology, data collection, and modelling approaches to ensure consistent understanding and comparability across study areas and between stakeholders and rightsholders. As a first step, synthesis documents from the collation of information contained in peer-reviewed documents and grey literature are needed to identify our current state of knowledge about how marine animals and aerofauna use the Scotian Shelf and designated wind energy areas. This effort will identify existing knowledge gaps in baseline datasets and can be supplemented by an accounting of existing data for physical environmental parameters (e.g., salinity, temperature, productivity) that can influence species distributions and habitat use patterns.

R&D Actions:

1. **Baseline Data Synthesis:** Environmental Data

   Objective: Synthesize current knowledge from multiple sources (peer-reviewed and grey literature) for each valued ecosystem component of concern on the Scotian Shelf and in designated wind energy areas, including marine mammals, aerofauna, fish, sea turtles, and marine invertebrates.

2. **Standardized Framework and Protocol for Terminology, Data Collection, and Modelling**

   Objective: Develop a standardized framework and protocol for the future collection and analysis of environmental data. Collaboration between Mi'kmaw communities, the Province of Nova Scotia, the Government of Canada, and other key stakeholders is needed to meaningfully develop the framework.

Priority 7: Baseline Data Summaries – Metocean and Geological Data

An accounting of metocean and geological baseline data is needed to facilitate offshore wind development and to support proponents in making technical decisions about their projects. This step, alongside environmental data synthesis, will identify existing knowledge gaps in baseline datasets. As with **Priority 6**, R&D roundtable participants noted the importance of establishing a standardized framework and protocol for defining terminology, data collection, and modelling approaches.

R&D Actions:

1. **Baseline Data Synthesis: Metocean Data**

   Objective: Synthesize current knowledge from multiple sources (peer-reviewed and grey literature) for meteorologic and oceanographic (metocean) data.

2. **Baseline Data Synthesis: Geotechnical and Geospatial Data**

   Objective: Synthesize current knowledge from multiple sources (peer-reviewed and grey literature) for geotechnical and geospatial data.

3. **Standardized Framework and Protocol for Terminology, Data Collection, and Modelling**

   Objective: Develop a standardized framework and protocol for the future collection and analysis of metocean and geological data. Collaboration between Mi'kmaw communities, the Province of Nova Scotia, the Government of Canada, and other key stakeholders is needed to meaningfully develop the framework.

Priority 8: Baseline Data Summaries – Socioeconomic

Compiling baseline socioeconomic data is essential to map the potential benefits, risks, and opportunities for communities across the province. Socioeconomic assessments of Nova Scotia are being initiated; however, further identification of community-specific needs and integration of local expertise in offshore wind are necessary for the sustainable development of the sector. Given the nature of supply chains to support offshore wind, socioeconomic effects are likely to be realized regionally within Atlantic Canada, but also nationally and potentially beyond; these far-reaching reaching effects require consideration. As with **Priorities 6 and 7**, roundtable participants noted the importance of establishing a standardized framework and protocol for defining terminology, data collection, and modelling approaches.

Marine Renewables Canada published the "Atlantic Canada Wind Energy Supply Chain Assessment Final Report", assessing the current state of the supply chain for offshore wind, regional strengths and opportunities, and actionable recommendations to enhance the supply chain and workforce.

Net Zero Atlantic is leading a study that will assess the socioeconomic impact of offshore wind in Nova Scotia, with a focus on identifying potential economic impacts of floating and fixed turbines, potential socioeconomic impacts on coastal communities and ocean users, and workforce readiness and transition strategies.

R&D Actions:

1. **Baseline Socioeconomic Data Synthesis for Communities**

   Objective: To establish a comprehensive baseline of socioeconomic data, including the state of the economy, demographics, workforce readiness, and community dynamics for high priority communities. This work will inform future community-specific research and opportunities identification.

2. **Standardized Framework and Protocol for Terminology, Data Collection and Modelling**

   Objective: Develop a standardized framework and protocol for the future collection and analysis of socioeconomic data. This requires establishing a shared "lexicon" for consistent data comparison over time. Collaboration between Mi'kmaw communities, the Province of Nova Scotia, the Government of Canada, and other key stakeholders is needed to meaningfully develop the research framework.

Priority 9: Engagement and Outreach to Nova Scotians

It is largely agreed that an effective approach to offshore wind development in Nova Scotia requires public participation in the process with genuinely informed communities. This requires a well-rounded understanding of baseline socioeconomic data (**Priority 8**) and community-informed and co-generated approaches to engagement, outreach, and education to address misinformation. Initial R&D actions should investigate best practices and work with key stakeholders and rightsholders to inform approaches.

Early community engagement and capacity building efforts across Nova Scotia have been led by Net Zero Atlantic, the Confederacy of Mainland Mi'kmaq, Unama'ki Institute of Natural Resources, and the Cape Breton Partnership. Youth engagement and education has been led by COVE through the Offshore Wind for Kids program. This early work has produced baseline information regarding offshore wind topics of interest in communities and potential methods for ongoing communication and engagement.

R&D Actions:

1. **Investigate Best Practices for Engagement and Develop Engagement Guidelines**

   Objective: Identify best practices on engagement and consultation with key stakeholders and rightsholders, including research on best practices to enhance public knowledge about offshore wind, addressing misinformation, and practices to enhance transparency and trust between the sector and communities. The outcome of this work will be to develop clear engagement and consultation guidelines for offshore wind researchers and developers, as well as establish how communities, stakeholders, and rightsholders seek to be engaged on offshore wind development along the timeline.

2. **Best Practices for Different Ways of Knowing in Early Education**

   Objective: Investigate best practices for early education for Indigenous and non-Indigenous knowledge systems, advancing key objectives outlined in Priority 2.

Priority 10: Models for Cumulative Effects Assessment and Adaptive Management

Cumulative effects assessment models are being explored by several federal departments, including Fisheries & Oceans Canada, Environment & Climate Change Canada, and Transport Canada to address responsibilities pursuant to specific legislative requirements. A more comprehensive approach to cumulative effects assessment that forecasts short- and long-term impacts and addresses existing methodological gaps is necessary to advance the sector. Furthermore, adaptive management was identified as a key strategy by roundtable participants to address uncertainties as offshore wind development progresses. The adaptive management approach involves consideration of new data and technologies as R&D progresses, as well as potential indirect and climate change-related impacts.

R&D Actions:

1. **Determine Methodologies for Cumulative Effects Assessment**

   Objective: To develop methodologies and systems for performing cumulative effects assessments at varying levels, integrating detailed technical knowledge from individual projects into a broader cumulative picture. Cumulative effects assessment would be applied in the mid-development phase as relevant data becomes available.

2. **Develop Adaptive Management Approach**

   Objective: Develop an approach to adaptive management that addresses complex species interactions and new physical, ecological, or socioeconomic data, creates effective mitigation measures, and develops metrics to monitor their success and impacts.

Priority 11: Cabling and Interconnections Development

This priority builds off grid infrastructure development work (**Priority 4**) to inform the design of a network of subsea cables and interconnections. The research should focus on best approaches for the design of the network and consideration of potential impacts on marine species.

R&D Action:

1. Identify and address data gaps regarding subsea array cables, offshore substations, and export cable routes. Identify ideal cabling depth and connection types (e.g., radial and hybrid connections). A jurisdictional review should be conducted to explore methods to prevent cable damage from ocean currents, the potential for in-cable sensors for use in monitoring and assess the potential effects of electromagnetic fields from subsea power cables on marine species (e.g., marine mammals, invertebrates, and fish).

Mid-Development Phase

In the mid-development phase, decisions related to offshore wind turbine design, equipment, and placement are expected to be made and submitted for regulatory approval. While R&D activities in the early development phase focus on synthesizing available data and identifying best practices, priorities in the mid-development phase would focus on addressing knowledge gaps, collecting necessary environmental, social, cultural, and economic data, and informing the design of offshore wind farms (e.g., foundation selection, array design, collector hubs, onshore substations).

Priority R&D Areas:

12. Baseline data collection – environmental data
13. Baseline data collection – metocean and geological data
14. Effects of environment on Infrastructure
15. Technology innovation and integrated digital planning
16. Climate change impacts
17. Mitigating fisheries-specific impacts
18. Effects monitoring innovations
19. Socioeconomic data and community priorities

Priority 12: Baseline Data Collection – Environmental Data

Following the development of synthesis documents for a suite of valued ecosystem components (e.g., marine mammals, aerofauna, fish, sea turtles, marine invertebrates), the existing knowledge gaps identified in baseline datasets need to be addressed. Studies should be designed to collect additional baseline data as required to acquire year-round information and eliminate seasonal gaps in data collection efforts. Data collection will follow the framework that was set in **Priority 6**.

Natural Resources Canada (NRCan), Fisheries & Oceans Canada (DFO), and Environment and Climate Change Canada (ECCC) are initiating new data collection on marine wildlife and habitats in and around the designated Nova Scotia wind energy areas. This data collection is expected to include data collection on marine mammals and megafauna, marine bids and bats, commercial fisheries and potential fisheries interactions. A range of mapping and modeling studies are expected for complex hydrodynamic phenomena.

R&D Actions:

1. **Data Collection: Marine Species**

   Objective: Collect data on marine species to address knowledge gaps and establish a baseline for designated wind energy areas. This includes an understanding of species dependence on habitat within the wind energy areas, enabling the measurement of changes during construction and operation. Marine species at risk and culturally important species are high priorities for this data collection. Roundtable participants identified the use of gliders as a potential tool to eliminate seasonal gaps in environmental data.

2. **Data Collection: Aerofauna**

   Objective: Collect data on aerofauna to address knowledge gaps and establish a baseline for high priority wind energy areas. Roundtable participants identified several priority topics for this data collection phase, such as interannual variability in aerofauna distribution, multi-year tagging of species to assess dispersal after breeding, and altitudinal flight patterns of migratory species. This action also includes reviews of available data on effects modelling, mitigation, and monitoring approaches.

Priority 13: Baseline Data Collection – Metocean and Geological Data

Following the synthesis of available baseline data, fill knowledge gaps with additional collection of metocean and geological data. Baseline information about metocean conditions is also needed to help ensure safety and to understand environmental conditions that might prevent site access during offshore wind operations. Data collection will follow the framework that was set in **Priority 7**.

R&D Actions:

1. **Baseline Data Collection: Metocean Data**

   Objective: Collect a range of meteorological and oceanographic data (e.g., wind, water, and wave data). Determine actual wind speeds in wind energy areas at specific turbine hub heights to inform turbine and site design, accounting for Nova Scotia-specific conditions like icing, storms, and saltwater spray.

2. **Metocean Data for Operating (Safe Facility Access)**

   Objective: Define and gather metocean data necessary for determining safe access to offshore facilities and enhance understanding of conditions that might prevent access (e.g., excessive wind).

3. **Baseline Data Collection: Geotechnical and Geospatial Data**

   Objective: Collect detailed geotechnical data (e.g., sea bottom characteristics) and geospatial data (e.g., wave height, period, and direction collected through wave buoys). For example, roundtable participants identified that research is needed on how the weight of potential offshore wind turbines interacts with subsea soils.

Natural Resources Canada (NRCan) is initiating new data collection for metocean data in and around the designated Nova Scotia wind energy areas (such as wind speed, water and air temperature, humidity, water salinity, wave data, extreme weather events). This data collection is expected to begin in 2026/2027.

The Geological Survey of Canada has been working since Spring 2023 to characterize the seabed geology of the Scotia Shelf. Activities conducted to date include over 4,500 km^2 of new, high resolution seabed mapping data, 20,000 km of new shallow high-resolution sub-bottom data, and 550 seabed samples (cores, grab samples, camera/photographic/video data), with supporting analysis by the Canadian Hydrographic Service and ongoing collaborations with ECCC, NRCan, and DFO. The Geological Survey of Canada is expected to build on this work with additional data collection in 2026/2027 followed by synthesis of all collected and compiled data in 2027/28.

Priority 14: Effects of Environment on Infrastructure

Following the synthesis of baseline environmental, metocean, and geological data, assessing the potential impact of environmental conditions on offshore wind infrastructure and activity is necessary to determine turbine and farm design.

R&D Action:

1. Identify potential impacts from Nova Scotia's offshore conditions (e.g., wind, waves, ice, storms) on offshore wind infrastructure.

Priority 15: Technology Innovation and Integrated Digital Planning

This research priority involves the development of advanced modelling technologies, digital planning, and leveraging technology innovation to enhance turbine and site design and, ultimately, offshore wind site performance.

R&D Actions:

1. **Enabling Technology Innovation and Automation in Nova Scotia**

   Objective: Foster local innovation in offshore wind technologies and automation, exploring robust powering solutions for remote operations at offshore wind sites. Existing ocean technology expertise can be leveraged to develop modular equipment or components that can be built locally (with joint venture opportunities).

2. **Integrated Digital Planning**

   Objective: Develop robust, interactive tools for geospatial and power system data integration to enable rapid scenario analysis and optimized offshore wind site selection. This action aims to streamline scenario analysis and project optimization by combining geospatial, environmental, and grid data.

Priority 16: Climate Change Impacts

Forecasting the potential impacts of climate change on meteorological, oceanographic, environmental conditions, and human use were key topics that intersect with offshore wind development. Advancing research in this topic would enhance mitigation strategies from the outset of offshore wind development. Discussions on this research priority during the roundtable also extended to potential effects on the longevity of offshore wind turbines, which should be factored into turbine and wind farm design.

R&D Actions:

1. **Climate Impacts and Meteorological and Oceanographic Conditions**

   Objective: Identify how the potential impacts of climate change may influence the forecasting of meteorological and oceanographic conditions. Historical baselines, crucial for statistical weather modelling, are diminishing, leading to increased uncertainty and risk. High-resolution (i.e., fine spatial-scale) observational data on the ocean is severely limited, making accurate localized predictions challenging.

2. **Climate Impacts and Environmental Constituents**

   Objective: Identify how climate change may influence environmental constituents, including key habitats, species at risk, and species of cultural importance.

3. **Impacts of Climate Change on Community Use of Resources**

   Objective: Roundtable participants identified that climate change may affect communities' future use of resources in Nova Scotia's offshore. For example, where commercial fisheries operate today may not be where those activities will occur in the future, largely due to issues like changing species distributions in response to climate change; this could have implications for farm design. Conducting interviews and mapping exercises with communities could identify traditional areas and resources that may be influenced by climate change, with the outputs informing effects mitigation strategies and the design of offshore wind farms.

Priority 17: Mitigating Fisheries-Specific Impacts

As the baseline environmental data (**Priorities 6, 12**) and offshore wind-related implications for fisheries (**Priority 5**) are being collected, the next stage of fisheries-specific research involves identifying the necessary measures to maintain the viability of fisheries operations in Nova Scotia's offshore. Research in this priority approaches mitigation measures in the short- and long-term, as well as offsetting mechanisms.

R&D Actions:

1. **Mitigation Mechanisms**

   Objective: Identify the specific mitigation mechanisms using baseline environmental, metocean and geological, and socioeconomic data specific for the fisheries sector in the Nova Scotia offshore.

2. **Mechanisms to Counterbalance/Offset Habitat Losses related to the Fisheries Sector**

   Objective: To identify effective mechanisms to counterbalance or offset habitat losses and other residual effects. This work moves beyond financial compensation outlined in Priority 5, Action 2 to focus on solutions that maintain the viability of fisheries operations in the short- and long-term.

Priority 18: Effects Monitoring Innovations

This research priority examines monitoring technologies and solutions to advance the development of the offshore wind sector in Nova Scotia. Comparing existing monitoring expectations in Nova Scotia's offshore with those of other jurisdictions and advancing novel approaches could increase reliability and productivity of effects monitoring for offshore wind sites.

R&D Actions:

1. **Monitoring Technologies and Solutions**

   Objective: Compare local monitoring expectations in Nova Scotia to other jurisdictions to identify gaps. From this work, assess whether existing equipment requires modification or improvements for more comprehensive information gathering and explore the potential for integrated monitoring approaches.

2. **Advanced Monitoring & Uptime Optimization**

   Objective: Explore the use of drones and Internet of Things (IoT, network of smart devices) sensors for real-time asset monitoring, aiming to reduce downtime, increase productivity, and enhance the statistical reliability of operational data.

Priority 19: Socioeconomic Data and Community Priorities

Following the consolidation and collection of baseline socioeconomic data for Nova Scotia (**Priority 8**), development of engagement guidelines (**Priority 9**), and fisheries sector-specific information (**Priority 5**), next steps will require a deeper understanding of community-specific priorities related to offshore wind development. The R&D roundtable participants highlighted socioeconomic data gaps concerning local economic development, job creation, equity, inclusion, supply chain readiness, and community acceptance. Equity, diversity, inclusivity, and accessibility-focused research is critical to understand these impacts across different communities and groups.

R&D Actions:

1. **Identifying Micro-Level Socioeconomic Effects and Community Priorities**

   Objective: Identify community-specific priorities and explore impacts of development on high-priority areas and groups. This would involve (but is not limited to):
   - Analyzing community-specific baseline data (e.g., employment rate, median household income, local business density) and the impact of different offshore wind development scenarios,
   - Identifying socioeconomic effects on housing, cost of living, cultural shifts, healthcare, education, and community infrastructure for Indigenous and non-Indigenous communities,
   - Drivers of social acceptability and meaningful community involvement in sector development.

2. **Estimate Macro-Level Socioeconomic Effects**

   Objective: Forecast potential socioeconomic effects at different timescales and identify the most likely scenarios for offshore wind development in Nova Scotia. This research would factor in increasing electrification, expected population increases across Nova Scotia, and indirect economic impacts (e.g., trade relationships and sale of goods).

Late Development Phase

The late development phase would involve site preparation to manufacture and install offshore wind turbines and the ongoing monitoring and maintenance necessary during offshore wind site operation. R&D priorities identified at the roundtable have implications for both the construction and operation stages of offshore wind sites. As the sector progresses through the development timeline and results from earlier phases are produced, R&D priorities for the late development phase are expected to take shape.

Priority R&D Areas:

20. Mitigation of environmental and social effects – empirical data
21. Public education through real-time offshore wind mapping
22. AI-driven analytics

Priority 20: Mitigation of Environmental and Social Effects – Empirical Data

As further data becomes available on the effects of construction and early operation of offshore wind sites on environmental constituents, ecosystems, and socioeconomic constituents, further research can be conducted on indirect effects of offshore wind and appropriate mitigation strategies that should be implemented. This work supports the adaptive management approach outlined in Priority 10.

R&D Actions:

1. **Minimizing Impacts using Innovative Technology Development and Empirical Data**

   Objective: Develop and implement new technologies and strategies that reduce offshore wind development's environmental and social footprint using empirical data collection from construction and operation stages. Examples of technologies and strategies identified at the roundtable include reduced noise generating technologies for piledriving and monitoring underwater sound during installation and operation, and innovative non-invasive survey technologies that avoid incursions onto fishing grounds, potentially leveraging existing fishing vessels for data collection.

2. **Assessing Indirect Effects using Empirical Data**

   Objective: Continuously monitor the indirect ecological impacts of offshore wind development and assess the effectiveness of implemented mitigation efforts. Use available offshore wind operational data to better understand species interactions with offshore wind to modify mitigation and monitoring programs as needed. For example, indirect effects, such as turbine infrastructure acting as fish aggregating devices or impacts on crustaceans, may require modified mitigation strategies as data becomes available from operating offshore wind sites.

Priority 21: Public Education through Real-Time Offshore Wind Mapping

Providing a platform and insights for the public into early operation of the first offshore wind farms would be useful to advance public understanding of offshore wind operation and its role in the energy transition. **Priority 9**, which will have identified guidelines and preferred approaches to how communities want to be engaged, would be an important consideration in the design of this priority.

R&D Action:

1. To enhance public education and understanding of offshore wind energy using interactive, public-facing platforms that combine real-time offshore wind generation data with Nova Scotia's hourly power demand. The platform should allow users to select identified wind energy areas, model energy output based on turbine numbers and types, and compare generation to real-time Nova Scotia Power grid demand.

Priority 22: AI-Driven Analytics

As wind farms move to the operational stage, empirical data can be used to enhance offshore wind performance, reliability, and predictability. The data outputs from advanced analytics and machine learning can be used to enhance current operations and future operations in Nova Scotia's offshore.

R&D Action:

1. Apply advanced analytics and machine learning (e.g., digital twins) to enhance offshore wind systems' performance, reliability, and predictability; this approach can assist with forecasting wind patterns, electricity production, and equipment performance and maintenance. It also includes analyzing large datasets from offshore wind installations to identify trends, anomalies, and optimization opportunities and building AI-driven tools for real-time decision-making in offshore operations.

Decommissioning Phase

This phase of development will involve the decommissioning of offshore wind turbines and infrastructure that has reached their end-of-life stage. The focus of the roundtable was largely on the enabling R&D priorities for offshore wind development in Nova Scotia; however, R&D priorities for decommissioning should be explored. The efficient and safe decommissioning of offshore wind will require site-specific considerations, which R&D actions in the mid and late development phases can inform.

Next Steps

We thank all roundtable participants for their contributions, which are reflected throughout this report and are instrumental in advancing a sustainable and efficient approach to offshore wind development in Nova Scotia.

Identifying and organizing the priorities that were discussed at the roundtable is an essential step toward a strategic, coordinated R&D effort. However, continued discussion and information-sharing is needed.

We welcome comments on the R&D priorities outlined in this report, as well as the addition of new priorities from experts across academic and applied research, Indigenous communities, industry, regulatory and policy sectors, traditional knowledge holders, and organizations with experience related to offshore wind development.

Shaping the Nova Scotia Offshore Wind R&D Plan

Net Zero Atlantic will compile and synthesize contributions for consideration into the upcoming offshore wind R&D plan, which will clarify research requirements, identify key contributors, and provide budget and timeline estimates for the R&D priorities. This plan will be an important tool for decision-makers and the offshore wind innovation ecosystem to align resources, reduce duplication, and direct investment toward the most critical knowledge gaps to support the efficient and sustainable development of Nova Scotia's offshore wind resource.

To provide comments on this report, please contact

offshorewind@netzeroatlantic.ca

2025 Nova Scotia Offshore Wind R&D Forum

A key opportunity to continue the discussion on strategic offshore wind R&D is the Nova Scotia Offshore Wind R&D Forum, taking place on Wednesday, September 24, 2025, at the Westin Nova Scotian in Halifax, NS. This one-day event will convene researchers, innovators, Indigenous and community leaders, policymakers, and industry professionals. Together, we aim to align cutting-edge research with the practical needs of offshore wind development in Nova Scotia.

To learn more about the Forum, use this link:

https://netzeroatlantic.ca/nova-scotia-offshore-wind-rd-forum

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