

# Clean Futures Plan



SUMMER 2019

 **BCFerries**

# Message from the CEO



At BC Ferries, our mission is to connect communities and customers to the people and places important in their lives. It is our privilege to operate in one of the most pristine environments in the world and it is our objective to be a leader in environmental and social governance.

BC Ferries knows that climate change is the greatest challenge of our generation and it is felt in BC and around the world. In December 2018, the BC Government released its CleanBC plan to reduce 2030 greenhouse gases (GHG) by 40 percent below 2007 levels, 60 percent by 2040 and 80 percent by 2050. Along with our continued investment in ensuring a safe, reliable and efficient ferry system for

the future, we want to serve our customers' interest by contributing to meet BC's GHG reduction goals.

Our Clean Futures Plan describes our strategy to reduce GHG emissions by replacing our legacy carbon-intensive fossil fuels with clean and renewable energy. While this cannot be achieved in a single step, it is our policy to continually seek among available energy sources the cleanest, lowest carbon-intensity option that can displace non-renewable diesel.

We know that liquefied natural gas (LNG) is a fossil fuel and understand our customers' desire to eliminate them. However, adopting LNG is important climate progress and we currently have five LNG-fueled vessels in our fleet that substantially outperform diesel-fueled vessels for emissions and costs. LNG has a lower carbon-intensity than marine diesel fuel, it is domestically sourced and it supports Canadian jobs. Its use reduces fuel costs and foreign exchange risk significantly, contributing to more affordable ferry fares. It does not pollute water or marine life if spilled into water as it evaporates, and is not persistent in the marine environment as are oils. It can be reliably delivered by BC companies without significant new infrastructure or transport risk. LNG is a significant complimentary step towards sustainable transportation for BC. We can be proud of the expertise we've developed and now share with other ferry operators.

The Company has two Island Class electric battery hybrid ships under construction for service to coastal communities. Batteries for these two new vessels are supplied by Corvus Energy, founded in BC. When delivered in 2019, we believe these vessels will be the most advanced and quietest battery-hybrid ferries. They are just the latest in a series of milestones we have achieved as part of our Clean Futures Plan, our strategy to progressively lower emissions across the fleet and be a leader in the energy transition to a lower carbon future. When electric charging technology matures to make electricity available in quantities required, BC Ferries plans to operate these ships as all-electric ferries, using only renewable energy.

Our Clean Futures Plan is leading us toward our next major vessel program for longer routes where all-electric operations is not technically possible yet. Up to five new large ships will feature high capacity energy storage systems, which could make possible departure and arrival in port, as well as in-port operations, to be completed using electricity. Our goal is ultra-clean emissions with ultra-low fuel consumption. Even these large ships will be designed for full electric operation when technology permits.

Our progress towards the GHG reduction targets will be rigorously measured to ensure that we stay on track. Our strategy and timeline are consistent with the International Maritime Organization (IMO) which began its data collection system on fuel oil consumption of ships on January 1, 2019. The initial GHG strategy by the IMO is to reduce the carbon intensity of international shipping an average of at least 40% by 2030 from 2008 level.

Ferry users expect reliability, so we must also be realistic in striving to meet BC's GHG reduction goals. There are real engineering and reliability issues to be solved and there is the significant matter of affordability. Without substantial external funding, as is the case in parts of Europe, our customers carry the cost of activities to meet BC's GHG reduction goals. That's why we are taking methodical and prudent steps as technology matures and costs stabilize.

At BC Ferries, we are ahead of the curve on reducing our GHG emissions. Every day we study, engineer, invest and act. We are moving along a carefully structured path designed to help protect coastal communities from climate change, unreasonable costs and unreliable technologies, our dedicated team is bringing sustainability and cleaner operations to our coastal ferry system.

Mark Collins  
BC Ferries' President & CEO



Salish Raven

# Introduction & Goals

With a vision of being trusted and valued, the mission of BC Ferries is to connect communities and customers to the people and places important in their lives. We strive to be sustainable; our environmental, social and economic impacts are central to our business decisions.

Since becoming an independent company in 2003, we have been on a path to greater sustainability by being continuously active in developing and implementing innovative and cost-effective ways to minimize our impact on the coastal environment in which we operate.

The future offers significant opportunities for advancing our sustainability objectives. The central mandate of our Clean Futures Plan is to rise to the challenge of global climate change by:

- Increasing our use of low carbon-intensive energy,
- Maximizing energy efficiencies, and
- Reducing emissions from waste.

## THE FUTURE OUTLOOK

<b>Getting you to the places that you need and want to be</b>	<ul style="list-style-type: none"><li>• BC Ferries will strive to meet the Clean BC 2030 climate targets by reducing the GHG intensity of our operations by transitioning to cleaner energy.</li></ul>
<b>Where you travel and where we work</b>	<ul style="list-style-type: none"><li>• By 2030, 40 per cent of our light duty vehicles will be all-electric or will only use low carbon fuel.</li><li>• By 2030, BC Ferries will work towards reducing emissions from terminals, facilities and buildings by 40 per cent.</li></ul>
<b>Reducing our waste</b>	<ul style="list-style-type: none"><li>• By 2030, we will strive to divert 60 per cent of all wastes from the landfill with the potential for 95 per cent of organic waste to be turned into a clean resource.</li></ul>
<b>Measuring our progress</b>	<ul style="list-style-type: none"><li>• By 2021, we will have an initial GHG inventory and a detailed policy roadmap on GHG emissions generating activities.</li><li>• By 2023, energy types will be assessed through the full lifecycle from the production and transportation, not just consumption.</li><li>• By 2025, BC Ferries will strive to track all energy use for all new vessels and redeveloped terminals.</li></ul>

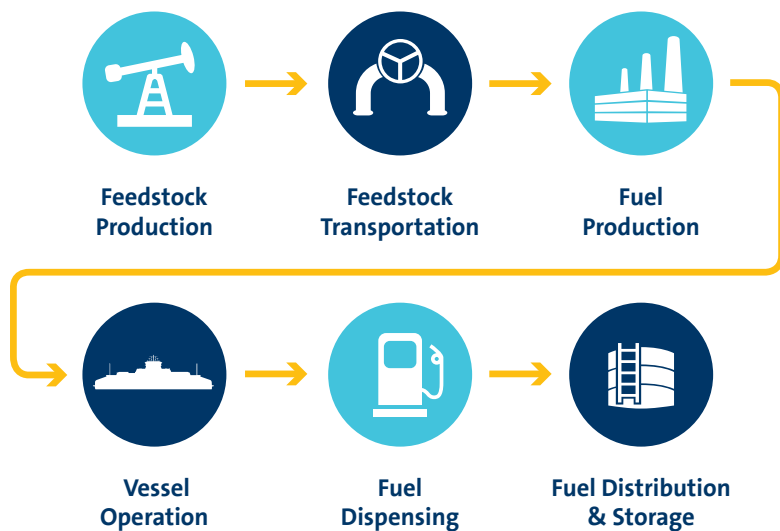
## CARBON INTENSITY OF FUELS FOR VESSEL OPERATION

We will meet climate targets by reducing the GHG intensity of our operations by transitioning to cleaner energy.

ENERGY SOURCE	CARBON INTENSITY (gCO <sub>2</sub> e/MJ)
<b>In Use</b>	
Diesel (non-renewable)	95
LNG (non-renewable)	67
<b>In Limited Use</b>	
Renewable Diesel	<25
<b>Future</b>	
Renewable LNG	<25
Electricity	15

## LIFECYCLE ANALYSIS OF FUELS FOR VESSEL OPERATION

Greenhouse gas from fuel will be assessed through the full lifecycle, not just at the point of consumption. From production and transportation to distribution and consumption, we will assess the environmental impact of fuel during all aspects the lifecycle.



## Our Coastal Legacy

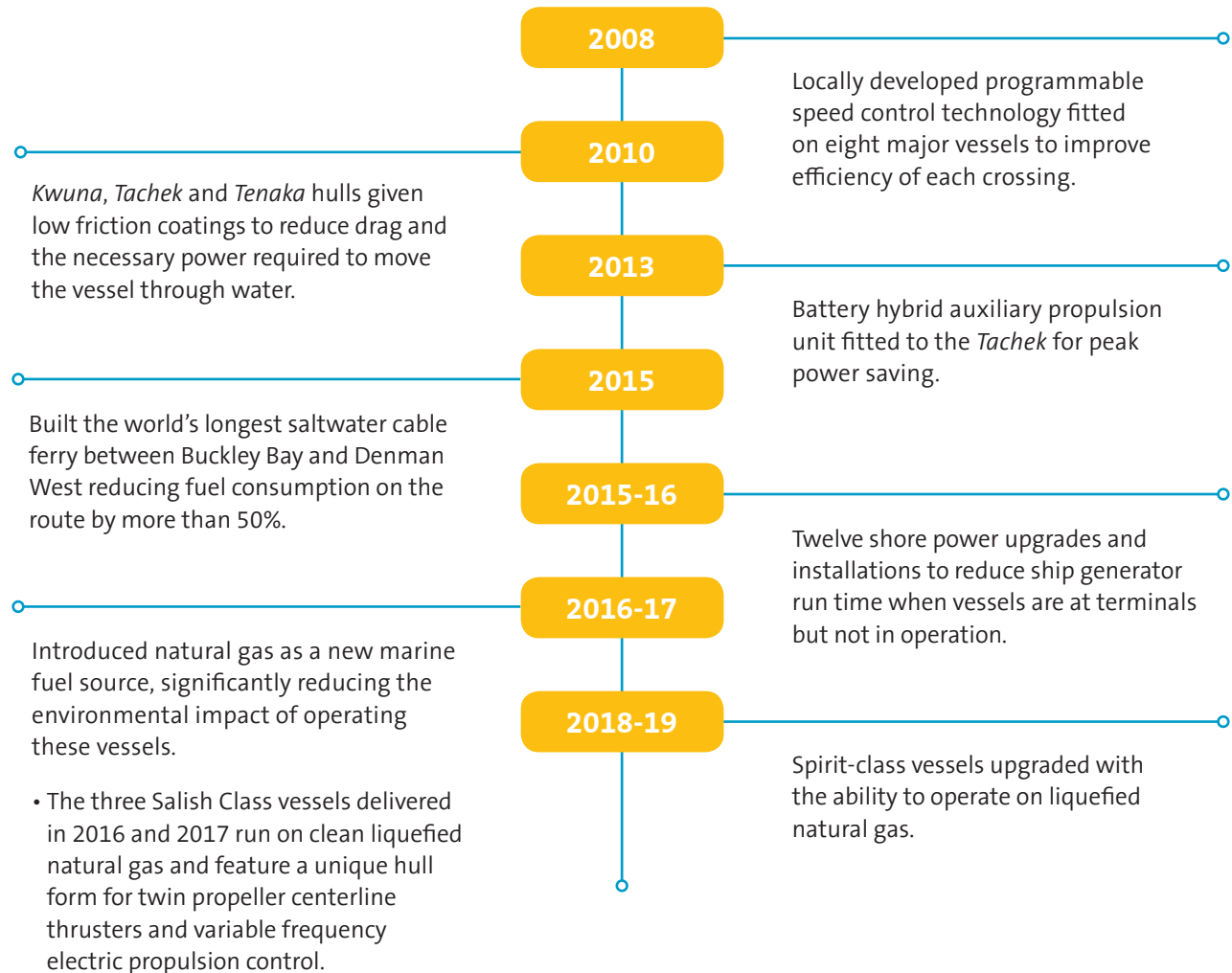
The rich legacy of our coastal ferry system has been dependent on the fossil fuel that is so critical to safe and reliable operations. About 94 per cent of BC Ferries total energy consumption is from fossil fuel sources. The long life of vessels and terminals, typically a half century of economic function, means that the transition into cleaner energy must allow for compatibility with an aging system.

BC Ferries efforts to limit fossil fuel usage in our legacy infrastructure achieved a 6 per cent reduction over twelve years from a variety of initiatives. Before 2008, BC Ferries focused on engine upgrades and replacements to reduce diesel consumption, introduced improved low friction hull coatings, and undertook a fleet-wide initiative to optimize vessel and route navigational path and speed parameters. We have worked with BC-based diesel fuel suppliers to introduce renewable biodiesel blends acceptable for marine engine use. A new major vessel standard platform was delivered in 2007 with delivery of the Coastal Class, with improved hull and propeller efficiency and adoption of diesel-electric propulsion for greater flexibility and energy management. It has been calculated that the Coastal Class meets EEDI (Energy Efficiency Design Index) standards for vessels to be designed in 2025.

*BC Ferries' anti-idling campaigns have reduced the fossil fuel burned by customers waiting to board ferries.*

# Clean Energy Transition

BC Ferries is adopting available alternate energy sources that provide the lowest carbon-intensity. The duration of this transition is governed by the speed in which technological, regulatory and economic barriers can be overcome as well as by the capacity of BC Ferries to execute large scale infrastructure changes without significantly disrupting normal operational services.



## A SHIFT TO BC NATURAL GAS



### THE LNG ADVANTAGE

- Lower carbon-intensity than marine diesel
- Domestically sourced, supports Canadian jobs
- Reliably delivered by BC companies
- Costs less, which helps to keep fares affordable
- Better for the environment than marine diesel

A shift to BC natural gas, displacing more than 22 per cent of the total diesel fuel consumption, has delivered the most significant step reduction in the GHG intensity of BC Ferries' fleet.

- Three Salish Class vessels were delivered in 2016 and 2017 powered by cleaner liquefied natural gas (LNG).
- Two Spirit Class vessels, the largest fuel consumers in the fleet, were converted at mid-life in 2018 and 2019 to use cleaner LNG. These project improvements also improved fuel efficiency:
  - Low friction coatings reducing hull resistance and increasing hydrodynamic efficiency.
  - Variable frequency drives used to decrease electric motor power consumption for heating, ventilation and air conditioning (HVAC) and other large consumers.
  - Hull, rudder and propeller modifications for improved efficiency.

The use case for LNG has been examined for all fleet vessels with significant remaining life span. Conversion requires lengthy and costly absence of the vessel from operations. With limited reserve vessel capacity just one conversion in a year is feasible. The three Coastal Class vessels and the Northern Expedition remain the only potential candidates for LNG conversion.

## INTEGRATING CLEAN TECHNOLOGIES

In addition to alternatives to our legacy fossil fuel, BC Ferries is investing in sustainable technologies like shore power, cable ferry technology, and high efficiency new vessel platforms.

To offset fossil fuel use, our ships switch to shore power at night and when not operational. Hydroelectric shore power is much cleaner and the shipboard generators are stopped to eliminate engine noise and emissions.

In 2013, the MV Tachek was fitted with a 200 kWh battery array for handling peak loads, such as when operating its new bow thruster. This was the first battery-hybrid installation by a West Coast ferry operator.

The world's longest saltwater cable ferry, the Baynes Sound Connector, was built in 2015 to operate between Buckley Bay and Denman West. Since its deployment the cable ferry has reduced diesel fuel consumption and associated GHG emissions on that route by more than 50 per cent.

In addition to having an LNG-fueled power plant, the three Salish Class vessels introduced in 2017 feature a innovative hull form for twin propeller centerline thrusters and variable frequency electric propulsion to maximize energy efficiency. A fourth Salish Class vessel is pending construction.

*We installed dual-fuel engines in our LNG powered vessels. The shift to a cleaner future is made through progressive steps in hybrid design. With hybrid design new energy sources can be adopted without compromising reliability or interoperability in the fleet.*



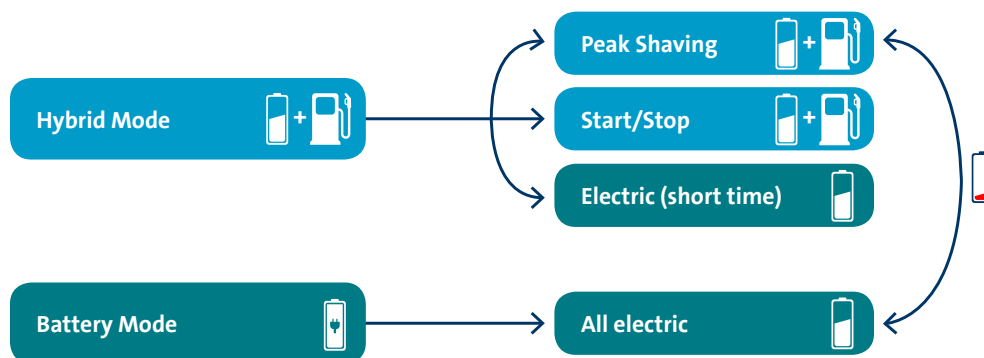
*BC Ferries has incorporated infrastructure into terminal retrofits that support walk-on and bike-on passengers so our customers have more sustainable transportation options.*

## READY FOR “ALL-ELECTRIC”

Significant external challenges currently preclude the operation of an all-electric vessel in BC, so BC Ferries is constructing the first two “electric ready” Island Class ferries. The shorter distances on many inter-island routes make these Island Class ferries candidates for all-electric operation when the infrastructure is available. The first two are scheduled to begin service in 2020. Four more vessels will follow in 2022.

The Island Class will have 800 kWh of Corvus Energy lithium-ion battery storage with the capacity to expand to the 2000 kWh necessary for all-electric operations. Corvus, founded in BC, is the world’s leading supplier of safe, innovative, and reliable energy storage for the marine industry. The propulsion thrusters are driven by electric motors enabling the multiple power modes.

In the absence of ready shore-side charging, the Island Class will operate in a hybrid battery power mode to maximize fuel efficiency of the generators. When the vessel power demand is lower, the generators will charge the batteries. On short routes, the batteries can be used as the primary power source to be re-charged by the generators only when necessary (Start/Stop). On longer routes, the batteries will supplement the generator sets when power demand is high (Peak Shaving). The power management system reduces fuel consumption and emissions.



*Joining the fleet in 2020, the Island Class will be among the most efficient and quietest battery-hybrid ferries world-wide.*



## HYBRID PROPULSION OPPORTUNITIES

Several existing vessels with electric propulsion systems (Capilano Class, Coastal Class, and Salish Class) present opportunities for battery hybridization and may be eventual good candidates for all-electric operation.

BC Ferries New Major Vessel (NMV) Class ferries concept, expected to enter service by the mid 2020's, will be designed for longer route distances. These vessels will have a mix of LNG and hybrid electric propulsion technology. Specifications have been developed with aggressive targets for energy efficiency and reduced GHG emissions. In addition, we plan to convert the NMV Class at their mid-life to a zero-emission vessel if the necessary energy storage technologies have matured in that time frame.

## REDUCING WASTE

Waste in general is a concern for British Columbians, in particular the decomposition of organic waste in landfills produces GHGs that contribute to climate change. Since 2015, BC Ferries has implemented a comprehensive solid waste management program which includes diversion of organics, where composting facilities are available. In 2018, we have reduced the total waste sent to the landfill by 9.5 per cent since 2015 and increased the proportion of organics diversion to 20 per cent of total waste generated. BC Ferries' food waste is sent to composting facilities which turn the organic materials into clean energy and compost-based soil.

## COLLABORATION

BC Ferries recognizes planning for a cleaner future is a collaborative and iterative process that requires continuous engagement with provincial and federal regulatory bodies to align goals and pathways to meet measurable objectives.

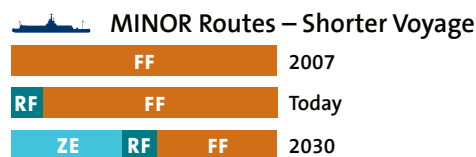
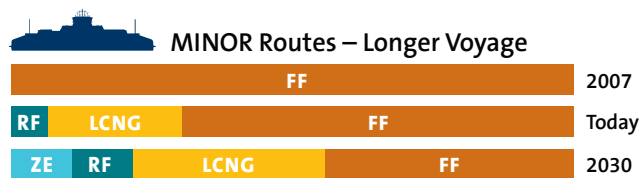
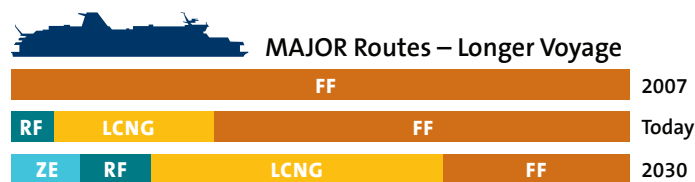
- BC Ferries and BC Hydro have been partnered in energy management over the last 10 years in the Power Smart Program. Previously focused on energy savings, the program has been redeveloped with emphasis on energy efficiency, development of clean technology, and incorporating opportunities for electrification.
- BC Ferries has worked extensively with FortisBC on the strategy to adopt lower carbon-intensive fuels for ships. We are participating as FortisBC's Climate Action Partner that aims to reduce GHG emissions and build a more sustainable future.
- BC Ferries is continuing to work with Transport Canada and Natural Resource Canada to fund research and development projects aimed at advancing clean technology and clean energy. Most recently, BC Ferries joined the Government of Canada's Clean Growth Hub and registered as a CIPEC Leader with NRCan's Canadian Industry Partnership for Energy Conservation (CIPEC), further cementing energy efficiency a top priority within our organization.

# Reaching for the Future

BC Ferries' fleet standardization strategy will reduce vessel variants from about 17 to five standard vessel platforms that will improve interoperability and maintainability. Within these standard platforms, clean future objectives can be advanced by making room for “drop in” technology that is not yet mature. Technologies for future vessel design and conversion is envisioned to include:

- Hull and propulsion systems that maximize energy efficiency.
- Shore charging systems and battery capacity to displace fossil fuel consumption.
- Shipboard power generation that can use alternative and renewable fuels.
- Fuel storage and transfer systems for safe handling of future fuels.

The strategy will place priority on vessel electrification . Where appropriate, current fossil fuels in large scale usage will be displaced by lower carbon intensive fossil fuels (like natural gas). The third phase of the strategy is an incremental displacement of all fossil fuels by renewable fuels adapted to marine applications.



## *Adoption of clean energy must not impair the reliability of the future fleet. Vessels must be able to operate on the energy source available regardless of where or when they are built or used, preferably using the lowest carbon-intensive energy.*

The most significant external barriers to realizing these clean energy futures are high capital costs and the development of supporting infrastructure and products for:

- High capacity grid-based electric supply into urban and remote terminals;
- Renewable fuel blends with sufficient energy density that can be “dropped in” to the existing fuel supply chain;
- Commercial maturity and technical readiness of Hydrogen as a large scale energy carrier in marine operations; and
- Commercially available synthetic renewable fuel adapted to marine operations.

Interoperability will enable fossil fuel reductions by route profile and vessel class, resulting in progressive steps towards the goal of a clean energy-based fleet.

BC Ferries is continually examining green technology and low carbon-intensive fuel options for its vehicles and equipment that will reduce emissions. Options that are underway include:

- Acquiring electric vehicles to replace existing fossil fuel vehicles;
- Replacing existing fossil fuel heavy duty equipment (for example: tuggers, forklifts, crane trucks) with electric, hybrid or other clean energy; and
- Installing electric vehicle charging stations for fleet, customer, and employee use.

BC Ferries will incorporate energy efficiency considerations into terminal, facilities and building design to reduce GHG emissions by engaging utilities providers at the conceptual stage to set site-specific energy efficiency objectives and define available incentives. It is our intention to prioritize renewable energy and explore opportunities for self-sufficient energy generation using solar, wind, thermal, and tidal technologies.

BC Ferries will continue to contribute to meeting BC’s climate targets to reduce the amount of waste we produce and to make better use of the organic waste we divert from the landfill as we seek to expand the generation of clean energy from our waste.

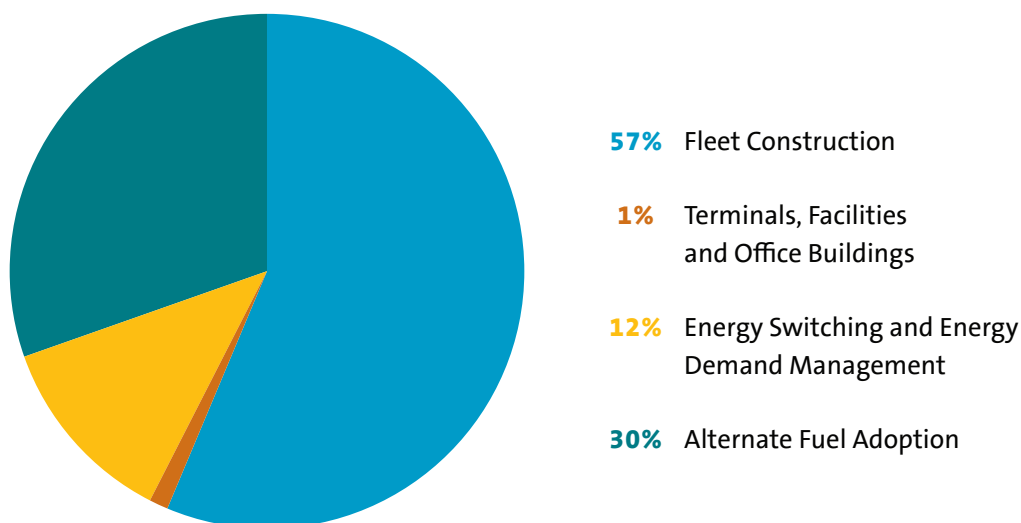
# Measuring Progress

BC Ferries is completing comprehensive data collection of our GHG emissions, which is consistent with the International Maritime Organization's strategy for data collection of fuel oil consumption of ships which began on January 1, 2019. The data collection will enable us to measure our progress towards meeting our 2030 targets and make adjustments and refine our approaches.

By 2030 we anticipate that we will have lowered our GHG emissions by 24 per cent compared to 2007 levels, which is aligned with BC's commitment of the transportation sector for the provincial 2030 GHG reduction target. More than half of the projected GHG reductions will come from the introductions of new vessel platforms, while approximately 30 per cent of projected GHG reductions may come from adoption of lower carbon-intensive energy.

To make our 2040 and 2050 targets achievable, we will focus future actions on areas where there are still significant GHG emissions and anticipate that these will require innovation and investment.

## PROJECTED REDUCTIONS TO ACHIEVE OUR 2030 TARGETS





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*Spirit of Vancouver Island  
and Spirit of British Columbia*