



Small Marine Outboard Electrification:

Insights and Recommendations
from the RowElectric Pilot

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For more information on the *RowElectric* project, please visit rowingbc.ca/rowelectric

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Executive Summary

Electric outboard motors are in a phase of rapid innovation, with new products emerging to meet a growing variety of marine uses. They now range from portable 1 kW units to powerful 250 kW systems capable of reaching speeds of around 40 knots. Electric outboards are being used on a wide variety of boats, including sailboats, rigid inflatable boats, workboats, water taxis, catamarans, and pleasure cruisers.

Input gathered from participants in the RowElectric pilot project, marine professionals and potential users highlighted the following factors driving adoption: environmental benefits (cleaner air and water, reduced CO2 emissions), quiet and convenient operation, and lower operating costs. Barriers are typical of other technologies in the early phase of adoption: high upfront costs, unfamiliarity and uncertainty (about range, speed, reliability, charging times), access to charging, and concerns about local servicing and support. The RowElectric pilot also highlighted the value of firsthand experience in identifying practical, sometimes situation-specific, benefits and issues.

Using what was learned from the interviews and pilot project, we recommend actions across five themes. 1. Financial support (e.g., rebates, loans) to reduce upfront cost and risk; 2. Charging: invest in charging infrastructure and increase awareness of and access to existing infrastructure; 3. Service support: invest in training marine technicians and users; 4. Education, awareness and outreach: provide reliable information using existing partnerships and channels (e.g., PlugIn BC, Emotive BC, trade shows and conferences), provide opportunities for people to test drive electric outboards and talk to users through ambassador programs, and demo boats at key locations and events; and 5. Regulation: consider developing consistent standards and terminology around electric outboards, batteries, and charging infrastructure.

We also recommend future work to better understand the scope and scale of the small marine outboard sector and the potential for reduced CO2 emissions and increased electricity demand, and to highlight policies and practices to promote efficiency.

The RowElectric Pilot Project

The aim of the RowElectric project is to accelerate the transition from gas to electric outboards by providing rowing clubs with first-hand experience and reliable data on performance, costs and reliability.

Rowing clubs commonly use 9.9 hp-25 hp gas outboards to power boats used by coaches and regatta umpires. Rowing clubs operate as many as ten boats, with the busiest boats typically used 2 to 6 hours per day, year-round (over 600 hours/year).

The RowElectric project, part of the Clean BC Commercial Vehicle Pilots (CVP) program, is piloting the use of five electric outboards at four different rowing clubs, collecting data on performance, user experience and costs under “real-world” conditions. The data will help rowing clubs assess the feasibility and costs (or savings) of converting from gas to electric outboards. The pilot is not intended to compare one electric outboard system or model to another. For reasons of availability, all five outboards are the same make; two are 6kW models and three are 12 kW models. All five are mounted on fibreglass coaching catamarans. The outboards were installed in Spring 2024, preliminary data were collected from Spring 2024-Fall 2025, and more detailed data collection began in the Fall 2025 and will end December 2026.

Each pilot club contributed 30%-50% towards purchase and installation costs and covered 66% of the cost of any electrical upgrades. The rest of the costs were covered by the RowElectric project through grants and cost sharing with CVP.



A Brief Introduction to Electric Outboard Systems

Electric Outboard Motors

Marine electric propulsion systems include electric inboard motors, stern drives and pod motors. This report focusses on outboard motors. Outboard motors are detachable self-contained units that are mounted on the transom (stern) of a boat. Electric outboard motors are powered by batteries; gas outboard motors are internal combustion engines powered by gas. An electric outboard system includes the electric motor unit (including the motor and propeller), batteries, battery management system (BMS), charger, throttle and connecting/communication cables. Some manufacturers sell all the components as an integrated system, whereas others sell only the motor, with users sourcing the other components separately.



Electric outboards may be either tiller-steered (the tiller and throttle are part of the motor) or remote-steered (the motor is connected, by cables or wirelessly, to a steering wheel and throttle on a console). Electric outboards range from small, portable motors of 1kW suitable for powering small tenders up to powerful, high-performance motors of 225 kW, capable of speeds of 30-40 knots.



Outboard motors – whether gas or electric – are normally referred to in terms of their power. The power of gas outboards is measured in horsepower (hp), whereas the power of electric outboards is measured in kW. Some manufacturers describe their electric outboards in terms of “horsepower equivalence” - an *estimate* of how its performance compares to a gas outboard, taking into account differences in torque, RPMs, and efficiency and how these affect perceived performance. As a rule-of-thumb, a 6-kW electric outboard is similar to a 9.9 hp gas outboard, a 12 kW is similar to a 20 hp gas outboard, and a 50 kW is similar to a 75 hp.

Electric outboard motors accelerate quickly, feel responsive and run smoothly even at low speeds compared to gas outboards, but top end speed is usually lower. Performance, including range, speed and “fuel efficiency” are strongly affected by hull design, total weight, wind and water conditions, and other factors that affect drag. And because the drag created by water is much greater than the drag created by air, factors that increase drag are even more important with boats than with EVs.

Batteries

Advances in battery technology and chemistry have dramatically increased the range and performance of electric outboards, making them practical for a wider range of marine uses. Lithium-Iron-Phosphate (LFP) batteries are becoming the battery of choice for marine use, although Nickel Manganese Cobalt (NMC) batteries are also used. Most small to medium sized electric outboards are powered by low voltage batteries (24V or 48V); more powerful motors are powered by high voltage batteries (96V or more). Many systems allow multiple batteries of the same model to be connected in parallel to increase battery capacity.

Charging

The charger, which converts AC current from an outlet into DC current to the battery, is a separate unit that connects to the battery bank at one end and plugs into a regular 110V or 220V outlet at the other end. A 110V outlet is the same as a Level 1 EV charger; a 220V outlet is the same as a Level 2 EV charger. For practical purposes and regular use, most batteries are too heavy to remove from the boat for charging. The charger is usually mounted on the boat and then connected to a GFCI outlet with a standard “shore power” cable. Most marinas in BC have 110V or 220V shore power outlets mounted on pedestals on the dock. Some batteries are also compatible with shore-mounted DC fast chargers (analogous to Level 3 DC “fast” chargers for EVs), although DC charging stations are still uncommon in Canada. Some batteries can be charged using solar panels; however, because solar charging is slower than charging through the electricity grid, it is most practical for small capacity batteries, for “topping up” the battery charge while underway, or where there is space for a large array of solar panels.



Charger



Shore power pedestal

Uses

Electric outboards can be used for recreation, including fishing, pleasure cruising, sailing, and watersports, and for commercial purposes, including water taxis, wildlife viewing, and workboats. They can be mounted on a wide range of boat types, including rigid hull inflatables (RHIBs), runabouts, pontoon boats, cruisers, and sailboats.

Uses vary widely in performance requirements (e.g., speed, range, torque) and frequency, duration, and seasonality of use. For example, recreational boaters may run their motor for only 100 hrs/year, mostly in the summer; whereas rowing coach boats are used year-round for more than 600 hours/year.

With *current battery and motor technology*, electric outboards are best suited for:

- Operating at low to moderate speeds.
- Shorter trips (say, less than 4-6 hours, depending on speed).
- Uses that involve lots of idling, slower speeds and changes between forward and reverse (e.g., coaching, near shore recreational fishing).
- Where quiet and clean operation are critical (e.g., on waterways where gas motors are prohibited, wildlife viewing).
- Where there are both access and time to charge between uses or to “top up” the battery (e.g., travelling between marinas or to a “mothership”, day use, coaching).

Uses are expected to expand as advances in battery and motor technology extend runtimes and as hulls are designed to optimize fuel efficiency.



Benefits of Electric Outboard Motors

Commonly cited benefits of electric outboards include:

1. Clean: no air pollution, including GHGs and noxious fumes, and no water pollution.
2. Quiet: resulting in a more pleasant experience, easier communication, and less impact on wildlife and neighbours.
3. Low maintenance, reliable, and long lifespan: electric outboards have fewer parts and less friction, heat and vibration than gas outboards, resulting in less maintenance, a longer lifespan, and more reliable operation.
4. Smooth, fast acceleration: “instant torque” results in fast acceleration and smooth controls. The faster acceleration allows planing hulls to get up on plane faster.
5. Low operating costs: particularly as the price of gas increases.

Adoption Trends

Electric outboards have been around for over 100 years¹, but until recently their use was limited by the capacity and weight of lead-acid batteries. Technological advances in lithium-ion batteries in the last 10-15 years, as well as innovations in motors and control systems, have dramatically improved performance and extended the range of electric outboards, making them practical for a broader range of marine uses. The industry is in a phase of rapid innovation, with a growing number of manufacturers and a growing number of products commercially available or in development. Electric outboards are in the early phase of adoption, with [Canadian Boating](#) estimating that electric outboards are about 5-10 years behind EVs on the adoption curve.

Adoption world-wide is being driven by²:

1. Technological advances in batteries, motors and control systems, leading to better performance (higher top speed, extended range, increased efficiency, faster charging) and simpler installation and operation. Electric outboards are now practical for a wider range of marine uses, and there are more options available to consumers.
2. Increasingly stringent environmental regulations on emissions and noise, particularly in the European Union.

¹ [Elco Motor Yachts](#). [Boating](#), December 8, 2025. [The evolution of outboard motors](#). [Fuber](#).

² [Explomar](#), May 9, 2025. [The Growing Electric Outboard Engine Market](#). [Future Market Insights](#) Inc., September 2, 2025. [Electric Outboard Engines Market \(2025-2035\)](#). [Markets and Markets](#), August, 2025. [Electric Boats Market](#)

3. Growing consumer preference for quiet, clean outboards, together with growing awareness of the benefits of electric motors and familiarity with EVs. Increasing adoption and familiarity with EVs is spilling over to other electric mobility systems, including electric outboards.
4. Dropping costs, particularly in batteries (linked to technological advances).

High upfront cost, gaps in charging infrastructure, concerns about performance and range, and access to servicing are consistently mentioned as barriers to adoption.



Factors Driving and Impeding the Adoption of Electric Outboards

As part of the RowElectric project, coaches and managers at the four pilot clubs as well as at five clubs that chose not to participate in the pilot were interviewed to identify factors that enable or impede adoption, and to identify policies or initiatives that might support adoption. In addition, input from the wider boating community was sought to supplement the rowing club interviews. Input was gathered in an online focus group of twelve people that included recreational boaters, outboard dealers, representatives from boating organizations and advocacy groups, and a boatyard owner. All were boaters themselves, and most had some expertise or experience with electric outboards. Additional input was gathered through informal conversations with people not able to participate in the focus group, including commercial boat operators, marine trade professionals, marina owners, and harbour authorities.

Reasons for Adopting Electric Outboard Motors

RowElectric pilot clubs identified the following key reasons for participating in the pilot.

Environmental Benefits

Including reduced GHG emissions, water and air pollution, along with the desire to be leaders in the rowing community. All four clubs mentioned the value of being “good community partners/neighbours”.

Quiet

Including reduced risk of hearing damage, reduced sensory and physical fatigue, and a more pleasant environment for coaches and athletes.

Lower Operating Costs

All four clubs anticipated that operating costs would be lower (although they were uncertain about whether the lower operating costs would be enough to offset the high upfront cost).

Similar drivers were identified by participants in the focus group.

Environmental Benefits

Including cleaner air, reduced emissions, no fuel spills or water contamination, and protection of local ecosystems.

Quiet

Including a more pleasant boating experience and less disturbance of shoreline residents.

Lower Operating Costs and Easy Maintenance

Including lower fuel costs, less mechanical failure, ease of start-up and operation. Participants noted that ease of use is especially attractive for occasional boaters, boat rentals (users and owners), and community programs.

Innovation and Future-Proofing

Including a desire to stay ahead of regulations that restrict use of gas outboards on certain waterways, to be leaders and innovators, and to align operations with their organizational sustainability goals.

Barriers to Adopting Electric Outboard Motors

Upfront Cost

The high upfront cost of electric outboards was cited by rowing clubs as the most significant barrier to adoption. Clubs often lack the capital to cover the initial purchase and installation, even if the expected lifecycle cost is lower. Clubs also noted competing demands for their limited capital, with priority often given to other capital investments such as rowing shells, boathouse facilities, or docks.

Risk

Some clubs perceived electric outboards as a risky investment, given uncertainties about performance, servicing costs and access, and the potential loss of a substantial financial investment if the electric outboard was fatally damaged or underperformed.

“If it doesn't work in our operation, then we got an expensive motor that we can't use.”

Charging Infrastructure

Few BC rowing clubs have adequate power in a convenient location to support charging. Upgrading to provide power at the dock and/or more electrical capacity at the boathouse is expensive, adding to the upfront cost and further raising the financial barrier.

Servicing and Technical Support

Concerns about access to servicing and technical support were another barrier to adoption. Although electric outboards are promoted as “low maintenance” and “reliable”, rowing clubs were skeptical. They also expressed concern about potential damage to an expensive motor from hitting rocks or debris. These concerns were amplified by the absence of local technical

support and parts. Clubs cited concerns about the cost, inconvenience, extended downtime and impact on operations if repairs were needed. They were hesitant to take the risk of a boat being unusable for extended periods.

“It just would be nice to have somebody here that we could actually say, can you come down? Let’s look at this.”

“...anybody in rowing kind of knows where to get a gas motor fixed, or how to take it on and off the boat. And the electric motor is just a bit more of a question.”

Transition Support

Many smaller organizations lack the staff/volunteer capacity to support the transition from gas to electric outboards. Given other priorities, they simply don’t have the time or energy to investigate options, co-ordinate implementation, and train users. Poorly defined roles and responsibilities, with staff and volunteers juggling multiple roles, results in inertia around decision-making and innovating. It is easier to stick with what is known and familiar.

Unfamiliarity and Lack of Information and Real-World Examples

Rowing clubs had questions about battery life, range, charging, and speed, as well as practicalities of retrofitting an electric outboard onto a boat designed for a gas outboard. Others expressed confusion about the relative power of electric outboards - how kW relates to horsepower. Clubs had questions about safety of the system itself, as well as how the extra weight and space taken up by the battery might influence rescue capability. Clubs were hesitant to make the transition without clearer answers to these and other questions.

“But it was really, from my perspective, a leap of faith, because we couldn’t call anyone and say....is this working for you? What do you think?”

These barriers and concerns were shared by others in the boating sector.

Upfront costs

Participants in the focus group cited high upfront costs, including limited availability of lower cost models and a shortage of information on total cost of ownership, as the biggest barrier to adoption.

Shortage of charging infrastructure

Participants noted that marinas may not have the electrical capacity to support widespread charging and highlighted the challenges in providing power to remote docks or older infrastructure.

Limited range and runtime

Including concerns that real-world range may not meet manufacturer claims, range anxiety, and concerns about impact of cold weather on range. Boaters also raised questions about range (and thus safety) in rough water and windy conditions.

Servicing and technical support

Including a shortage of local distributors and service professionals.

Availability and supply constraints

There are relatively few distributors and models currently available in BC. Buyers can't visit local marine stores to compare systems, there are no formal opportunities to test drive different models, and there are long lead times for purchase and installation. It may be difficult for a potential buyer to find a model suited to their use that is available locally.

Other barriers mentioned during discussions with boaters and those in the marine sector included:

- Limited opportunity to test electric outboards and compare models.
- Limited exposure to or awareness of current battery and motor technology and the range of models now available. Some boaters still think of electric outboards as small trolling motors and are unaware of recent advances in high-power, high performance motors and higher capacity batteries.
- Perceived risk of being an “early adopter” of new technology.
- Inertia – it's easier to stay with known, familiar technology.
- Safety – concerns about the risk of battery fires and working with high voltage systems, particularly around water.
- Concerns about environmental impacts of lithium-ion batteries.

RowElectric Experience

The RowElectric pilot has provided valuable lessons, insights and information on both benefits and limitations of electric outboards. Overall, coaches love them, particularly valuing the quiet ride and ease of use. The boats perform well, range is not an issue and charging fits easily into the routine at all four clubs. Experience has also supported concerns about risk of damage and lack of local servicing support and has provided important lessons around both charging infrastructure and weight limits.

Quiet, Smooth Ride

Many rowing coaches suffer hearing loss and complain of fatigue from the vibration and noise of gas outboards. For coaches at RowElectric pilot clubs, reduced noise (including reduced vibration and sensory fatigue) was cited as the top benefit of the electric outboards.

“It's so dead quiet, you don't have that constant ringing in your ear by the gas motors.”

The quietness of the electric outboard also allowed more effective coaching: coaches and athletes could communicate more easily, they were better able to hear subtle cues that are normally masked by the gas outboard, and one coach noted the value of being able to hear athletes communicating amongst themselves in the rowing shell. Coaches were able to coach without using power megaphones, reducing noise and irritation for those living and recreating nearby.

“The biggest benefit from the coaching perspective, was the sound - its quiet. They can hear the athletes. They can hear what’s going on. They can hear the oars in the water, so they get feedback on what’s going on in the boat that they cannot get with a gas motor. The noise just drowns that out.”

Ease of Use

Ease of use was consistently highlighted as a main benefit of the electric outboards. Coaches appreciated the time saved in not having to fill, carry and hook up fuel tanks, as well as not being exposed to fumes and leaks. The electric outboards also saved time as they don’t need to be warmed up before a training session.

“I appreciate not smelling like gas all the time”.

“There isn’t all this screwing around at the beginning of practice with, you know, dragging gas cans down, and making sure there’s gas, and trying to start the engine, and then it might not start. There’s none of that, right? They get in the boat, they turn it on, and it goes.”

Improved Handling and Performance

Coaching involves frequent changes in speed, stops and starts, and periods of idling. Gas outboards have to be throttled down in order to shift gears, are often difficult to idle (sputtering and stalling at low RPMs) and can be difficult to restart. Coaches found that the electric outboards were simply easier to use, noting the faster acceleration and consistently smooth controls. Top speeds were sufficient to keep up with even the fastest crews. Some coaches also noted improved maneuverability, possibly because the smoother throttle control allowed for more precise turning, or because the smaller motor allowed it to turn through a wider arc.

Range and Charging

With only 10%-40% of the battery capacity used per session, range was simply not an issue and coaches quickly lost their range anxiety. Batteries were charged overnight, every one to two days, and could be “topped up” during the day if necessary. This routine worked well at all four clubs.

Operating Costs

Operating costs are still being evaluated, but clubs noted they are using less gas, saving both money and time.

Servicing, Support and Damage

Experience has reinforced the issue of lack of local support and parts. Although user manuals provide guidance on troubleshooting when the system displays error codes, clubs are less familiar and comfortable working with electric outboards.

Propeller damage (from hitting submerged rocks and logs) has been an issue at two locations, with nine propellers damaged in less than two years. Replacement propellers are expensive and need to be ordered in, putting the boat out of use for 1-2 weeks each time. One motor suffered catastrophic failure from a faulty seal, possibly caused by the propeller becoming entangled in a high-tension steel cable. Although the motor was replaced under warranty, the boat was out of use for about 3 months.

Charging Infrastructure

One of the clubs operates at three locations, only two of which have charging infrastructure. This has limited flexibility in moving coach boats between locations and limited overall use of the electric outboard. Clubs have also learned through experience the importance of proper handling and storage of power cables in a marine environment to prevent corrosion and short circuiting.

Weight

Coaches who use the 12 kW outboards have noted that the extra weight of the batteries limits the number of passengers they can carry without affecting speed and handling. Total weight and weight distribution affect the handling of one boat in particular, likely because of its design.

Weeds

Coaches have learned that the electric outboard struggles in the thick mats of weeds that are present at one lake during the summer. It seems to catch more weed than gas outboards, likely because of the size and shape of the underwater “pod” that houses the motor. Although not enough of a problem to limit its use, coaches find it frustrating.

Efficiency

Range is a key performance factor influencing boaters’ decisions about whether to switch to an electric outboard. For all boats, regardless of how they are powered, range is determined by the amount of “fuel” on board (battery capacity in the case of electric outboards) and fuel efficiency. Electric outboards are inherently more efficient than gas outboards in converting “fuel” into propulsive power, with less energy lost to friction, vibration and heat. Electric outboards convert fuel into propulsive power with 90%-97% efficiency; whereas gas outboards are around 25%-30% efficient.³ The desire to increase efficiency and range is a significant driver of innovations

³ [Boattest.com. May 10, 2023. Maximize your fuel economy.](https://www.boattest.com/news/2023/05/10/maximize-your-fuel-economy/)

in the design of electric motors. For example, newer axial and transverse flux motors are more efficient than traditional radial flux motors.

Direct drive configurations – where the motor is mounted underwater at the bottom of the outboard and connected directly to the propeller shaft – convert fuel into propulsive power more efficiently than L-drive configurations; however, efficiency is reduced by the drag and turbulence created by the underwater motor. For small to medium-sized motors, direct drives tend to be more efficient; for large motors (greater than about 12 kW) L-configurations tend to be more efficient.

Fuel efficiency has always been an important concern for boaters, regardless of the source of propulsion. This is because the drag created by moving through water (and thus the power required to overcome that drag) is significantly higher than the drag created by moving through air. Water is denser than air and creates more drag. Speed and hull design have the greatest impact on drag and fuel efficiency. Other factors that affect efficiency include weight, trim, hull surface, current, wind and water conditions, and driving behaviour.

1. Hull design: Hull shape and design determine how the boat moves through the water and how much drag it creates. Multihulls (catamaran and pontoon boats) are more efficient than monohulls; V-shaped hulls are more efficient than flat-bottom boats. Foiling boats are the most efficient and may become more common as technology and design continue to advance. A number of electric outboard manufacturers have partnered with boat designers and boatbuilders to build, design and sell boats specifically designed for electric outboard motors, often with a focus on efficiency.
 2. Speed: Drag, and the power required to overcome it, increase exponentially with speed, meaning that small increases in speed lead to big increases in fuel consumption. Operating at wide-open throttle kills range. The relationship between speed and fuel efficiency is a bit more complicated with planing hulls: planing hulls use the most fuel when travelling just below planing speed and when getting up onto plane. Once on plane, fuel efficiency improves.
 3. Weight: More weight creates more drag. Removing unnecessary weight will improve fuel efficiency and range. For smaller motors, modular, “plug and play” batteries can provide the flexibility to carry only the number of batteries needed for a particular outing.
 4. Trim: Trim is the angle at which a boat moves through the water. Generally, a boat is most efficient when it is cruising level with the water line. Distributing weight to optimize trim for the shape of the hull and for the boat speed can improve efficiency and range. For example, more weight in the bow can help a boat get up on plane; too much weight in the bow will result in the boat plowing through the water. Trim can also be adjusted by adjusting the angle of the motor or trim tabs on the transom, either manually or using the power trim button.
-

5. Hull surface: Some estimate that a moderately fouled hull can reduce fuel efficiency by 10%-30%.⁴ Lines and fenders dragging in the water will also reduce efficiency.
6. Current: When feasible, boaters can use currents to their advantage when planning trips, routes and time of travel.
7. Wind and water conditions: efficiency (and range) will be better in calm conditions. Tailwinds will enhance efficiency; headwinds will reduce efficiency.
8. Driving behaviour: Driving behaviour can be modified to optimize fuel efficiency and range. Avoiding driving at wide-open throttle (driving only as fast as you need to), finding the optimum speed for the boat, driving at a constant speed (as much as possible), and avoiding frequent acceleration and deceleration will all improve efficiency.

Policy Recommendations

Based on the drivers, barriers and experiences highlighted by rowing clubs and members of the marine sector, we identify actions across five themes that will support the transition from gas to electric outboard motors, particularly during this early phase of adoption.

Theme 1: Financial

Provide financial incentives/support to reduce the upfront cost and financial risk.

High upfront cost was consistently cited as the main barrier to adoption of electric outboards. The RowElectric pilot demonstrates that clubs are willing (and able) to switch to electric outboards when the upfront cost and perceived financial risk are reduced.

1.1 Provide rebates for purchase of electric outboards.

1.2 Provide targeted access to zero or low interest loans through financial institutions, possibly with support from the provincial government (similar to [BC StudentAid](#), the BC Student loan program). Keep the application process simple so that it is not a barrier to not-for-profit clubs or small businesses.

1.3 Develop a simple cost calculator that would enable people to compare the full lifecycle costs of gas and electric outboard systems, taking into consideration maintenance and repairs, fuel costs, purchase costs (including loan interest if applicable), and lifespan.

⁴ [Hull2prop](#). September 9, 2025. How underwater hull cleaning improves fuel boat efficiency. [Underwater Marine Solutions](#). How much fuel can you save with regular hull cleaning?

1.4 Consider targeting support first to sectors where marine electric propulsion has the largest benefits and is most feasible (e.g., competitive watersports – rowing, sailing, canoe/kayak/dragonboat, whale watching and wildlife viewing, pontoon boat rentals).

Theme 2: Charging

Invest in publicly accessible charging infrastructure.

Convenient access to charging was consistently cited as a barrier to adoption. The RowElectric pilot demonstrates that users are willing (and able) to switch to electric outboards when charging infrastructure is available or when there is financial support to install it.

2.1 Provide incentives and support for marinas, fuel docks, Harbour Authorities, local community docks and even private dock owners to install or upgrade power to support charging and to make “charging slips” available to boaters.

2.2 Consider developing “marine-charging networks” that link popular boating destinations on both coastal and inland waterways. Start by identifying docks with publicly accessible power, and then “fill in the gaps”, by working with dock owners, local government and the boating community to upgrade or install power and provide boaters with access to it.

2.3 Make information about charging slips and their location readily available to boaters (e.g., integrate into commonly used apps and resources such as [Navionics](#), [OceanConnect](#), [Waggoner Cruising Guide](#) etc).

2.4 Consider installing DC fast chargers at strategic locations.

2.5 Explore the potential for mobile [solar-powered charging docks](#) to provide charging in remote or difficult to access areas. These could include both trailers with battery banks located on land for trailerable boats and floating docks (e.g., [SolarStation](#), [Powerdock](#)).

2.6 Explore the potential and feasibility of “Vehicle to Grid” charging, both to offset the cost to boaters and to provide BC Hydro with access to power.

2.7 In collaboration with key partners and stakeholders, develop a Provincial charging strategy that recommends and prioritizes charging locations, routes, and investments.

Theme 3 Service Support

Train marine electricians and marine technicians to work with marine electric propulsion systems.

Concerns about where to get timely support in the event of an issue, and the potential impact of extended downtimes on operations were raised by rowing clubs, reinforced by their experience, and echoed by others in the marine sector.

3.1 Incorporate training on marine electric propulsion systems into existing Skilled Trades courses for marine electricians and marine mechanics.

3.2 Provide incentives and support for those wanting to take or upgrade training specific to marine electric propulsion systems.

3.3 Explore the development of “short courses” on marine electric propulsion systems (such as those offered by [Island Institute](#)) targeted at both users and marine service professionals.

3.4 Develop training in collaboration with existing training institutions, such as Quadrant Marine Institution, BCIT, local colleges etc.

Theme 4 Awareness, Outreach and Education

Provide boaters with reliable and independent information that is relevant to their use.

Rowing clubs had questions about speed, range, charging, safety, maintenance and how the electric outboard would fit in with club operations. Rowing clubs and others in the marine sector were sometimes unfamiliar with terminology, charging requirements, the range of electric outboards that are available, or types of boats they can be used with.

4.1 Establish a trusted “go to” source for independent, reliable information on small marine electrification. Consider expanding the scope of PlugIn BC and Emotive BC to include marine electric propulsion or create similar programs specifically for marine electric propulsion in collaboration with the boating/marine sector.

4.2 Publish information on small marine electrification (including the RowElectric Going Electric Handbook, Understanding Electric Outboards, and Summary of Electric Outboard Systems).

4.3 Highlight marine electric propulsion systems at conferences and trade shows, such as [Everything Electric](#), [Electric Mobility Canada](#), and boat shows. Make it a theme or focus in order to attract a range of providers and boaters across all aspects of marine electrification and its use.

Provide opportunities for people to test drive different systems and talk to users. The RowElectric pilot is demonstrating the value of practical experience and tips, and the power of experiencing rather than simply reading about benefits.

As one coach noted:

“...come try it, because it is enlightening to actually get in the boat and feel it, not hear it, and just see how it operates, and get a feel for what it can do. And those are all things we didn't know going into it...that's what caused the trepidation.”

4.4 Establish a “marine electric” ambassador program: a network of boaters willing to provide test drives and talk to people interested in switching to electric propulsion (consider linking access to financial support with being an ambassador).

4.5 Include opportunities for “test drives” at boat shows and conferences.

4.6 Provide “demo boats” at popular anchorages/destinations - for people to see and test drive.

4.7 Consider targeting funding towards electric outboard motor education as part of other education and awareness programs.

Theme 5 Regulation

The early phase of adoption is an opportunity to develop consistency in standards and terminology that will make it easier for potential buyers to compare electric outboard systems and determine the system that will best meet their needs.

5.1 Consider standardizing how the power of electric outboards is measured and reported.

5.2 Consider standardizing how battery capacity is reported.

5.3 Consider including smart controllers as standard on all chargers, to make it easy to manage demand.

5.4 Consider developing standards for marine charging slips (current, voltage, outlet configuration, safety, method of payment).

5.5 Explore the opportunities raised by regulations that restrict the use of gas outboards on some waterways. Participants in the focus group identified these regulations as drivers of adoption in specific locations. Electric motors provide an increasingly viable alternative to gas motors, making such restrictions more acceptable and providing opportunities to showcase electric outboards.

Recommendations for Further Work

1. Having a better picture of the marine outboard sector will help to target resources, prioritize investments and initiatives and determine the potential impacts of widespread transition from gas to electric outboards on GHG emissions and electricity demand.
 - Define the scope and scale of small marine outboard sector, including the number and size of outboards, locations, hours of use, and types of use.
 - Define the potential for GHG emission reductions and the potential impact on power demand (including by season and time of day).
 - Explore the potential for access to stored power through V2G charging.
2. Range is a key performance factor influencing boaters' decisions about whether to switch to an electric outboard and which electric outboard system to choose. Range is affected by how efficiently electricity is converted power, and how efficiently power is converted into distance travelled. At a provincial scale, optimizing efficiency will be important to managing electricity demand.
 - Provide boaters with information related to range and efficiency, as it applies to electric outboards, including factors that affect efficiency (e.g., motor and battery technology, boat design, weight etc.) and best practices for optimizing efficiency.
 - Provide recommendations on policies to promote efficiency in design and use of electric outboard systems.

