Clean & Prosperous Washington

Low Carbon Prosperity Institute

EXECUTIVE SUMMARY

ABSTRACT

Meeting stringent 50% emissions reductions by 2030 requires an acceleration of low-carbon transportation solutions. With billions of dollars anticipated from the Climate Commitment Act (CCA) for the transportation-focused Carbon Emissions Reduction Account (CERA), state-directed investments are poised to play a major role in this acceleration, complementing other programs and funding sources. These investments can close the remaining emissions gap towards the state's greenhouse gas (GHG) limits by accelerating emerging technologies, riding cost-competitive technology waves, and supporting critical emerging technologies throughout this decisive decade. At the same time, transportation decarbonization can improve quality of life through air quality benefits while unlocking long-term fuel cost savings.

This report examines seven specific decarbonization approaches through a series of case studies which span off-road, on-road, freight, and marine transportation activities and focus on electrification strategies. Through these case studies, we offer two main contributions: First, we develop a methodological approach centered on key metrics that span costs and benefits of potential projects; Second, we use this methodology to evaluate a first batch of case studies and provide unique insights for each one, with an understanding that there are many more interventions that merit consideration with this methodology.

We focus on a set of data-driven metrics across these case studies, including net public health and climate benefits of reducing air pollution, cumulative GHG emissions avoided, abatement costs of emitting less GHGs, net present value lifetime costs of deploying the less polluting solution, and the potential value of credits earned under Washington's new Clean Fuel Standard program. The incremental upfront costs will unlock lower carbon pollution, long-term fuel cost savings, and significant air quality benefits. If designed well and deployed strategically, these investments will also catalyze reduced inequity of pollution exposure and harms.

Scaled to the broader market, these strategies have a combined potential of billions of dollars of investment opportunities, while representing a range of outcomes and justifications for investment. All require additional, upfront investment over a higher pollution alternative. Some provide net savings over their lifetime, some have benefits that outweigh their increased lifetime costs, and others require more substantial investments but can catalyze the broader market. All have potential to reduce pollution exposure to overburdened communities, although some more than others. There is compelling justification to pursue any of these technologies, but the priorities and trade-offs should be considered against desired goals and outcomes.

> **IN EXAMINING THESE SPECIFIC DECARBONIZATION STRATEGIES, THIS REPORT OFFERS A DATA-DRIVEN APPROACH THAT CAN BE REPLICATED ACROSS A BROADER SOLUTION SET.**

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The seven case studies evaluated in this report cover a broad scope of transportation emissions including off-road, on-road (both heavy-duty and light-duty), marine, and freight applications. While broad in scope and scalable to match available funding, the specific decarbonization solutions examined consider only a subset of transportation decarbonization strategies. These strategies focus on switching from liquid fossil fuels to electricity, covering a range of investment needs and potential impacts. They are not one-size fits all, but rather range in terms of overall cost-effectiveness and impacts on air quality.
Each of these strategies offers the potential for public health benefits and reduced fuel costs that pay back at least a portion of upfront costs over time. Cost-effectiveness should not be the only consideration. Even without long-term cost savings or net benefits, investments can stimulate technology in harder to decarbonize--but necessary--sectors of the economy and address environmental health disparities.

This report centers on data-informed insights and a framework that can inform investment strategies by evaluating important metrics: estimated cost-effectiveness, public health benefits from improved air quality, and GHG emissions reduction potential for each technology considered. Other insights include the potential value of Clean Fuel Standard (CFS) credits and the implications of upfront capital costs as a barrier to technology access and adoption. There is not a one-size fits all narrative that cleanly captures these case studies, although all require an upfront premium to transition. Each technology has unique merits and returns different benefits and costs. These merits are influenced by proximity to population centers and are accompanied by different investment dynamics given the different use cases and technological maturity. To help contextualize these merits, we consider four broad categories:

- Long-term cost savings, with additional benefits. Example: Ferry System Electrification.
- Long-term net financial costs, but net benefits are greater than the net costs. Example: Ocean-Going Vessel Shore Power.
- Costs that are greater than benefits, but may play important market transformation role. Example: Electric Motor Coaches and other On-road Heavy-Duty Vehicles.
- Difficult to quantify net costs and benefits, but necessary to accelerate the market. Example: EV Charging Infrastructure.

With the transportation focused *Carbon Emissions Reduction Account (CERA)* under the Climate Commitment Act's Cap-and-Invest program slated for more than $5.2 billion in investments before 2040, these case studies could require a substantial portion of the investments. There are different strategies for prioritizing use of these funds, mapping to the four broad categories we highlighted above. The investment dynamics are different for each case study, but in all of them, some level of state-directed public investment is necessary to deliver potential benefits and meet statewide GHG limits. Leveraged investments will be a major component of decarbonizing our transportation system, meaning the state's funding can be multiplied by unlocking additional private and federal funding. Although financial performance is one relevant consideration, non-financial barriers may dampen the uptake of cost-effective approaches. Access to capital, consumer awareness through education and outreach, and the design of incentives factor into both the rate of uptake and the distribution of impacts.

While some of these investments have limited additional scale (electric ferries, shore power), others operate within markets that are potentially orders of magnitude larger than the scope of the case study. These case studies are not intended as a specific package or portfolio, and should be carefully considered on various program goals and merits. Considering the general scalability and performance of these types of decarbonization strategies may provide useful framing. Assuming that the on-road vehicle strategies in particular scale to a broader market over the next 10 years, total private-public investment needs scale well into the billions of dollars. Financing this, and unlocking the associated benefits, will require substantial contributions from many sources: state, federal, private, and utility among them.

CASE STUDY CATEGORIES

MARINE & FREIGHT

FERRY SYSTEM ELECTRIFICATION

The transition of the Washington State Ferry fleet to primarily battery-electric propulsion. The scope of this case study includes the conversion of three existing ferries to electric-hybrid, new builds of eight hybrid-electric ferries, and terminal electrification projects at five ferry terminals to allow for charging of ferries during regular operation.

OCEAN-GOING VESSEL SHORE POWER

Infrastructure investments at Terminal 18 in the Seattle Harbor, operated by the Northwest Seaport Alliance, that would allow for Ocean-Going Vessels to use electricity rather than auxiliary engines for ship power needs while docked.

CARGO-HANDLING EQUIPMENT

This case study considers infrastructure investments at Seattle and Tacoma Port operations covering several categories of emerging technologies for cargo-handling equipment. Adoption of electric and hybrid equipment leads to early retirement of older equipment and reduced use of diesel for moving goods at the ports.

VEHICLES

DRAYAGE TRUCKS

Drayage trucks are on-road, heavy-duty trucks that transport containers and bulk freight to and from ports. This case study considers early retirement (scrapping) of older drayage trucks and replacement with new, battery electric trucks and charging infrastructure.

MOTOR COACHES (Heavy-Duty Vehicles)

Motor Coaches are a class of on-road, heavy-duty passenger vehicles traveling a variety of routes (fixed, commute, on-demand trips). This case study considers a private fleet of motor coaches with annual travel demand of 35,000 miles per vehicle.

PASSENGER VEHICLES

The passenger electric vehicle market is rapidly evolving in both models offered and pricing. This case study considers two vehicle classes and two purchase years to span a range of near-term price premiums and payback periods for new vehicle purchases.

ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

EV Charging Infrastructure is an essential precursor to widespread adoption of electric vehicles This case study summarizes needs assessments and installation costs based on studies in California and Oregon and applies this to Washington's market and ambition for electrifying heavy-duty and light-duty transport.

These case studies demonstrate some of the potential impacts associated with decarbonizing our transportation system, combining programs that deliver net benefits at affordable costs or cost-savings with other programs that can help stimulate market readiness in harder to decarbonize sectors. Initial costs and access to ongoing cost savings are real barriers to deployment. Adept investment strategies can mobilize net benefits that exceed net system costs while improving equity from pollution exposure. Even without attempting to cost-optimize this set of case studies, incorporate sustained price declines in electric vehicle costs, or consider strategies that payback or moderate the upfront EV charging infrastructure costs, a simplified, scaled-up version of these case studies offers:[1]

- 16 million tCO_2e of avoided GHGs
- Public health and climate benefits that balance 80% of the net costs (220% of net costs before charging infrastructure for LDVs is factored in)
- Abatement costs of less than $120/$tCO_2e$ ($40/$tCO_2e$ before charging infrastructure for LDVs is factored in)
- Clean Fuel Standard revenue potential that is greater than the net costs

The combined capital costs from a hypothetical, scaled-up version of these case studies is on the order of $4 to $5 billion, leading to net present value (NPV) costs of $0.5 to $1.3 billion. These costs would be shared between various parties, both public and private. How major EV charging infrastructure needs are funded is a critical component to the ultimate cost-benefit assessment. In this hypothetical example, we have not attempted to quantify anything related to EV infrastructure aside from the upfront capital costs, although we would expect some level of payback on those investments.

Investments highlighted in the case studies will need to be complemented with additional investments in other decarbonization strategies such as public transit and non-motorized mobility that reduces vehicle-miles traveled and additional sector-specific interventions including aviation and liquid fuels. Whatever form the portfolio of programs ultimately takes, new funding sources designated for emissions reductions should not be tapped to sustain ongoing programs. New funding is designed to enable additional programs and infrastructure that create additional and durable benefits rather than to maintain the status quo of ongoing programs at current levels of funding. An example of this funding approach is paying only the additional, incremental costs of electrifying new ferries and terminals rather than the full costs which would have largely been required whether the ferry system was electrified or not. There are existing VMT-reduction, public transit, and EV incentives that represent a baseline standard of action. Those programs should be continued without reallocation of newly approved funding sources, although scaling those programs could provide additional impact beyond the status quo.

EXECUTIVE SUMMARY FOOTNOTES

[1] *We make a rough estimate of what scaling these case studies to a broader market would look like through the 2020s. We consider the following scaling from the individual case studies: Drayage Trucks from 10 to 500, Motor Coaches or similar HDV from 60 to 1,000, Light-duty vehicles to 300,000 total, Cargo-Handling Equipment to one-third of the current equipment at the Seattle and Tacoma Ports, and Shore Power to a nearly doubling (90% increase) of impact by extension to three additional terminals (Terminal-30, PCT – Pierce County Terminal, and WCT – Washington United Terminals) based on relative emissions reduction potential reported in the Terminal 18 Shore Power Grant update (item 8D, second table on page 3) from September 2021 NWSA meeting materials. t.ly/YIRi Ferry system electrification has modest scaling potential on the timeframe considered, so only use the totals from the case study. For EV infrastructure, HDV charging infrastructure is considered within the respective case studies but for LDVs additional public charging infrastructure beyond the vehicle-specific case study is needed. Public EV infrastructure for LDVs alone totals over $800 million in NPV by 2030 assuming a growing stock of electric LDVs to reach 1 million electric LDVs.*