

Clean Transportation and Mobility Innovation Report

Rhode Island's Roadmap to a Clean Transportation Future

JANUARY 2021



January 19, 2021

The Honorable Gina M. Raimondo
Governor of the State of Rhode Island
82 Smith Street
Providence, Rhode Island 02903

Dear Governor Raimondo:

On behalf of the Mobility Innovation Working Group, I am pleased to present you with the final report summarizing the findings and recommendations of the Working Group. This report is the product of five months of work by the Mobility Innovation Working Group members, each of whom brought their own perspectives and experiences to the effort across a range of professions, within the state agencies and across a variety of viewpoints. Working Group members recognized the significant and unique opportunity to inform the state's vision for a clean transportation future.

In addition, we conducted a series of public meetings and heard from a wide range of experts that spoke to the future of transportation, the importance of equitable policy in transportation and climate, as well as local and national organizations that advocated for policies and investments in clean transportation and mobility.

As a coastal state with unique vulnerability and beauty, the need for Rhode Island to take bold action to mitigate greenhouse gas emissions while strengthening our resiliency is clear. As the state's biggest contributor to greenhouse gas emissions statewide, the transportation sector poses unique challenges and opportunities. Some of these opportunities include capitalizing on technological advances, industry growth opportunities, and innovative solutions to lessen our carbon footprint.

Your signature on the Transportation and Climate Initiative Program (TCI-P) Memorandum of Understanding establishes Rhode Island as a national leader in this bipartisan and regional effort to provide resources for investments in Rhode Island's clean transportation needs that are generally outlined in this report. The recommendations and initiatives in this report are relevant to today as well as bold and ambitious to address the future with TCI-P in place.

In addition, this report comes amidst the global COVID-19 pandemic, the unprecedented impacts on public health, and the resulting economic uncertainty facing Rhode Island citizens and businesses. The pandemic has reinforced the public health inequities that impact the state's most vulnerable. This context reiterated the need to build back better with cleaner and more equitable transportation options for our citizens.

The final report is intended to inform the design of a statewide mobility strategy that will build on Rhode Island's existing portfolio of clean transportation policies and initiatives to further transportation options and promote economic development.

The final report consists of 4 major sections: **1) Facts, Trends, and Issues; 2) Rhode Island Clean Transportation and Mobility Audit and Peer State Inventory; 3) Investment Portfolios; and 4) Recommendations and Action Steps.**

The report opens with a section summarizing the **Facts, Trends, and Issues** that emphasize the impact of transportation emissions on climate change and the impact that climate change has on Rhode Islanders. Climate change is a clear and present threat to the lives and well-being of Rhode Islanders here and now. Fortunately, the state has several strategic advantages in taking action to mitigate the cause of climate change and prepare for the hazards expected to emerge over the coming decades.

The second section of the report summarizes the **Rhode Island Clean Transportation and Mobility Audit and Peer State Inventory**. The state has engaged in numerous initiatives to promote clean transportation and improved mobility. The Audit was an essential first step in developing recommendations to meet the state's mobility goals and establishes the baseline for the state's pursuit of its ambitious environmental, clean transportation, and equity vision.

The third section of the report summarizes and highlights three illustrative **Investment Portfolios** of clean transportation investments. The portfolios were evaluated using an investment tool that translates dollar values into benefits including changes in vehicle-travel, greenhouse gas emissions reductions, air pollutant reductions, the value of health benefits, and economic benefits.

The report closes with **Recommendations and Action Steps** of the Working Group that are organized into six categories: 1) Create a healthier environment for all Rhode Islanders with specific benefits for residents of our most overburdened and underserved communities; 2) Establish Rhode Island as a national leader in bold transportation and climate commitments; 3) Modernize, expand and invest in state transit and transportation assets to more effectively move people and improve accessibility; 4) Improve air quality by taking steps to electrify the transportation sector; 5) Create a 21st century mobility infrastructure that capitalizes on the emerging changes in transportation technology; and 6) Unlock economic opportunity, promote green job creation, and support business and supply chain industries. The recommendations include programmatic, legislative, and regulatory initiatives that are focused on developing accessible mobility options, reducing greenhouse gas emissions, and creating sustainable jobs.

The Working Group members feel the greatest contribution we can make is to encourage action and we feel confident that this report provides an ambitious and actionable framework. We look forward to continued collaboration as we set Rhode Island on the path to a clean transportation future, one that promotes green economic development and ensures equitable benefits for all Rhode Islanders.

Sincerely,

A handwritten signature in black ink, appearing to read 'Colleen Quinn', with a stylized flourish at the end.

Colleen Quinn

Chair, Mobility Innovation Working Group

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Glossary

1% Storm Surge Event	A storm surge event that is expected to happen once per century, or a 1% chance of happening in a given year.
Active Transportation	Any self-propelled, human-powered mode of transportation, such as walking or bicycling.
Autonomous Vehicle (AV)	A vehicle that is capable of sensing its environment and moving safely with little or no human input.
Battery Electric Vehicles (BEV)	Fully electric vehicles with rechargeable batteries and no gasoline engine.
Bus Rapid Transit (BRT)	A high-quality bus-based transit system that delivers fast and efficient service that may include dedicated lanes, busways, transit signal priority, off-board fare collection, elevated platforms, and enhanced stations.
Cap-and-Invest	An approach that limits the total amount of emissions from an industry or the whole economy. The total emissions limit—or cap—gets lower and lower over time, which means that less and less pollution is permitted from the capped sources of pollution, resulting in cleaner air and improved public health.
Clean Transportation	Clean transportation utilizes technology to replace or reduce the direct use of fossil fuels, which generate greenhouse gas (GHG) emissions. This includes electric vehicles, as well as strategies to reduce the use of single occupancy vehicles and improve public transit.
Clean Transportation and Mobility Audit ("The Audit")	The goals for this audit were to provide a baseline for the development of the state's first Clean Transportation Mobility Innovation Strategy, address recommendations for pathways and policies to enable the state's future mobility goals and identify initiatives/programs related to electrification of transportation, autonomous vehicles and transportation/transit planning work.
COVID-19 Pandemic	An ongoing pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The World Health Organization declared the outbreak a Public Health Emergency of International Concern in January 2020 and a pandemic in March 2020.
DC Fast Charging	A DC fast charging port is capable of charging to 80% of an electric vehicle's battery in less than an hour.
Electric Bicycle (E-Bike)	A bicycle with an integrated electric motor which can be used to assist propulsion.

Electric Vehicle Supply Equipment (EVSE)	Provides for the safe transfer of energy between the electric utility power and the electric vehicle.
Electrification	The process of replacing technologies that use fossil fuels (coal, oil, and natural gas) with technologies that use electricity as a direct source of energy.
Environmental Justice	The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.
EV Rebate Program	Like an incentive program, a rebate program is used to promote or encourage specific actions or behavior, in this case it is in the form of a discount or refund by the retailer or manufacturer selling the EV.
Fuel-Cell Electric Vehicle (FCEV)	FCEVs are powered by hydrogen. They use a propulsion system similar to that of electric vehicles, where energy stored as hydrogen is converted to electricity by the fuel cell.
Greenhouse Gases (GHGs)	Gases in Earth's atmosphere that trap heat. Excess GHGs emitted into the atmosphere by human use of fossil fuels is the primary cause of global climate change.
Internal Combustion Engine (ICE)	In an ICE, the ignition and combustion of the fuel occurs within the engine itself. The engine then partially converts the energy from the combustion to work.
Lead by Example	Executive Order 17-10 <i>“Lead by Example in Energy Efficiency and Clean Energy”</i> has enabled ZEV fleet adoption in Rhode Island. To comply with the Executive Order, at least 120 state fleet vehicles will need to be purchased by 2025. As of May 2020, there are 40 ZEVs in the state fleet.
Level 2 Charging	All level 2 chargers require a 240-volt power source.
Light Duty Vehicles	A vehicle that is primarily used to transport passengers and cargo (e.g., cars, vans, SUVs, pickup trucks).
Little Roady Pilot Project	An electric autonomous shuttle operating in an overburdened and underserved part of Providence.
Low Emission Vehicle (LEV)	A motor vehicle that emits relatively low levels of exhaust.
Memorandum of Understanding (MOU)	A type of agreement between two or more parties. It expresses a convergence of will between the parties, indicating an intended common line of action.

Micromobility	A category of light-weight transportation designed for individual use. In most markets today, micromobility means shared scooters and bicycles (both human-powered and those with electric motors, docked and dockless).
Mobility as a Service (MaaS)	A consumer-centric model of transportation where various transport modes (such as car and bicycle sharing, taxis, and car rentals/leases) can be accessed via an on-demand, real-time mobile (i.e. smart phone) platform that provides everything to the consumer, from travel planning to payments.
Clean Transportation and Mobility Innovation Strategy ("The Strategy")	The strategy to promote equity, innovation, and economic development and job creation for Rhode Island's transportation sector.
Multi-State Medium- and Heavy-Duty (MHDV) Zero Emission Vehicle (ZEV) Memorandum of Understanding (MOU)	A 15-state MOU which commits to completely phase out fossil fuel-burning medium- to heavy-duty truck and bus sales by 2050, with a target for 30 percent of new truck and bus sales to be zero-emission by 2030.
New Mobility	Those emerging elements of the transportation system that are enabled by digital technology, publicly available, driven by real-time data, and often providing curb-to-curb transportation.
Plug-In Electric Vehicle (PEV)	Any road vehicle that can be recharged from an external source of electricity, such as wall sockets.
Plug-In Hybrid Electric Vehicle (PHEV)	PHEVs use batteries to power an electric motor and another fuel, such as gasoline, to power an internal combustion engine (ICE). The vehicle typically runs on electric power until the battery is nearly depleted, and then the car automatically switches over to use the ICE.
Regional Greenhouse Gas Initiative (RGGI)	A cooperative effort among the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia to cap and reduce power sector CO ₂ emissions.
Renewable Energy	Energy from sources that are naturally replenishing but flow-limited; renewable resources are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Examples include solar-, wind-, and hydro-power.
Resilient Rhody	Rhode Island's first comprehensive climate preparedness strategy.

Rhode Island Department of Environmental Management (DEM)	The state agency that serves as the chief steward of the state’s natural resources.
Rhode Island Department of Transportation (RIDOT)	The state agency which designs, constructs, and maintains the state’s surface transportation system, including roads, bridges, rail stations, the tolling program, bicycle paths, and ferry service.
Rhode Island Division of Public Utilities and Carriers (DPUC)	The state body responsible for the laws and regulations relating to public utilities and carriers.
Rhode Island Division of Statewide Planning (DSP)	The state’s primary planning body, serving as both the Metropolitan Planning Organization and Regional Planning agency.
Rhode Island Office of Energy Resources (OER)	The state agency which leads the state toward a clean, affordable, reliable, and equitable energy future.
Rhode Island Public Transit Authority (RIPTA)	The statewide public transportation operator, including fixed route, demand response, flex service, and ferry service.
Single Occupancy Vehicle (SOV)	A privately-operated vehicle whose only occupant is the driver who uses the vehicle mainly for personal travel and daily commuting to work.
Smart Growth	A general term for policies and practices that integrate transportation and land use decisions, for example by encouraging more compact, mixed-use development within existing urban areas, and discouraging dispersed, automobile dependent development at the urban fringe.
Transit-Oriented-Development (TOD)	TOD includes a mix of commercial, residential, office and entertainment centered around or located near a transit station. Dense, walkable, mixed-use development near transit attracts people and adds to vibrant, connected communities.
Transportation and Climate Initiative (TCI)	A collaborative greenhouse gas emissions Cap-and-Invest program of 12 Northeast and Mid-Atlantic states and the District of Columbia that seeks to reduce carbon emissions from the transportation sector.

**Transportation Network
Company (TNC)**

TNCs provide prearranged transportation services for compensation using an online application or platform. Examples include Uber and Lyft.

**Transportation, Equity,
Climate and Health (TRECH)
project**

A multi-university research initiative conducting independent analysis of the regional Cap-and-Invest program of the Transportation and Climate Initiative. The initiative quantified the overall public health benefits of cutting greenhouse gas emissions from the transportation sector.

Urban Heat Island Effect

Urbanized areas that experience higher temperatures than outlying areas. Structures such as buildings, roads, and other infrastructure absorb and re-emit the sun's heat more than natural landscapes such as forests and water bodies.

**Volkswagen Diesel
Settlement Environmental
Mitigation Trust Fund**

In 2015, it was discovered that Volkswagen diesel vehicles sold in the United States had fraudulently passed environmental testing, resulting in an historic \$2.7 billion settlement. This funding (referred to in this report as “VW funding”) was made available to the states for projects and programs that improve air quality and have supported many clean transportation efforts in Rhode Island.

Zero Emission Vehicle (ZEV)

A vehicle that does not emit exhaust gas from the onboard source of power.

Abbreviations

ARRA	American Recovery and Reinvestment Act
BEV	Battery Electric Vehicle
BRT	Bus Rapid Transit
CARB	California Air Resources Board
CCAT	Connecticut Center for Advanced Technology
CMP	Congestion Management Plan
CSE	Center for Sustainable Energy
DMV	Department of Motor Vehicles
DOE	Department of Energy
DOH	Department of Health
DOT	Department of Transportation
DPUC	Division of Public Utilities and Carriers
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
FCEV	Fuel-Cell Electric Vehicle
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GHG	Greenhouse Gas
ICE	Internal Combustion Engine
LEV	Low Emission Vehicle
L RTP	Long-Range Transportation Plan
MaaS	Mobility as a Service

MHDV	Medium- and Heavy-Duty Vehicle
MOU	Memorandum of Understanding
NESCAUM	Northeast States for Coordinated Air Use Management
OER	Office of Energy Resources
OSCC	Ocean State Clean Cities
PEV	Plug-In Electric Vehicle
PHEV	Plug-In Hybrid Electric Vehicle
PUC	Public Utilities Commission
RGGI	Regional Greenhouse Gas Initiative
RIDEM	Rhode Island Department of Environmental Management
TCI	Transportation and Climate Initiative
TMP	Transit Master Plan
TNC	Transportation Network Company
TOD	Transit-Oriented Development
TRECH	The Transportation, Equity, Climate and Health Project
ZEV	Zero Emission Vehicle

Executive Summary

*Executive Summary to the Clean Transportation
and Mobility Innovation Strategy*



This Strategy presents a relevant, bold, and ambitious vision for Rhode Island to transition its transportation network to a cleaner and healthier system. With this Strategy, the Ocean State can be a nation-leading model for clean transportation, supporting a more equitable and economically vibrant state.



INTRODUCTION

The goal of this report is to provide the mobility vision for Rhode Island's future built upon core values of innovation, equity, public health, and economic development. The aim is to respond to numerous short- and long-term trends that open opportunities for implementing new technologies and strategies to build a more equitable and environmentally responsible transportation system. Rapid changes in technology and travel behavior are challenging traditional 20th century models of transportation. Long-standing issues such as a changing climate and the aging population are being compounded by these rapid developments, exacerbated by the COVID-19 pandemic.

Because the transportation system is the top contributor of greenhouse gas (GHG) emissions in Rhode Island, at approximately 36% of all emissions, it is impossible to meet the state's GHG reduction goals of an 80% reduction by 2050 without aggressively transforming the transportation sector. Bold initiatives to electrify motorized transportation, expand public transportation options, and encourage infrastructure as well as community design that allows for active transportation are all needed in order to meet this ambitious goal.

With the signing of the Transportation and Climate Initiative Program (TCI-P) Memorandum of Understanding (MOU) in December 2020, Rhode Island has the exciting opportunity to use new revenues from this regional collaborative to fund cutting edge clean mobility programs. This new funding is integral to the full realization of the recommendations made by the Mobility Innovation Working Group ("Working Group")¹, which informed the overall findings of this report.

This summary provides a concise overview of the key findings from this Clean Transportation and Mobility Innovation Strategy. It is a quick high-level reference for key stakeholders to learn about the transportation vision developed by the Working Group.

¹ The Mobility Innovation Working Group consists of state agency leaders and external stakeholders who informed the design of this statewide mobility strategy to reduce GHG

STRUCTURE OF THE REPORT

The report is divided into four main sections:

- Section 1: Facts, Trends, and Issues
- Section 2: Clean Transportation and Mobility Audit and Peer State Inventory
- Section 3: Illustrative Investment Portfolios
- Section 4: Recommendations and Action Steps

Taken together, this report paints a picture of a state that has already made substantial progress on clean transportation initiatives and innovative mobility solutions. However, there is still much opportunity for further progress and experimentation to reduce pollution and improve the lives of Rhode Islanders, especially those in overburdened and underserved communities.

SECTION 1: FACTS, TRENDS, AND ISSUES

While GHG emissions generated from the transportation sector are the largest portion of the state's overall emissions, Rhode Island has several unique advantages that it can leverage to reduce pollution.

Rhode Island is a geographically small state, approximately one-quarter the size of Los Angeles County. As most of the state's population is located in and around Providence, there is ample opportunity to make low- and no-emissions forms of transportation such as biking, walking, and public transit competitive with single-occupancy vehicle (SOV) travel.

Rhode Island also has a single transit agency and a single statewide planning organization, making integrated and coordinated transportation and land use planning much easier than in more fragmented regions. Similarly, Rhode Island has one major utility, National Grid, serving 99% of the electric and natural gas distribution in the state. Taken together, Rhode Island has a streamlined framework for undertaking programs and efficiently engaging key decision makers to reduce GHG emissions.

emissions and simultaneously promote accessible and affordable transportation options for all Rhode Islanders, especially those in overburdened and underserved communities.

Section 1 further demonstrates that efforts to transform the transportation system must consider numerous issues:

- **Equity:** Transportation decisions have historically magnified burdens to overburdened and underserved communities, especially communities of color, low-income neighborhoods, and areas with large immigrant populations. Highway building in the post-war period divided neighborhoods and degraded air quality, resulting in measurably higher rates of asthma.
- **Vehicle Electrification:** While vehicle electrification is a necessary step to a cleaner transportation system, there are multiple challenges with implementation. One challenge is upgrading grid capacity to handle hundreds of thousands of vehicles charging daily. Another is dealing with vulnerabilities in the electrical grid itself, some of which were laid bare when 120,000 Rhode Islanders lost power during Superstorm Sandy in 2012. Additionally, transportation funding is currently dependent on the gas tax, which will no longer be viable as more vehicles electrify.
- **Job Creation and Innovation:** The economic disruption of the COVID-19 pandemic underscores the importance of tying economic development opportunities to the decarbonization of the transportation sector. While the electrification of the transportation system represents a substantial cost, it also holds significant job creation potential as new charging stations, electric grid improvements, and job training will all be needed to realize this transition.
- **Health and Safety:** Decarbonizing the transportation system is also projected to have substantial health and safety benefits for Rhode Islanders. Modeling from the Transportation, Equity, Climate and Health (TRECH) report suggests that the Northeast region can expect up to 1,100 fewer deaths attributed to additional physical activity and reduced exposure to poor air quality as a result of the implementation of TCI-P initiatives.
- **Transportation Options:** Expanding transportation options is a key aspect of the effort to reduce emissions from transportation. Active transportation (biking and walking) offer plenty of opportunity for expansion, as more than half of all trips taken within the U.S. are to destinations less than a 20-minute bicycle ride in distance. Transit is also a key component, as even diesel buses are much more energy efficient per passenger-mile than the average private

vehicle. New mobile technology that coordinates these various options, known as Mobility as a Service (MaaS), provides the promise of consolidating these many options into a single mobile app that allows people to plan and choose the best option for their trip.

This important context sets the stage for understanding the programs and policies the state has undertaken thus far and lays the foundation for potential options moving forward.

SECTION 2: CLEAN TRANSPORTATION AND MOBILITY AUDIT AND PEER STATE INVENTORY

Over the past 5 years, Rhode Island has engaged in numerous initiatives to promote clean transportation and improve mobility. To better understand the full implications of prior initiatives, the state undertook an internal audit of programs and outcomes, developed by state agencies, related to mobility innovation and clean transportation.

There were several key takeaways from this audit:

- As of June 30, 2020, there were **3,078 Zero-Emissions Vehicles (ZEVs)** registered in the state.
- ZEVs have increased 552% from 2015 to June 30, 2020. ZEVs account for 0.44% of the light-duty vehicles in Rhode Island, and there are 2.9 ZEVs per 1,000 Rhode Islanders in the state. As of December 2020, there are 133 Public Charging Stations and 413 Charging Ports statewide.
- Mass transit projects are being pursued to address clean transportation and mobility and reduce congestion by providing an alternative to single rider automobiles and, in turn, reducing emissions. The Rhode Island Public Transit Authority's (RIPTA)'s 2020 budget of **\$123 million** in operating expenses and **\$57.9 million** in capital expenses supported essential energy-efficient mobility services to Rhode Islanders.
- Rhode Island invested **\$1.225 million** in its public transportation autonomous vehicle pilot project Little Roady and was one of the first states to pilot such a program.

- The state has invested **\$1.9 million** in diesel reduction projects that are environmentally and economically beneficial.

Peer states were also assessed to inform potential opportunities for new programs and initiatives that state agencies could consider. Some options were incentive programs for vehicle electrification targeted at low-income residents, particularly in rural areas; financing schemes for grid upgrades to accommodate increasing electrification of vehicles; and public transportation subsidies for recently hired employees of certain firms to ensure that people newly entering the workforce have the ability to get to work.

Altogether, these two assessments show that Rhode Island has laid a solid foundation upon which to build further efforts in decarbonizing the transportation system. This sets the context for potential investment portfolios for environmental sustainability efforts considered in Section 3.

SECTION 3: ILLUSTRATIVE INVESTMENT PORTFOLIOS

This Clean Transportation and Mobility Innovation Strategy will position Rhode Island to achieve aggressive targets for GHG reductions while expanding mobility, improving health, and creating jobs for all communities in the state. The clean transportation investment portfolios presented in this section illustrate the additional benefits the state could achieve by investing further in various forms of innovative and equitable mobility.

To show the range of benefits that Rhode Island might achieve, three illustrative portfolios (“Electrification”, “Mobility”, and “Blended”) were created using a mix of the following strategies:

1. Electrification and alternative fuels;
2. Vehicle travel reduction;
3. Transit and rail; and
4. Traffic efficiency.

The portfolios of clean mobility strategies were evaluated using the Investment Strategy Tool (“The Tool”) created specifically to estimate impacts from Transportation and Climate Initiative Program investments in clean transportation. The Tool was applied to each of the portfolios in order to compare the impacts of

the various strategies. This Tool translates dollar values of investment strategy into benefits including changes in vehicle-travel, GHG emissions reductions, air pollutant reductions, the value of health benefits, and economic benefits, as listed above.

The analysis showed that there are important tradeoffs between the three strategies. The “Electrification” strategy, which focused on electrification of vehicles (private and public), showed the greatest opportunity for GHG reductions. However, because low-income households are less likely to own a vehicle and more likely to use transit, it was not as effective as the “Mobility” strategy in producing a more equitable system. The “Mobility” strategy directed investments toward transportation options like transit, biking, and walking, as well as improvements in the system to reduce traffic congestion.

The “Blended” option sought to balance the other two strategies, though the exact balance between electrification and mobility is a decision that policymakers in Rhode Island will have to determine. The analysis of these portfolios provides key information as decision-makers in Rhode Island consider the recommendations and initial action steps developed by the Working Group, presented in Section 4.

SECTION 4: RECOMMENDATIONS AND ACTION STEPS

Based on the overall trends impacting Rhode Island, past efforts undertaken in the state related to mobility innovation, and the potential benefits of different clean transportation initiatives, the Working Group developed a list of 24 recommendations and 37 initial action steps for the state to consider. The recommendations and initial action steps listed in this section are critical for meeting Rhode Island’s effort to aggressively reduce GHG emissions from the transportation sector. These recommendations are meant to be relevant, ambitious, and nation-leading efforts that will benefit from the collaboration of numerous state agencies, elected officials, private sector partners, and grassroots stakeholders.

The recommendations and initial action steps are organized into six overarching categories:

1. Create a healthier environment for all Rhode Islanders with specific benefits for residents of our most overburdened and underserved communities;

2. Establish Rhode Island as a national leader in bold transportation and climate commitments;
3. Modernize, expand, and invest in state transit and transportation assets to more effectively move people and improve accessibility;
4. Improve air quality by taking steps to electrify the transportation sector;
5. Create a 21st century mobility infrastructure that capitalizes on the emerging changes in transportation technology; and
6. Unlock economic opportunity, promote green job creation, and support business and supply chain industries.

Introduction

*Introduction to the
Clean Transportation and
Mobility Innovation Strategy*



In the face of transportation systems that will be affected by new technologies, new modes, and changes in mobility preferences, The Mobility Innovation Working Group was convened to inform a roadmap towards a clean transportation future. This document presents the results of strategy modeling and recommendations for 'next steps' in Rhode Island's Mobility Innovation journey.



ESTABLISHING A MOBILITY VISION FOR RHODE ISLAND

Rhode Island's transportation sector is faced with growing challenges brought on by climate change, structural inequities, and the harsh and uneven economic impacts of a global pandemic. While the state intensified its response to the threat of climate change over the past decade, the dramatic health and economic impacts of COVID-19 have drawn even more attention to the need for cohesive long-term solutions. To that end, Rhode Island has responded with a highly collaborative effort to develop a roadmap for its clean transportation future.

The *Rhode Island Clean Transportation and Mobility Innovation Strategy* ("The Strategy") is the culmination of a cross-sector effort. Launched by Governor Gina Raimondo with the formation of the Mobility Innovation Working Group ("The Working Group"), this 26-member panel of experts was comprised of equal participation from the private and non-profit sectors as well as key state agency representatives. The Working Group was chaired by Colleen Quinn, who has worked for more than a decade as a pioneer and thought leader in the clean transportation sector. Under Ms. Quinn's leadership, the Working Group came together with a set of common goals that should guide development of clean transportation investments and policies.

This approach to Rhode Island's transportation future is closely aligned with the state's participation in the groundbreaking Transportation and Climate Initiative Program (TCI-P). TCI-P is a multi-jurisdictional regional collaboration of east coast states and the District of Columbia that is focused on developing equitable investments in a clean energy economy. TCI-P's overall goal is decarbonization of the transportation sector to dramatically reduce GHG emissions.

The transportation sector is at an inflection point. Rapid changes in technology, demographics, and travel behavior are challenging 20th century modes of operation. Long-standing issues such as a changing climate and the aging population are being compounded by rapid developments, such as shared mobility and the COVID-19 pandemic.

This report directly responds to these many challenges and opportunities with a bold vision for Rhode Island's mobility future. Using a highly collaborative process that focuses on equity as a central tenet, the Ocean State has charted a path that embraces creativity and innovation in the face of unprecedented challenges.

MOBILITY INNOVATION WORKING GROUP FRAMEWORK

The groundwork necessary to advance an effective Strategy for Rhode Island began with formation of a diverse, committed, and highly talented Working Group. Their shared experience in energy, environment, and technology across the full range of transportation modes guided the direction and content of this report, generating a comprehensive and well-informed approach.

Five webinar and workshop-style sessions were held over six months with the Working Group and included national subject matter experts, such as Dr. Daniel Sperling, author of Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future, as well as detailed presentations on equity and automated vehicle technologies. Following a series of workshop-style sessions, Working Group members were asked to submit actionable recommendations that would lead to meaningful policy, infrastructure, employment, and investment changes in Rhode Island's transportation system.

Members of the public were also welcomed to attend the five virtual Working Group sessions, as well as a 2-hour Public Comment Meeting on October 22, 2020. This framework facilitated an inclusive and iterative process. Working Group Meeting schedules, agendas, and notes can be found in Appendix D.

THE IMPACT OF THE COVID-19 PANDEMIC

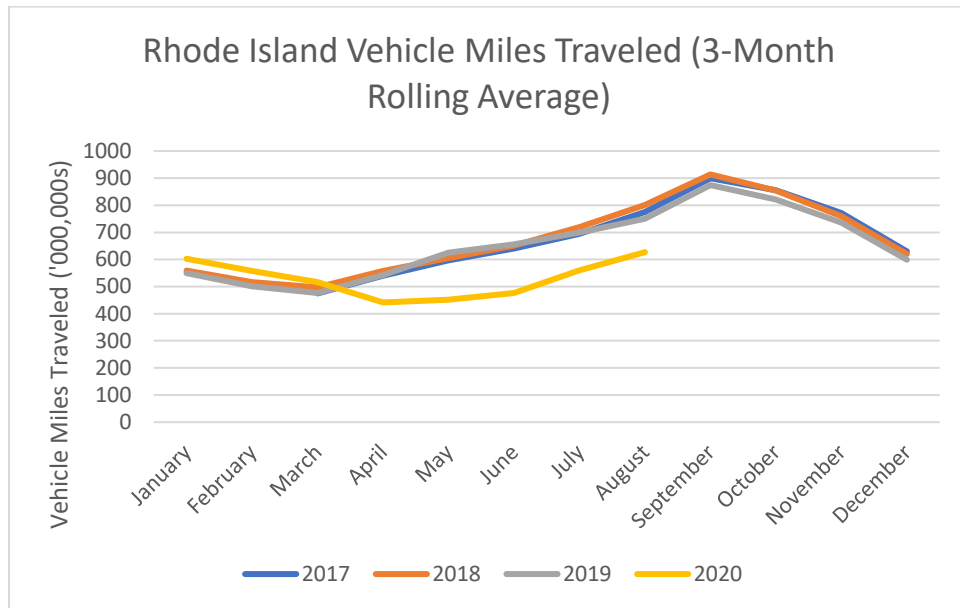
In Rhode Island and around the world, the COVID-19 pandemic has been a profound disruption to virtually all aspects of life, particularly impacting the transportation system. The pandemic has produced numerous uncertainties, including state and federal funding levels, employment and the economy, and volatility in transit and rail ridership as telework and online learning became a daily routine. This public health crisis is important context for this Strategy, as it will have reverberations in future travel behavior for years to come.

This Strategy has taken this context into consideration and has been well informed by the statewide Long-Range Transportation Plan (LRTP) *Moving Forward RI 2040*, adopted by the State Planning Council/Metropolitan Planning Organization in December 2020. The LRTP includes this language for context, "This LRTP was prepared amidst the COVID-19 pandemic. While the immediate effects of COVID-19 on the state's transportation system have been significant, at the time of the release of this plan in late 2020, the long-term effects are unknown and speculative

at best. These effects include changes in congestion, travel patterns, decreased use of public transit and potential limited state funding such as tolling and gas tax revenues.”

Some travel patterns have been more impacted than others. As seen in Figure 1, vehicle miles traveled by personal vehicles has declined by only about 16% as of August 2020 according to the Federal Highway Administration.ⁱ

Figure 1. Rhode Island Vehicle Miles Traveled

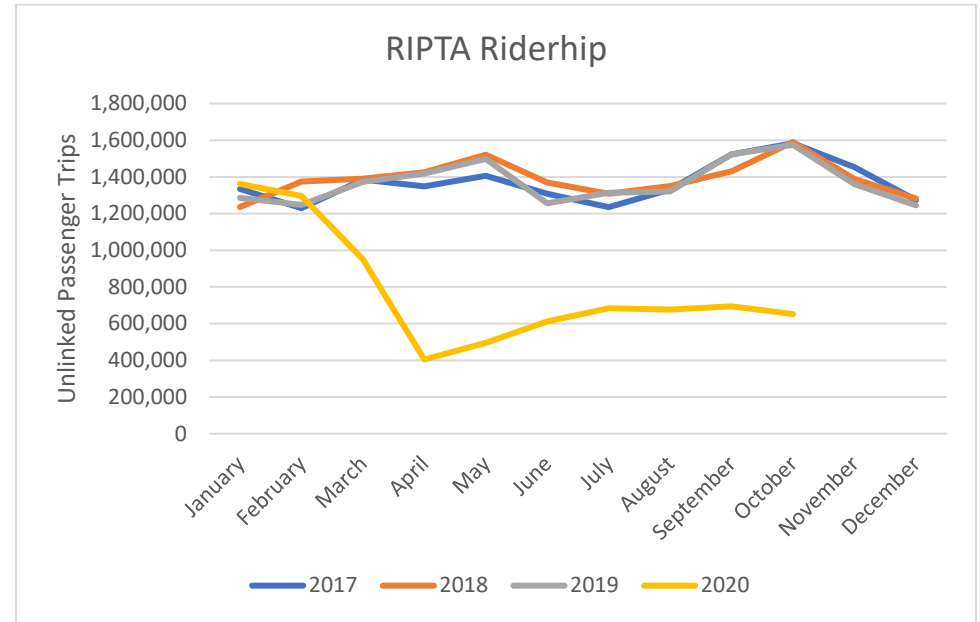


However, the impact to public transportation ridership has been much more substantial. April of 2020 saw a 70% ridership decline relative to the same month in 2019, and ridership had only rebounded to 40% of typical ridership by October 2020 (Figure 2).ⁱⁱ

While short-term reluctance to be in enclosed public spaces like a transit bus may subside as vaccines are distributed and “herd immunity” is achieved, longer term behavior changes may linger. More people are working from home or learning remotely than ever before, and many businesses and schools have invested heavily in the infrastructure to make those virtual systems work. Continued work- or learn-

from-home practices may be the new norm for many Rhode Islanders, even if only a few days per week.

Figure 2. RIPTA Ridership



The ultimate decisions and priorities for investment in sustainable, equitable, reliable, and fiscally responsible transportation infrastructure in Rhode Island will evolve as we come to understand the long-term impacts of this ongoing public health crisis.

TRANSPORTATION AND CLIMATE INITIATIVE (TCI)

The Transportation and Climate Initiative is a collaboration between Rhode Island and 12 other states and the District of Columbia that seeks to improve transportation, develop the clean energy economy, and reduce carbon emissions from the transportation sector (a map of participating jurisdictions is shown in Figure 4 on the next page). The timeline for TCI is shown below in Figure 3. TCI recognizes that New England and the Mid-Atlantic states are part of an integrated transportation system and that to affect meaningful change in any one jurisdiction, change must be affected across all jurisdictions. Put simply, a regional problem requires a regional solution.

This collaborative effort focuses on advocacy, research, and policies to promote these desired outcomes, and led directly to the execution of the Memorandum of Understanding that created the Transportation and Climate Initiative Program. Rhode Island, Connecticut, Massachusetts and the District of Columbia became the first signatories to the TCI-P Memorandum of Understanding on December 21, 2020. This important step further cements Rhode Island as a national leader in clean transportation and commits the state to incremental reductions in GHG emissions

over the coming decade, pending passage of enabling legislation.

The TCI-P is a regional “Cap-and-Invest” program, which sets a cap on transportation-generated GHG emissions for each jurisdiction and then slowly reduces that cap annually. The TCI-P will work by requiring large gasoline and diesel fuel suppliers to purchase “allowances” for the pollution caused by the combustion of fuels they sell in participating jurisdictions. Those proceeds from the auction can then be used to fund a variety of programs that support clean transportation initiatives in participating states. Different portfolios of investments are explored in greater detail in Section 3 of this report.

Beginning with a base year of 2023, jurisdictional CO₂ emissions budgets are expected to decline equal amounts each year by at least 30 percent by 2032. Delaware, Maryland, New Jersey, New York, North Carolina, Pennsylvania, Vermont, and Virginia have participated actively in developing the TCI-P and have the opportunity to join the program in the future. If all of the TCI jurisdictions eventually choose to implement the TCI-P, total proceeds available for investment could exceed \$2 billion annually.

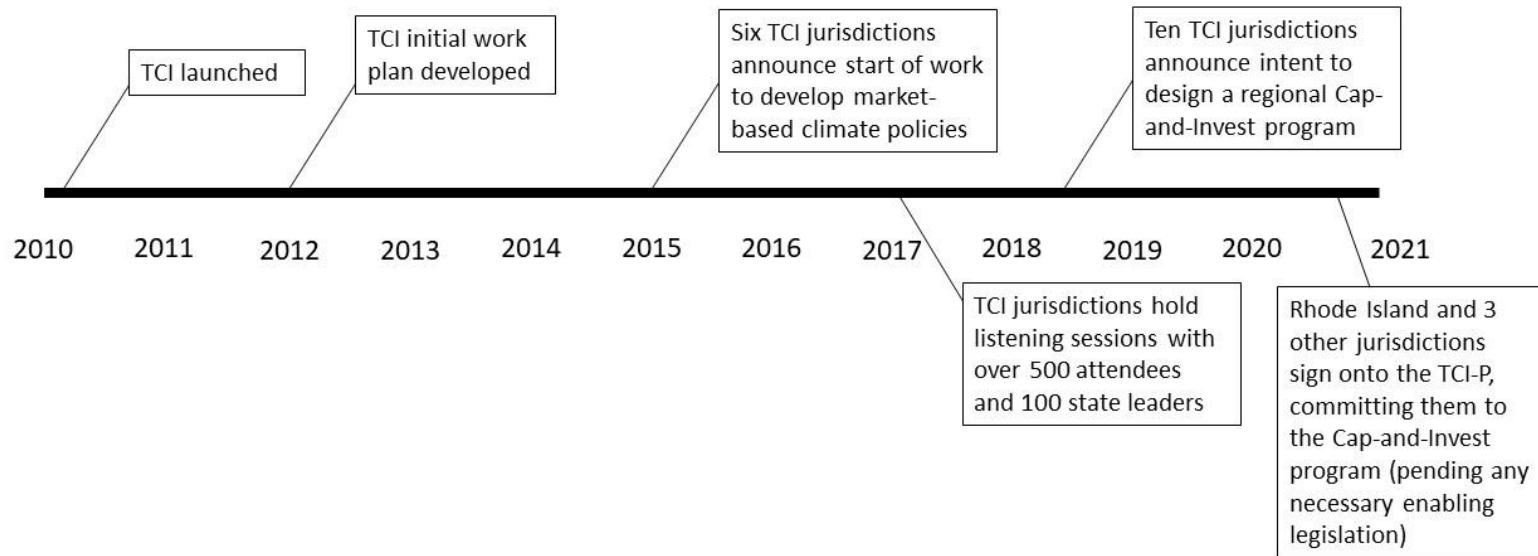
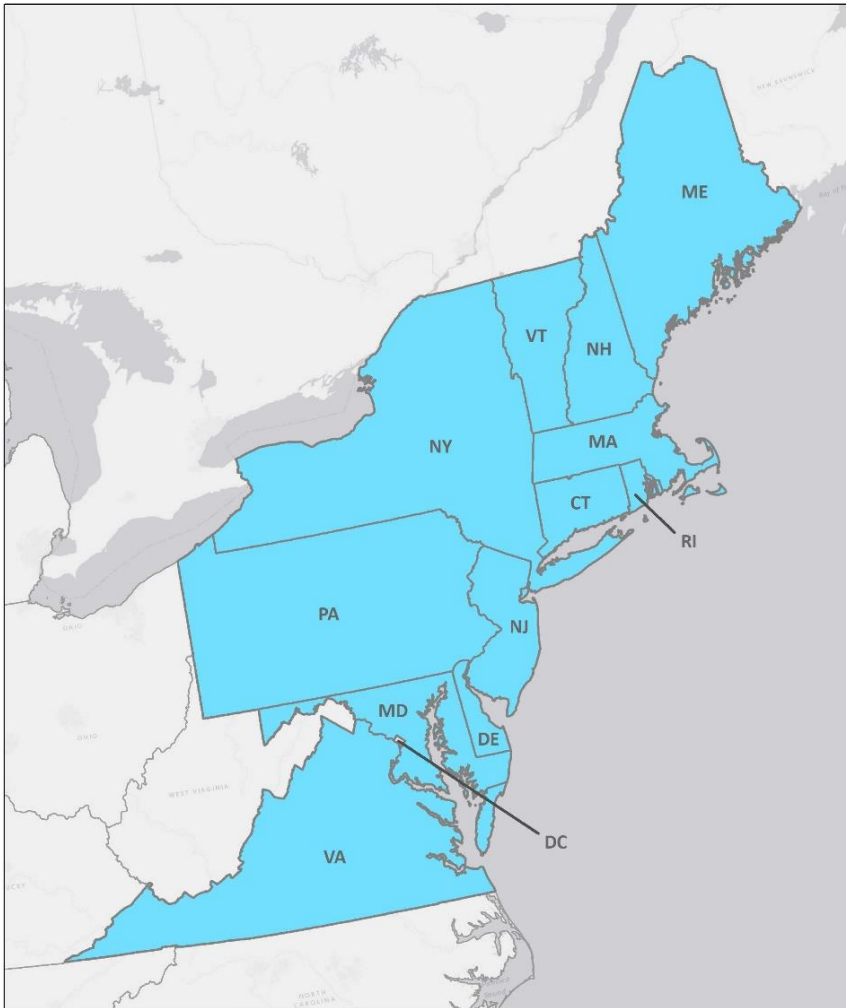


Figure 3. TCI Timeline

Figure 4. TCI Participating Jurisdictions



This report is a timely response to the many long-term trends and unexpected recent disruptions impacting Rhode Island's transportation system. The following sections provide the vision for transportation innovation in Rhode Island over the next several years:

- Section 1 is a broad look at the trends and issues that Rhode Island is facing, such as technology changes and demographic trends.

- Section 2 provides an overview of recent efforts by state agencies as well as Rhode Island's peer states to promote cleaner transportation.
- Section 3 provides different portfolios of investment options for the proceeds from the TCI-P GHG allowance auctions.
- Section 4 lays out the recommendations and initial action steps the state can take in pursuit of this ambitious clean transportation vision.

This document represents months of work, dialogue, and deliberation between a broad cross-section of stakeholders to craft a shared vision. It charts the path forward that cements Rhode Island as a national leader in clean transportation and mobility innovation for years to come.

Section 1

Facts, Trends and Issues



Climate change is a clear and present threat to Rhode Islanders, and transportation is a leading contributor to the greenhouse gas emissions that cause climate change. It is critical to focus efforts on creating a more sustainable, efficient, and equitable transportation system.



TRANSPORTATION AND CLIMATE CHANGE

Rhode Island has emerged as a national leader in tackling climate change head-on. To comprehensively address climate change, it is essential that the state seek to transform the transportation sector to reduce GHG emissions and protect the environment in the short- and long-term. Transforming the transportation sector, though, will do much more than that – it will also promote public health, generate green economic development, and increase equitable mobility options.

While the State of Rhode Island has laid the foundation for its transition to a decarbonized transportation network, significant work remains. This section provides context on the transportation sector's role in achieving the state's bold environmental sustainability goals.

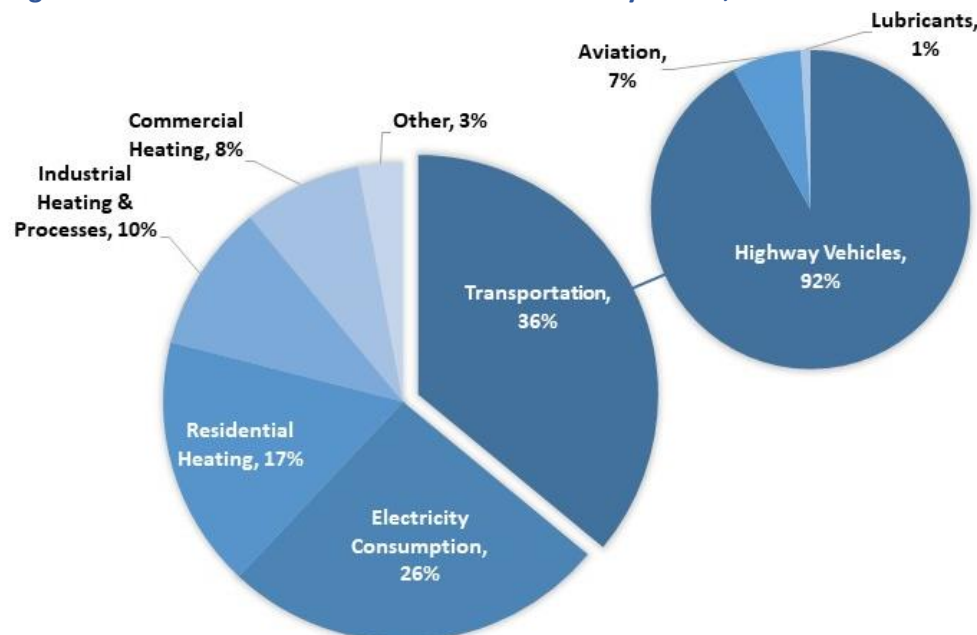
TRANSPORTATION DRIVES CLIMATE CHANGE

Transportation is a primary driver of climate change, and the transition away from fossil fuels in transportation is essential to the future health and prosperity of the state. It is therefore imperative that Rhode Island focuses on the transportation sector in order to meet its GHG reduction goals.

As the state's top contributor of GHG emissions, transportation comprises 36% of all emissions, followed by electricity consumption and residential heating (Figure 5).ⁱⁱⁱ Of all transportation-related emissions, 92% comes from highway vehicles (personal cars, long-haul trucks, etc.).^{iv}

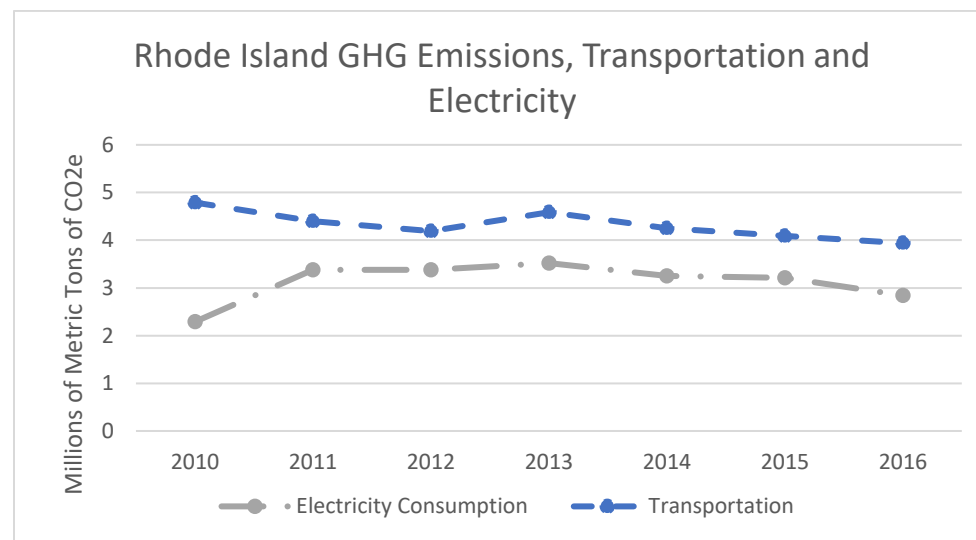
Thanks to the state's aggressive environmental initiatives outlined in Section 2 of this report, Rhode Island has already made significant progress in reducing GHG emissions from transportation over the last several years. When combined with more recent improvements in GHG emissions from the electricity generation sector (Figure 6), Rhode Island is among the most energy efficient states in the country, with the lowest energy consumption on a per capita basis. Rhode Island is also in the top ten states for lowest energy use per dollar of gross domestic product (GDP) generated.^v

Figure 5. Share of GHG Emissions in Rhode Island by Sector, 2016



Source: Rhode Island GHG Emissions Inventory

Figure 6. Rhode Island Transportation and Electricity GHG Emissions



Source: Rhode Island's 2016 GHG Emissions Inventory

As ZEVs become more common, the environmental impacts of electricity production and transportation will become more intertwined, linking together GHG emissions from the two sectors. The vast majority (91%) of Rhode Island's electricity is currently generated by natural gas,^{vi} a fuel that produces less GHGs than other fossil fuels but still contributes to climate change. However, Rhode Island is making progress in generating more of its energy from renewable sources, with a goal of 100% renewable energy by 2030.

Given the reliance on fossil fuels for electricity production that is expected to last for several more years, increasing the share of ZEVs is insufficient on its own if the state is to meet its GHG reduction targets. Today's transportation system is dominated by people driving alone (80% drove alone to work in 2018, the most recent information available),^{vii} and so creating a system with more efficient travel options and patterns (e.g., shared rides, walking, biking, using transit) is an important element of the Strategy for reducing emissions.

CLIMATE CHANGE THREATENS TRANSPORTATION INFRASTRUCTURE

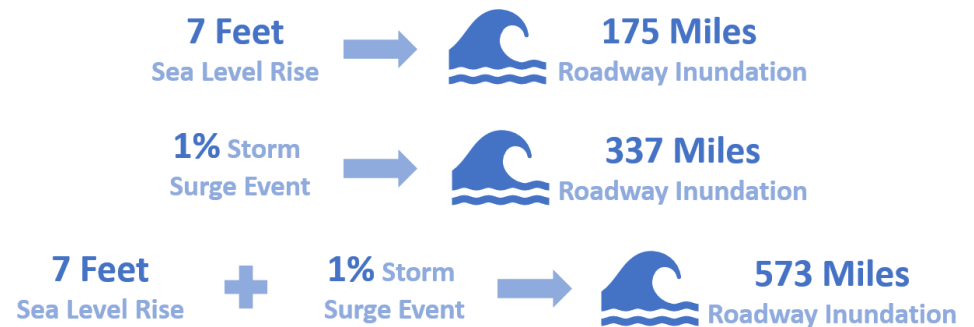
The transportation sector not only drives climate change through its GHG emissions, it is also vulnerable to its impacts (Figure 7).^{viii} Over the past decade alone, eight climate-related disasters have hit Rhode Island, posing a threat to the safety and well-being of its residents and causing billions of dollars in damages.

Figure 7. Hazards Associated with Climate Change



Extreme weather jeopardizes transportation facilities, particularly in coastal areas. The Division of Statewide Planning modeled the consequences of a seven-foot rise in sea level, finding such an increase would inundate 175 miles of roadway.^{ix} When combined with a 1% storm surge event (i.e. once per century, or 1% likelihood in any given year), climate change-driven sea level rise considerably exacerbates the potential infrastructure damage in Rhode Island, as shown in Figure 8.^x

Figure 8. Impact of Sea Level Rise on Rhode Island Roadways



Source: Rhode Island Division of Statewide Planning

THE TRANSPORTATION SYSTEM MAGNIFIES CLIMATE CHANGE IMPACTS

Extreme storms are only a small portion of the overall negative impacts that climate change is expected to have in Rhode Island. Extreme heat waves are especially concerning, as the “urban heat island” effect magnifies excessive heat in heavily built-out areas like Providence. Large transportation facilities like urban arterial highways and overpasses contribute to this phenomenon.

Unfortunately, the negative impacts of the urban heat island effect and extreme heat exacerbated by climate change are likely to be disproportionately felt by low-income communities of color. As demonstrated by Groundwork Rhode Island's interactive publication *Climate Safe Neighborhoods*, areas of Pawtucket, Providence, and Woonsocket that were historically redlined (“redlining” was the practice of refusing bank loans to households located in communities of color) have less tree coverage, more impervious surface, and higher average surface temperatures.^{xi}

Put simply, the transportation system as it exists today worsens the climate crisis, exacerbates its negative impacts (especially in the state's most overburdened and underserved neighborhoods), and is itself vulnerable to the consequences of a changing climate. Fortunately, Rhode Island has some built-in features which give it a head start in transforming the system and addressing its vulnerabilities, as described in the next section.

RHODE ISLAND'S UNIQUE ADVANTAGES

While Rhode Island has vulnerability related to climate change, it also has several inherent structural and organizational advantages that position it well to respond to the challenge. These include:

- **Rhode Island is a geographically small state:** At 1,212 square miles, Rhode Island is the smallest state in the nation and approximately one-quarter the size of Los Angeles County, California. With most of the state's population located in and around Providence, there is an extraordinary opportunity to develop low- and no-emissions transportation options like biking, walking, and transit that are competitive with car travel.
- **Rhode Island has a single transit agency and statewide planning organization:** Unlike its neighboring states, Rhode Island has a highly consolidated transportation planning and operations model, with a single transit provider (Rhode Island Public Transit Authority) and a single transportation planning agency (Division of Statewide Planning). Where other states and jurisdictions may struggle with fragmentation of the decision-making process for linking transportation, land use, environment, and equity goals, Rhode Island's cohesive transportation planning and operations landscape allows for a high degree of coordination.
- **Rhode Island has one major energy utility:** National Grid services 99% of the electric and natural gas distribution for the State of Rhode Island. This creates the opportunity to work with just one utility as opposed to numerous private and public utilities in order to further renewable energy and vehicle electrification efforts.

These inherent advantages give Rhode Island a head start in being able to develop a Strategy that provides recommendations across multiple sectors and state

agencies, and which apply statewide. These advantages will need to be leveraged in order to mitigate the substantial carbon emissions generated by the transportation system, described in the next section.

ROLE OF MOBILITY IN FIGHTING AND ADAPTING TO CLIMATE CHANGE

Any meaningful strategy for achieving GHG reduction goals must include an ambitious agenda for transportation that embraces innovation and creativity. Transportation electrification, equity, mode shift, and health and safety are all crucial aspects of decarbonizing the transportation system and are discussed in greater detail below.

THE ROLE OF TRANSPORTATION ELECTRIFICATION

Globally, the electrified transportation sector is gaining market share, with both new ZEV manufacturers emerging and major automotive manufacturers announcing commitments to electrify their fleets. Because most trips in Rhode Island are made by single occupancy vehicles and most goods are moved by freight trucks, encouraging this market shift is essential to an effective climate change strategy. The ZEV market could ultimately contribute substantially to reducing dependence on fossil fuels, leading to emissions reductions and associated health and environmental benefits.

It is crucial that Rhode Island implements policies and makes the necessary infrastructure investments to continue developing the market for ZEVs. While auto manufacturers are committed to the production of electric vehicles, ZEV sales vary considerably state-by-state. California leads the nation in ZEV sales due to its early and aggressive promotion of policies and goals which incentivize marketing and distribution to that state. Rhode Island is on the lower end of the spectrum of ZEV sales (Table 1 on the next page). Further development of consumer incentives would send signals to automotive manufacturers that Rhode Island is primed for ZEV marketing and distribution.

Table 1. 2019 ZEV Registrations as a Percentage of all Light Duty Vehicles

State	% New ZEV Sales
California	7.9%
Colorado	3.1%
Connecticut	2.0%
District of Columbia	4.9%
Hawaii	3.2%
Maine	1.4%
Maryland	2.1%
Massachusetts	2.2%
New Jersey	1.6%
New York	1.4%
Oregon	4.1%
Rhode Island	1.3%
Vermont	2.3%
Washington	4.3%
US Average	2.0%

Source: HIS Markit, Vehicle Registration Data for Calendar Year 2019

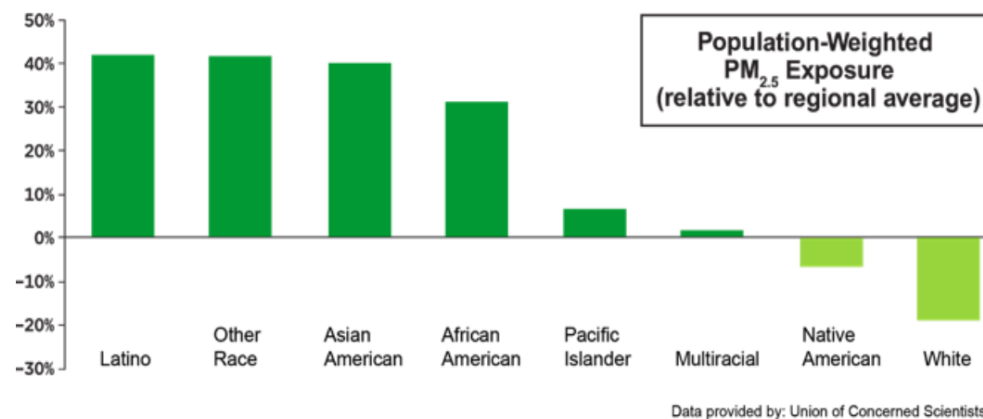
However, the pathway towards electrification is not without concerns. Three potential challenges stand out:

- **Electric Grid Capacity:** A substantial increase in ZEVs would put new stress on existing electrical grid infrastructure. As the residential heating sector is also converted from oil and gas to electric, grid infrastructure investments needed in keeping up with future electricity demand could be substantial.
- **Electric Grid Vulnerability:** During Superstorm Sandy (2012), nine substations went out of service, 1,433 sections of wires went down, and 63 poles were broken, cutting electricity to approximately 120,000 Rhode Islanders.^{xii} While the market shift away from internal combustion engines would help to mitigate tailpipe emissions, it also adds new vulnerability through dependency on an electrical grid in need of modernization.
- **Transportation Funding Sources:** Finally, as more individuals convert to ZEVs, the revenue generated from the state gas tax would decline, impacting the state's ability to fund capital projects.

Another concern is generating enough renewable energy to feed new demand for electricity. Fortunately, a growing proportion of Rhode Island's electricity is generated by wind energy. The first (and, to date, only) American offshore wind farm began operating off of Block Island in 2017, contributing to the 23-fold increase in wind energy generated in Rhode Island between 2015 and 2019.^{xiii} Accelerating this trend will be essential to reducing GHG emissions.

THE ROLE OF EQUITY

Establishing a cleaner transportation system must be complemented by enhanced health, access, and opportunity for the state's most underserved and overburdened communities. As noted by the environmental justice nonprofit Dream Corps in the 2019 report *Designing an Equitable Cap-and-Invest Policy for Transportation*, "Low-income communities and communities of color are disproportionately impacted by climate and air pollution, pay a disproportionate amount of their incomes on transportation costs, and often lack mobility options that would help them reach jobs, medical care, and other services compared to whiter, wealthier communities."^{xiv}

Figure 9. Exposure to PM 2.5 by Race in the Northeast and Mid-Atlantic States

Source: Dream Corps

The report notes that the history of building highway facilities through low-income communities of color has placed a much heavier environmental burden, especially in regards to particular soot and other fine particulate matter, affecting these neighborhoods (Figure 9). The impact of these burdens has been documented in

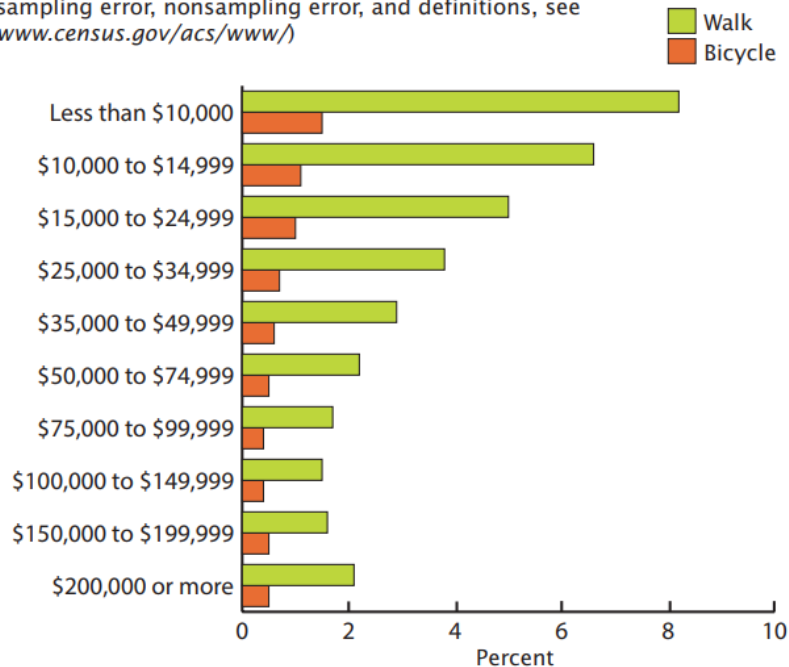
higher asthma rates in areas adjacent to major arterial highways,^{xv} and exposure to fine particulate matter (PM 2.5) has also been linked to heart attacks, arrhythmias, and premature deaths.^{xvi} There is also emerging science on negative cognitive impacts resulting from PM 2.5 exposure.^{xvii}

Investments in active transportation, which do not result in direct GHG emissions or degraded air quality, can make a meaningful contribution in addressing this inequity.

Figure 10. Walking and Bicycling to Work by Household Income

Walking and Bicycling to Work by Household Income: 2008–2012

(Data based on sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see www.census.gov/acs/www/)



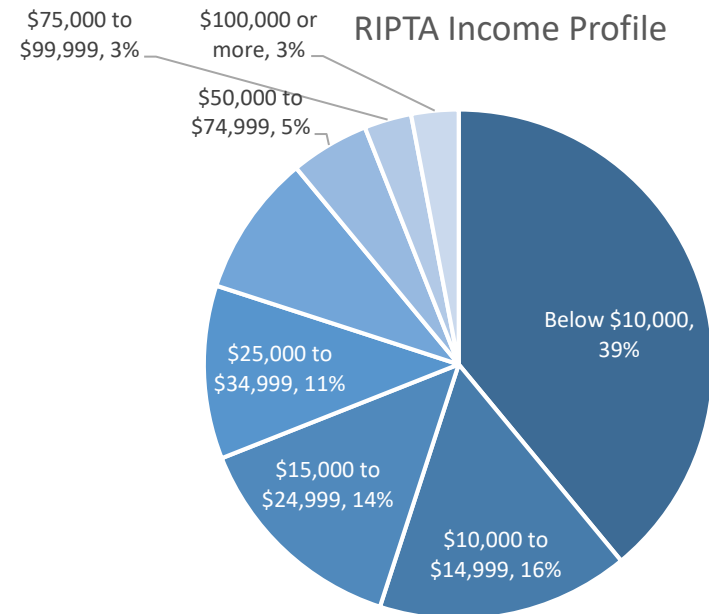
Source: US Census Bureau

The US Census Bureau has conducted research showing that low-income Americans are more likely to bicycle or walk to work (Figure 10).^{xviii} This suggests that investments in biking and walking are not only environmentally friendly modes of

transportation, but also have a disproportionately positive impact on overburdened communities.

Similarly, investments in public transportation are likely to have a positive impact on the state's overburdened and underserved households. RIPTA's on-board rider surveys show that public transportation is heavily relied on by low-income households, with nearly 40% of riders reporting a household annual income of under \$10,000 (Figure 11). This indicates that transit investments to attract new riders would not only decrease GHG emissions but also improve air quality and enhance the mobility of low-income Rhode Island residents.

Figure 11. RIPTA Users Household Income Profile



Source: 2018 RIPTA Title VI Program

Altogether, these statistics demonstrate that a low-carbon transportation plan relying solely on electric vehicles is unlikely to reduce the historic inequalities in the transportation system. For example, with the cost of a new ZEV Nissan Leaf at \$31,600, an electric car is out of the reach of most low-income households. Therefore, a robust low-carbon transportation strategy that embraces non-

automotive forms of travel is necessary to ensure that overburdened and underserved communities benefit from the efforts outlined in this Strategy.

THE ROLE OF TRANSPORTATION OPTIONS

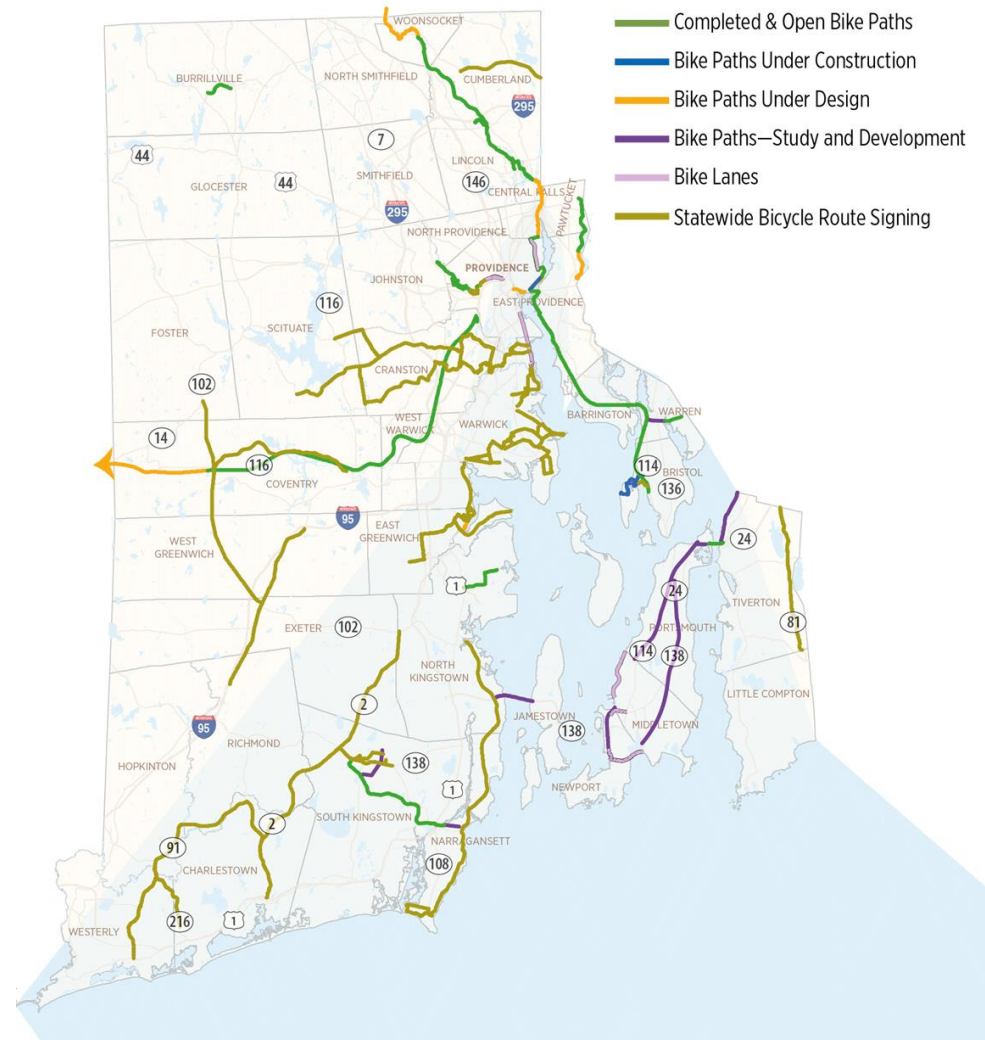
Encouraging mode shift from cars to lower-emission modes of transportation is crucial to achieving GHG reduction goals. The vast majority of all vehicles have traditional internal combustion engines, comprising 97% of 2017 vehicle sales in the US.^{xi} While there is opportunity to reduce emissions in light duty vehicles through new propulsion technology, this should be accompanied by shifting people to other modes of transportation.^{xx} This shift could include expanding the share of people traveling by bicycle or micromobility devices (e.g. electric bicycle, scooter), on foot, or using public transportation. Mobility as a Service (MaaS), which is defined by a mobile app to bundle this variety of modes into an easy to use service, also provides much opportunity for mode shift.

ACTIVE TRANSPORTATION

According to data from the National Household Travel Survey, more than half of all trips taken within the U.S. are to destinations less than a 20-minute bicycle ride in distance, and a quarter of all trips are to destinations within a 20-minute walk.^{xxi} Despite the proximity of a majority of trips, bicycling and walking comprise only 4% of all work trips in the state.^{xxii} This provides ample room for growth in the number of Rhode Islanders using those modes. Active transportation presents opportunities for improving the environmental impacts of the transportation system, as well as promoting improved health outcomes for the state's residents.

Active transportation trips are carbon neutral (i.e., do not generate greenhouse gases) and particularly appropriate for trips under five miles. As the second-most densely populated state in the nation, Rhode Island is especially well positioned to capitalize on its historic community centers to promote biking and walking for transportation. An effort concurrent to this planning process is the *Bicycle Mobility Plan*, which envisions a statewide network of bicycle routes that would stitch together the state for those traveling by bicycle (Figure 12). Additionally, bicycle- and scooter-share programs offer the opportunity for more active transportation use.

Figure 12. Statewide Bicycle Network



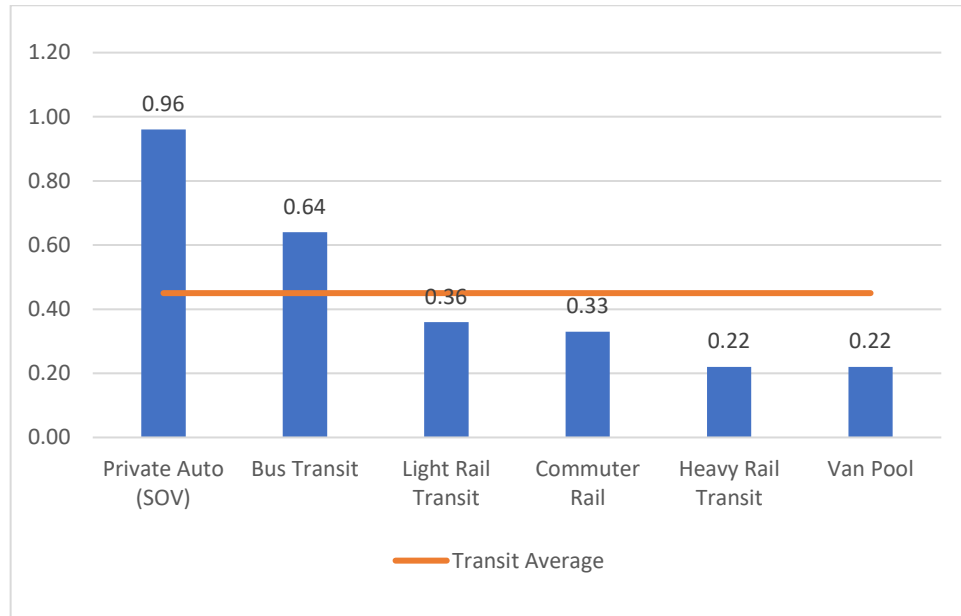
Source: *Moving Forward RI*

A relatively new development in active transportation is the emergence of electric bicycles (e-bikes). These e-bikes, which can either use pedal-assist or no-pedal propulsion, greatly expand the range and speed of traditional bicycles. The global market for e-bikes is projected to grow to \$27.26 billion by 2025 from \$17.12 billion in 2017^{xxiii}.

TRANSIT

Increasing the share of trips made using public transit is a critical component of reducing GHG emissions associated with the transportation sector. On average, transit trips produce half the CO₂ per mile that trips made with a single-occupancy vehicle produce (Figure 13).^{xxiv}

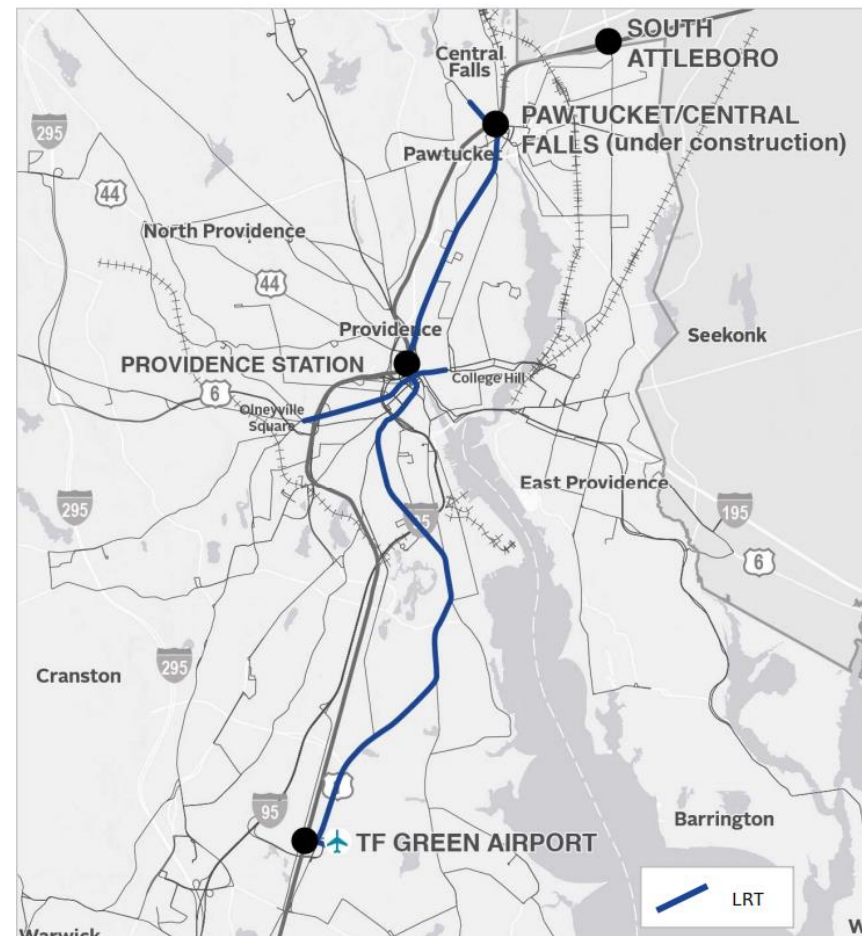
Figure 13. CO₂ Emissions Per Passenger Mile



Source: Federal Highway Administration (2010)

Even when running a conventional diesel bus, connecting more Rhode Islanders with public transportation options will have a net environmental benefit, particularly if these trips are shifted from driving alone. Rhode Island benefits from having a robust multimodal transportation system, including intercity bus, commuter and local bus, and commuter and intercity rail. Additionally, there are multiple Flex Service zones around the state, which bring public transportation to areas that have little or no fixed route service. RIPTA's *Transit Master Plan* envisions numerous improvements to these existing services, as well as expansions into new unserved areas and the development of new high-capacity services like light rail transit (Figure 14).^{xxv}

Figure 14. Conceptual Light Rail Transit Alignment



Source: RIPTA

Rhode Island also has a changing demographic and population distribution underscoring the continued need to invest in a robust, convenient, and accessible public transportation network to encourage mode shift away from single- and low-occupancy vehicles. While the population of Rhode Island is unlikely to grow substantially in the coming decades (roughly 2% growth between 2010 and 2040), the proportion of Ocean State residents over age 65 is projected to increase by 74% by 2040.^{xxvi} As these residents age, they are increasingly likely to need alternatives to driving due to physical impairments.

Additionally, 60% of projected growth is expected to occur in the largest metropolitan statistical area (greater Providence).^{xxvii} This growing concentration of population in the state's primary urban area will further reinforce the importance of public transportation, as traffic congestion and parking constraints make public transportation a more attractive option for those traveling in denser areas.

The environmental benefits of transit are enhanced further through the past and planned purchases of all-electric buses for the RIPTA fleet. Most recently, in June 2020, RIPTA was awarded over \$6 million by the Federal Transit Administration for the purchase of 17 electric buses. RIPTA is committed to continuing progress on reducing GHG emissions from its operations through new investments in electric vehicles.

MOBILITY AS A SERVICE

RIPTA's integrated fare collection system, Wave, moves RIPTA closer to the broader concept of Mobility as a Service (MaaS), a consumer-centric model of transportation where various transport modes (such as car and bicycle sharing, taxis, and car rentals/leases) can be accessed via an on-demand, real-time mobile (i.e. smart phone) platform that provides everything to the consumer, from travel planning to payments. Between RIPTA's smart fare collection system, Wave, and its Flex Service, Rhode Island is moving toward a system where users have multiple travel options at their fingertips.

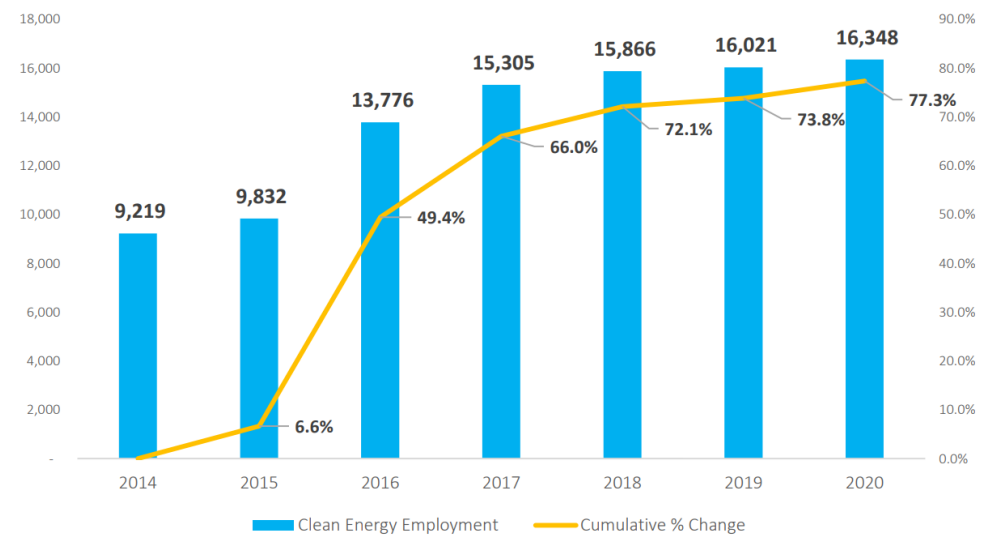
Wave can be used to pay for multiple modes provided by RIPTA, including bus, trolley, van, or Flex Service. Expansion of this fare platform to other modes, including bikeshare, ride hailing (Uber/Lyft), MBTA services, and Amtrak, while logistically and technically complex, would offer even greater travel options to users of the app. MaaS implementations can also include trip planning functions and integrate Transportation Network Companies (e.g., Uber) into the smart phone app, further expanding the suite of services at riders' fingertips. Nonetheless, the implementation of the mobile payment app Wave is a crucial first step toward this kind of fully integrated system.

THE ROLE OF JOB CREATION AND INNOVATION

As of the drafting of this report (January 2021), the nation is in the midst of the worst economic recession since at least 2008 and possibly since the 1930s. The COVID-19 pandemic has generated extreme turmoil in the state's economy as entertainment venues shuttered, large events were canceled, restaurants closed or shifted to take-out only, and supply chains were disrupted. Moreover, the downturn caused by the COVID-19 pandemic hit lower income workers in service industries especially hard.

This economic disruption underscores the importance of tying economic development opportunities to decarbonizing the transportation sector. While the electrification of the transportation system represents a substantial cost, it also holds significant job creation potential as new charging stations, electric grid improvements, and job training will all be needed to realize this transition. Macroeconomic analysis suggests that, nationwide, vehicle electrification could generate a net gain of between 51,500 and 108,400 jobs per year between 2015 and 2040.^{xxviii} Rhode Island can become a national leader developing human capital and expertise that other states tap into as they develop their own next-generation mobility systems.

Figure 15. Rhode Island Clean Energy Employment, 2014 - 2020



Source: Rhode Island office of Energy Resources

This movement toward electrification of the transportation system is complemented by the job creation potential from broader renewable energy initiatives. As reported by the Office of Energy Resources, there has been a remarkable 77.3% increase in the number of clean energy jobs in the state since 2014 (Figure 15 on the previous page).^{xxix} Importantly, these clean energy jobs pay relatively high wages, with entry-level clean energy sales representatives earning 51% more than the median wage of other kinds of sales representatives in the state.

Solar energy and energy efficiency jobs tend to center on installation, maintenance and construction – jobs which are difficult to outsource. Furthermore, these jobs are accessible to those often left out of high-paying jobs, such as the formerly incarcerated or those without higher education. Almost half of the current workforce in energy efficiency has a high school diploma or less, and these jobs pay on average 8% - 19% more than area median wages.^{xxx}

Figure 16. Job Creation Associated with Active Transportation per \$1 Mill. Spent



Source: American Association of State Highway and Transportation Officials, 2012

Construction jobs resulting from infrastructure investment present another job creation opportunity. Interest rates are at historic lows, making the cost of financing

construction more accessible to state and local transportation agencies.^{xxxi} Investments in active transportation are particularly attractive for job creation purposes, as the American Association of State Highway and Transportation Officials has shown that active transportation construction projects generate the highest number of construction jobs per dollar spent of any roadway investment (Figure 16).

THE ROLE OF HEALTH AND SAFETY

Decarbonizing the transportation system is also projected to have substantial health and safety benefits for Rhode Islanders. Some of these benefits, such as improved air quality, have already been described. The Transportation, Equity, Climate and Health (TRECH) project, a multi-university research initiative conducting independent analysis of the TCI, quantified the overall public health benefits of cutting greenhouse gas emissions from the transportation sector.^{xxxii}

Some of the preliminary key findings of this project are that, by 2032, the Northeast region can expect:

- Up to 1,100 fewer deaths attributed to additional physical activity and reduced exposure to poor air quality;
- Up to 4,700 childhood asthma cases avoided; and
- Up to \$140 million in total annual monetized health benefits.

There are also safety benefits to increased bicycling and walking. For bicyclists, as the rate of bicycling increases, the rate of bicycle crashes decreases.^{xxxiii} This is likely due to increased driver awareness of bicyclists, better adherence to relevant traffic laws (on both ends), and more dedicated infrastructure. Supporting a shift to biking and walking, in addition to reducing GHG emissions, creates a virtuous cycle where the active transportation environment gets safer as more people engage in it.

In addition to the safety benefits of active transportation, mode shift from private vehicles to public transportation also results in increased safety. In 2018, there were 146 times more fatalities on highways than on transit, suggesting that transit investments which attract new users (e.g., high-capacity, high-frequency transit) could result in a substantial safety benefit.

CONCLUSION

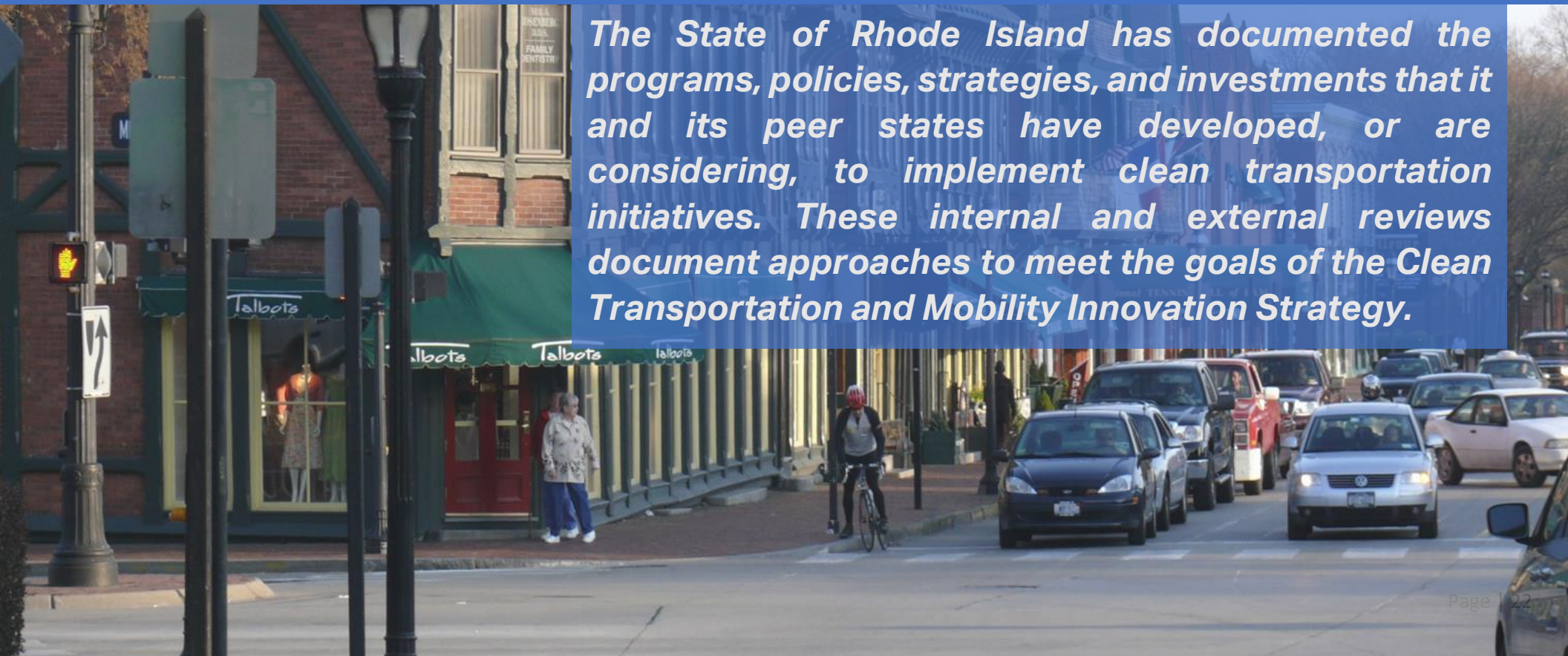
Climate change is a clear and present threat to the lives and well-being of Rhode Islanders. Compounding this challenge is the unprecedented disruption of the COVID-19 pandemic discussed in this report's Introduction. Fortunately, Rhode Island has several strategic advantages in seizing the opportunity to rebuild its system stronger post pandemic, taking action to mitigate the cause of climate change and preparing for the hazards expected to emerge over the coming decades. Creativity, innovation, and an enduring commitment to the state's vision for a cleaner transportation system are all necessary in order to meet the challenges of a changing climate.

Section 2

Rhode Island Clean Transportation and Mobility Audit and Peer State Inventory



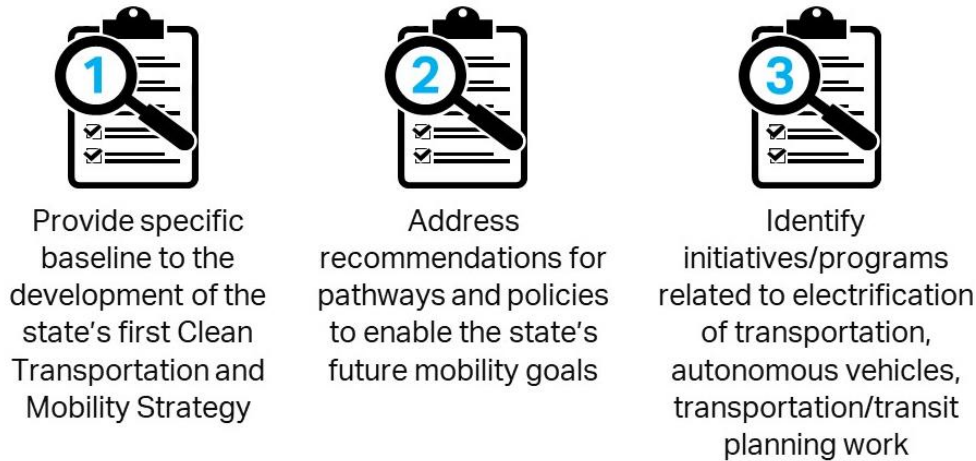
The State of Rhode Island has documented the programs, policies, strategies, and investments that it and its peer states have developed, or are considering, to implement clean transportation initiatives. These internal and external reviews document approaches to meet the goals of the Clean Transportation and Mobility Innovation Strategy.



RHODE ISLAND CLEAN TRANSPORTATION AND MOBILITY AUDIT

Over the past five years, Rhode Island has engaged in numerous initiatives to promote clean transportation and improve mobility. In an effort to better understand the full implications of prior initiatives, the state established three goals for its *Clean Transportation and Mobility Audit* (“The Audit”), shown in Figure 17.

Figure 17. Objectives of The Audit



The Audit was an essential first step in developing recommendations to meet the state's mobility goals and establishes the baseline for the state's pursuit of its ambitious environmental, clean transportation, and equity vision. The Audit demonstrated that the state has a firm foundation in developing a systemwide, multimodal approach to transforming its transportation system and reducing environmental impact. This vision is supported through programs, incentives, pilot projects and grants, handbooks, proceedings, tax policies, and education and outreach. These efforts, when combined with the inventory of peer states' related initiatives (described further below), provide the foundation for The Strategy.

FACTS AND NUMBERS

There is considerable need for investment in more affordable and cleaner energy in Rhode Island, and the state has been making progress in meeting this need over the past several years. Given the fact that transportation accounts for

approximately **36%** of statewide greenhouse gas emissions, these investments are critical to improving access to clean, reliable energy for all Rhode Island residents.

The following statistics provide a snapshot of the current clean transportation landscape:

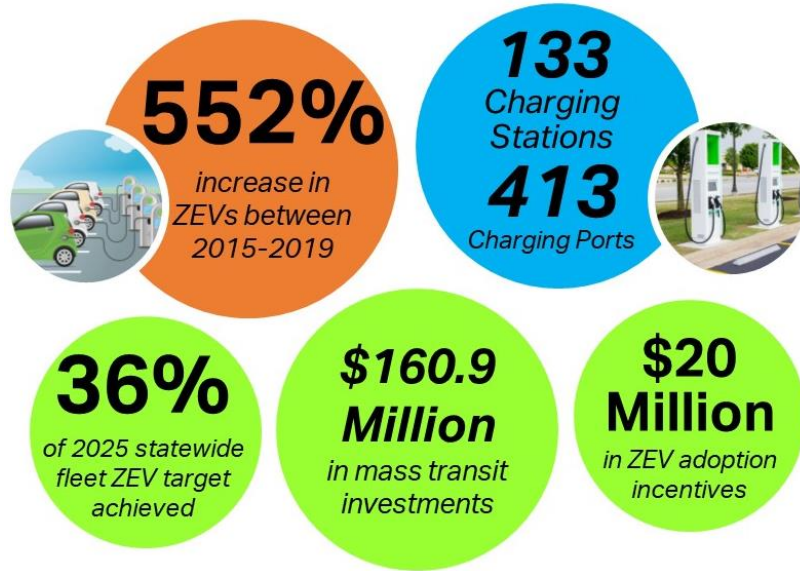
- As of June 30, 2020, there were **3,078 Zero-Emissions Vehicles (ZEVs)** registered in the state.
- ZEVs have increased 552% from 2015 to June 30, 2020. ZEVs account for 0.44% of the light-duty vehicles in Rhode Island, and there are 2.9 ZEVs per 1,000 Rhode Islanders in the state. As of December 2020, there are 133 Public Charging Stations and 413 Charging Ports statewide.
- Rhode Island has invested approximately **\$20 million in incentives** to lower the cost of ZEV Adoption:
 - \$575,000 (2016-2017) ZEV Rebate Purchase Program;
 - \$6 million in ratepayer funding and \$1.4 million from the VW Settlement (see explanation below for more detail) to support ZEV charging station deployment;
 - \$725,000 in incentives for state and municipal agencies for fleet electrification; and
 - \$10.7 million for all-electric zero emission transit buses.
- The Rhode Island portion of the 3.3 million vehicles goal set by the regional ZEV memorandum of understanding (MOU) is up to **43,000 by 2025**.
- In order to support up to 43,000 plug-in electric vehicles, Rhode Island will need up to an estimated **1,008** workplace Level 2 charging ports, **628** public Level 2 charging ports, and **86** public DC Fast Charging ports.^{xxxiv}
- Executive Order 15-17 *Lead by Example in Energy Efficiency and Clean Energy* has enabled ZEV fleet adoption in Rhode Island. To comply with the Executive Order, at least **120 state fleet** vehicles will need to be purchased by **2025**. As of December 2020, there are **43 ZEVs** in the state fleet.
- Mass transit projects are being pursued to address clean transportation and mobility and reduce congestion by providing an alternative to single rider automobiles and, in turn, reducing emissions. RIPTA's 2020 budget of **\$123**

million in operating expenses and **\$57.9 million** in capital expenses supported essential energy-efficient mobility services to Rhode Islanders.

- Rhode Island invested **\$1.225 million** in its public transportation autonomous vehicle pilot project Little Roady and was one of the first states to pilot such a program.
- The state has invested **\$1.9 million** in diesel reduction projects that are environmentally and economically beneficial.

These investments and outcomes indicate the commitment that the State of Rhode Island has shown in creating a more equitable, cleaner transportation system (Figure 18).

Figure 18. Audit Key Data Findings



REVIEW OF INITIATIVES AND PROGRAMS BY STATE AGENCY

This section provides an overview of some of the roles, responsibilities, and ongoing efforts of Rhode Island agencies in the pursuit of clean transportation and mobility options. The findings discussed below are based on a survey of the following state agencies conducted in 2020: Department of Environmental Management (DEM), Department of Transportation (RIDOT), Division of Statewide Planning (DSP),

Division of Public Utilities and Carriers (DPUC), Office of Energy Resources (OER), and the Rhode Island Public Transit Authority (RIPTA).

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (DEM)

DEM serves as the chief steward of the state's natural resources. Its mission is to protect, restore, and promote the state's environment. DEM contributes to a more equitable, cleaner transportation system through the following activities:

- Enforcement of the Low Emissions Vehicle Regulation Program and ZEV Mandate;
- Tracking ZEV adoption in the state; and
- Providing funding for clean transportation initiatives.

In 2004, Rhode Island adopted the California Air Research Board's (CARB's) low- and zero-emissions vehicle standards. Those standards require manufacturers to meet fleet average emission standards and that a certain portion of vehicle sales be made up of ZEVs. This mandate requires car manufacturers selling in Rhode Island to meet certain fleet averages in the number of low- and zero-emission vehicles.

Additionally, DEM provides funding and grants for clean transportation initiatives, including allocating money from the VW Settlement (totaling over \$14 million). DEM allocated most of the VW Settlement funding to invest in all-electric RIPTA buses. DEM is helping prepare the state to implement the TCI-P, a groundbreaking multi-jurisdictional program that puts a brake on transportation pollution while accelerating investment and innovation in cleaner transportation and healthier communities for all. TCI-P is described in greater detail in the Introduction of this report.

DEPARTMENT OF TRANSPORTATION (RIDOT)

RIDOT designs, constructs, and maintains the state's surface transportation system, including roads, bridges, rail stations, the tolling program, bicycle paths, and ferry service. It is responsible for the state's surface transportation infrastructure, including 1,100 miles of roadway, 1,178 bridges, and five rail stations.

In 2016, with the passage of the sweeping RhodeWorks legislation, RIDOT underwent a complete restructuring as mandated by the legislation. As a result, RIDOT developed the first ever 10-year transportation plan for the state and has adopted unprecedented accountability measures. The \$5 billion plan aims to bring Rhode Island's infrastructure into a state of good repair and enhance travel options by the year 2025. This multimodal plan includes projects that support biking, walking, transit, and other efforts that expand environmentally friendly travel options.

In keeping pace with cutting edge and clean transportation technologies, RIDOT initiated the Little Roady Pilot Project— an electric autonomous shuttle operating in an overburdened and underserved part of Providence. Since it began operation in May of 2019, Little Roady has provided over 40,000 trips. Electric autonomous shuttles like Little Roady will play a critical role in transit systems of the future, providing low- and no-emissions first- and last-mile connections.

To expand transit options in Rhode Island, RIDOT also established a ferry connection between Newport and Providence. During its first year of operation (2016), 33,000 trips were taken, and by 2019 had increased 40% to over 46,000 trips per year.

DIVISION OF STATEWIDE PLANNING (DSP)

DSP promotes and encourages best practices for the balanced growth and development of the state of Rhode Island. It is the state's only Metropolitan Planning Organization (MPO) and Regional Planning Agency (RPA). Rhode Island is one of only two states served by a single RPA (the other being Hawaii) and the only state served by a single MPO, which provides tremendous opportunity for comprehensive and coordinated statewide transportation and land use planning. Under these roles, DSP is responsible for the production of planning documents that guide Rhode Island's long-term vision for the transportation sector. All recent iterations of these documents highlight the growing need to plan for the long-term transformation of Rhode Island's transportation system.

Significant projects related to mobility and clean transportation are included in the suite of plans under the umbrella of *Rhode Island Moving Forward: Transportation for the Next 20 Years*. These include the *Long-Range Transportation Plan* (LRTP),

the *Bicycle Mobility Plan*, and the *Transit Master Plan*. Together, these plans form the foundation for the multimodal 20-year vision for the state.

The *Congestion Management Plan* (CMP) is also an important planning document that supports mobility goals of connecting people and places, reinventing the transportation network, strengthening communities, promoting environmental sustainability, and supporting economic growth. The CMP is coordinated with existing statewide plans including the LRTP, RIDOT's 10-year transportation plan, modal plans, and major corridor plans.

DIVISION OF PUBLIC UTILITIES AND CARRIERS (DPUC)

DPUC is responsible for the laws and regulations relating to public utilities and carriers. The DPUC played a pivotal role in establishing the National Grid Electric Transportation and Charging Programs, which includes support for the following:

- **Charging Station Demonstration Program** – Provides site hosts of Level 2 and DC Fast Charging stations with make-ready work necessary to host charging stations. Charging station locations include, but are not limited to, workplaces, apartment buildings and public transit stations.
- **Distribution Demand Discount Pilot for DC Fast Charging Stations** – Provides limited-time discounted electric bills for new or existing customers with DC Fast Charging stations using the general commercial electric rate (classified as G-02) or large commercial and industrial rate (classified as G-32). Twenty-five percent of the stations receiving the discount are stations that enable public transit.
- **Fleet Advisory Services** – Provides advice, through internal and third-party expertise, to operators of Rhode Island-based fleets interested in electrifying their fleets.
- **Off-Peak Charging Rebate Pilot** – Rewards customers for charging their ZEVs during off-peak hours in order to study customer charging patterns and understand customer responsiveness to time-differentiated price signals.

DPUC also regulates transportation network companies (e.g., Lyft, Uber) and establishes safety and other regulations for these operators. Although use of these services has been impacted by the COVID-19 pandemic, these providers are expected to continue playing a substantial role in the transportation system into the future and should be included in conversations around fleet electrification and equity of access.

OFFICE OF ENERGY RESOURCES (OER)

The mission of OER is to lead the state toward a clean, affordable, reliable, and equitable energy future. OER develops policies and programs that respond to the state's evolving energy needs, while advancing environmental sustainability, energy security, and a vibrant clean energy economy. OER is committed to working with public- and private-sector stakeholders to ensure that all Rhode Islanders have access to cost-effective, resilient, and sustainable energy solutions. OER is responsible for key clean transportation initiatives including:

- **The Drive EV Rebate Program** – This program, which was active from January 2016 through July 2017, provided rebates for electric vehicles and supported the purchase of 254 electric vehicles in the state.
- **Charge Up! Program** – This program, which was active from July 2016 through October 2019, offered incentives to state agencies and municipalities to install electric vehicle charging stations and purchase electric vehicles. 50 charging stations were installed, and 8 electric vehicles were purchased through the program.
- **Electrify Rhode Island** – This program, launched in October 2019, incentivizes the installation of charging stations at workplaces, multi-unit dwellings, state and local government properties, and publicly accessible locations.

The Electrify RI Program was funded with VW funding while the DRIVE EV Rebate Program and the Charge UP! Program were funded through other sources.

RHODE ISLAND PUBLIC TRANSIT AUTHORITY (RIPTA)

RIPTA plays a crucial role in meeting the state's transportation needs and climate goals. In 2019, RIPTA published their *Sustainable Fleet Transition Plan* to support their decision-making process around alternative fuel sources. Based on the plan's recommendations, RIPTA is actively working to electrify their fleet and has been awarded more than \$6 million in grant funding from the Federal Transit Administration (FTA) for the purchase of 17 electric buses.

Additionally, through a partnership with the Rhode Island-based firm eNow and Rhode Island Commerce's Renewable Energy Fund, RIPTA buses are outfitted with roof-mounted solar panels to optimize battery life performance. As a result, buses start more reliably and put less strain on the alternator throughout the day.

To make transit more accessible for low income customers, RIPTA has introduced fare capping through its smart card system, The Wave. Fare capping works as follows:

- All riders paying single ride fares for trips will max out the total cost at daily and monthly pass rates.
- On a daily basis, at 2020 fare levels, riders pay \$2 per trip until they spend \$6, the cost of a daily pass. For the rest of the day, all subsequent rides are free.
- Daily expenditures also roll up to monthly pass costs. At 2020 fare levels, after spending \$6 per day for 11 days and \$4 on the 12th day (\$70 total, the cost of a monthly pass), all subsequent trips for the rest of the month are free. This system also applies to riders who use discount fares.

Shifting people from personal vehicles onto transit is an important means of reducing greenhouse gas emissions, and RIPTA is pursuing multiple efforts to increase ridership, including: undertaking a Comprehensive Operational Analysis to optimize routes and improve bus stops; implementing Transit Signal Priority, which allows for smoother bus operations through congested corridors; providing real time arrival information on its website and mobile app; and adding high-capacity bus service through downtown Providence, including along the state's first dedicated bus lanes.

LEAD BY EXAMPLE

Under Governor Raimondo's *Lead by Example in Energy Efficiency and Clean Energy* Executive Order, state agencies have undertaken multiple clean transportation initiatives to pave the way for other businesses, institutions, and jurisdictions to follow suit. These include:

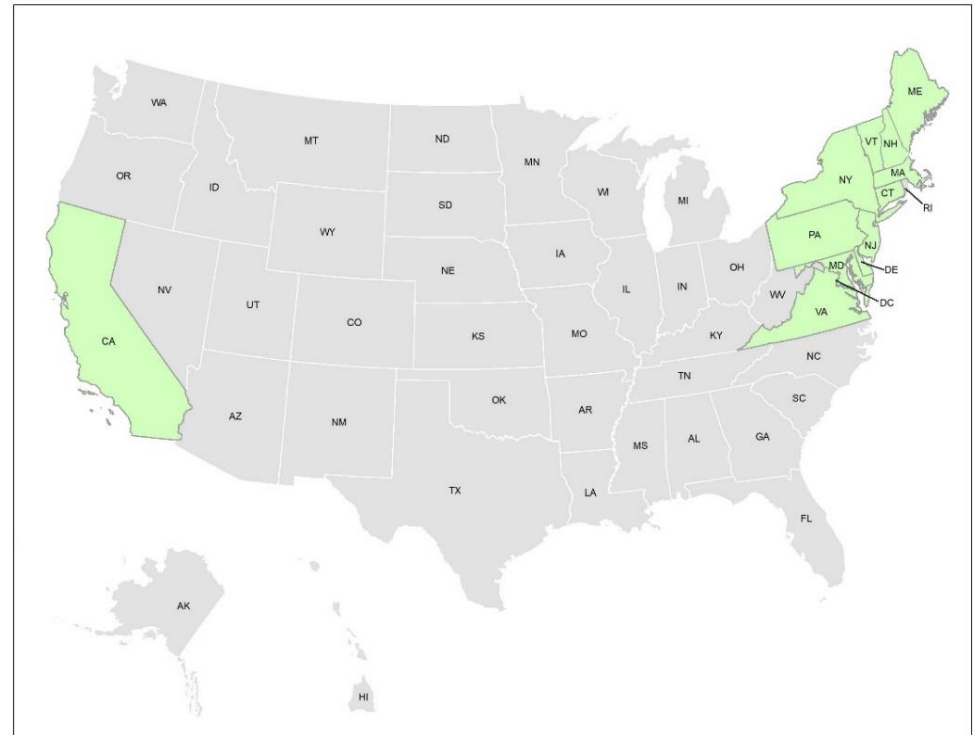
- DPUC has installed two dual electric vehicle supply equipment (EVSE) charging stations at their headquarters in Warwick, RI.
- DPUC also constructed a Solar Canopy Project over their headquarters' parking lot, offsetting approximately 40% of the building's electric consumption. Additionally, their solar carport consists of four dual ChargePoint CT4000 charging stations with ports to charge eight electric vehicles at once.
- OER procured 43 ZEVs for the state fleet, with a plan to purchase 120 ZEVs by 2025.

This Executive Order continues to provide high-level guidance for Rhode Island agencies as they replace their vehicle fleets and make new physical plant investments.

PEER STATE INVENTORY

To better guide Rhode Island's mobility innovation goals, the Working Group undertook a *Peer State Inventory*, which reviewed peer states' practices and identified more than 70 specific investments, 30 programs, 10 independent and supporting plans, and multiple legislative actions. These practices were put into three categories: Innovation, economic development and job creation, and equity. Peer states included those participating in the Transportation and Climate Initiative, as well as California (Figure 19). This work identified benchmarks for Rhode Island to measure its own progress, as well as new ideas for meeting clean transportation goals. The inventory addressed programs or policies initiated through executive order, legislative action, or state agencies (i.e. transportation, energy, environmental management), and is shown in Table 2.

Figure 19. States Included in Peer State Inventory



SUMMARY OF PEER STATES' POLICIES, PROGRAMS, REGULATIONS AND INITIATIVES

Table 2. Summary of Peer States' Clean Transportation Initiatives

Innovation	Economic Development and Job Creation	Equity
Vermont – The Better Connections (BC) Program ^{xxxv} awards approximately \$200,000 annually for projects that increase transportation options, build resilience, and strengthen economic vitality in Vermont's community centers.	Connecticut – Charge Up CT Buildings ^{xxxvi} provided free electric vehicle charging stations to commercial property owners that used the Connecticut Green Bank C-Pace program to finance energy efficiency improvements to their building.	Vermont – The Vermont Statewide Vehicle Incentive ^{xxxvii} authorizes \$2,000,000 to support two incentive programs for the purchase or lease of new and used high-efficiency vehicles targeting low-income Vermonters.
New Hampshire – The Residential EV Charging Station Incentive ^{xxxviii} is a New Hampshire Electric Cooperative program which provides rebates for the residential installation of EVSE. The rebate value is up to \$300 and the EVSE must be metered separately.	Maine – The Moving Maine Network ^{xxxix} is a multi-sector, statewide collaborative that works to improve access to transportation for all, with a special focus on people with disabilities who experience mobility barriers.	California – The California Clean Mobility Voucher Program ^{xl} is a statewide initiative to support ZEV car sharing, ride-sharing, and other innovative initiatives for low-income communities. The total program is valued at \$20.82 million and includes set asides for tribal authorities and needs assessments.
California – In California, several utility providers have committed to investing \$1 billion over the coming years into grid infrastructure. ^{xli} These improvements will be funded through increased ratepayer fees.	Virginia – The Virginia Telework Tax Credit ^{xlii} allowed Virginia businesses to receive up to \$50,000 in tax credits for telework-related expenses. This tax credit worked to reduce total vehicle miles traveled by encouraging employers to allow employees to work from home.	Pennsylvania – The Pennsylvania Active Transportation Plan ^{xliii} focuses on the role of active transportation providing support to lower income residents who rely on bicycle and pedestrian infrastructure as necessary parts of their transportation system.
Connecticut – The Eversource Electric Vehicle Rate Program ^{xliv} offers more favorable rates to commercial property owners who install publicly accessible charging infrastructure.		New Jersey – Executive Order No. 7 ^{xlv} requires that funds from RGGI be directed to projects that benefit communities that are disproportionately impacted by environmental degradation and climate change.
Delaware – The Get a Job/Get a Ride Program ^{xlvi} provides a free 30-day bus pass to recently hired employees of partner businesses. The program aims to ensure that people can get to work and possibly expand the number of people using transit.		Connecticut – The Connecticut General Assembly passed Public Act 19-71 ^{xlvii} which established a goal of electrifying 30% of the state's heavy-duty fleet purchases (including buses) by 2030. The goal is to improve air quality for communities with high levels of transportation pollution.

KEY TAKEAWAYS

Both the *Clean Transportation and Mobility Audit* and the *Peer State Inventory* demonstrate that there is a strong commitment within Rhode Island and in peer states to improve the way our transportation systems work for people and the environment. The programs, initiatives, and investments identified in the audit and benchmarking exercise are actively working to expand transportation options and, importantly, expand clean and equitable transportation access for all residents.

INNOVATION

The Audit showed that Rhode Island has made a powerful commitment to innovation through interstate agreements and home-grown initiatives that provide national leadership on new mobility solutions. Examples include:

- **Regional Agreements** – Rhode Island has signed onto the Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding (MOU). This MOU focuses on transitioning larger vehicles, such as pickup trucks, box trucks, school buses, and long-haul delivery trucks, to electric vehicles. The goal is to ensure that 100 percent of all new truck and bus sales are ZEV by 2050, with an interim target of 30 percent by 2030.
- **State Vehicle Fleet Transition** – The *Lead by Example in Energy Efficiency and Clean Energy* Executive Order requires the state to purchase at least 120 new zero-emission fleet vehicles by 2025. Rhode Island is 36% of the way there at 43 ZEVs currently in the state fleet, with five years left to add the remaining 77 ZEVs.

Other examples of innovation undertaken by specific state agencies are included above, such as the autonomous electric shuttle pilot “Little Rody.” As past sources of funding that supported these efforts are spent down, new resources will be necessary to continue progress into the future.

ECONOMIC DEVELOPMENT AND JOB CREATION

Engagement of the business community and opportunities for job creation are key focuses of Rhode Island’s state agencies according to the Audit. Investments in vehicle electrification hold great opportunity for new private sector jobs.

Creating jobs in clean transportation builds on impressive job growth in Rhode Island’s clean energy sector. As of the 4th quarter of 2019 there were more than 16,000 jobs in clean energy in the Ocean State, an increase of 77.3% since 2014. New investments in clean transportation infrastructure and technology will expand upon this success, such as charging station installation, electric grid upgrades, and construction projects. This is in addition to the potential for expanding the number of people working in public transportation, which already employs over 800 people at RIPTA as of fiscal year 2019.

EQUITY

The Audit found that equity and environmental justice are core concerns across State of Rhode Island agencies. As the Audit showed, transportation is the top energy cost for Rhode Island families (40% of household energy expenditures on average) and the state is hoping to not only create a cleaner transportation system, but also one that is less financially burdensome to its 125,000 residents living in poverty^{xlviii}. The two goals – equity and environment – must be pursued hand in hand in order to realize a truly sustainable future.

There are several examples of how equity is ingrained in Rhode Island processes:

- **Equity Partnership** – DEM signed an MOU with the Racial and Environmental Justice Coalition to establish a partnership to advise on equity issues.
- **Bicycle Planning** – The recently published *Bicycle Mobility Plan* promotes equity by prioritizing public engagement and investing in new facilities in traditionally overburdened and underserved communities.
- **Human Service Transportation Planning** – RIPTA established a Human Service Coordinating Council and hired a dedicated human services planner to support vulnerable populations in accessing transportation solutions and other support services.

- **Transit Fare Policy** – Recognizing the substantial up-front cost of a monthly pass, RIPTA implemented the new Wave fare system, as described above.

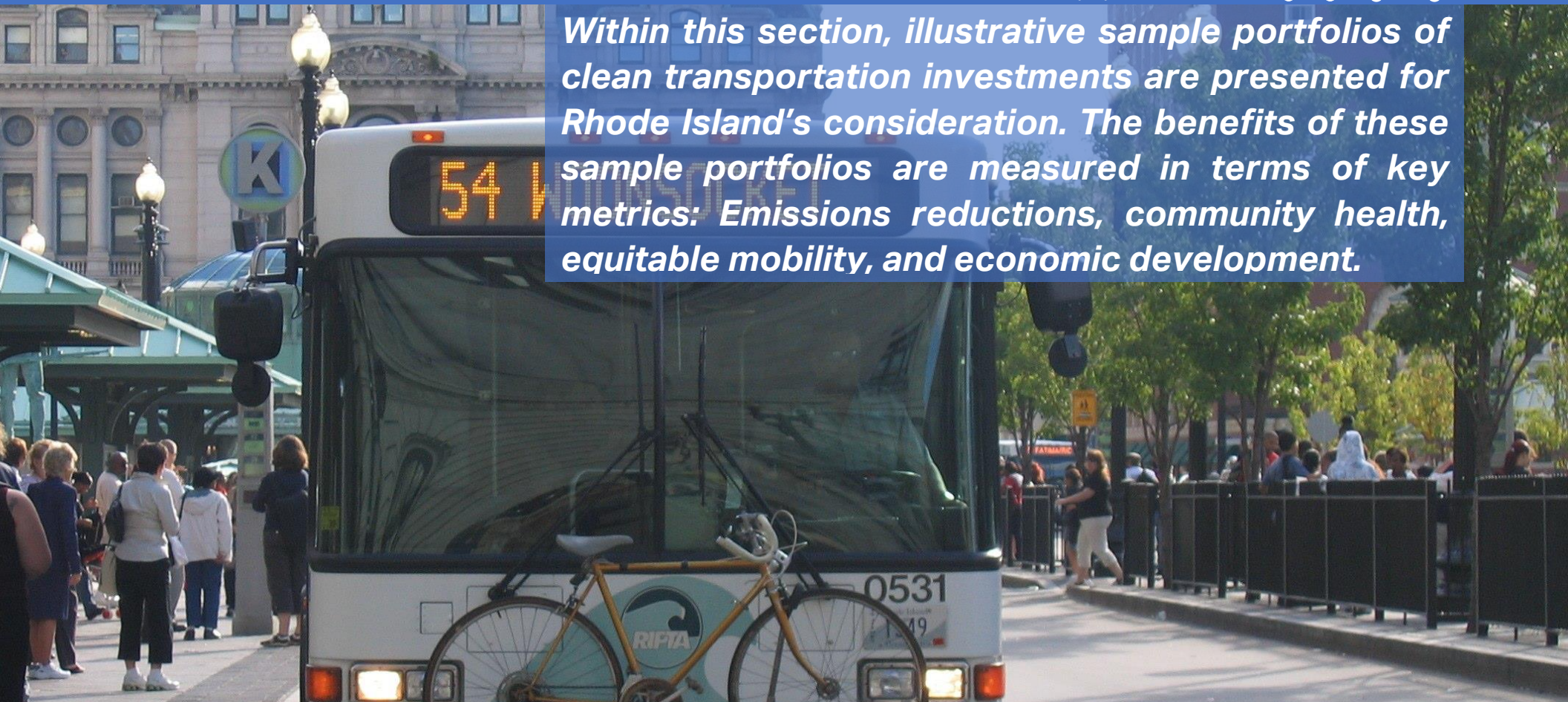
The above initiatives are a sample of the various efforts that have been undertaken or are ongoing to create a more just and equitable transportation system in Rhode Island.

Section 3

Illustrative Investment Portfolios Analysis



Within this section, illustrative sample portfolios of clean transportation investments are presented for Rhode Island's consideration. The benefits of these sample portfolios are measured in terms of key metrics: Emissions reductions, community health, equitable mobility, and economic development.



CLEAN TRANSPORTATION INVESTMENT PORTFOLIOS

As documented by the *Rhode Island Clean Transportation and Mobility Audit*, Rhode Island has numerous programs and policies in place supporting clean and innovative mobility. The Strategy will position Rhode Island to achieve aggressive targets for GHG reductions while improving mobility, improving health, and creating jobs for all communities in the state. The clean transportation investment portfolios presented in this section illustrate the additional benefits the state could achieve by investing further in various forms of innovative and equitable mobility.

METHODOLOGY FOR CREATING INVESTMENT PORTFOLIOS

To show the range of benefits that Rhode Island might achieve, three illustrative portfolios were created (presented in greater detail later in this Section). Each portfolio represents a mix of investments across a maximum of 18 different strategies. Table 3 shows the strategies included in the sample portfolios. They are divided into four broad categories:

1. Electrification and alternative fuels;
2. Vehicle travel reduction;
3. Transit and rail; and
4. Traffic efficiency.

Clean transportation options considered include electric cars, trucks, and buses; shared ride incentives; expanded public transportation through traditional fixed route service, as well as microtransit; and micromobility options such as electric bicycles and scooters. Different types of investments will yield different benefits and deciding on the investment strategy requires careful consideration of those tradeoffs. Some investments will mainly reduce emissions, while others will primarily improve mobility and access. An investment portfolio weighted towards electrification, for example, will result in different benefits than a portfolio weighted towards transit and shared mobility.

Table 3. Strategies Considered in Portfolios by Category

Electrification and Alternative Fuels	
Light-duty electric vehicles	Consumer incentives to purchase electric vehicles, direct purchase for public fleets, development of public charging infrastructure, and grid improvements.
Electric transit buses	Direct purchase of public agency electric transit buses and/or charging infrastructure.
Electric school buses	Direct purchase or reimbursements to school districts to purchase electric school buses and/or charging infrastructure.
Electric trucks	Incentives for medium-duty truck fleet operators to purchase new battery-electric trucks and/or charging infrastructure; direct purchase for public fleets.
Hydrogen trucks	Investment in hydrogen refueling infrastructure; incentives for purchase of hydrogen fuel cell trucks.
Vehicle Travel Reduction	
Shared ride incentives	Monetary incentives to encourage travelers to use shared-ride rather than solo-ride options for ride hailing (e.g., Uber) and taxi services.
Micromobility: Shared e-scooters & e-bikes	Subsidies for shared electric scooter and/or electric bicycle programs (capital, operating, user-side subsidies).
Micromobility: E-bike ownership subsidies	Discounts or rebates for purchase of an electric bicycle.
Land use/smart growth	Investments, incentives, and technical assistance to encourage infill, compact development, and transit-oriented development.
Bicycle investment	Investment in bicycle infrastructure.
Pedestrian investment	Investment in pedestrian infrastructure.
Travel demand & mobility management	Education, outreach, and incentive programs to encourage alternatives to automobile travel.

Transit and Rail

Bus rapid transit (BRT)	Construction and operation of new BRT services using mainly exclusive lanes and dedicated stations.
Commuter/intercity rail	Construction and operation of new and/or enhanced commuter or intercity passenger rail services.
Bus service: Expansion	Additional vehicle trips focusing on increasing frequency or time-of-day coverage on existing routes.
Bus service: Efficiency	Operational improvements that reduce run times and emissions, such as transit signal priority and queue jump lanes.
Electric microtransit	Subsidies or incentives for microtransit (app-enabled, flexible-route services using smaller vehicles than standard buses).

Traffic Efficiency

Traffic operations	Traffic management strategies, such as traffic signal coordination, to smooth traffic flow.
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The strategies listed in Table 3 were selected using the following process:

- The first step was selecting a list of actions from a universe of GHG reduction strategies identified from national studies and best practices in other states.
- The list was refined based on input from the Mobility Innovation Working Group, as well as comments received during the public comment hearing.
- These strategies were then bundled into logical “portfolios” based on related themes.
- A preliminary analysis of benefits vs. costs was conducted for each portfolio.
- Based on feedback from the Working Group, the final set of three portfolios was created and benefits were evaluated.

The metrics used to evaluate the portfolios are shown in Table 4.

Table 4. Portfolio Evaluation Metrics

Metric	Description/Rationale
Greenhouse gas emissions	Supports the state’s clean energy and climate protection goals.
Fine particulate matter (PM _{2.5}) emissions reduction	PM _{2.5} is the pollutant from vehicle exhaust with the most serious health effects.
New non-single occupancy vehicle (SOV) trips	Represents benefits to mobility for people without access to cars or to improve mobility while reducing emissions.
Value of health benefits	Includes monetary value of benefits of air pollution reduction, increased physical activity, and traffic safety, considering the value of premature deaths prevented.
Jobs created	A measure of economic benefit to Rhode Island’s communities.

INVESTMENT STRATEGY TOOL

The sample portfolios of clean mobility strategies were evaluated using the Investment Strategy Tool (“The Tool”) created specifically to estimate impacts from TCI-P investments in clean transportation.^{xlix} The Tool was applied to each of the sample portfolios in order to compare the impacts of the various strategies. This Tool translates dollar values of investment strategy into benefits including changes in vehicle-travel, GHG emissions reductions, air pollutant reductions, the value of health benefits, and economic benefits, as listed above.

The Tool incorporates Rhode Island-specific data and was further refined for this assessment. Appendix C contains more information on The Tool and how it was applied for this assessment. The estimates provided by The Tool are general benefits based on modeling and were developed from observed experiences in similar projects elsewhere. The actual benefits realized by Rhode Island will vary based on the specific mix of initiatives and policies in which the state ultimately chooses to invest.

In order to create three illustrative portfolios, outputs from The Tool specific to each strategy were first considered. The Tool illustrates the magnitude of the impact (for example, how many new electric vehicles or shared mobility trips) that could potentially result from a given level of investment. The Tool outputs also illustrate how cost-effective each strategy is expected to be at achieving each of the key metrics. Cost-effectiveness can be measured, for example, in terms of dollars spent per ton of pollutant reduced, per new trip served, or per new job created. Each strategy is rated on a four-level scale (-, +, ++, +++) corresponding to the benefits shown in Table 5.

Table 5. Benefits Key

Benefits Range	GHG tons/\$M	PM2.5 lbs/\$M	New non-SOV trips per \$M	New jobs per \$M	Value of health benefits per \$M
-	<10	<1	<1,000	<1	<\$0.1M
+	10 – 100	1 – 10	1,000 – 50,000	1 – 10	\$0.1 – \$0.25M
++	100 – 1,000	10 – 100	50,000 – 250,000	10 – 20	\$0.25M - \$2.5M
+++	>1,000	>100	>250,000	>20	>\$2.5M

Note: A typical car emits about 4 to 5 tons of GHG per year, so 100 tons is equivalent to taking 20 cars off the road, and 1,000 tons is equivalent to taking 200 cars off the road.

Table 6 shows how the strategies perform on the key metrics. Based on these results, electrification and alternative fuel strategies generally provide the greatest GHG and pollutant emissions benefits, but do not provide significant benefits for mobility. Land use and smart growth incentives also show high cost-effectiveness for reducing GHG emissions. In contrast, single-occupancy vehicle trip reduction and transit investment provide the greatest mobility benefits. Health benefits flow from both approaches (vehicle electrification and SOV-trip reduction) due to reduced air pollution and additional physical activity from biking and walking.

Table 6. Cost-Effectiveness of Clean Transportation Strategies

Strategy	GHG	PM2.5	New non-SOV trips	Jobs	Health benefits
Light duty EVs	+++	+++	-	+	++
Electric transit buses	+++	+++	-	+	+++
Electric school buses	+++	+++	-	+	++
Electric trucks	+++	+++	-	++	++
Hydrogen trucks	+++	+++	-	++	++
Shared ride incentives	+	+	+++	+	+
Micromobility: Shared e-scooters & e-bikes	+	+	++	+	++
Micromobility: E-bike ownership	++	++	+++	+	++
Land use/smart growth	+++	++	-	++	++
Bicycle investment	++	++	+++	++	+++
Pedestrian investment	+	+	+++	++	+++
Travel demand & mobility management	++	++	+++	++	++
Bus rapid transit	+	+	+++	++	+
Commuter/intercity rail	+	+	++	++	+
Bus service: Expansion	+	-	++	+++	+
Bus service: Efficiency	++	+	++	+++	++
Electric microtransit	+	+	+++	++	+
Traffic flow improvements	+++	-	-	+++	-

TRANSPORTATION AND JOB CREATION

Job creation estimates are particularly complex to generate. Transportation investments support job creation in several ways:

- Direct and indirect jobs associated with infrastructure construction or installation of equipment (e.g., EV support equipment), which last for the

duration of the construction period ("indirect" jobs are those created as a result of spending from directly created jobs).

- Direct and indirect jobs associated with ongoing operations, maintenance, and service provision (e.g., transit operators, mobility service providers).
- Jobs created as a result of economic growth from business productivity gains or consumer cost savings that are then spent on non-transportation items, which grow over time as the benefits of investments flow through the economy.

Rhode Island can be expected to realize the greatest jobs benefits if supply chains can be developed to produce and maintain innovative mobility technology in the state (e.g., electric vehicle infrastructure development). Policy choices discussed in Section 4 of this report can help Rhode Island's economy maximally benefit from these new technologies.

Multiple sources were utilized in this analysis to estimate the number of jobs created per million dollars invested in each strategy. This included outputs from economic modeling conducted in support of TCI-P, as well as a review of various literature sources on transportation investment and job creation. The sources reviewed and findings are detailed in Appendix C.

ILLUSTRATIVE INVESTMENT PORTFOLIOS

Strategies were grouped into sample portfolios based on similar themes (e.g., electrification) and prioritized based on their relative efficacy at achieving different benefits. Strategies were not selected and prioritized based simply on their cost-effectiveness on any given metric. Instead, an effort was made to achieve a balance of benefits across each portfolio.

Stakeholder input was also considered when developing the three portfolios. For example, Working Group members suggested that the most effective approach to increase transit ridership in Rhode Island would be to increase the frequency of service on existing routes. Therefore, transit investment was prioritized towards the "Bus service: Expansion" strategy. Working Group members also suggested that, in order for micromobility strategies to achieve the greatest benefits, they

needed to be paired with investment in bicycle and pedestrian infrastructure to ensure that people would feel safe using these services.

Many of these strategies are also consistent with, and support, the state's existing plans. For example, the Rhode Island Division of Statewide Planning has developed a *Bicycle Mobility Plan* and a *Transit Master Plan* that lay out specific strategies and priorities for improving bicycle transportation and transit service. The *Congestion Management Plan* recommends traffic flow improvements on various corridors, as well as additional efforts to reduce travel demand and create more transportation-efficient land use patterns. The state already has electrification goals and programs, which will be further enhanced with the implementation of recommendations from the Working Group.

The potential funding available for each strategy was also considered in relation to the requirements of the strategy. The historic signing of the TCI-P Memorandum of Understanding by Rhode Island (in addition to Connecticut, Massachusetts, and the District of Columbia) provides essential funding to implement the ambitious clean transportation actions outlined in this report (pending passage of enabling legislation). For illustrative purposes, it was assumed that Rhode Island will have access to an average of \$22 million per year in new funding between 2022 and 2032. This level of funding will be necessary to achieve the 20% reduction in GHG emissions from gasoline and diesel fuels in 2032 vs. 2022.

The actual revenue from the TCI-P program can vary depending upon the program details that have yet to be finalized, as well as other economic and technical factors such as the price of oil and overall economic growth. This funding will help to leverage more transformative changes, such as modernizing the electricity grid and supporting local land use planning to reduce the need for vehicle travel.

Table 7 shows approximately how much of each strategy could be funded if 10% of the portfolio (a little over \$2 million per year) were invested in that strategy. These are illustrative numbers and may vary considerably depending upon project-specific costs, and costs and impacts may evolve over time. Details supporting these estimates are provided in Appendix C.

The three sample investment portfolios modeled are described in detail below.

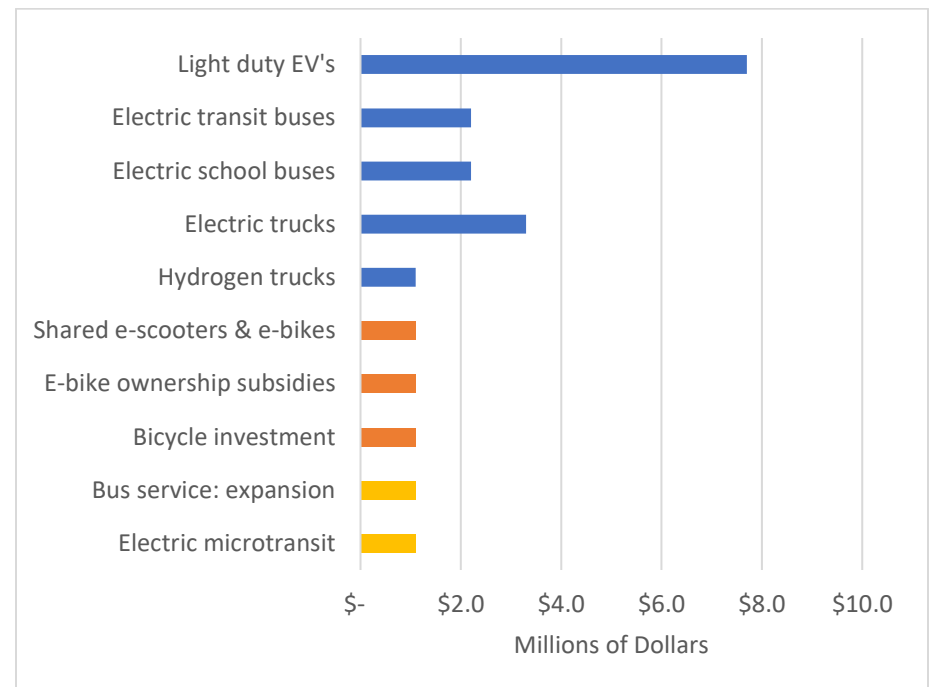
Table 7. Quantity Funded at \$2.2 Million Average Annual Investment per Strategy

Strategy	Quantity Funded	
Light duty EVs*	350	New EVs per year
Electric transit buses	6	New electric transit buses per year
Electric school buses	11	New electric school buses per year
Electric trucks	30	New electric trucks per year
Hydrogen trucks	17	New hydrogen trucks per year
Shared ride incentives	1.3	Million shared ride trips per year
Micromobility – shared e-scooters & e-bikes	900,000	Micromobility trips per year
Micromobility – e-bike ownership	1,100	New e-bikes per year
Land use/smart growth	120	Annual new housing units built in smart growth areas
Bicycle investment	14	New miles of bicycle lanes and paths added per year
Pedestrian investment	3	New miles of complete streets per year
Travel demand & mobility management	3,100	Workers benefiting from \$3/day transit or rideshare subsidy
Bus rapid transit	1-2	Miles of new BRT infrastructure by 2032
Commuter/intercity rail	<1	Miles of new/upgraded rail by 2032
Bus service: Expansion	52	Additional daily revenue-hours of bus service
Bus service: Efficiency	120	Miles of bus routes with efficiency improvements by 2032
Electric microtransit	1,300	New daily trips on microtransit
Traffic flow improvements	120	Miles of roadway covered with intelligent traffic control infrastructure

* Assumes a \$6,300 subsidy per EV per year.

PORTFOLIO 1 – ELECTRIFICATION EMPHASIS

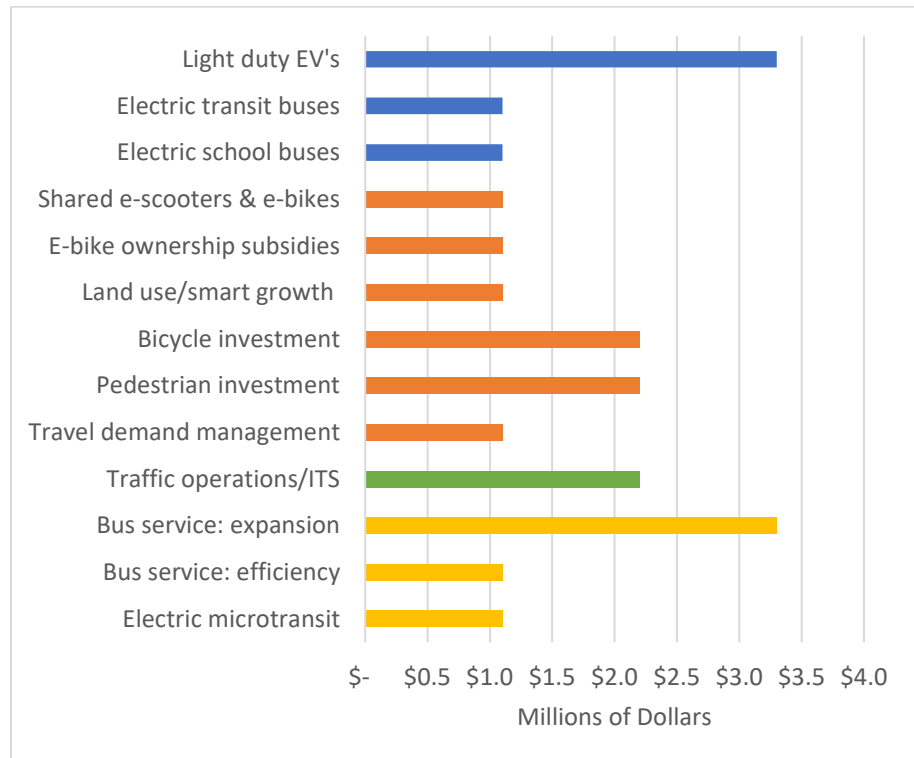
The “Electrification” portfolio places 75% of new investments into electrification and alternative fuel strategies, and 25% into mobility strategies (SOV travel reduction and transit). The mix of investments and average annual funding level is shown in Figure 20. Due to limited funding, only a subset of the travel reduction and transit strategies are included, focusing on micromobility and expanded transit service (including microtransit served by electric vehicles). Each strategy included in this portfolio is funded at a minimum of 5% of the portfolio, or just over \$1 million per year.

Figure 20. Portfolio 1 – Electrification Emphasis

PORTFOLIO 2 – MOBILITY EMPHASIS

The “Mobility” portfolio places 75% of new investment into mobility strategies and 25% into electrification/alternative fuel strategies. The mix of investments and average annual funding level is shown in Figure 21. Funding for electrification focuses on light-duty vehicles and buses, currently the most viable and cost-effective strategies, as the electric truck market is still developing. Mobility strategies are expanded to include land use and travel demand/mobility management, as well as additional bicycle and pedestrian investment. Additional bus services are funded, as well as efficiency improvements to enhance existing services. Finally, traffic operations strategies are funded to reduce emissions by improving traffic flow.

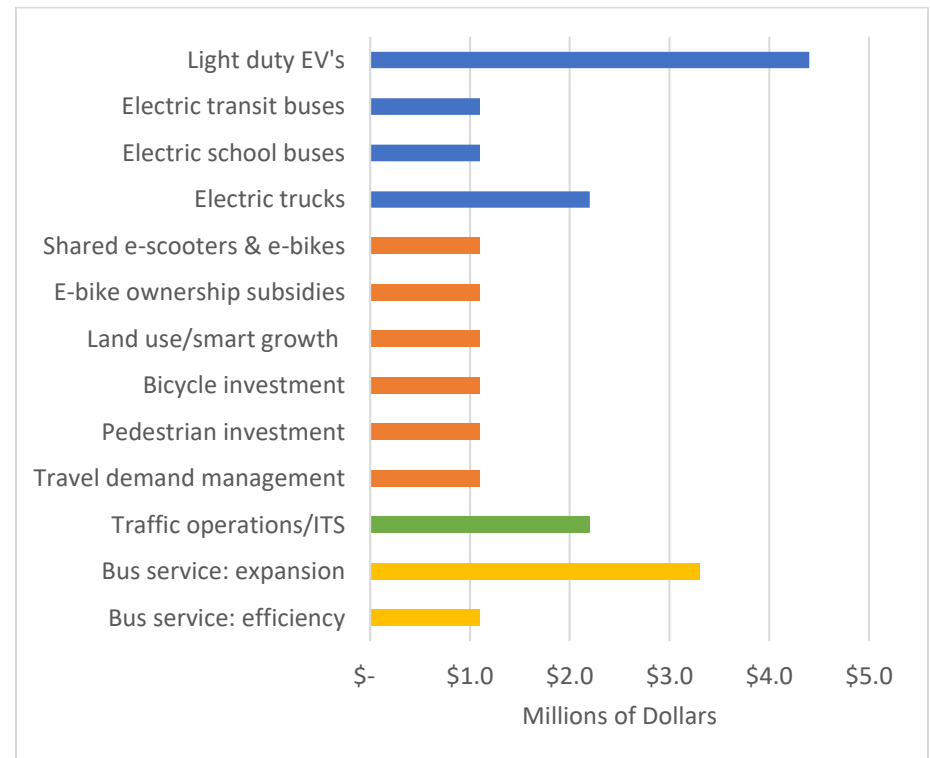
Figure 21. Portfolio 2 – Mobility Emphasis



PORTFOLIO 3 – BLENDED

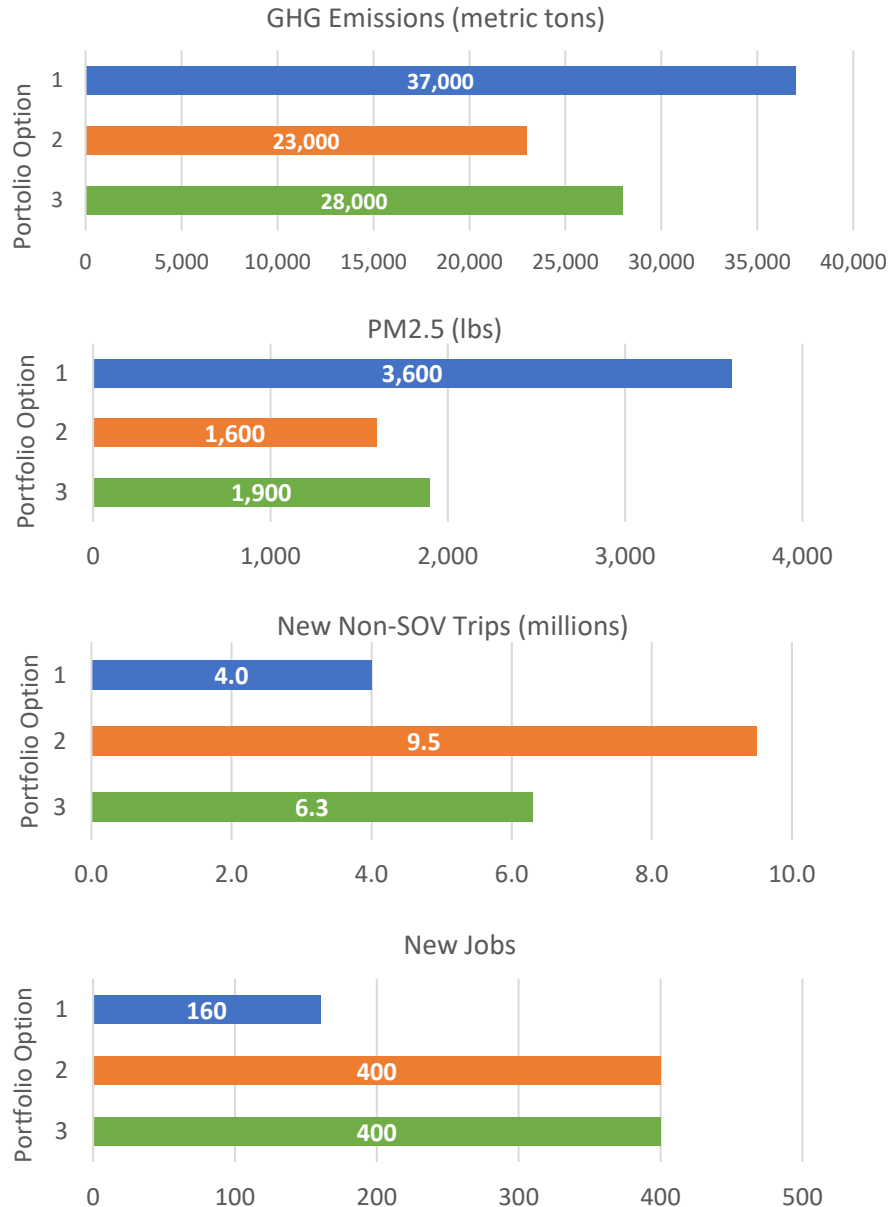
The “Blended” portfolio places 40% of new investment into electrification and alternative fuel strategies, and 60% into mobility strategies including SOV travel reduction, transit, and traffic flow improvements. The mix of investments and average annual funding level is shown in Figure 22. Each included strategy is funded at a minimum of 5% of the portfolio or just over \$1 million per year.

Figure 22. Portfolio 3 – Blended

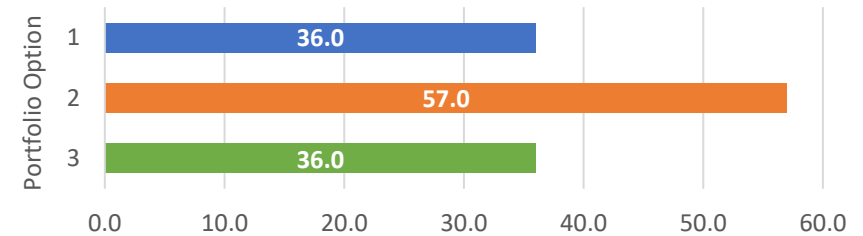


Sample Portfolio Benefits shown in Figure 23 on the following page compare the overall benefits estimated for each portfolio. It shows the annual benefits in the year 2032; benefits will increase to that level over time as investments are made each year.

Figure 23. Benefits of Portfolios to Rhode Island in 2032



Health Benefits (\$M)



CONCLUSIONS

As might be expected from the performance of individual strategies, Portfolio 1 (“Electrification”) would provide the greatest benefits for GHG reduction, as well as air pollution reduction. The air pollution reductions contribute to significant health benefits, while new non-SOV trips created by the mobility investments support additional health benefits through increased physical activity. This portfolio would have a net benefit to job creation, although it has the lowest overall impact on this metric of the three portfolios.

Portfolio 2 (“Mobility”) would have the greatest mobility benefits as measured in terms of new non-SOV trips served. It also shows the greatest health benefits resulting from investment in travel alternatives that support physical activity. Portfolio 2 supports a higher level of job creation than Portfolio 1, though does perform less well on GHG and air quality measures. The relatively good performance on jobs is a result of active transportation infrastructure and transit services creating more jobs per dollar than the average infrastructure investment. Traffic flow improvements would also provide indirect job benefits through more efficient traffic movement resulting in less “on-the-clock” delay for businesses. SOV travel reduction options would also provide job benefits via cost savings to consumers, who can reduce their costs of owning and operating a motor vehicle.

Portfolio 3 (“Blended”) generally shows a level of impact that falls between Portfolios 1 and 2 on each metric, as might be expected given the blended approach. Job creation would be high for this portfolio due to the inclusion of traffic flow improvements that benefit businesses, as well as transit services and vehicle travel reduction resulting in consumer cost savings.

While any of these portfolios would provide significant benefits for Rhode Island, there are tradeoffs between the level of benefits across these metrics and policymakers can utilize these illustrative portfolios as a reference point in their consideration of different investments.

EQUITY CONSIDERATIONS

An overarching goal of The Strategy is promoting equitable outcomes - to ensure that the benefits of investments would accrue to all affected communities, especially those that have been overburdened and underserved in the past. Because efforts focusing on personal vehicles would primarily benefit higher-income households, the portfolio assessment considered equity by ensuring that all the portfolios include investments supporting non-SOV travel and air pollution reductions. The extent to which investments would support equitable outcomes, however, would depend on the specific choices made as those investments are set. For example:

- Electrification of vehicles, especially medium- and heavy-duty vehicles, would do the most to reduce pollution from trucks and buses operating in historically burdened neighborhoods and improve health outcomes.
- Transit investments and service improvements, as well as other mobility investments such as bicycle infrastructure and e-bike incentives, can be directed into communities with high proportions of car-free households. An important consideration is that investments shifting travel mode from SOV to other forms of transportation would have greater GHG benefits, whereas investments serving car-free households would have greater benefits for equitable mobility. This is a tradeoff that needs to be balanced.
- Land use policies such as infill, transit-oriented development, and walkable “smart growth” districts, can be designed with protections against gentrification to ensure that affordable housing is maintained in areas where car-free mobility is an attractive option.

This modeling exercise serves to provide information on outcomes that can be expected from pursuing specific actions towards developing a cleaner transportation system in Rhode Island. The next section outlines those

recommendations and initial action steps developed by the Working Group, and driven by these equity considerations, fiscal constraints, agency goals, and community priorities developed during this deliberative process.

Section 4

Recommendations and Initial Action Steps



This section describes the recommendations and initial action steps needed to transition Rhode Island to a clean and equitable transportation system. These recommendations and action steps are relevant, bold and ambitious and cement Rhode Island's nation-leading status in environmental stewardship and innovative transportation initiatives.



MOBILITY INNOVATION RECOMMENDATIONS AND ACTION STEPS

The recommendations and action steps listed in this section are critical for meeting Rhode Island's effort to aggressively reduce GHG emissions from the transportation sector. These recommendations are meant to be relevant and ambitious nation-leading efforts that will benefit from the collaboration of numerous state agencies, elected officials, private sector partners, and grassroots stakeholders:

RELEVANT: These recommendations are relevant to the most urgent issues of the day, directly addressing the pressing social equity issues that have been exacerbated by the COVID-19 pandemic. As described in Section 1, overburdened and underserved communities located near transportation facilities (e.g. urban highways) have long borne the brunt of transportation-related pollution. To address systemic inequity, Rhode Island commits to devoting no less than 35% of revenues generated by the TCI-P carbon fees to these vulnerable communities, pending the passage of enabling legislation.

These underserved communities have also been disproportionately impacted by the COVID-19 pandemic. As discussed in the Introduction, the pandemic has been a profound and fundamental disruption to transportation patterns. These recommendations consider not only these impacts, but also the fact that, *despite* the pandemic, climate change is still a looming threat driven by transportation emissions.

AMBITIOUS: These recommendations build on the ambitious initiatives already underway to make the state's transportation system cleaner and move the state further towards net zero carbon emissions. Examples of this aggressive pursuit of an ambitious transformation of the transportation system include cutting-edge 21st-century mobility projects such as the automated and fully electric public transportation project, Little Rody, as well as active transportation projects like the comprehensive and connected vision for a statewide "Greenway Network" proposed in the *Bicycle Mobility Plan*.

Rhode Island has committed to a goal of having up to 43,000 ZEVs on its roadways by 2025 and has worked to transition its own state fleet to ZEVs. In recommending that all traditional gasoline-powered vehicle sales be phased out by 2040, the state is continuing its ambitious pursuit of a cleaner transportation system. Even in a

state with a track record for follow-through, exciting challenges remain as the state seeks to attain the scale needed to achieve these important goals.

NATION-LEADING: Rhode Island is nation-leading on climate change mitigation and environmental sustainability. Rhode Island built the country's first (and to date, only) offshore wind farm in 2016, establishing the Ocean State as the national leader in production of offshore wind energy. Following this achievement, the state convened the Mobility Innovation Working Group, a cross-sector group of public and private stakeholders focused on informing a statewide clean transportation and mobility strategy. This collaboration has set a precedent that other states can look to in forming a coalition to tackle climate change and transition to a lower-carbon transportation system.

In December of 2020, Governor Raimondo made history by signing the TCI-P Memorandum of Understanding. In doing so, Rhode Island, along with three other east coast jurisdictions, has committed to implementing aggressive caps in GHG emissions generated from the transportation sector. This participation in the regional collaborative to create a more clean and just transportation system further cements Rhode Island as a national leader.

These relevant, ambitious, and nation-leading recommendations are broken down into the six categories found in Table 8.

Table 8. Recommendations by Category

Recommendations
Create a healthier environment for all Rhode Islanders with specific benefits for residents of our most overburdened and underserved communities.
1. Advocate for legislation directing no less than 35% of TCI-P revenue to benefit overburdened and underserved communities.
2. Establish or designate a community advisory board to engage overburdened communities and provide input on TCI-P investments and clean transportation policy ideas.
3. Promote transparency by publicly sharing programs, policies and investments in clean transportation, including expenditures and/or efforts directed to overburdened communities.
Establish Rhode Island as a national leader in bold transportation and climate commitments.
4. Take steps to implement the Transportation and Climate Initiative Program and to maximize benefits from revenue.
5. Consider setting a transportation GHG reduction goal to substantially reduce GHG emissions in the transportation sector in order to meet the state's climate goals.
Modernize, expand, and invest in state transit and transportation assets to more effectively move people and improve accessibility.
6. Focus on the implementation of <i>Transit Forward RI</i> , the 20-year plan, with priority consideration given to the improvement of accessibility, service frequency and span in urban areas to improve mobility for underserved populations. In addition, expand lifeline service and flexible microtransit in rural parts of the state.
7. Create a forward-looking transit structure by establishing five to seven Next Generation Transit Districts (NGTDs) with rapid, high-capacity, high-interval electrified transit between NGTDs to spur transit-oriented development and establish a framework that allows for innovation, local design, and flexibility.
8. Consider establishing a Task Force to review existing land use statutes, make recommendations for their modernization, and consider inclusion of incentives to enhance transit-oriented development or otherwise promote mobility.
9. Promote active mobility by implementing a new statewide bike and scooter share program with a partial subsidy from private, state, or federal funds to make access to affordable micromobility options more widely available.
10. Enhance the current complete streets program which would result in more walking and biking for short trips (under 3 miles), which constitutes a significant number of VMTs, while also providing opportunities for improved public health.
Improve air quality by taking steps to electrify the transportation sector.
11. Consider establishing a goal that, by 2040, all new cars, light duty trucks, and buses sold in Rhode Island will be electric or technology neutral that meets the same emission standards.
12. Move quickly to create faster and more frequent rail service between Boston and Providence by electrifying the rail system. For a train to arrive every 30 minutes, the rail system will need to be electrified.

Recommendations

13. Develop an EV roadmap that delineates the steps the state must take to materially impact/increase the adoption rate of Zero Emissions Vehicles (including BEV's, PHEV's, Fuel Cell/Hydrogen as well as medium- and heavy-duty vehicles) in Rhode Island for both private and public sectors in the next 10 to 15 years. The roadmap would include a suite of complementary policies to grow consumer awareness and lead by example, including rebates, education and outreach efforts, and state agency fleet electrification requirements.

14. Promote Medium-/Heavy-Duty Zero Emissions Vehicle fleet adoption by promulgating regulations based on the Medium- and Heavy-Duty ZEV MOU signed by Rhode Island in July of 2020.

15. Continue progress on its ambitious public transit bus and school bus electrification plans.

Create a 21st century mobility infrastructure that capitalizes on the emerging changes in transportation technology.

16. Create and/or continue to develop a plan for ubiquitous charging (and/or alternative fuel) infrastructure including EV corridors, along roadways/highways, fast charging, and hydrogen and fuel cell charging. Plans should include public, workplace, and residential locations that are future-proofed in order to be prepared to support goals for increasing future electric vehicle volumes.

17. Create an integrated regulatory strategy in Rhode Island to support the state's clean transportation goals with a framework that will ensure ratepayer benefits, and enable a competitive market and private investment, as well as grid integration.

18. Establish Intelligent Transportation Systems including transportation data sharing across state agencies, increasing Smart City/State technologies, and considering investment in newer Freight ITS technologies.

19. Explore development of a Statewide Mobility Services Program (SMSP) utilizing emerging technologies and practices to incorporate microtransit and micromobility into the development of a statewide mobility services program to expand access to public transit, fill in first-/last-mile gaps, provide lifeline service in rural areas, and offer new options for frequent short trips.

20. Enable and promote a statewide telecommunications infrastructure (5G, Wi-Fi, and their future counterparts) to support the availability of real time transportation data and the deployment of connected and automated vehicles. This infrastructure would allow for the establishment of real time traffic and asset management systems and would promote telecommuting opportunities for businesses and employees.

21. Consider regulatory structures that enable the safe and reliable deployment of connected and autonomous vehicles leveraging the experience of the RIDOT TRIP process and program.

Unlock economic opportunity, promote green job creation and support business and supply chain industries.

22. Establish a Mobility Innovation Transformation Initiative that supports technology and business model innovations in new transportation services. This initiative should facilitate public-private partnerships and financing to support technology and business model innovations in new transportation service.

23. Develop a policy agenda, in partnership with the Department of Labor and Training, focused on workforce development and training opportunities.

24. Develop incentives for individuals and small businesses with light-duty vehicles operating in neighborhoods (plumbers, electricians, delivery, etc.) to convert to ZEVs.

These recommendations are followed by specific initial action steps that will guide their implementation over the coming years.

I. Create a healthier environment for all Rhode Islanders with specific benefits for residents of our most overburdened and underserved communities.

The health of residents in overburdened and underserved communities is disproportionately affected by the pollution stemming from adjacent transportation facilities such as highways. The impacts of this exposure to air pollution are substantial; as described in Section 1, a recent report from the TRECH project estimated that up to 10,000 premature deaths result from air pollution in the northeast region annually. If the technologies and policies driving current climate projections are not addressed immediately, the same people are likely to bear the brunt of bigger challenges to come. Rhode Island needs to assess, prioritize, and invest in informed mobility-related solutions to the many problems affecting vulnerable communities.

Ensuring equitable outcomes for overburdened communities is at the core of all the Working Group's recommendations. A plan that does not consider the historic inequities imposed on people of color, low-income communities, immigrant populations, and other overburdened and underserved groups is an insufficient solution to the daunting environmental challenges that Rhode Island faces. While many of these communities are in urban core areas, there are areas of poverty with extremely limited mobility options throughout the state. As outlined in Section 1, a well-crafted and deliberate climate solutions strategy can begin to amend some of these long-standing inequities.

EQUITY RECOMMENDATIONS

The Working Group has recommended the following recommendations in order to enhance equity in the state.

1. Advocate for legislation directing no less than 35% of TCI-P revenue to benefit overburdened and underserved communities.

With the signing of the TCI-P MOU, Rhode Island joined a shared commitment among the participating jurisdictions to invest at least 35% of proceeds from the auction of carbon allowances into overburdened and underserved communities. In order to fully commit Rhode Island to this aspirational goal, the state will require enabling legislation.

Why is this recommendation important?

- The impacts of climate change, especially extreme heat, are likely to be disproportionately felt in low-income neighborhoods and communities of color.
- The negative impacts of past transportation investments, such as highway building, have disproportionately fallen on low-income neighborhoods and communities of color.
- Targeted investments will ensure targeted benefits to the most overburdened and underserved communities.

2. Establish or designate a community advisory board to engage overburdened and underserved communities and provide input on TCI-P investments and clean transportation policy ideas.

The public is involved in the decision-making process in various ways through traditional transportation funding sources. This includes public comment periods relating to the Transportation Improvement Program, federal Civil Rights requirements for major projects or transit service changes, and the environmental review process for large projects.

However, given the scale and reliability of new investments on the horizon through participation in TCI-P, Rhode Island should establish or designate an advisory board

with representation from community stakeholders to provide guidance on how new funding is invested in clean transportation projects.

Why is this recommendation important?

- Communities that are disproportionately impacted by transportation pollution are often excluded from decision-making processes, which exacerbates historic inequities. Rhode Island should give a formal role to an advisory body, which can advise on the use of proceeds from the TCI-P carbon allowance auctions as the state invests in new clean transportation programs.
- Including community members through formal channels in the decision-making process for new investments legitimizes difficult decisions and builds a constituency and buy-in for the state's clean transportation programs.

3. Promote transparency by publicly sharing programs, policies and investments in clean transportation, including expenditures and/or efforts directed to overburdened and underserved communities.

Sharing information, in a public and accessible way, is an important step towards ensuring that all Rhode Islanders can understand and see the progress towards clean transportation and equitable mobility. It is particularly important that overburdened and underserved communities are aware of the investments and policies directed towards benefitting their communities.

Why is this recommendation important?

- By sharing information on policies and investments, all Rhode Islanders will better understand the direct benefits of clean transportation.
- Promoting transparency is an essential step in establishing more frequent lines of communication between the state and overburdened and underserved communities.

INITIAL EQUITY ACTION STEPS

The Working Group has identified the following action steps to promote a more equitable transportation system in Rhode Island.

- Develop transparent performance measurement standards that allow the state to measure the impact of clean transportation initiatives and policies on overburdened and underserved communities. The state might also consider identifying metrics to measure pollution burden.
- DEM should continue its work to identify high-emitting engines/vehicles and encourage replacement with cleaner vehicles, where possible.
- Develop a functioning toolkit to assist in the implementation of equitable clean transportation programs. Suggestions include public data dashboards and a mobility app to integrate options, including MaaS and last-mile options.
- Consider public-private partnerships aimed at developing a vehicle financing program that expands opportunities for low- and moderate-income Rhode Islanders to finance electric vehicle purchases.
- Consider conducting a “mobility infrastructure audit” within overburdened and underserved communities, in partnership with community leaders. The audit should seek to identify gaps in pedestrian and bicycle infrastructure, including operating streetlights, shaded bus stops and safe sidewalks.

II. Establish Rhode Island as a national leader in bold transportation and climate commitments.

Strategic reduction of carbon emissions generated by the transportation sector is essential to advancing Rhode Island's interests in mitigating the effects of climate change. The approach proposed herein encourages cost-effective emission reductions in the sector while raising revenues to fund new investments, enabling the transformation of the transportation sector.

NATION-LEADING RECOMMENDATIONS

The Working Group developed the following recommendations to continue Rhode Island's national leadership in clean transportation.

4. Take steps to implement the Transportation and Climate Initiative Program and to maximize benefits from revenue.

By signing the regional TCI-P MOU, Rhode Island has made an important step in committing itself to reducing GHG emissions from the transportation sector. The auctioning of carbon emission allowances is estimated to bring over \$20 million per year to the state, providing a sustainable funding source for state transportation policy priorities that support decarbonization, modernization, and equity. Implementation of the programmatic elements of TCI-P should be guided by a data-driven framework that maximizes tangible benefits from new investments.

Why is this recommendation important?

- Decarbonizing the transportation system is a massive undertaking that demands fact-based evaluation of realistic outcomes from different investment options. Implementation of the TCI-P should be guided by the best available data to determine how its revenues should be invested.
- In maximizing benefits from the revenue, Rhode Island is setting a national example of the dividends that can come from investment in clean transportation.

5. Consider setting a transportation GHG reduction goal to substantially reduce GHG emissions in the transportation sector in order to meet the state's climate goals.

The *Resilient Rhode Island Act* of 2014 established statewide targets for reducing GHG emissions, with incremental GHG reduction targets every 15 years. The state should follow up on this landmark piece of legislation with transportation sector-specific goals of GHG reductions as a complement to Rhode Island's participation in TCI-P.

Why is this recommendation important?

- Establishing targets for reducing GHGs from the transportation sector will enable the state to measure the performance of its investments against a stated goal.
- Developing a target would put Rhode Island in line with other states that have established aggressive and binding GHG emissions reduction targets, some of which (including Massachusetts and California) require net-zero carbon emissions by mid-century.

INITIAL NATION-LEADING ACTION STEPS

The Working Group created the following initial action steps to continue Rhode Island's national leadership in clean transportation.

- To implement the TCI-P in 2022, the state should collaboratively work with elected officials to pass enabling legislation during the 2021 legislative session. State leadership and the elected officials should collaboratively work to determine specific expenditures of TCI-P revenue.
- Establish a formalized framework for evaluating investment/policy options: Develop objective and meaningful metrics that promote equitable outcomes and can be used to evaluate future potential clean transportation policy options and track progress. Metrics may include associated GHG emissions reductions, public health impacts, economic impacts and impacts on overburdened and underserved communities.

III. Modernize, expand, and invest in state transit and transportation assets to more effectively move people and improve transit accessibility.

Contributions from the Working Group demonstrate that there is broad support for investing in Rhode Island's transportation assets, including public transit. From ensuring that Rhode Islanders get to work on time to reducing traffic, it is important that the state repair existing transportation infrastructure, expand non-SOV transportation options, and make consistent progress on carbon-free transportation.

While urban core areas are best suited for high-capacity public transportation like bus rapid transit and light rail, residents of suburban and rural areas who cannot drive are often in need of life-critical transportation options. Flexible transportation using new technology would help to not only reduce GHG emissions, but also provide essential transportation services to these residents.

In addition, input from the public encouraged a vision for the state to capitalize on mobility strategies that present unique opportunities, such as a connected and safe statewide bicycle route network and electrified transportation. This report's release is timed closely with the release of Rhode Island's *Long-Range Transportation Plan*, *Bicycle Mobility Plan*, and *Transit Master Plan*. The recommendations and actions found here would be augmented by implementation of those other plans.

TRANSIT RECOMMENDATIONS

The Working Group has developed the following recommendations for ways to encourage non-SOV transportation to reduce GHG emissions.

6. Focus on the implementation of *Transit Forward RI*, the 20-year plan, with priority consideration given to the improvement of accessibility, service frequency and span in urban areas to improve mobility for underserved populations. In addition, expand lifeline service and flexible microtransit in rural parts of the state.

Transit access is a major contributor to improving mobility. Focusing on the improvement of transit fundamentals (service frequency, span of service) helps create a system that is more attractive to more people, which helps transition people away from single-occupancy vehicles.

Why is this recommendation important?

- Investments in transit help create jobs, improve access to jobs, and provide business development in overburdened and underserved communities, especially in urban areas.
- *Transit Forward Rhode Island* recommendations were developed to yield the highest benefits for the state.

- Rhode Islanders living in rural areas without access to a personal vehicle have tremendous difficulty engaging in life-critical trips, such as medical appointments and grocery shopping. This is expected to worsen as people age in place in these transit-poor regions.

7. Create a forward-looking transit structure by establishing five to seven Next Generation Transit Districts (NGTDs) with rapid, high-capacity, high-interval electrified transit between NGTDs to spur transit-oriented development and establish a framework that allows for innovation, local design, and flexibility.

Rhode Island requires maximum flexibility to accommodate the development of new technologies and business models as they emerge. Developments such as connected and autonomous vehicles, app-enabled on-demand transportation services, and new propulsion systems are coming to the market with increasing speed. Establishing specific zones where these new technologies and approaches can be piloted and refined would help to blaze the trail to a lower-carbon transportation system, as well as improving mobility and access for Rhode Island residents.

Why is this recommendation important?

- Transportation technology is changing at a rapid pace, with app-enabled ride hailing services having broad market penetration and micromobility entering new markets around the world. Rhode Island should prepare for new travel patterns and customer demands in the future.
- The COVID-19 pandemic is a profound inflection point in travel behavior, with an unprecedented level of working from home and remote education, and declining public transportation use. New services and approaches are needed to understand mobility needs of the future.
- Due to its size and willingness to innovate, Rhode Island is in a unique position to function as a mobility laboratory that the rest of the country looks to as these new technology and travel patterns are more generally adopted.

8. Consider establishing a Task Force to review existing land use statutes, make recommendations for their modernization, and consider inclusion of incentives to enhance transit-oriented development or otherwise promote mobility.

It has been more than 30 years since Rhode Island last took a comprehensive look at the way in which communities are empowered to regulate land development. It is therefore worthwhile to commission a Task Force to review the zoning and subdivision enabling acts. The Task Force would develop recommendations regarding ways to modernize the acts, incorporate innovative planning techniques, and develop ideas for streamlining and coordinating development processes for communities in Rhode Island. Reforming land use statutes would require the active collaboration of multiple actors, including the Executive Branch, the General Assembly, the Division of Statewide Planning, municipalities, and key stakeholder groups.

Why is this recommendation important?

- Land use is inextricably linked to transportation patterns and, therefore, GHG emissions from the transportation sector. Transit-oriented development and walkable community design both require zoning codes that allow for more compact development.
- Modernizing land use regulations would help remove roadblocks to smart growth through a consensus-driven process.

9. Promote active mobility by implementing a new statewide bicycle and scooter share program with a partial subsidy from private, state, or federal funds to make access to affordable micro-mobility options more widely available.

As the smallest state in the union, Rhode Island has a unique opportunity to use active mobility to fully connect its communities. The state should explore possible opportunities to fund investments outlined in the *Bicycle Mobility Plan*, as well as supporting complete streets investments as identified by municipalities. Active transportation infrastructure investments would support a statewide bicycle- and scooter-share program, which should be implemented in communities of all kinds.

Why is this recommendation important?

- Rhode Island's communities are often disconnected by limited active mobility infrastructure. By investing in safer connections throughout the state, more residents would have the confidence to rely upon active mobility as their main form of transportation with transit service as the mode for longer distance travel.
- Bicycle- and scooter-share programs in other states and jurisdictions (including neighboring Massachusetts) have demonstrated the market demand for shared micromobility. Rhode Island has an opportunity to engage in a public-private partnership with station sponsors, bicycle- and scooter-share companies, and municipalities to make these zero-emissions vehicles broadly available.

10. Enhance the current complete streets program to increase walking and bicycling for short trips (under 3 miles), which constitutes a significant number of VMTs, while also providing opportunities for improved public health.

Over the last several years, the State Transportation Advisory Committee (TAC) has fielded more requests to include local complete streets type projects in the State Transportation Improvement Program than resources would allow. Enhancing the current complete streets program would result in more walking and biking across the state.

Why is this recommendation important?

- Work in Health Equity Zones has shown the dangers of extreme heat, poorly designed streets and intersections, and failing infrastructure. Complete streets policies and planning can help to alleviate some of these harms.
- Urban communities have relatively low levels of car ownership and people in these neighborhoods rely on safe streets for walking to school, shopping, and accessing public transportation.
- This recommendation would complement climate change adaptation measures such as strategic inclusion of shade trees and pervious surfaces.

INITIAL TRANSIT ACTION STEPS

The Working Group has developed the following action steps to promote use of non-SOV modes of travel in Rhode Island.

- Consider the installation of statewide docking stations for electric scooters and bicycles to provide transit riders with access to alternative and/or last-mile transit options.
- Consider public-private partnerships between ride-hailing/micro-mobility companies, local government, and transit operators to address last-mile challenges in public transit.
- Consider options for fare subsidization including expanding programs like the ECO pass and the UPASS where businesses and universities provide free or subsidized passes to ride RIPTA or creating a Commuting Alternatives Program for state employees that includes free or reduced cost RIPTA bus passes or MBTA passes.
- Install bus-on-shoulder lanes along state highways and in high-congestion areas where frequent bus service currently operates.
- Promote the public transportation network program to local businesses and identify programs that encourage public and private sector workforces to utilize public transit.
- Study investments outlined in the statewide *Bicycle Mobility Plan* and consider which investments should be adopted and funded. In addition, the state might consider providing financial incentives for electric bicycles to aid in displacing single-passenger vehicle trips.
- Consider more incentives for carpooling and more disincentives for single-passengers and single-occupant travel to avoid congestion and decrease VMT.
- The Division of Statewide Planning, in conjunction with stakeholders, should complete development of regulations for the Municipal Infrastructure Grant Program, to include transit-oriented development, sustainability/resiliency, and mobility as important factors in the award of future funds.

- Develop state-specific online resources for trip planning and scheduling that would improve access, particularly for overburdened and underserved communities, to all transportation alternatives open to them.

IV. Improve air quality by taking steps to electrify the transportation sector.

With the most ambitious renewable energy goal in the nation, Rhode Island is focused on rapidly increasing its clean energy portfolio. Clean transportation and clean energy efforts must work in parallel to create a better environment for all Rhode Islanders. Rhode Island cannot meet its GHG emissions goals without electrification of passenger vehicles, buses, medium- and heavy-duty vehicles, and state fleet vehicles, and supported by adding charging stations throughout the state. This is clearly demonstrated by the illustrative investment portfolios in Section 3.

Personal behavior can be hard to change, and the move from driving internal-combustion engine cars to ZEVs will be no different. The Working Group heard from Professor Dan Sperling, who wrote in his book *Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future*¹ that fundamental changes in the way of thinking aimed at changing behavior or preference is fundamental to the transportation revolution. The State of Rhode Island will continue to show leadership by converting RIPTA vehicles and the state fleet to ZEVs. Leadership by example can go a long way in encouraging broader private-sector and household adoption of these same technologies. Bold targets for investment, increasing the number of charging stations, and public policies that support vehicle electrification will be critical to success.

ELECTRIFICATION RECOMMENDATIONS

The following recommendations were developed to promote and facilitate electrification of the transportation system.

11. Consider establishing a goal that, by 2040, all new cars, light duty trucks, and buses sold in Rhode Island will be electric or technology neutral that meets the same emission standards.

Addressing the state's Climate goal will require a massive transition of the vehicle fleet (cars, trucks and buses) to ZEV Technology. California and Massachusetts have both set phase-out goals of traditional internal combustion engine vehicles by 2035. Because vehicle fleets turn over slowly (the Energy Information Administration estimated in 2017 that household vehicles are used for 10.5 years on average, and pickup trucks have a life of 13.6 years^{li}), the Working Group recommends adopting a target of selling only ZEVs in Rhode Island by no later than 2040.

Why is this recommendation important?

- The majority of GHG emissions from the surface transportation sector come from personal vehicles.
- Rhode Island can send a signal to vehicle manufacturers that it can depend on a robust market for ZEVs, encouraging these companies to focus sales efforts on the state and, ultimately, increasing economy of scale and efficiency of ZEV production.
- While shifting trips from SOVs into transit and active transportation is an important strategy to reducing overall GHG emissions, it is insufficient on its own to meeting the state's GHG reduction goals. Aggressively incentivizing the state's residents to use ZEVs is essential to reducing GHG emissions.

12. Move quickly to create faster and more frequent rail service between Boston and Providence by electrifying the rail system. For a train to arrive every 30 minutes, the rail system will need to be electrified.

Given the large numbers of commuters in Rhode Island, connecting Providence and Boston with frequent and electrified rail service would make Rhode Island a more

desirable place to live and would simultaneously protect the environment. Amtrak trains run faster than commuter rail trains between Providence and Boston, and so commuter rail fare integration with Amtrak would allow for better access to faster service and more frequent trains for commuters along that corridor.

Why is this recommendation important?

- Providing reliable, fast, and affordable rail service would reduce SOV trips and decrease congestion, consequently reducing GHG emissions along a highly frequented route.
- Developing high-quality travel options could generate economic development opportunities in both cities.
- Improved rail service would create sustainable jobs in both Rhode Island and Massachusetts.
- Electrifying would lead to less speed disparity between Amtrak and MBTA Providence Line trains, and therefore more service.

13. Develop an EV roadmap that delineates the steps the state must take to materially impact/increase the adoption rate of Zero Emissions Vehicles (including BEV's, PHEV's, Fuel Cell/Hydrogen as well as medium- and heavy-duty vehicles) in Rhode Island for both private and public sectors in the next 10 to 15 years. The roadmap would include a suite of complementary policies to grow consumer awareness and lead by example, including rebates, education and outreach efforts, and state agency fleet electrification requirements.

Electrification of the U.S. fleet, powered by clean energy, holds the promise to significantly reduce carbon emissions and enhance the quality of life for all Americans. Action needs to include a public education campaign highlighting benefits of this transition, a clear focus on making ZEV purchases affordable for all Rhode Islanders, and the creation of a charging infrastructure that supports electrification and reduces obstacles to adoption such as range anxiety and the ongoing cost of energy.

Why is this recommendation important?

- Making alternative powered vehicles widely available and affordable allows all strata of the Rhode Island economy to participate in this new paradigm.
- A deliberate “Roadmap” is needed to coordinate the exponential increase in charging infrastructure and other ancillary services required to facilitate widespread ZEV adoption.

14. Promote Medium-/Heavy-Duty Zero Emissions Vehicle fleet adoption by promulgating regulations based on the Medium- and Heavy-Duty ZEV MOU signed by Rhode Island in July of 2020.

Rhode Island joined 14 states and the District of Columbia in signing a joint MOU committing to work collaboratively to advance and accelerate the market for electric medium- and heavy-duty vehicles, including large pickup trucks and vans, delivery trucks, box trucks, school and transit buses, and long-haul delivery trucks (big-rigs).

The goal is to ensure that 100 percent of all new medium- and heavy-duty vehicle sales be zero-emission vehicles by 2050 with an interim target of 30 percent zero-emission vehicle sales by 2030.

Accelerating the electrification of trucks and buses is an essential step to achieve the deep economy-wide emission reductions needed to avoid the worst consequences of climate change and protect the health of millions of Americans. While trucks and buses only account for 4 percent of vehicles on the road, they are responsible for nearly 25 percent of total transportation sector greenhouse gas emissions. In fact, emissions from trucks are the fastest growing source of greenhouse gases, and the number of truck miles traveled on the nation’s roads is forecast to continue to grow significantly in the coming decades.

Why is this important?

- Fossil fuel-related emissions from medium- and heavy-duty vehicles (MHDVs) are a major source of nitrogen oxides (NOx), particulate matter, and toxic air emissions, which are preventing many densely populated areas from achieving compliance with federal ambient air quality standards.

- Emissions from MHDVs are a widely acknowledged, but unaddressed, environmental justice problem that directly and disproportionately impacts overburdened and underserved communities located near freight corridors, ports and distribution centers.

15. Continue progress on its ambitious public transit bus and school bus electrification plans.

RIPTA’s electrification pilot project focused on deploying electric buses to high-density neighborhoods with high ridership and high rates of asthma. Rhode Island should continue this progress in focusing electrified public transportation vehicles and school buses to these overburdened and underserved communities.

Why is this recommendation important?

- Data from the Rhode Island Department of Health (RIDOH) shows that low-income neighborhoods have disproportionate levels of childhood asthma. RIDOH partnered with RIPTA to identify appropriate routes for electric transit buses that would most benefit neighborhoods with poor air quality. This process should continue and expand to include school buses.
- Replacing diesel-powered heavy- and medium-duty vehicles has a particularly beneficial impact on particulate matter air pollution, a main driver of a wide array of respiratory and cognitive health problems.

INITIAL ELECTRIFICATION ACTION STEPS

The Working Group developed the following initial action steps in order to pave the way for electrification of the transportation system.

- Sustain purchase incentives and implement other policies that encourage customers to consider electric vehicles. Specifically, the state should reinstate and fund the DRIVE rebate program.
- Provide incentives to municipalities and companies for installing charging stations and electrifying fleets.
- RIDOT and MBTA should continue to work on identifying and implementing infrastructure improvements to support an electrified rail system.

- Consider adopting the California Advanced Clean Truck Rule and adding EV trucks to the existing Natural Gas truck 2,000-pound weight exemption in Rhode Island (a full exemption already exists at the federal level).
- Continue to expand the state's clean fuel fleet with the adoption of medium- and heavy-duty zero-emission vehicles and alternative fuel vehicles, with the goal of supporting the state in meeting their current *Lead by Example* goal: 25% of new light-duty state fleet purchases and leases will be zero-emissions by 2025.
- The state's fleet should also include an electric charging infrastructure to support employee travel patterns, and home-based charging would ensure the vehicles are usable.
- Improve the state vehicle acquisition process to centralize the purchase/replacement of vehicles, making the ZEV acquisition process more accessible and easier to undertake across all state agencies.
- Develop education and outreach campaigns to ensure that consumers are aware of benefits and incentives of purchasing an EV. One example of this type of partnership is the "Drive Change Drive Electric" consumer awareness campaign, which is currently funded by six Northeast and Mid-Atlantic states and twelve automakers.
- Expand the network of air quality monitors to thoroughly capture transportation pollution data from impacted communities throughout the state.

V. Create a 21st century mobility infrastructure that capitalizes on the emerging changes in transportation technology.

To meet the state's GHG reduction goals, the state needs all types of vehicle owners, including residents, businesses, non-profits, and government agencies to significantly reduce reliance on fossil fuels. However, without a robust charging network, consumers may not have confidence in the reliability necessary for wide-scale EV adoption. One critical element of this network is to ensure that charging stations are readily available. This refers not only to homes and workplaces, but

also locations that support longer journeys, such as existing gas stations or at highway rest stops. Several recommendations below provide methods for ensuring development of this infrastructure that is deployed across all types of neighborhoods in the state.

A modern and responsive transportation technology infrastructure will play an important role in the transformation and electrification of the grid. Incorporating technology into a 21st century infrastructure will ensure that the transportation system can remain updated and relevant. Further, ensuring access to reliable and affordable technology will connect more Rhode Islanders virtually and will decrease the need for daily commuting and SOV trips. A modern, well-integrated and clean mobility infrastructure will ensure that Rhode Island is prepared for the inevitable transformation of the transportation system.

21ST CENTURY INFRASTRUCTURE RECOMMENDATIONS

The Working Group developed the following recommendations to ensure that the State develops the critical infrastructure needed to deploy and scale electric vehicles, as well as ensure that grid integration and new technology developments are incorporated into the decarbonization of the transportation system.

16. Create and/or continue to develop a plan for ubiquitous charging (and/or alternative fuel) infrastructure including EV corridors, along roadways/highways, fast charging, and hydrogen and fuel cell charging. Plans should include public, workplace, and residential locations that are future-proofed in order to be prepared to support goals for increasing future electric vehicle volumes.

As automakers ramp up production of electric vehicles, states have a significant role to play in creating customer demand and preparing the market for zero-emission technologies. Incentives and infrastructure development are two of the key factors to increasing demand. Rhode Island needs a roadmap for developing infrastructure, including along roadways/highways, fast recharging, and critical needs for other public charging.

Furthermore, Rhode Island does not have any fueling infrastructure for fuel cell electric vehicles, which are an important option for ensuring consumers' needs are met with the widest array of electric vehicle options. Fuel cell electric vehicles offer a zero-tailpipe, all-electric option with longer range utility and usage patterns that may be more appropriate to customers in truck-centric, cold weather, and/or rural areas.

Why is this recommendation important?

- The auto industry is undergoing a significant transformation. Considering the shift to electrification along with other technology advancements, like connectivity and shared ownership, the auto industry needs a supportive market to roll out its vehicles and to transition today's vehicles on the road to cleaner, affordable, and more efficient options.
- Electric bicycles and scooters can serve as important first- and last-mile connections to transit or help to replace car trips. Localized, community-level charging hubs can help to keep e-bikes and scooters charged within the neighborhoods they serve.
- The state would need to massively scale up its charging infrastructure if it is to meet its overall GHG reduction goals.

17. Create an integrated regulatory strategy² in Rhode Island to support the state's clean transportation goals with a framework that will ensure ratepayer benefits, and enable a competitive market and private investment, as well as grid integration.

The Rhode Island Public Utilities Commission has acted to address the role of the utility to support clean transportation. These include the approval of National Grid's EV Off-Peak Charging Rebate Pilot, Charging Station Demonstration Program, and a Discount Pilot for Direct Current Fast Charging Station Accounts. The challenge before the state is to facilitate the scale of the Electric Vehicle market and manage

² An integrated strategy contemplates a new set of regulations in transportation electrification that will need to be aligned among relevant state agencies to achieve coherent and consistent policy goals. As an example, the State of Rhode Island recently signed onto the Multi-State Medium- and Heavy-Duty Zero Emission

the growth to the utility load in a way that enables long term grid benefits to ratepayers.

Why is this recommendation important?

- Electric utilities are an integral partner to the successful management and development of an electric grid that can support the electrification of the transportation system.
- There should be a connection between rate payer-supported investment in the grid and benefits that accrue to the rate payers.

This connection between rate payer benefits and new investments in the grid and charging infrastructure should be balanced with the equity values of the state, ensuring that overburdened and underserved neighborhoods are given their fair share of electric transportation investments.

18. Establish Intelligent Transportation Systems (ITS) including transportation data sharing across state agencies, increasing Smart City/State technologies, and considering investment in newer Freight ITS technologies.

The Smart City/State Transportation Initiative would be an effort to use Intelligent ITS technology – in the form of cameras, sensors, and communication devices – to glean how and when roadways/highways and the transit system (rail and bus) are being used. This will enable the state to more actively manage the system and make more informed decisions based on accurate data. These ITS technologies would allow real-time predictions and modifications to create smoother traffic flows and less congestion and greenhouse gas emissions.

The state can also implement a Transportation System Management and Operations (TSMO) framework, which is a set of strategies that focus on operational improvements to maximize existing infrastructure performance. The benefits of TSMO can include improved quality of life, smoother and more reliable traffic flow,

Vehicle Memorandum of Understanding that will require regulations to support and accelerate the deployment of medium- and heavy-duty vehicles through a collaborative process with state agencies.

improved safety, reduced congestion, less wasted fuel, cleaner air, and more efficient use of resources (facilities and funding).

Why is this recommendation important?

- TSMO strategies are designed to optimize the performance of the transportation system and improve the user experience as they travel to their destination while, at the same time, reducing congestion and poor air quality.
- TSMO also results in important safety benefits resulting from less stop-and-go traffic and can boost economic outcomes through less time wasted in congested traffic.
- There is already funding available through the federal Congestion Mitigation/Air Quality Program, as well as numerous other federal and state funding sources, that can be used to leverage both these health and economic goals while also pursuing emissions reductions.

19. Explore development of a Statewide Mobility Services Program (SMSP) utilizing emerging technologies and practices to incorporate microtransit and micromobility in order to expand access to public transit, fill in first-/last-mile gaps, provide lifeline service in rural areas, and offer new options for frequent short trips.

Incorporating microtransit and micromobility into the development of a SMSP would open up broader access to public transportation and reduce the number of short trips taken by SOV. Microtransit is a flexible on-demand service that can be effectively used to expand the service hours in urban areas, while also providing cost-effective transportation in lower-density parts of the state. Targeted deployment of microtransit can also be undertaken at strategic locations like university campuses.

Why is this recommendation important?

- This transition away from fossil fuel-powered SOVs will take a reimagining of what the transportation system looks like, and new technology-enabled modes like microtransit and micromobility hold a great deal of promise for residents in all kinds of communities.

- Embracing new on-demand modes of travel, especially in rural areas, is essential to planning for the generational shift expected to take place as Baby Boomers age in place in auto-oriented suburban and rural areas.

20. Enable and promote a statewide telecommunications infrastructure (5G, Wi-Fi, and their future counterparts) to support the availability of real time transportation data and the deployment of connected and automated vehicles. This infrastructure would allow for the establishment of real time traffic and asset management systems and would promote telecommuting opportunities for businesses and employees.

The future of transportation will require an adequate telecommunications network, a robust electric grid, and facilities to charge electric cars. The telecommunications network can be a key component of a carbon-free transportation future, facilitating the more efficient operation of the transportation system through real-time operations information. It also allows for Rhode Islanders to avoid many trips altogether, such as working remotely some or all the time (made much more common as a result of the COVID-19 pandemic).

Why is this recommendation important?

- Connected and autonomous vehicles rely on a robust high-bandwidth (5G) communications network in order to operate most efficiently. This allows for dynamic rerouting of the transportation system to ensure minimized congestion, as well as a safe operating environment.
- Real-time data would help to ensure that capital assets are operating at peak efficiency, helping to ensure a balanced electric grid and keeping public transportation moving with minimal mechanical failures.

21. Consider regulatory structures that enable the safe and reliable deployment of connected and autonomous vehicles, leveraging the experience of the RIDOT TRIP process and program.

The Rhode Island Transportation Innovation Partnership (TRIP) process was launched in 2017 and engaged multiple state agencies to investigate ways that connected and highly autonomous vehicles (CAVs) can meet the transportation

needs of the state's residents. TRIP has multiple goals, including safer transportation, environmental sustainability, equity, economic development, and promoting Smart Cities. The state should use the findings and experiences of this initiative to inform regulatory structures that ensure the future reliability of CAVs.

Why is this recommendation important?

- CAVs are the future of the transportation system and offer numerous benefits. They reduce the likelihood of a crash due to better reaction time and more cautious driving characteristics and also offer the possibility of massively driving down the cost of transportation services.
- New technology opens the possibility of new vulnerabilities, such as malware and hacking, telecommunications outages, and programming or other technology failures.
- Regulatory structures should closely tie CAV development and deployment to the overarching environmental and equity goals of the state to ensure that this new technology does not repeat past injustices in the transportation system.

INITIAL 21ST CENTURY INFRASTRUCTURE ACTION STEPS

The Working Group created the following action steps to prepare Rhode Island for future transportation technology developments.

- Develop a comprehensive, five-year strategy to expand electric vehicle charging infrastructure at state-owned facilities and properties to serve the alternative transportation needs of state agency fleets and employees. The strategy should catalogue existing electric vehicle charging infrastructure at state properties, identify ideal locations for new charging infrastructure, and establish fiscal and procurement-related plans to successfully implement charging station investments.
- Fund the development of publicly accessible charging infrastructure. This would include a mix of public level 1 and 2 charging and DC fast charging stations, and support development of charging infrastructure in low-income and environmental justice communities.

- Engage the utility, state agencies and a diverse group of stakeholders to develop a successor program to National Grid's Transportation Electrification program.
- Take steps to establish Intelligent Transportation Systems: 1) Facilitate transportation data sharing in order to address the state's transportation obligations, including public safety and congestion management, as well as future planning and policy development; 2) increase Smart City/State and TSMO technologies and operations to better manage the transportation system; 3) consider investment in newer freight ITS technologies to provide advanced information and communications technologies; and 4) develop an Integrated Mobility Management System for Rhode Island to produce the roadmap for the implementation of a public-transit led MaaS ecosystem.
- Use the MaaS model to develop an app uniting all transportation modes, encouraging clean and accessible transit and micromobility options.
- Pursue public-private partnerships that will aid in the modernization of the state's transportation infrastructure.
- Design utility programs to meet the state's goals for sharing the benefits of Transportation Electrification with low-/moderate- income and other overburdened and underserved communities.
- Consider policies such as time of use rates, off-peak power times, Vehicle Grid integration (VGI), as well as demand charge reform and Commercial EV rates.

VI. Unlock economic opportunity, promote green job creation, and support business and supply chain industries.

Transportation is likely to see substantial changes over the next two decades. The combination of on-demand mobility, autonomous and connected vehicles, and vehicle electrification will create a mobility landscape far different from the one we know today. If rolled out deliberately, this future holds the promise of creating a dramatic acceleration of productivity, as well as a substantially improved quality of life. The clean transportation roadmap for the 21st century must also include

appropriate business models, technology, marketing, and government initiatives. Global industry participants would also necessarily play a large role in this evolving landscape.

New investments pursuing a clean transportation vision would create training opportunities building employment in low- and no-emissions transportation technology and services. Innovative companies, powered by the newly trained workforce, will address transportation challenges, enable cost reductions, and create new expertise. The rest of the nation can look to these companies as they transition their own transportation systems to increasingly electric and/or other no-emissions technology, further supporting the state's economy.

ECONOMIC DEVELOPMENT RECOMMENDATIONS

The Working Group developed the following recommendations dealing with economic development and job creation resulting from efforts to decarbonize the transportation system.

22. Establish a Mobility Innovation Transformation Initiative that supports technology and business model innovations in new transportation services. This initiative should facilitate public-private partnerships and financing to support technology and business model innovations in new transportation service.

Rhode Island should enable financing through public/private partnerships (such as the Rhode Island Infrastructure Bank) in order to address gaps in the market and direct capital to clean transportation enterprises.

Why is this recommendation important?

- Transportation electrification is a key part of the energy innovation equation, including fleet management services, grid services, energy storage, data management for transportation planning, and battery development.
- The initiative could tackle some of the most pressing transportation problems, such as how to increase private sector investment to support 21st

century infrastructure needs and how to integrate travel options, ticketing and payment, and innovate on first-/last-mile challenges.

- The initiative would support local companies, local jobs, and the local innovation ecosystem.

23. Develop a policy agenda, in partnership with the Department of Labor and Training, focused on workforce development and training opportunities.

The current transportation sector is largely powered by petroleum-based fuels. Transitioning the existing workers into a clean energy transportation sector is important in maintaining and growing solid middle-class jobs. Existing and new workers would need training to adapt to changing infrastructure and to provide stability and opportunities for workers.

In terms of state action, this might include: development of responsible bidding and acceptable vendor labor practices, such as a plan for training or re-training of existing workers in impacted fields; partnering with local and regional companies in advancing clean transportation; and planning for the transition of workers into a clean energy transportation sector.

Why is this recommendation important?

- To lead the transformation, Rhode Island must partner with industry-leading companies who operate in the area in order to develop incentives that help with capital investments and job maintenance and creation.
- Special attention must be paid to local hiring practices that give opportunities to historically overburdened and underserved communities.
- The state can lead the way with a legislative agenda on procurement processes, worker training, company incentives, and marketing to ensure that new employment opportunities are broadly shared.

24. Develop incentives for individuals and small businesses with light-duty vehicles operating in neighborhoods (plumbers, electricians, delivery, etc.) to convert to ZEVs.

Current programs, such as the Diesel Emissions Reduction Act (DERA), focus on large trucks and equipment, but still replace them with more up-to-date diesel

equipment. With Ford releasing the new F-150 electric, there may be an opportunity to replace smaller fleet vehicles that do not travel long distances with electric. The state should include incentives for these fleet vehicles to convert to electric, where feasible, given the current state of technology.

Why is this recommendation important?

- The market for electrified medium-duty vehicles and small commercial vehicles (pickup trucks and vans) is small but growing. Creating incentives for these vehicles could help to expand the market.
- Incorporating ZEVs into private fleets would help to increase the visibility of ZEVs more generally and raise awareness of these vehicle options.
- Vehicles serving industrial sites that are in overburdened and underserved communities would have a positive equity benefit if they are converted to electric.

INITIAL ECONOMIC DEVELOPMENT ACTION STEPS

The Working Group developed the following action steps to ensure broad access to jobs in clean transportation paying middle-class wages or higher.

- Conduct outreach to Rhode Island youth through high-schools and community colleges to educate students about green jobs and allow for job shadowing, internships, site tours, etc.
- Explore and establish accreditation programs at local community colleges and universities to enable apprentice programs for Electric Vehicles/EV charging installation, maintenance and repair.
- Engage relevant supply chain industries, such as marine electric supply chain firms, to enable job creation in Rhode Island machine shops and adjacent industries.
- Engage in dialogue with individuals and small businesses to better understand their needs as it relates to fleets and electrification options.

CONCLUSION

The recommendations and initial action steps presented in this section have been developed with the buy-in of state agencies, private sector firms, grassroots stakeholders, and are based on the best available science. These recommendations and action steps lay out a bold yet realistic roadmap for setting Rhode Island on a path towards a clean transportation future, one that improves public health, promotes green economic development, and protects the environment. Implementation of these recommendations will cement Rhode Island as a nation-leading innovator in clean transportation and equitable mobility, and other states will look to it for inspiration in meeting their own environmental goals.

APPENDIX A: RECOMMENDATIONS AND ACTION STEPS CONSOLIDATED LIST

Recommendations

1. Advocate for legislation directing no less than 35% of TCI-P revenue to benefit overburdened and underserved communities.
2. Establish or designate a community advisory board to engage overburdened and underserved communities and provide input on TCI-P investments and clean transportation policy ideas.
3. Promote transparency by publicly sharing programs, policies and investments in clean transportation, including expenditures and/or efforts directed to overburdened and underserved communities.
4. Take steps to implement the Transportation and Climate Initiative Program and to maximize benefits from revenue.
5. Consider setting a transportation GHG reduction goal to substantially reduce GHG emissions in the transportation sector in order to meet the state's climate goals.
6. Focus on the implementation of Transit Forward RI, the 20-year plan, with priority consideration given to the improvement of accessibility, service frequency and span in urban areas to improve mobility for underserved populations. In addition, expand lifeline service and flexible microtransit in rural parts of the state.
7. Create a forward-looking transit structure by establishing five to seven Next Generation Transit Districts (NGTDs) with rapid, high-capacity, high-interval electrified transit between NGTDs to spur transit-oriented development and establish a framework that allows for innovation, local design, and flexibility.
8. Consider establishing a Task Force to review existing land use statutes, make recommendations for their modernization, and consider inclusion of incentives to enhance transit-oriented development or otherwise promote mobility.
9. Promote active mobility by implementing a new statewide bicycle and scooter share program with a partial subsidy from private, state, or federal funds to make access to affordable micromobility options more widely available.
10. Enhance the current complete streets program which would result in more walking and bicycling for short trips (under 3 miles), which constitutes a significant number of VMTs, while also providing opportunities for improved public health.
11. Consider establishing a goal that, by 2040, all new cars, light duty trucks, and buses sold in Rhode Island will be electric or technology neutral that meets the same emission standards.
12. Move quickly to create faster and more frequent rail service between Boston and Providence by electrifying the rail system. For a train to arrive every 30 minutes, the rail system will need to be electrified.
13. Develop an EV roadmap that delineates the steps the state must take to materially impact/increase the adoption rate of Zero Emissions Vehicles (including BEV's, PHEV's, Fuel Cell/Hydrogen as well as medium- and heavy-duty vehicles) in Rhode Island for both private and public sectors in the next 10 to 15 years. The roadmap would include a suite of complementary policies to grow consumer awareness and lead by example, including rebates, education and outreach efforts, and state agency fleet electrification requirements.
14. Promote Medium-/Heavy-Duty Zero Emissions Vehicle fleet adoption by promulgating regulations based on the Medium- and Heavy-Duty ZEV MOU signed by Rhode Island in July of 2020.
15. Continue progress on its ambitious public transit bus and school bus electrification plans.

Recommendations

16. Create and/or continue to develop a plan for ubiquitous charging (and/or alternative fuel) infrastructure including EV corridors, along roadways/highways, fast charging, and hydrogen and fuel cell charging. Plans should include public, workplace, and residential locations that are future-proofed in order to be prepared to support goals for increasing future electric vehicle volumes.
17. Create an integrated regulatory strategy in Rhode Island to support the state's clean transportation goals with a framework that will ensure ratepayer benefits, and enable a competitive market and private investment, as well as grid integration.
18. Establish Intelligent Transportation Systems (ITS) including transportation data sharing across state agencies, increasing Smart City/State technologies, and considering investment in newer Freight ITS technologies.
19. Explore development of a Statewide Mobility Services Program (SMSP) utilizing emerging technologies and practices to incorporate microtransit and micromobility in order to expand access to public transit, fill in first-/last-mile gaps, provide lifeline service in rural areas, and offer new options for frequent short trips.
20. Enable and promote a statewide telecommunications infrastructure (5G, Wi-Fi, and their future counterparts) to support the availability of real time transportation data and the deployment of connected and automated vehicles. This infrastructure would allow for the establishment of real time traffic and asset management systems and would promote telecommuting opportunities for businesses and employees.
21. Consider regulatory structures that enable the safe and reliable deployment of connected and autonomous vehicles, leveraging the experience of the RIDOT TRIP process and program.
22. Establish a Mobility Innovation Transformation Initiative that supports technology and business model innovations in new transportation services. This initiative should facilitate public-private partnerships and financing to support technology and business model innovations in new transportation service.
23. Develop a policy agenda, in partnership with the Department of Labor and Training, focused on workforce development and training opportunities.
24. Develop incentives for individuals and small businesses with light-duty vehicles operating in neighborhoods (plumbers, electricians, delivery, etc.) to convert to ZEVs.

Initial Action Steps

1. Develop transparent performance measurement standards that allow the state to measure the impact of clean transportation initiatives and policies on overburdened and underserved communities. The state might also consider identifying metrics to measure pollution burden.
2. DEM should continue its work to identify high-emitting engines/vehicles and encourage replacement with cleaner vehicles, where possible.
3. Develop a functioning toolkit to assist in the implementation of equitable clean transportation programs. Suggestions include public data dashboards and a mobility app to integrate options, including MaaS and last-mile options.
4. Consider public-private partnerships aimed at developing a vehicle financing program that expands opportunities for low- and moderate-income Rhode Islanders to finance electric vehicle purchases.
5. Consider conducting a “mobility infrastructure audit” within overburdened and underserved communities, in partnership with community leaders. The audit should seek to identify gaps in pedestrian and bicycle infrastructure, including operating streetlights, shaded bus stops and safe sidewalks.
6. To implement the Transportation and Climate Initiative Program in 2022, the state should collaboratively work with elected officials to pass enabling legislation during the 2021 legislative session. State leadership and the elected officials should collaboratively work to determine specific expenditures of TCI-P revenue.
7. Establish a formalized framework for evaluating investment/policy options: Develop objective and meaningful metrics that promote equitable outcomes and can be used to evaluate future potential clean transportation policy options and track progress. Metrics may include associated GHG emissions reductions, public health impacts, economic impacts and impacts on overburdened and underserved communities.
8. Consider the installation of statewide docking stations for electric scooters and bikes to provide transit riders with access to alternative and/or last-mile transit options.
9. Consider/prioritize public-private partnerships between ride-hailing/micro-mobility companies, local government, and transit operators to address last-mile challenges in public transit.
10. Consider options for fare subsidization including expanding programs like the ECO pass and the UPASS where businesses and universities provide free or subsidized passes to ride RIPTA, or creating a Commuting Alternatives Program for state employees that includes free or reduced cost RIPTA bus passes or MBTA passes.
11. Install bus-on-shoulder lanes along state highways and in high-congestion areas where frequent bus service currently operates.
12. Promote our public transportation network program to local businesses and identify programs that encourage public and private sector workforces to utilize public transit.
13. Study investments outlined in the statewide Bicycle Mobility Plan and consider which investments should be adopted and funded. In addition, the state might consider providing financial incentives for electric bicycles to aid in displacing single-passenger vehicle trips.
14. Consider more incentives for carpooling and more disincentives for single-passengers and single-occupant travel to avoid congestion and decrease VMT.
15. The Division of Statewide Planning, in conjunction with stakeholders, should complete development of regulations for the Municipal Infrastructure Grant Program, to include transit-oriented development, sustainability/resiliency, and mobility as important factors in the award of future funds.

Initial Action Steps

16. Develop state-specific online resources for trip planning and scheduling that would improve access, particularly for overburdened and underserved communities, to all transportation alternatives open to them.
17. Sustain purchase incentives and implement other policies that encourage customers to consider electric vehicles. Specifically, the state should reinstate and fund the DRIVE rebate program.
18. Provide incentives to municipalities and companies for installing charging stations and electrifying fleets.
19. RIDOT and MBTA should continue to work on identifying and implementing infrastructure improvements to support an electrified rail system.
20. Consider adopting the California Advanced Clean Truck Rule and adding EV trucks to the existing Natural Gas truck 2,000-pound weight exemption in Rhode Island (a full exemption already exists at the federal level).
21. Continue to expand the state's clean fuel fleet with the adoption of medium- and heavy-duty zero-emission vehicles and alternative fuel vehicles, with the goal of supporting the state in meeting their current Lead by Example goal: 25% of new light-duty state fleet purchases and leases will be zero-emissions by 2025.
22. State fleet should also develop an electric charging infrastructure to support employee travel patterns, and home-base charging would ensure the vehicles are usable.
23. Improve the state vehicle acquisition process to centralize the purchase/replacement of vehicles, making the ZEV acquisition process more accessible and easier to undertake across all state agencies.
24. Develop education and outreach campaigns to ensure that consumers are aware of benefits and incentives of purchasing an EV. One example of this type of partnership is the "Drive Change Drive Electric" consumer awareness campaign, which is currently funded by six northeast and mid-Atlantic states and twelve automakers.
25. Expand the network of air quality monitors to thoroughly capture transportation pollution data from impacted communities throughout the state.
26. Develop a comprehensive, five-year strategy to expand electric vehicle charging infrastructure at state-owned facilities and properties to serve the alternative transportation needs of state agency fleets and employees. The strategy should catalogue existing electric vehicle charging infrastructure at state properties, identify ideal locations for new charging infrastructure, and establish fiscal and procurement-related plans to successfully implement charging station investments.
27. Fund the development of publicly accessible charging infrastructure. This would include a mix of public level 1 and 2 charging and DC fast charging stations, and support development of charging infrastructure in low-income and environmental justice communities.
28. Engage the utility, state agencies and a diverse group of stakeholders to develop a successor program to National Grid's Transportation Electrification program.
29. Take steps to establish Intelligent Transportation Systems: 1) Facilitate transportation data sharing in order to address the state's transportation obligations, including public safety and congestion management, as well as future planning and policy development; 2) increase Smart City/State and TSMO technologies and operations to better manage the transportation system; 3) consider investment in newer freight ITS technologies to provide advanced information and communications technologies; and 4) develop an Integrated Mobility Management System for Rhode Island to produce the roadmap for the implementation of a public-transit led MaaS ecosystem.

Initial Action Steps

- | |
|---|
| 30. Use the MaaS model to develop an app uniting all transportation modes, encouraging clean and accessible transit and micromobility options. |
| 31. Pursue public-private partnerships that will aid in the modernization of the state's transportation infrastructure. |
| 32. Design utility programs to meet the state's goals for sharing the benefits of Transportation Electrification with low-/moderate- income and other overburdened and underserved communities. |
| 33. Consider policies such as time of use rates, off-peak power times, Vehicle Grid integration (VGI), as well as demand charge reform and Commercial EV rates. |
| 34. Conduct outreach to Rhode Island youth through high-schools and community colleges to educate students about green jobs and allow for job shadowing, internships, site tours, etc. |
| 35. Explore and establish accreditation programs at local community colleges and universities to enable apprentice programs for Electric Vehicles/EV charging installation, maintenance and repair. |
| 36. Engaging relevant supply chain industries such as marine electric supply chain firms will enable job creation in Rhode Island machine shops and adjacent industries. |
| 37. Engage in dialogue with individuals and small businesses to better understand their needs as it relates to fleets and electrification options. |

APPENDIX B: CLEAN TRANSPORTATION AND MOBILITY AUDIT

CLEAN TRANSPORTATION AND MOBILITY AUDIT

December 2020

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Department of Environmental Management

I. OVERVIEW

Agency Scope and Mission

The Rhode Island Department of Environmental Management (DEM) serves as the chief steward of the state's natural resources with a broad scope that includes restoring and conserving lands, waters, wildlife and marine resources.

For the purposes of this audit, the most relevant role of DEM is the chief enforcer of environmental laws including promoting clean air locally and regionally by supporting strong public policies and regional efforts.

Goals include:

- Act to counter climate change and its effects, both locally and regionally.
- Protect and restore our environment to create greener, healthier communities.
- Reduce greenhouse gas emissions from human activities using strong local and regional partnerships.
- Integrate climate change considerations into all levels of decision-making including policies, plans, regulations, and strategies.
- Coordinate climate communication, outreach, and planning efforts across state and local partners to ensure effective implementation of the state's resilience and emissions reduction goals.
- Advocate and enforce environmental compliance fairly and effectively.

II. CLEAN TRANSPORTATION REGULATIONS ENFORCED BY DEM

Low Emission Vehicle (LEV) Regulation Program and Zero Emission Vehicle (ZEV) Mandate:

- Rhode Island has adopted the California motor vehicle emissions standards and compliance requirements specified in Title 13 of the California Code of Regulations.³ These regulations apply to passenger vehicles, light-duty trucks, and medium-duty passenger vehicles.
- In 2004, Rhode Island adopted California Air Resources Board's (CARB) Low Emission Vehicle standards for Model Year 2008-2017 vehicles. Both LEV and ZEV were adopted at this time. Reporting began in 2009.
- In 2012, ZEV amendment enhanced compliance flexibility and extended program requirements for MY2018-2025.
 - Increased sales percentage requirements for ZEVs and Plug-In Hybrid Electric Vehicles PHEVs, which become more stringent over the course of the program.
 - Allows manufacturers to "pool" or trade emissions and ZEV credits among other states that have adopted CA standards.

³ <https://www.law.cornell.edu/uscode/text/42/7507>

LEV Standards:

Require manufacturers to meet fleet-average emissions targets through the sale of vehicles that emit low levels of pollutants that contribute to ozone formation such as nitrogen oxides (NOx), and other pollutants such as carbon monoxide, carbon dioxide, and particulate matter that pose risks to public health. The purpose of the program is to ensure that motor vehicle standards in Rhode Island are consistent with California's Advanced Clean Cars Program (ACCP). RI incorporated ACCP rules under its LEV Regulation 250-RICR-120-05-37.

ZEV Sales Requirements:

- **FORMULA:** Require manufacturers to meet a certain portion of sales with electric, plug-in hybrid, and fuel cell electric vehicles. Auto manufacturers are required to produce a number of ZEVs and plug-in hybrids each year, based on the total number of cars sold in Rhode Island by the manufacturer. Manufacturers with higher overall sales of all vehicles are required to make more ZEVs.
- **CREDITS:** Requirements are in terms of percent credits, ranging from 4.5% in 2018 to 22% by 2025. Manufacturers are to produce vehicles and each vehicle receives credits based on its electric driving range. The more range a vehicle has, the more credit it receives. Credits not needed for compliance in any given year can be banked for future use, traded, or sold to other manufacturers.

III. TRACKING AND REPORTING OF ZEVs BY DEM

A. Reporting:

- i. DEM releases annual ZEV credit bank balances⁴ each year, as well as the total number of vehicles produced for that model year, and the total number of ZEVs and plug-in hybrids.
- ii. Report annually on ZEV MOU state landing page (by community):

Estimated Timeline: 2021- Pending DMV staff resources. DEM and DMV have discussed providing this level of detail to all Rhode Islanders. DMV states that this is feasible and our goal is to have a public-facing dashboard highlighting ZEV registration at the community level (example of NYS dashboard).⁵

B. Tracking registered ZEVs:

- i. DEM with the assistance of DMV can manipulate the DMV Registration Database to calculate the number of ZEVs registered in our state.
- ii. DEM obtains vehicle identification numbers (VINs) from automakers.

⁴ <http://www.dem.ri.gov/programs/air/mobile.php>

⁵ <https://www.nyserda.ny.gov/All-Programs/Programs/ChargeNY/Support-Electric/Map-of-EV-Registrations>

- iii. DMV provides the registration database and manipulation capabilities.
- iv. Updates will be provided at minimum once a year but with the goal of every 6 months to the Climate Change Rhode Island Snapshot.⁶

IV. FUNDING AND GRANTS FOR CLEAN TRANSPORTATION INITIATIVES

C. Volkswagen Settlement Funds (Appendix D)

i. DEM's Beneficiary Mitigation Plan (RIPTA and OER)

- 1. DEM developed a Beneficiary Mitigation Plan (BMP)⁷ for implementing the state's initial allocation of \$14,368,857 from the Volkswagen Diesel Settlement (VW Settlement) funds. The purpose of the BMP is to execute environmental mitigation projects that reduce emissions of nitrogen oxides (NOx). Development of the BMP included stakeholder involvement, a public information session, and a public comment period. DEM will allocate dollars in three main categories designed to implement projects that reduce NOx emissions.

ii. Funding Allocations

- 1. \$10.7M Rhode Island Public Transit Authority (RIPTA) All-electric zero-emission transit buses⁸
- 2. \$1.5M Rhode Island Office of Energy Resources (OER) Electrify RI Program⁹
- 3. \$2.15M Administrative Costs

iii. Emission Reduction Benefits

- 1. Based on modeling, Rhode Island estimates the Volkswagen defeat device vehicles emitted between 29 and 98 tons of excess NOx per year.
- 2. Rhode Island anticipates achieving 12-30 tons of NOx reductions per year from the RIPTA electric bus program.

iv. Benefits to Overburdened and Underserved Communities

- 1. Electric buses are being deployed across routes that serve overburdened and underserved communities. Enhanced service on these bus routes will increase mobility, economic, and health prospects of these environmentally and economically disadvantaged communities. To access current and historical information and reports, please visit the Volkswagen Diesel Emissions Environmental Mitigation Trust website.¹⁰ As required under the trust, DEM works with RIPTA and RIOER to submit updated reports every 6 months.

⁶ <http://climatechange.ri.gov/climatesnapshot/>

⁷ <http://www.dem.ri.gov/programs/air/documents/vwmitplanf.pdf>

⁸ <https://www.ripta.com/electric-bus/>

⁹ <http://www.energy.ri.gov/electrifyri.php>

¹⁰ <https://www.vwenvironmentalmitigationtrust.com/state-trust/rhode-island>

D. Clean Diesel Grant Programs

i. State Grants- Diesel Emission Reduction Act (DERA)

1. Contained within the Energy Policy Act of 2005, provides grants to states and other eligible entities to achieve significant reductions in diesel emissions. DEM applies and receives funds from the U.S. Environmental Protection Agency (EPA).
2. In Rhode Island, the program targets the replacement of medium and heavy-duty diesel trucks and buses and diesel-powered marine engines. DEM provides reimbursement grants to awardees to replace and scrap their old engines with cleaner equipment. Awardees are required to provide cost-share to cover ~60-75% of total project costs.
3. Since 2011, DEM has provided ~\$1.9M in grants to municipalities,¹¹ organizations, and individuals for diesel reduction projects that are environmentally and economically beneficial. Due to increased outreach efforts by DEM (in part due to the RI Clean Diesel Funds), the program has been significantly oversubscribed in recent years.
 - a. FY18 (October 1, 2018-September 31, 2019 project period). The project budget received from EPA equaled \$274,250. DEM received 25 applications, accounting for ~\$5M in total project costs, requesting ~\$1.5M in DERA funding.
 - b. FY19 (October 1, 2019-September 30, 2020). The project budget received from EPA equaled \$316,027. DEM received 17 applications, accounting for ~\$2M in total project costs, requesting ~\$732,000 in DERA funding.
 - c. FY20 (October 1, 2020 – September 31, 2022). The project budget received from EPA equaled \$328,663. DEM received 41 applications, accounting for \$6M in total project costs, requesting \$1.8M in DERA funding.

ii. State Clean Diesel Fund Regulation

In January 2016, the RI General Assembly authorized the creation of a Clean Diesel Fund within DEM with the purpose of reducing emissions from heavy-duty diesel engines operating on state roads and helping companies improve supply chain efficiency as described in the EPA's SmartWay Program.

1. DEM had to promulgate regulations in order to establish the fund.
2. DEM used the guidance of the General Law to develop the new Air Pollution Regulation.
3. Public Comment Period held from December 30, 2016-January 31, 2017
4. Public Hearing held on January 19, 2017

¹¹ <http://www.dem.ri.gov/programs/air/diesel-reduction.php>

5. During 2017, DEM accepted applications and expected to receive annually appropriated monies and provide reimbursement grants to grantees for undertaking emission reduction measures.
6. In 2017, roughly \$252,000 was used to replace four trucks. The Department is currently within the five-year data collecting part of the fund.

No additional appropriated monies have been provided to the program therefore no applications are being accepted at this time. The regulation is still on the books.

iii. National Grants- EPA's DERA

EPA's DERA National Grants¹² provide an opportunity for states nationwide to submit applications for projects that achieve significant reductions in diesel emissions and exposure, particularly from fleets operating in areas designated by the EPA Administrator as poor air quality areas.

DEM partnered with the companies in the Port of Providence to submit a grant application for a Competitive Diesel Emissions Reduction Act Grant to replace old, polluting, diesel vehicles with newer, cleaner vehicles. We were selected to receive over \$400,000 for the grant and when combined with the match contributions from the companies that will be purchasing the new vehicles, the combined total is over \$1.3 million dollars in cleaner, new vehicles. Projects are underway and the newer cleaner vehicles are expected to be in use by September 2022.

iv. School Bus Rebates- EPA's DERA

EPA's DERA School Bus Rebate Program¹³ offers public and private fleet owners' rebates for the replacement of old diesel school buses with new buses certified to EPA's cleanest emission standards. EPA awards selected applicants \$15,000-20,000 per bus for scrapping and replacing old buses.

DEM distributes program information to contacts and provides technical support if needed. In 2018 and 2019, EPA selected at least one applicant from each state.

- Cranston Public School District was awarded \$180,000 for 9 buses in 2018 and \$120,000 for 6 buses in 2019.

v. DEM's Hospital Idle Reduction Grant

The Rhode Island Attorney General provided DEM with \$17,500 from the Settlement Funds to be used solely to implement the Hospital Idle Project. The project will consist of the construction of idle reduction technology for parked ambulances at hospitals to eliminate harmful tailpipe emissions and noise. Hospitals eligible for grant funding would be in the Providence metro area and

¹² <https://www.epa.gov/dera/national>

¹³ <https://www.epa.gov/dera/rebates>

located in disadvantaged communities that share an unfair burden of air pollution.

The RFP, application, and press release were issued in July 2020. The application period was open through November 13, 2020. No applications were received.

V. *INVESTMENTS AND OUTCOMES*

E. EV Growth and Infrastructure

As of June 2020, there were 3,078 ZEVs registered in the state (conservative estimate because it doesn't capture registered model year 2020+ vehicles).

- ZEVs have increased 552% from 2015 to Mid-2020.
- ZEVs account for ~0.44% of the light-duty vehicles in Rhode Island.
- There are ~2.90 ZEVs per 1,000 Rhode Islanders.

The number of public fueling stations in our state:

Data tracked and updated by OER/OSCC on the AFDC Station Locator website.¹⁴
April 2020: 133 stations/471 charging outlets

VI. *LEAD BY EXAMPLE*

- DEM has 12 ZEVs in their fleet
- 4-dual port charging stations at 235 Promenade Street headquarters.

VII. *EDUCATION AND OUTREACH*

F. Drive Change, Drive Electric¹⁵

Drive Change, Drive Electric is a unique partnership between auto manufacturers and state agencies promoting the use and adoption of electric vehicles. The initiative was announced in New York on March 29th, 2018 and has continually developed since its creation. The main goal of the Drive Change, Drive Electric Campaign: increase EV sales in the Northeast and allow potential customers to warm up to the idea of EVs. This campaign is at the centerpiece of our collaboration with the auto manufacturers.

- Through the Collaboration for ZEV Success, we collectively identified the need for this campaign and brought it to life, and it is now the principal focus of our public/private partnership. Partnering to implement a regional approach to consumer outreach among likely North East car buyers results in a better and more cost-effective campaign.

¹⁴https://afdc.energy.gov/stations/#/analyze?region=US-RI&country=US&access=public&access=private&fuel=HY&fuel=LPG&fuel=ELEC&lpg_secondary=true&hy_nonretail=true&ev_levels=all

¹⁵ <https://driveelectricus.com/>

- While states and OEMs do not always agree on regulatory issues and there will be ongoing legal proceedings in the years ahead, we agreed at the outset of this collaboration to find other ways to work together to promote ZEV technologies. The campaign helps us achieve our mutual goal to advance the market for ZEVs and serves as the cornerstone for a constructive relationship.
- DEM sits on the Drive Change, Drive Electric campaign Steering Committee and has contributed financially to support campaign efforts (\$10,000 in 2019 and \$15,000 in 2020).
- State contribution in 2019 equaled \$585,000 (NY providing the most) and OEM contribution equaled \$855,000 for a total budget of \$1,440,000.
- 2020 total budget = ~\$1M
- MA contributed 100k per year for both 2020 and 2021.

G. Destination Electric

This is the DCDE campaign's way of localizing the effort to bring awareness to EVs and charging infrastructure on a local level. Destination Electric focuses on engagement from small, local businesses found in Destination Electric cities. If the small business is located within walking distance of public charging infrastructure, the business can support Destination Electric by putting a sticker on their door/window to show customers that charging is located nearby. The sticker brings awareness to residents and visitors that charging is located nearby, and in return, the small business is showcased on the DCDE website under the Destination Electric tab.

Each participating state has two "Destination Electric cities". Rhode Island's two cities are Providence and Newport. A questionnaire is done annually by the public to gauge barriers to adoption of EVs.

H. Regional/RI Marketing Results

RI business recruitment for Destination Electric as of 2020: Newport- Anchorbend Glassworks, The Bodhi Spa, Empire Tea & Coffee, Friskie Fries, Breakwater Surf. Providence- Ellie's, Gracie's, Small Point Café, Sydney, Cellar Stories Bookstore, Ocean State Sandwich Company.

2019: 25,000 clicks from the vehicle explorer tool to an auto manufacturer website. This means that there is some engagement on the website and that users are curious enough to click off the website to read more about EV models.

I. Dealership Engagement

DEM also participates in the Northeast States for Coordinated Air Use Management (NESCAUM) Dealership group, dealership success has been seen among states with active dealership associations.

The Rhode Island Auto dealers Association does not actively participate in this group but has been engaged in state collaboration when consumer incentives were provided through the RIOER Drive Program.

VIII. ADDITIONAL RELEVANT CLEAN VEHICLE REGULATIONS AND PROGRAMS ADMINISTERED BY DEM

J. Rhode Island's Light-Duty Inspection and Maintenance Program

Implemented in January 2000, the RI I/M program¹⁶ requires a biennial inspection (safety and emissions) of subject vehicles in a test-and-repair system. This emissions testing ensures that vehicles are well maintained and operating as designed and do not exceed established pollutant levels. The program ensures that RI is positioned to comply with the National Ambient Air Quality Standards for Ozone, reduces the amount of particulate matter emitted into the air, and protects human health. The Rhode Island Department of Motor Vehicles (RIDMV) and DEM are jointly responsible for the administration of this program.

K. SmartWay

SmartWay is an EPA voluntary public-private program¹⁷ which helps companies advance supply chain sustainability by measuring, benchmarking, and improving freight transportation efficiency.

- i. DEM acts as an affiliate to help spread the word about sustainable supply chain transportation efforts and growing the SmartWay Program.
- ii. The following Rhode Island shipper and logistics companies that participate in SmartWay improved their overall performance by using more and better carriers to move their freight: Arpin International Group, Arpin Van Lines, CVS Health, CVS Transportation, Delivery Management Services, Trans-Link, Truckers America Corp, UNFI, and Virginia Transportation. The carriers submit efficiency and air quality performance data to EPA annually.

L. Anti-Idling Regulation

In accordance with 250-RICR-120-05-45,¹⁸ diesel motor vehicles may not idle unnecessarily for longer than five consecutive minutes during any 60-minute period. This includes heavy-duty diesel vehicles used to perform any state public works contracts. Unnecessary idling does not include circumstances exempted by law and regulations DEM has adopted, such as when it is necessary to operate heating and cooling equipment to ensure the health or safety of drivers and passengers.

Other vehicles exempt from these requirements include, but are not limited to, the following: 1) emergency response, public safety, or military vehicles; 2) armored vehicles

¹⁶ <https://rules.sos.ri.gov/regulations/part/250-120-05-34>

¹⁷ <https://www.epa.gov/smartway>

¹⁸ <https://rules.sos.ri.gov/regulations/part/250-120-05-45>

being loaded or unloaded; 3) non-road vehicles, and 4) vehicles making deliveries of fuel or energy products.

Violators of these regulations can be fined up to \$100 for the first offense and up to \$500 for each succeeding offense.¹⁹ The purpose of this requirement is to prevent unnecessary idling, conserve fuel, and reduce exposures to toxic vehicle exhaust.

DEM issues yearly reminders to school districts about the importance of anti-idling.

Currently under development is an educational toolbox for school districts, which will include information on health impacts, fact sheets, window decals, signage, etc.

IX. NATIONAL AND REGIONAL COMPLEMENTARY POLICIES, COLLABORATION AND ADVOCACY

M. Transportation and Climate Initiative Program (TCI-P)

The Transportation and Climate Initiative Program (TCI-P) is a groundbreaking multi-jurisdictional program that puts a brake on transportation pollution while accelerating investment and innovation in cleaner transit and healthier communities for all. On December 21, 2020, Governor Raimondo signed onto the TCI-P MOU, which commits Rhode Island, Massachusetts, Connecticut and the District of Columbia to investing \$300 million per year in cleaner transportation choices and healthier communities. TCI-P is predicted to reduce greenhouse gas emissions in the region by 26% and generate \$3 billion for further clean transportation investments by 2032.²⁰

i. Regional Policy Design Process

DEM's Director, Deputy Director, Deputy Chief Legal Counsel, Chief Public Information Officer, Office of Air Resource's Deputy Administrator, Supervising Air Quality Specialist and Senior Air Quality Specialist all participate in various regional committees and workgroups including the Leadership Team, Executive Policy Committee, Communications, and Outreach Workgroup, Technical Analysis Working Group (TAWG), TAWG modeling subgroup, TAWG regulated entities subgroup, TAWG model rule subgroup, Complementary Policies Workgroup, and Legal Workgroup. For more information, visit TCI Regional Policy Design Process website.²¹

ii. Anticipated Timeline:

- 2021: Participating jurisdictions take any legislative steps that could be needed to implement the regional program and conduct rulemaking processes to adopt the regulation.
- 2022: Program implementation begins.

¹⁹ Reference Rhode Island General Laws 23-23-29.2¹⁹ and 31-16.1

²⁰ <https://www.transportationandclimate.org/final-mou-122020>

²¹ <https://www.transportationandclimate.org/main-menu/tcis-regional-policy-design-process-2019>

N. Volkswagen Appendix C

As part of Appendix C of the VW Settlement, Volkswagen must invest \$2 billion to promote the use of ZEVs and ZEV technology in the United States. \$800M is to be spent in CA, \$1.2 billion in the rest of the country. The \$1.2 billion is to be spent in four 30-month cycles. Electrify America and NESCAUM have signed an agreement where NESCAUM has been retained to develop recommendations for strategic regional investments in the Northeast Corridor.

- i. DEM through NESCAUM ZEV Taskforce and the Electrify America Steering Committee provides comments and direction to support charging infrastructure investments in our state and the northeast.
- ii. DEM provided direction on Cycle 3 investments, focusing on: (1) DC fast charging along travel corridors; (2) community charging hubs serving EV drivers without home charging; and (3) community charging hubs to support the electrification of transportation network companies (TNCs) and taxi fleets. In addition, DEM also urged for investment in brand-neutral education and projects to increase access to ZEVs.

O. Northeast Corridor Infrastructure Strategy

Federal Highway Administration (FHWA) established a national network of alternative fueling and charging infrastructure²² along national highway system corridors.

- 2016- I-95 designated by FHWA as Alt-Fuel Corridor for Electric Vehicles
- 2017- I-95 and Rt. 6 designated by FHWA as Alt-Fuel Corridor for CNG and Hydrogen
- 2018 – RIDOT installed signs along I-95

DEM through NESCAUM developed the Northeast Corridor Regional Infrastructure Strategy (see supporting documents).

P. National Building Code Reform

DEM worked with NESCAUM to support EV-ready building code amendments to the 2021 International Energy Conservation Code (IECC) for newly constructed and commercial properties. We submitted two rounds of public comments in support of the proposed EV-ready requirements and conducted outreach to voting code officials in our state.

- DEM provided support documents to all RI voting code officials before the IECC vote (See supporting documents below).
- In December 2019, the amendments were approved by the body of voting officials.
- Final adoption will not occur until approval by the ICC Board of Directors.

²² https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/

Q. National Advocacy

DEM (through NESCAUM ZEV Taskforce) provided EV incentive and infrastructure funding recommendation letters to the Senate Finance, Senate Environment and Public Works, House Ways and Means, and House Transportation and Infrastructure committees.

R. Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding (MHD ZEV MOU)

Rhode Island signed onto the Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding (MOU). This MOU focuses on transitioning larger vehicles, such as pickup trucks, box trucks, school buses, and long-haul delivery trucks, to electric vehicles. The goal is to ensure that 100 percent of all new truck and bus sales are ZEV by 2050, with an interim target of 30 percent by 2030.

The Northeast States for Coordinated Air Use Management (NESCAUM) launched a new webpage to enable the public to learn more about the MHD ZEV Action Plan development process and to provide input on the plan. The webpage includes announcements, key documents, online learning materials (e.g. recording of informational webinars), and a portal for the public to submit suggestions, ideas, and comments.²³

X. *DISCONTINUED AND PAUSED INITIATIVES*

S. Building Code Reform

Since the December 2019 vote, the National Association of Homebuilders (NAHB) mounted a back-channel effort to defeat the EV-ready amendments. NAHB challenged the eligibility of more than 1,000 state and local government code officials who were registered to vote on the 2021 code amendments. This effort failed. In a direct request to the ICC Board that bypassed the prescribed public appeal process, NAHB also asserted that EV-ready requirements are beyond the scope of the IECC and should be rejected by the ICC Board. The NESCAUM_EV-Ready Amendments_3-23-2020 letter supports the final adoption of the EV-ready amendments and responds to NAHB's scoping argument.

T. US DOE EV Smart Fleets Program: DOE Cut Program

The U.S. Department of Energy "EV Smart Fleets" program was cut. The program provided materials including an EV Fleet Procurement Analysis Tool that state fleet managers and procurement officials could use to compare the life-cycle costs and emissions of EVs and conventional vehicle models. DEM through NESCAUM provided documents and resources to RI State Fleet. There has been no additional action on this since 2016.

U. Aftermarket Catalytic Converter Rules: Delay at Federal Level

Due to continued delays at the federal level, several states (New York and Maine) have adopted their own rules based upon the OTC model rule. Other states considering a similar rule include Maryland, New Jersey, Colorado, and Connecticut. DEM (through the

²³<https://www.nescaum.org/documents/medium-and-heavy-duty-zero-emission-vehicles-action-plan-development-process/>

OTC Mobile Sources Committee) will continue to work with EPA to push for an updated federal program because a strong federal program is preferable to a patchwork of state rules that often cross over between environmental and motor vehicle agencies and may encourage product dumping in states that do not adopt a rule.

V. DEM's Hospital Idle Reduction Grant

The RFP, application, and press release were issued in July 2020. The application period was open through November 13, 2020. No applications were received.

W. Clean Diesel Fund

No additional appropriated monies have been provided to the program therefore no applications are being accepted at this time. The regulation is still on the books.

XI. MAJOR INITIATIVES ON THE HORIZON IN CLEAN TRANSPORTATION

X. CARB's Advanced Clean Truck Rulemaking (ACT):

California proposed the first in the nation rulemaking,²⁴ which requires medium- and heavy-duty vehicle manufacturers to sell an increasing number of electric (Class 2B to Class 8²⁵) trucks in California.

- i. Zero-emission truck sales: Manufacturers who certify Class 2B-8 chassis or complete vehicles with combustion engines would be required to sell zero-emission trucks as an increasing percentage of their annual California sales from 2024 to 2030. By 2030, zero-emission truck/chassis sales would need to be 55% for class 2b-3 vehicles, 75% of class 4-8 straight truck sales, and 40% of truck tractor sales.
- ii. The regulation and supporting policies/incentives could result in ~100,000 ZEVs on CA's roads by 2030, and as many as 300,000 in 2035.
- iii. Company and fleet reporting: Large employers including retailers, manufacturers, brokers, and others would be required to report information about shipments and shuttle services. Fleet owners with 100 or more trucks would be required to report about their existing fleet operations. This information would help identify future strategies to ensure that fleets purchase available zero-emission trucks and place them in service where suitable to meet their needs.
- iv. DEM (through the NESCAUM ZEV Taskforce and Mobile Sources Committee) will continue to learn and monitor CA's rulemaking. This could be identified as a state action in the future multi-state MHDV ZEV Action Plan.

²⁴ <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks>

²⁵ <https://afdc.energy.gov/data/10381>

Y. CARB's Heavy-Duty NOx Rulemaking:

California is in the process of finalizing a rulemaking,²⁶ which would include more stringent standards for NOx emissions, revised certification test procedures including a new low load cycle, amendments to the emissions averaging, banking and trading program, amendments to warranty length and useful life periods, updated certification durability demonstration requirements, revisions to the heavy-duty in-use testing program and revisions to warranty rate based corrective action.

- i. New standards could result in a 90% reduction in NOx emissions compared to the emissions of today's diesel engines.
- ii. To the extent possible, CARB plans on coordinating its regulatory efforts with U.S. EPA's Cleaner Trucks Initiative.

Z. EPA's Cleaner Trucks Initiative:

Heavy-duty engine NOx emissions standards were last updated 20 years ago by EPA. EPA is currently developing a regulation to control heavy-duty NOx emissions.

- i. DEM has been engaged (with the Ozone Transportation Commission and NESCAUM) on the proposed rulemaking to ensure a final Cleaner Trucks Initiative regulation results in substantial in-use NOx emission reductions, set stringent new engine emissions standards, and maintains state authority to adopt emissions standards established by the Clean Air Act.
- ii. OTC submitted comments²⁷ to EPA on its Cleaner Trucks Initiative. The comments were developed through the OTC Mobile Sources Committee. OTC's comments requested that EPA establish a NOx certification standard of 0.02 grams per brake horsepower-hour, equivalent to a 90 percent reduction from current standards.
- iii. The comments made the case that deep additional reductions in NOx emissions are needed for states in the OTR to meet the National Ambient Air Quality Standards (NAAQS). The comments followed an August 2019 letter from the OTC to EPA urging the agency to establish stringent new engine standards for NOx. In a related effort, the Mobile Sources Committee, in conjunction with the Modeling Committee, have begun to analyze the NOx emissions and ozone reductions that could be realized with the introduction of new federal heavy-duty engine NOx emission standards.

EPA is expected to release a Notice of Proposed Rulemaking on the Cleaner Trucks Initiative in the summer of 2020.

²⁶https://ww2.arb.ca.gov/our-work/programs/heavy-duty-low-nox/heavy-duty-low-nox-meetings-workshops?utm_medium=email&utm_source=govdelivery

²⁷<https://otcair.org/upload/Documents/Correspondence/OTC-MANEVU%20CTI%20ANPR%20comments%20200220%20final.pdf>

AA. Rhode Island's Heavy-Duty Inspection and Maintenance Program (Under Development)

In accordance with RI general law, chapter 31-47.2,²⁸ it has been determined in the public interest to establish a program regulating emissions from heavy-duty diesel trucks and buses traveling in the state. Rhode Island Heavy-Duty Inspection and Maintenance Program: will help ensure heavy-duty vehicles operating in RI are well maintained and have properly functioning emissions control systems for the duration of their on-road operations. This program is under development in coordination with the DMV.

XII. EQUITY

A. DEM signed an MOU with the Racial and Environmental Justice Coalition to establish a liaison that will advise DEM on issues related to equity and environmental justice.

B. Community-Scale Air Toxics Monitoring Report

- i. I-95 passes through Providence neighborhoods with some of the highest poverty and childhood asthma rates in the state.
- ii. Long-term outcomes:
 1. Reducing exposures of members of the public to pollutants from highway vehicles; and
 2. Reducing ambient levels of air pollutants in the near-road environment.
- iii. DEM was awarded over \$260,000 for an EPA Community-Scale Air Toxics Grant with which it will monitor levels of volatile organic air toxic compounds near the Port of Providence and characterize the risk to the most highly impacted populations including surrounding environmental justice areas, schools, hospitals, residences and recreation facilities. This study will focus on VOCs found in diesel exhaust and petroleum products. Monitoring will begin in 2021.
 1. In addition to monitoring for VOCs through the Community Scale Grant, DEM's Office of Air Resources has recently deployed five low-cost sensors which measure particulate matter (PM25). These sensors are located at the sites planned for the Community Scale study.
 2. The comprehensive port study also includes a survey of all sources in the area for chemical and fuel use and inspections at facilities located in the Port area.

²⁸ <http://webserver.rilin.state.ri.us/Statutes/TITLE31/31-47.2/INDEX.HTM>

Department of Transportation

I. OVERVIEW

The Rhode Island Department of Transportation (RIDOT) designs, constructs, and maintains the state's surface transportation system. This includes not only roads and bridges but also the state's rail stations, tolling program, bike paths, and ferry service. RIDOT has about 700 employees, maintains 1,100 miles of roadway (724 urban and 374 rural) and 1,178 bridges, runs five rail stations, and has an annual budget of about \$570 million.

RhodeWorks:

In 2016, with the passage of the sweeping RhodeWorks legislation, the department underwent a complete restructuring as mandated by the legislation. RIDOT developed the first ever 10-year transportation plan for the state and has adopted unprecedented accountability measures. The \$5 billion RhodeWorks program provides for the planning, execution, management, and funding to bring Rhode Island's infrastructure into a state of good repair by the year 2025.

In 2020, RIDOT is in its fifth year of implementing RhodeWorks. In the past four years RIDOT achieved significant results, including:

- Overseeing 207 projects with a total investment of \$2.2 billion - including work on 333 bridges
- Completing 119 projects - including 69 bridges - worth \$518.6 million
- Launching the first-in-the-nation large tractor trailer truck only tolling system
- Completing 36 pavement projects worth \$167.5 million
- Completing 28 traffic projects for an investment of \$62.6 million
- Spending half a million dollars on a stormwater program

As of December 2020, RIDOT has 47 active projects with valued at \$2.1 billion. Work includes a combination of bridge repair, replacement, and preservation activities on 241 bridges.

II. TRANSIT PROJECTS TO PROMOTE CLEAN TRANSPORTATION AND MOBILITY

A. Rail Transit:

Rhode Island Department of Transportation (RIDOT) is investing substantially in its rail transit infrastructure.

- i. Improvements to Kingston Station in South Kingstown, near the University of Rhode Island, to bolster handicap accessibility. New high-level platforms, and third track and interior rehabilitations are now complete.
- ii. Providence Station State of Good Repair Project, which includes improvements to Providence Station HVAC, public restrooms, an expanded passenger waiting area, and overall westward expansion towards the Providence Place mall that will expand retail dining areas. This \$25M project to keep one of Rhode Island's most critical rail stations in a state of good repair is half-funded through a

Federal Grant with a full match provided by a cooperative effort between the state of Rhode Island and AMTRAK.

- iii. The Pawtucket Central Falls Station project will provide Rhode Islanders with yet another linkage for MBTA and AMTRAK service and is already in construction. RIDOT awarded a design/build contract in late 2018 and full construction began in Summer 2020. This project was enabled by a 2016 Tiger Grant for the Pawtucket / Central Falls Commuter Rail Station Project

B. Mass Transit Ridership and Interest

Mass transit ridership and interest increased close to 50% before COVID-19. The continued improvement and expansion of Rhode Island's commuter rail infrastructure has reinvigorated interest and adoption for mass transit in the state. Mass transit reduces congestion on roadways by providing an alternative to single-rider automobiles, and in turn reduces emissions from automobiles.

- i. 43.74% Increase in trip utilization in Q1/Q2 FY20
 - 1. In Fiscal Year 2016, the average number of weekday trips being taken from Rhode Island's rail stations amounted to 3,557.
 - 2. Quarter 1 and Quarter 2 for FY20 indicated an average weekday trip figure of 5,113, a 43.74% increase to 2016.
 - 3. Even in the face of COVID-19 closures during Quarter 3, average daily trips still amounted to 3,330.
 - 4. As COVID-19 related restrictions eased in Rhode Island and Massachusetts ridership at each station gradually increased. However, at the close of 2020 ridership is still substantially below pre-pandemic levels, with an approximately 80 percent decline at Providence Station and 88 percent decline at TF Green and Wickford Junction.

C. Ferry System: Unique Clean Transportation Asset to RI

In 2016, the state initiated the Providence-Newport Ferry Program in order to provide a means of non-bus mass-transit between the state capital of Providence and Rhode Island's tourism capital of Newport. Opening season saw 33,000 trips alone and has provided Rhode Islanders with an expedient, congestion-reducing, and scenic method of traveling between two of the state's tourism destinations.

- i. Ferry ridership and reach:
 - 1. 2019 season: The Providence-Newport Ferry gained a 9% year-over-year increase in ridership with 46,405 passengers spread across 134 days of operation.
 - 2. During the COVID-19 pandemic, RIDOT continued with a successful Ferry season while maintaining all COVID-19 protocols. The Ferry ran from June to October and total Ferry passengers totaled 15,071. The season began in late June, operating under all appropriate Phase 2 and Phase 3 rules and regulations found in state's reopening plans. Ferry

service was provided to more than 15,000 before its seasonal conclusion on Columbus Day Weekend.

3. The 2019 numbers are the highest ferry ridership figures across four years of operation, and since the 2016 inaugural season the ferry has seen an overall increase in ridership of 40%.
4. The reach of the ferry was also expanded in 2019 with additional service being offered out of Bristol.
5. Economic Impact to the region primarily contributed to tourist economy
6. Surveys of passengers during the 2019 season indicated that ferry passengers spent an estimated total of nearly \$2 million in the local Newport economy, averaging \$87 per person.
7. Of the respondents, 57% were native Rhode Islanders with 40% hailing from other states. The remaining 3% represents international tourists.
8. Passenger feedback was overwhelmingly positive, and 56% of all respondents claimed that their decision to travel to Newport was enabled by the Providence Newport Ferry.
9. This figure is up from 40% in 2016.

III. INVESTMENTS IN ELECTRIC VEHICLES, FAST CHARGING INFRASTRUCTURE AND COMPLEMENTARY POLICIES IN RENEWABLES AND ENERGY EFFICIENCY

A. Purchasing Electric Vehicles for RIDOT Fleet

- i. In accordance to Rhode Island's 2030 clean energy targets, RIDOT has aggressively pursued the acquisition of electric vehicles for its motor pool. RIDOT is moving to operate the entirety of its vehicle fleet using EVs.
- ii. At this time 10 new vehicles have been purchased and are in use, distributed throughout the fleet.

B. EV Infrastructure: DC Fast Charging Stations Installation

RIDOT is also committed to providing services for users that choose to adopt emerging green technologies such as commercial EVs, and the department has recently installed high-speed charging stations at two Park 'n Ride stations off Interstate 95.

C. Complementary Policies in Solar, Energy Efficiency, and Renewable Electricity

This initiative is working to source electricity to charge these vehicles in a more environmentally conscious manner.

- i. RIDOT is exploring the installation of solar panels in areas that have already been deforested, such as highway rights-of-way or Park 'n Ride locations. Clear cutting of forests to construct solar farms has an adverse impact on carbon sequestration, and RIDOT is in a unique position to utilize the abundance of undeveloped space in its highway medians to avoid that cost.

- ii. Not only would this initiative generate energy from renewable sources, just as arrays on RIDOT buildings have done, but it would provide RIDOT with the opportunity to sell this energy to National Grid.
- iii. Rhode Island was the first state to convert the totality of our highway lighting from incandescent bulbs to 113-watt LEDs. This conversion involved 7,566 roadway fixtures owned by DOT and saves 5,134,539 kilowatt hours (kWh) per year. The estimated annual energy savings generated by this program is \$821,526.

IV. OUTCOMES AND OBJECTIVES MET AS A RESULT OF COMPLETED PROGRAMS AND INITIATIVES

- A study on the efficacy of the adoption of EVs in the RIDOT motor pool, based on the department's current inventory of 10 vehicles, is pending.
- The conversion of incandescent highway lighting fixtures saves 5,134,539 kWh per year, which converts to \$821,526 in monetary savings.
- The installation of high speed EV charging stations at Park N' Rides is very recent, and at the time of writing this report these stations have not yet been activated. Data is not yet available.

V. DISCONTINUED AND PAUSED INITIATIVES AS A RESULT OF COVID-19

The outbreak of COVID-19 has inflicted delays and setbacks on many of RIDOT's ongoing initiatives, but the Department remains committed to achieving the goals set forth in its 10-Year Plan.

A. Mass Transit

COVID-19 has made many riders question the viability of mass transit and opt for more private, albeit congestion-inducing alternatives. In turn, it is government's duty to re-assure the public that mass transit will remain a viable, reliable, and safe method of transportation when service reopens following the pandemic. Rhode Island's continued investment in and enthusiastic support of mass transit is also an investment in clean transportation. Despite reductions in ridership caused by COVID-19, RIDOT remains committed to partnering with MBTA and Amtrak to improve accessibility for the state's railway network.

B. EV Fleet Purchasing

Financial shortfalls incurred by COVID-19 resulting from reductions in Gas Tax income have delayed further acquisition of EVs in the RIDOT motor pool.

VI. AUTONOMOUS VEHICLES

A. Obligation to the Future of Technology

RIDOT's obligation is to serve Rhode Islanders today and to stay ahead of emerging policy trends and to mirror RIDOT's 10-Year Plan—where projects are envisioned and planned a decade in advance—mandating that RIDOT monitor opportunities afforded by emerging technology closely.

B. Rhode Island Transportation Innovation Partnership (TRIP)

This multiagency effort, led by RIDOT, accepted proposals in 2018 for an autonomous vehicle transit pilot program in Providence, which began operations in Spring 2019.

- i. Program Initiation: Prior to the establishment of TRIP, RIDOT had hosted a Technical Committee meeting of the World Road Association (PIARC) in April of 2017. This event included an international mini summit on Connected and Automated Vehicles (CAVs), the road ahead for transit policy, and the implications of autonomous transit on urban planning. The insights provided by both the domestic and international speakers inspired RIDOT to deploy its own CAV strategy in order to further its spatial planning and economic development objectives.
- ii. RFI: Shortly after this summit, RIDOT issued Request for Information (RFI) #7553496 to solicit information from parties experienced in the use of CAVs to facilitate the adoption and integration of this technology by the State of Rhode Island.
- iii. TRIP Objectives:
 - 1. Safer transportation
 - 2. Sustainability, fuel reduction, reduced congestion
 - 3. Improved and equitable mobility
 - 4. Economic growth and a strong workforce
 - 5. Smart cities, data management, and privacy

C. Public/Private Collaboration:

The Transportation and Innovation Partnership entailed a collaboration between private and public experts in the field of CAVs.

- i. CAV Expo at the New England Institute of Technology (NEIT) in September of 2017.
- ii. The insights derived from both the RFI and this expo culminated in a November 2017 joint research forum with the University of Rhode Island (URI) titled *“Transportation Innovation Partnership (TRIP): Leading the Way for Research”*.
- iii. TRIP Autonomous Mobility Challenge RFP served as the starting gun for a pilot program to test the feasibility and safety of multi-passenger autonomous vehicles in an urban environment.
- iv. Public Engagement: an opportunity to directly engage the public with the agenda that RIDOT had now spent over a year coordinating with technical experts to transform into policy.

- v. High Profile and Press: The year-long pilot garnered substantial attention from media outlets throughout the region and country, as the largest test site for on-road autonomous public transit.

RIDOT has compiled press coverage and feedback on the Little Roady program since its inception. This repository of press can be found in the footnoted link.²⁹

D. The Little Roady Autonomous Vehicle Shuttle Pilot

Started in May 2019 under contract with Michigan-based startup May Mobility.

- i. Feedback from Riders
 - 1. Community feedback was actively sought by the State of Rhode Island and its partners throughout the program, including a public meeting in early 2019 in the city of Providence on the shuttle route.
 - 2. The feedback received by riders spurred the state to work more closely with May Mobility to address occupant concerns such as the lack of air conditioning during times of elevated heat or limited access to individuals with disabilities.
- ii. Safety related incidents
 - 1. As of the end of April 2020, the Little Roady Pilot Program had seen 13 safety incidents over the course of the 42,000 rides provided since its May 15, 2019 launch. However, each of these safety incidents occurred at a time when either humans were operating the vehicle, the vehicle was stopped, or were the result of actions by other drivers; These incidents involved collisions with other vehicles or objects along the shuttle route, and no injuries were recorded.
 - 2. Human intervention vehicles: The Little Roady shuttles included a human attendant that is able to override the autonomous functions of the vehicle when needed.
- iii. Stakeholder engagement

The Rhode Island Transportation Innovation Partnership (TRIP) included not only RIDOT, but also the City of Providence, the Quonset Development Corporation, the University of Rhode Island, and other partners.

²⁹ <https://drive.google.com/file/d/1zazD6liTW31Mn6v9kNxEb8f7cvNCY0ql/view>



E. Research Component

TRIP also includes a research component, with the goal of studying autonomous mobility solutions, ridership, workforce impacts, environmental impacts, and technology adoption, among others.

Please refer to the attached Draft Mid-Term Shareback Report.

- i. The draft report surveyed riders of the Little Roady Pilot Project to analyze the efficacy of the program, public interest in its continuation, and whether it had improved transit accessibility to various parts of Providence.
- ii. While the attached Draft Mid-Term Shareback Report provides some advance insight into the research component that RIDOT built into the TRIP Mobility Challenge, RIDOT is continuing to work with our research team, led by 3x3 Design with participation from Brown University, and a final report is expected to be available for review in 2021.

F. Outcomes on TRIP Objectives

i. Safer Transportation:

In the long run, autonomous vehicles may have the potential to eliminate many of the human factors that cause traffic fatalities. In the short term, as we transition to this new mode of travel and test them, CAVs must be able to safely share the road with all users. In addition, RIDOT maintains that CAVs must be able to operate within the limitations of the existing infrastructure rather than requiring specialized and expensive infrastructure investments.

The Mid-Term Shareback report indicates that many riders of the Little Roady pilot program found the shuttle to be *nearly as safe as a human-operated bus, and safer than opting for bicycles or scooters* (n=665). From the program's launch on May 15, 2019 to the end of April of 2020, Little Roady witnessed 13 traffic incidents along its urban route from Olneyville Square to RIDOT Headquarters. None of these incidents resulted in physical harm to roadway users, and all either involved human control of the vehicle or liability by another driver on the road.

ii. Sustainability:

We will work to ensure that integration of CAV technology achieves reductions in fuel use and associated carbon emissions.

At this time RIDOT does not have any data to support this but is continuously monitoring ridership rates and is investigating ways of ensuring that EVs are being charged via energy sources that are not detrimental to the environment.

iii. Equitable Mobility:

Integration of this new technology will adapt to the needs of a broad user base and accommodate a diverse set of needs.

The Little Roady program provided free and accessible public transit to an underserved urban community that previously lacked that even a bus route. Service from 12 stops continues every 10-15 minutes between 6:30am and 6:30pm along a total route length of 5.3 miles. The service has been used by commuters, shoppers, residents and tourists alike.

iv. Economy and Workforce:

Rhode Island supports training for new career pathways that will help offset any changes in job opportunities, encourage new investment, and expand opportunities for our workforce.

The Little Roady Pilot Program was deployed in the Woonasquatucket Urban Innovation District. This burgeoning section of Providence has witnessed a substantial influx of public and private investment in recent years. Despite the district's status, it was considered a transit desert due to the absence of RIPTA service in the area. Little Roady provided residents within the district with a means to access Providence's Central Business District in an expedient, reliable, and affordable manner. Stops at the State House and Providence Train Station provide easy access to the headquarters of some of the state's largest employers and universities. Furthermore, the Providence Station connection tethers Little Roady to Amtrak and MBTA service to provide intermodal public transit opportunities to the Woonasquatucket district.

Despite the fact that the Little Roady network used autonomous vehicles, these assets have not made the need for human operation redundant. CAVs remain an emerging field of technology, and their imperfections necessitate a human attendant to ensure the safety of other passengers. Furthermore, the Little

Roady route is heavily trafficked by traditional automobiles and pedestrians, and the propensity for these parties to make errors will remain even with a perfectly safe autonomous navigation system. In fact, the first of the aforementioned safety incidents that involved a Little Roady shuttle entailed another vehicle sideswiping the shuttle while in traffic.

Further exploration of CAVs will provide new job opportunities for Rhode Islanders. These opportunities may come from the improved accessibility of public transit, direct employment in the program, or as this project grows and the state studies ways to continue to be a national leader in this technology.

v. Smart Cities:

Our infrastructure can serve as a platform for information-gathering and sharing to improve our systems, expand efficiencies, and allow for connectivity while protecting the privacy of individual users.

The Smart Cities component of Little Roady has yet to be exercised. May Mobility installed Roadway Sensor Units (RSUs) to utility poles on route, but they are proprietary to the company and have been since removed. The TRIP partnership has explored use of dedicated traffic signalization in the corridor, but they were not needed due to RSUs being utilized by the vendor.

G. Autonomous, Connected Legislation and Policy

As of August 2019, over 30 states have enacted legislation related to autonomous vehicles, with 26 states specifically authorizing testing, piloting, or operating autonomous vehicles. 12 states have approved at scale AV operations, with the caveat that vehicles comply with, or receive exemptions from federal safety standards. Despite authorizing legislation, regulations for AV operations are only beginning to take shape.

What has RIDOT done to explore legislation to authorize testing, piloting or operating Autonomous Vehicles? Have there been hearings on legislation or policy considerations for autonomous, shared or Transportation as a Service?

- i. RIDOT has proposed a Legislative Commission for the Study of Emerging Transportation Technologies (see attached Word doc), however the request did not receive traction at the time. RIDOT is prepared and ready to support any legislative initiatives on the technical and public policy side.
- ii. RIDOT reviewed existing legislation and determined the best course was permissive rather than restrictive statutes.
- iii. RIDOT is also a member of a research consortium comprised of all the DOTs from the New England states, namely the New England Transportation Consortium (NETC). NETC has recently published an RFP for proposals for a team to review all of the region's policies and regulations on AVs and will come up with recommendations that would help states adopt complimentary policies/legislation.

H. Policies and Programs Addressing Various Topics

i. Congestion management of traffic today and the challenges of the future

The Division of Statewide Planning has put together a Congestion Management Plan (CMP), through a committee RIDOT sits on, to address the state's long-term congestion challenges and action items. The plan, which passed the State Planning Council in mid-2020, is based upon goal areas established under the RIDSP Moving Forward 2040 plan. These primary objectives are as follows:

- Improve reliability of the transportation system
- Reduce recurring congestion
- Improve freight and goods movement
- Increase modal choice and competitiveness
- Improve intermodal connectivity
- Promote and invest in innovative congestion management technologies
- Promote land development and infill development/redevelopment in transportation-efficient locations
- Reduce emissions and improve air quality

The objectives listed above support additional goal areas of connecting people and places, reinventing the transportation network, strengthening communities, promoting environmental sustainability, and supporting economic growth. Each of the primary CMP objectives also has its own list of performance measures to ensure that progress towards these goals is tracked effectively.

The Congestion Management Plan is coordinated with existing statewide plans including the Long-Range Transportation Plan (LRTP), State Transportation Improvement Program (STIP) Ten Year Plan, modal plans, and major corridor plans. Interagency communication and coordination ensure that congestion related goals and strategies present in all of these plans are in consideration.

Rhode Island agencies have developed a comprehensive action plan for the next five or more years to ensure the implementation of the Congestion Management Process. These actions fall under activity categories of Planning, Implementation, Data Collection, Evaluation and Monitoring, and Coordination.

ii. Modernizing the transit system and state and municipal transportation assets to more effectively and sustainably move people throughout the state

1. The Kennedy Plaza Transportation Hub project is an initiative to modernize a key intermodal transit link between buses and rail. In order to improve accessibility, this initiative will develop three bus 'sub hubs' at Kennedy Plaza, Providence Station, and near the Garrahy Judicial Complex near I-195. This effort involves coordination among RIDOT, RIPTA, the city of Providence, the Providence Foundation, and private landowners along the route.
2. In 2018, RIDOT received a State of Good Repair (SOGR) grant for \$12.5 million dollars from the Federal Railroad Administration (FRA) and

Department of Transportation (USDOT). This grant was matched by the state of Rhode Island and its partners in Amtrak to pursue a \$25 million project to modernize and expand Providence Train Station. The modernization will include new bathroom facilities, HVAC installation, expanded passenger waiting areas, improvements to fire safety, and an extension of the building westward towards Providence Place Mall that will afford additional retail space. Thirty-percent design has been completed at this time, and a Scope of Work has been submitted for final design. Design will begin by January/February 2021 and the construction is slated for March/April 2022.

3. The Pawtucket Central Falls station project reopens access to the rail lines after nearly 40 years of halted service. This facility will once again serve as a critical middle link between the cities of Boston and Providence and expand economic opportunities. To date much of the work on this project has focused on engineering with some collaboration with Amtrak for track work. The project is under construction.
 4. Cross-Honoring Program: When the immediate threat posed by COVID-19 has lessened, RIDOT and its partners in MBTA and Amtrak will begin a cross-honoring program. Holders of MBTA monthly passes will be permitted to board an Amtrak train out of Rhode Island-based stations to travel to South Station in Boston at no additional cost. As part of this agreement RIDOT will reimburse Amtrak for the difference in ticket costs for the trip. While this agreement was signed in early March of 2020, the program is on hold until service returns to normal levels.
 5. Ongoing operational enhancements within RIDOT support the effectiveness and reliability of transit operations. RIDOT, the University of Rhode Island, and RIPTA have worked closely to develop the “T-Link” Bus Service. This service mirrors the train routes of Kingston, Wickford Junction, T.F. Green, and Providence to allow riders that may potentially miss a train to have a ‘backup’ into Providence Station. Furthermore, regular bus service between the URI Kingston campus and Wickford Junction bus station has helped to alleviate parking congestion on the URI campus while providing students with readily available transit access to pursue work or leisure.
- iii. Prioritizing transportation projects that address sustainable outcomes and smart growth policies

RIDOT partners with DOA’s Division of Statewide Planning (RIDSP) to prioritize projects in the State Transportation Improvement Plan that reflect the goals set by the State Planning Commission in the Long-Range Transportation Plan.³⁰ Sustainability and smart growth policies are among those favored in by planners in judging which projects get approved for use of precious transportation funds.

³⁰ <http://www.planri.com/>

- iv. Transportation Data Collection- availability of real time transportation information for planning purposes
 - 1. As of July 2020, RIDSP and RIDOT, through membership with the I-95 Corridor Coalition purchased Travel Time Data for the state to support numerous planning, operations, research, communications, and performance measuring/monitoring activities.
 - 2. These needs include, but are not limited to: Origin, destination, and modal data; travel conditions and trends over time in traffic congestion, travel time reliability/traveler information, mode share, mode choice, and travel routing/paths/patterns; tracking long-term responses to transportation system changes; tracking impacts of crashes, incidents, and special events; user response to construction and work zones; detecting system disruptions; tracking historical travel demand and travel times; and measuring/analyzing traveler movement, behavior, and preferences under a variety of transportation system conditions.
 - 3. In addition, with the help of the Division of Information Technology and other state partners and consultants, RIDOT has begun using PowerBI tools for crash databases that show real-time incidents and work-zone safety hazards.
 - 4. RIDOT is also developing a GIS-based data tool for project information that helps bundle projects based on greatest need and financial advantage.
- v. Development of a strategy to support connected and autonomous vehicles

RIDOT in consultation with the Little Rody partners (City of Providence, RIPTA, FHWA) did develop a strategy that was going through implementation, which has been sidetracked by COVID-19 and the actions taken by May Mobility. The strategy included continuation of Little Rody on the same route, working with City and May Mobility for upgrading infrastructure and May Mobility vehicles to enable two-way V2I (Vehicle to Infrastructure) Communication and starting a new route at a different location in Providence, including a segment where vehicles would be required to be 100% autonomous.
- vi. Development of VMT (Vehicle Miles Traveled) standards

As a member of the I-95 Corridor Coalition, RIDOT was asked to take part in a VMT measurement pilot, that then could translate into mileage-based user fees.³¹ Demonstration pilots have been done in North Carolina, New Jersey, Virginia, Delaware and Pennsylvania. Rhode Island has elected not to take part in this project due to the state's truck-only tolling program.

I. Discontinued and Paused Initiatives

- i. Suspended Little Rody Program: The autonomous service portion of the mobility pilot was suspended by May Mobility due to the COVID-19 pandemic.

³¹ <https://tetcoalitionmbuf.org/>

RIPTA provided traditional small-vehicle (paratransit bus) service for the period of March 15 – June 30, 2020. RIDOT continues working with the research team to finalize its report, including the incorporation of additional components that compare riders’ perspective during both the autonomous and paratransit services along that route.

- ii. Strategy on Connected, Automated Vehicles: RIDOT in consultation with the Little Roady partners (City of Providence, RIPTA, FHWA) did develop a strategy that was going through implementation, which has been sidetracked by COVID-19 and the actions taken by May Mobility.
- iii. Cross Honoring Program with AMTRAK and MBTA: While this agreement was signed in early March of 2020, the program is on hold until service returns to normal levels.

VII. EQUITY

- A. RIDOT launched the Rhode Island Transportation Innovation Partnership (TRIP) in 2017. This multi-agency effort accepted proposals in 2018 for an autonomous vehicle transit pilot program in Providence.

- i. Equity goal: “Integration of this new technology will adapt to the needs of a broad user base and accommodate a diverse set of needs.”
- ii. The Little Roady Pilot Project offers free rides along a fixed route in Providence in autonomous vehicles.

While not a direct goal of the project, the Little Roady pilot project was truly a “Sustainable Transportation Equity Project,” as it addressed community residents’ transportation needs, increased access to key destinations (e.g., schools, grocery stores, workplaces, daycare facilities, community centers, medical facilities), and reduced GHG emissions. Furthermore, it provided direct employment opportunities to 75 people, the majority of whom were members of the community it served.

- B. RIDOT’s Office of Civil Rights provides guidance and support to RIDOT employees to ensure meaningful implementation of Title VI principles in the department’s daily operations. The office also oversees the department’s sub-recipients of federal funds to ensure their compliance with Title VI.

Division of Statewide Planning

I. OVERVIEW

It is important to note that the Division of Statewide Planning (DSP) often plays a supporting role as the staff to the single statewide Metropolitan Planning Organization (MPO) in Rhode Island. [The official MPO in Rhode Island is the State Planning Council, an appointed body of 27.]

This model is unique within the United States, as 48 states have more than one MPO and 49 states have more than one regional planning agency: DSP not only serves as staff to the single, statewide MPO but also as the single planning agency for the region--in this case, the state.

There are a wide variety of Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) requirements for planning that govern much of DSP's work, since FHWA and FTA funding comprises greater than 70% of DSP's funding. DSP receives slightly less than \$2.5 million in FHWA funds annually, and around \$600,000 in FTA funds specifically for the Three C Planning Process – Continuing, Cooperative, and Comprehensive.

The work of DSP is primarily transportation-related, from participation as a member agency on the state's Executive Climate Change Coordinating Council (EC4) to the more obvious administrative and public outreach component in developing and amending the State Transportation Improvement Program (STIP). DSP acts as a partner to all transportation agencies, an administrative ombudsman for planning issues, serving as guides to develop a holistic plan to move Rhode Island forward. The overarching goal of DSP is to ensure equitable, sustainable, and resilient development that meets the needs of the present without compromising the needs of the future. The federally required Long-Range Transportation Plan (LRTP) was adopted by the State Planning Council on December 10, 2020- this should be considered an important element of the statewide mobility strategy.

II. CLEAN TRANSPORTATION AND MOBILITY INITIATIVES

The most important ongoing projects within the Division that are related to mobility and/or clean transportation are:

- A. The Long-Range Transportation Plan (LRTP).³²
- B. The Congestion Management Plan³³
- C. The State Transportation Improvement Program (STIP) and the migration to an e-STIP (electronic STIP). The STIP is a programming document, not a plan, but it is intended to lay out the specific strategies and projects included in the LRTP and other, associated planning documents, such as RIDOT's Transportation Asset Management Plan (TAMP) and the Transit Asset Management Plan (acronym soup, also a TAMP) developed by RIPTA. The migration to e-STIP is anticipated to take about two years and result in a system that's more accessible to

³² <http://www.planri.com/>

³³ <http://www.planning.ri.gov/planning-areas/transportation/congestion-management.php>

- the public and where RIDOT, RIPTA, and DSP will all be able to see project obstacles, progress, and connections via a geographic information systems (GIS) base.
- D. Development of project selection criteria for STIP projects, particularly those in the Transportation Alternatives Program (TAP), a joint project with RIDOT.
 - E. Development/redevelopment of the State Data Center with robust data capabilities and access to U.S. Census Bureau data (DSP is the official State Data Center for Rhode Island) along with data obtained through the University of Maryland and the I-95 Corridor Coalition (July 1 it became The Eastern Transportation Coalition (TETC)) (Vehicle Probe Data), RIGIS map data, the state's Travel Demand Model, and other databases and modeling software.
 - F. In FY2021, DSP is moving to update the state's Freight and Goods Movement Plan (an update is required every 5 years). This plan addresses issues of movement of goods into, out of, and through the state, along with technology and innovation surrounding freight movement and emissions. See Freight section of the website, including the current Freight plan.³⁴

III. *RI MOVING FORWARD 2040*

A. Status of RI Moving Forward 2040 Long-Range Transportation Plan

The Rhode Island State Planning Council, the Metropolitan Planning Organization (MPO) for the State of Rhode Island, adopted Transportation 2040, the state's Long-Range Transportation Plan at their December 10, 2020 meeting.

Under the umbrella of Transportation 2040, the state has also adopted its first Transit Mobility Plan, and Congestion Management Process Plan. These plans, together with the LRPT appendices, represent the culmination of staff and consultant efforts on behalf of the Division of Statewide Planning, working in collaboration with the Rhode Island Department of Transportation (RIDOT) and Rhode Island Public Transit Authority (RIPTA), over the course of several years.

B. Priorities of RI Moving Forward 2040

The plan envisions a multimodal transportation network that connects people, places and goods in a safe and resilient manner by providing effective and affordable transportation choices that are supportive of healthy communities, provide access to jobs and services, and promote a sustainable and competitive Rhode Island economy.

By 2040, Rhode Island's transportation system will help create quality places to live and work and support communities through improved connectivity. Rhode Islanders will be more active, healthier, and more socially and economically integrated into the community.

This is a completely different LRTP than has existed before: not only have federal requirements changed, making a data-driven performance basis mandatory within the plan,

³⁴ <http://www.planning.ri.gov/planning-areas/transportation/freight-planning.php>

but DSP is looking upon the development of the LRTP as an opportunity not just to present a wish list of transportation projects but to find the common denominators among a series of plans and develop forward-thinking guidance to direct the state's future work. The goals of the plan, specifically, are:

- Support economic growth through transportation connectivity and choices to attract employers and employees
- Promote environmental sustainability by prioritizing non-single occupancy vehicle focused strategies and investments
- Strengthen communities through the local transportation network to enhance travel, place, and quality of life
- Maintain transportation infrastructure to create a reliable network providing adequate travel choices
- Connect people and places across all modes and options for more efficient and effective travel

C. Delays Related to COVID-19

DSP has included a brief discussion of COVID-19 and its impacts on transportation in the LRTP and worked with RIPTA to review the impacts on the TMP. DSP experienced a several-month delay in the process due to COVID-19: DSP needed ensure that public input was incorporated, and that outreach plans and tools were adjusted accordingly.

IV. *BICYCLE MOBILITY PLAN*

In addition to the BMP itself, DSP is working to develop a guidebook for municipalities to explain the process for inclusion of bicycle and pedestrian projects in future iterations of the STIP: What information will be critical to include in future applications and what will be required of municipal, private, and community-level project sponsors?

Status of Program Recommendations as Outlined in the RI Moving Forward: Bicycle Mobility Plan Report:

- Revise the Rhode Island Driver's Manual to include rules related to bicycles - has not been updated
- Improve and increase enforcement of laws related to bicycles and safe road sharing - no significant changes
- Strengthen the Safe Routes to School program – This program has not continued
- Expand STIP funding for bicycle and path projects – At this time, as RIDOT begins to incorporate bicycle and pedestrian features into projects statewide, it is anticipated that funding for additional connections will be integrated into project budgets, and no additional, separate funding has yet been identified.
- Implement "Toward Zero Deaths (TZD)" policies statewide and locally – Performance measures have been adopted by RIDOT and the MPO at the state level to begin to address this goal.

V. *CONGESTION MANAGEMENT PLAN (CMP)*

A. Overview

A Congestion Management Process (CMP) is a systematic process for identifying congestion and its causes, developing monitoring processes to measure transportation system performance and reliability and developing congestion management strategies and moving them into the funding and implementation stages. Federal law requires all metropolitan areas with populations greater than 200,000 residents to develop a Congestion Management Process. As the DSP is responsible for metropolitan planning through Rhode Island, the plan associated with the CMP was developed to meet this requirement for the Providence metropolitan area. This plan has been adopted, both separately and as a component of the LRTP.

B. Status of the Plan

The CMP has been approved.³⁵ The CMP has one goal: to “Reinvent the Transportation Network”, and a number of strategies look at HOV lanes, innovative technologies, and other opportunities.

The overall LRTP also addresses many innovative technologies as opportunities including shared mobility, trucking and e-commerce, connected and automated vehicles and development patterns.

VI. *EQUITY*

A. Bicycle Mobility Plan

i. The BMP identified 7 vulnerable populations as it relates to mobility:

1. Children
2. Older adults
3. People of color
4. Limited English proficiency
5. Limited motor vehicle access
6. Limited formal education
7. Low-income households

ii. Goal 4 of the BMP: Promote equity in bicycle planning and funding

Objective 4.1: Invest in bicycle facilities in traditionally under-served communities

Objective 4.2: Distribute project funding to all regions of the state, taking into account need, collision hot spots, and future demand

Objective 4.3: Prioritize bicycle education and encouragement programs throughout the state, including traditionally under-served communities

³⁵ <http://www.planning.ri.gov/planning-areas/transportation/congestion-management.php>

Objective 4.4: Partner with traditionally under-served communities in public engagement efforts

- B. The Rhode Island Division of Statewide Planning (RIDSP) is guided by Title VI and environmental justice mandates, and strives to not only meet these mandates, but to create an overall transparent, inclusive planning process. Through the following objectives:
 - i. Enhance its analytical capabilities to ensure that the Long-Range Transportation Plan (LRTP) and the State Transportation Improvement Program (STIP) comply with Title VI;
 - ii. Identify residential, employment, and transportation patterns of low-income and minority populations so that their needs may be identified and addressed, and the benefits and burdens of transportation can be fairly distributed; and
 - iii. Evaluate and, where necessary, improve the public involvement process to eliminate barriers and engage minority, disabled, elderly, and low-income populations in regional decision-making.

Division of Public Utilities and Carriers

I. OVERVIEW

A. Unique Structure: Two Regulating Bodies

The Rhode Island Public Utilities Commission (Commission or PUC) and Division of Public Utilities and Carriers (Division or DPUC) are two distinct regulatory bodies: The Division of Public Utilities and Carriers and a three-member Commission. The Division carries out laws relating to public utilities and carriers, and the regulations and orders of the Commission governing the conduct and charges of the public utilities, including possessing broad investigative authority. The Commission serves as a quasi-judicial tribunal that has authority to hold investigations and hearings concerning utility rates, tariffs, tolls and charges, as well as facility accommodations and locations.

B. Funding

The Commission is funded primarily through fees paid by utility companies

The Commission does not receive any general revenue funding, the costs are a pass-through expenditure and are paid by regulated utilities pursuant to G.L. § 39-1-23. The FY2020 Budget provides a total operating budget of \$12.2 million, including \$12.0 million in restricted receipts and \$178,002 in federal funds.

C. Division Powers

- i. The Division is an indispensable party in all Commission proceedings with a statutory charge to enforce all directives of the Commission. Both entities may conduct inquiries, investigations, and hearings to effectuate their respective duties. Both may issue orders that have the force and effect of law.
- ii. The Division, which is headed by an Administrator who is not a Commissioner, exercises the jurisdiction, supervision, powers and duties not specifically assigned to the Commission, including the execution of all laws relating to public utilities and carriers and all regulations and orders of the Commission governing the conduct and charges of public utilities. The Administrator serves on the Governor's Policy Team on Climate.
- iii. The Division has exclusive jurisdiction over the rates, tariffs, tolls, and charges and the sufficiency and reasonableness of facilities and accommodations of common carriers of property and passengers over the State's public roadways, pursuant to Title 39, Chapters 12, 13 and 14.
- iv. Additionally, the Division supervises and regulates the TNC Industry: See 815-RICR-50-10-5.³⁶

³⁶ http://www.ripuc.ri.gov/eventsactions/docket/D_17_27_Final.pdf

D. Approach to Audit Response

- i. Review of public filings associated with Docket Nos. 4770 and 4780 (National Grid Rate Case and Settlement);
- ii. The agency's own knowledge and experience of the industries it regulates and of the companies over which it has jurisdiction; and
- iii. The agency's efforts to transform its fossil-fuel based vehicle fleet to one that operates largely on electric or electric/hybrid power.

II. *INTERNAL POLICIES, PROGRAMS, AND INITIATIVES TO PROMOTE CLEAN TRANSPORTATION*

A. Governor's Executive Order 15-17 "Lead by Example in Energy Efficiency and Clean Energy"

The Division of Capital Asset Management and Maintenance (DCAMM), within the Department of Administration, in coordination with the Office of Energy Resources, shall develop strategies for reducing fossil fuel use and greenhouse gas emissions from the State fleet, with the goal of ensuring that a minimum of 25 percent of new light-duty state fleet purchases and leases will be zero-emissions vehicles by 2025.

- i. Installation of Charging Stations at DPUC HQ
 1. In November of 2016, the Division installed two (2) dual electric vehicle supply equipment (EVSE) charging stations at 89 Jefferson Blvd. The installation of these units was accomplished by virtue of a grant from OER.
 2. In September of 2017, the Division constructed a Solar Canopy Project (Canopy Project) for 89 Jefferson Blvd., Warwick, Rhode Island 02888, the Division's place of operations. The Canopy Project involved the installation of 150 solar panels on a galvanized, zinc-coated steel frame. The Canopy Project serves as a solar carport that provides shelter for parked vehicles during inclement weather and offsets approximately 40% of the building's electric consumption. The solar carport consists of four (4) dual ChargePoint CT4000 charging stations with ports to charge eight (8) electric vehicles (EVs) at one time.
- ii. Purchasing Electric Vehicles for DPUC Fleet
 1. In December 2016, the Division added a hybrid Chevy Volt to its fleet of vehicles.
 2. In January 2019, the Division added the fully electric Chevy Bolt to its fleet of vehicles.
 3. In February 2020, the Division replaced two (2) combustion engine vehicles (Ford Escapes) with hybrid plug-ins (Subaru Crosstreks).

iii. Future Projects

The Division has had informal discussions with OER about the following two future projects:

1. Re-install the original two (2) dual electric vehicle supply equipment (EVSE) charging stations to increase the total number of charging ports from eight (8) ports to twelve (12) ports; and
2. Adding a second solar carport with additional charging stations in the parking lot at 89 Jefferson Blvd. This project will be added to the agency's capital budget in the next submission. The Division is hopeful this project can commence in FY 2022.

III. OUTCOMES AND OBJECTIVES MET AS A RESULT OF COMPLETED PROJECTS

- A. Clean Vehicle Fleet Transformation: As a result of its "clean vehicle" fleet initiative, the Division has transformed its vehicle fleet from one that was powered exclusively by fossil fuels to a fleet that operates largely on electric or electric/hybrid power today. The following chart reflects the Division's "clean vehicle" initiative from 2013 to 2020.

Year	Make/Model	Purchase Date	Type	Replaced
2013	Toyota Camry	5/17/13	Hybrid - no plug in	2001 Ford Taurus - Gas Combustion
2013	Toyota Highlander	5/17/13	Hybrid - no plug in	N/A - Added to Fleet
2014	Ford Explorer	6/18/14	Gas Combustion	2000 Ford Explorer - Gas Combustion
2016	Chevy Equinox	4/21/16	Gas Combustion	N/A - Added to Fleet
2017	Chevy Volt	12/8/16	Hybrid - Plug In	N/A - Added to Fleet
2019	Chevy Bolt	2/1/19	Electric	N/A - Added to Fleet
2020	Subaru Crosstrek	2/18/20	Hybrid - Plug In	2009 Ford Escape - Gas Combustion
2020	Subaru Crosstrek	2/18/20	Hybrid - Plug In	2010 Ford Escape - Gas Combustion

IV. POLICIES ON THE ELECTRIFICATION OF TRANSPORTATION

- A. Dockets, Proceedings and Decisions to consider the "Role of the Utility in Electrification of Transportation"

The following dockets, proceedings and decisions consider the role of Rhode Island's investor owned electric utility (IOU), The Narragansett Electric Company, d/b/a National Grid (NGrid or Company), that relate to plug-in electric vehicles (PEVs) and/or the PEV infrastructure market:

- i. The Narragansett Electric Co. d/b/a National Grid - Application for Approval of a Change in Electric and Gas Base Distribution Rates, Docket No. 4770;
- ii. The Narragansett Electric Co. d/b/a National Grid's Proposed Power Sector Transformation ("PST") Vision and Implementation Plan, Docket No. 4780; and

- iii. Approved Amended Settlement Agreement: PUC Order No. 23823. On June 6, 2018, NGrid, the Division and intervening parties (Settling Parties) in these two (2) dockets presented the PUC with a comprehensive settlement of Docket Nos. 4770 and 4780. On August 24, 2018, the PUC approved an Amended Settlement Agreement (ASA) at an open meeting and can be found at the link in the footnotes.³⁷

B. Block Island Utility District and Pascoag Utility District Plans on Transportation Electrification

The State's two (2) other electric utilities, Block Island Utility District and the Pascoag Utility District, are incorporated, not-for-profit, quasi-municipal utilities that possess a very small customer base and geographical footprint within Rhode Island.

The Division will continue to monitor any proposals these utilities submit to remove barriers to the installation of PEV infrastructure and to promote competitive PEV rates within their respective service territories.

V. *SETTLEMENT PRINCIPLES*

- A. The Role of the Utility: Perhaps the greatest catalyst in the current PEV infrastructure landscape is the introduction of public electric utilities in the PEV infrastructure market. Subject to the terms of the ASA, the major elements of the NGrid's role in RI were agreed to in the ASA – the PUC approved settlement in the Company's most recent rate case.
 - i. Precludes utility ownership of EV infrastructure:

The Program precludes National Grid from owning Level 2 or direct current fast charging (DCFC) ports developed as part of this initiative.
 - ii. Promotes competition and customer choice:

Bars National Grid from acting to preclude third party provider market development and precludes National Grid from having a say in the customer's decision on its choice of EVSE product or network services.
 - iii. Lowers cost to participating customers by socializing the cost among all ratepayers: National Grid will provide and cover the cost of the make ready work necessary to host a charging station agreeing to provide site hosts with the make ready work necessary to host a charging station. The costs associated with the make ready work are billed to all ratepayers. Electric ratepayers funding the decarbonization of the transportation sector is not sustainable or equitable in the long-term. The costs of decarbonizing the transportation sector should be borne by those who use the transportation infrastructure. However, it's reasonable for electric ratepayers to support this pilot on a short-term basis to "jumpstart" adoption of charging stations. Higher electric bills are an obstacle to transportation electrification.

³⁷ [http://www.ripuc.ri.gov/eventsactions/docket/4770-4780-NGrid-Ord23823%20\(5-5-20\).pdf](http://www.ripuc.ri.gov/eventsactions/docket/4770-4780-NGrid-Ord23823%20(5-5-20).pdf)

B. Promote Access, Compatibility, And Interoperability of The Plug-In Electric Vehicle Charging Network

- i. Pursuant to the terms of the ASA, under the "Charging Demonstration Program" all make-ready site hosts must have a choice of EVSE and network services. While NGrid may "prequalify" options for equipment and services, all pre-qualified equipment must have open standards for communications and operations.

VI. *PROGRAM DESIGN IN NATIONAL GRID ELECTRIFICATION OF TRANSPORTATION PROGRAM*

The culmination of a two-year stakeholder process, the EV transportation plan in the ASA represents a significant first step for implementing a "statewide" EV plan for Rhode Island.

A. Charging Station Demonstration Program for National Grid to implement:

- i. 38 sites /320 Ports Level 2 charging stations; and
- ii. 12 sites/ 46 Ports DCFC stations.

The initial 3-year budget for the program was approximately \$7 million, subsequently revised to approximately \$6 million.³⁸

B. Fleet Advisory Services

- i. Under the ASA, NGrid has agreed to provide an advisory service through internal and third-party expertise to support electrification of customer fleets.
- ii. Under the fleet advisory services program, NGrid agreed to conduct long-term fleet electrification studies of twelve fleet operators, including government light-duty, corporate light-duty, public transit, government medium/heavy-duty (on road and off-road) and municipal school buses.
- iii. It is anticipated that the fleet advisory services program will drive participation in other EV programs, and, as the studies are completed, incent electrification of operators' vehicle fleets.

C. Time of Use Rate Pilot

- i. Under the ASA, NGrid agreed to offer a pilot to reward customers for charging their EVs during off-peak hours.
- ii. Under this program, participating customers earn a rebate for every kWh charged between 9 p.m. and 1 p.m., 6 cents per kWh from June to September and 4 cents per kWh during all other months.

³⁸ These budget figures have been subject to change since the initial audit.

D. Demand Charge Reform

- i. Under the "Discount Pilot for Direct Current Fast Charging Station Accounts" program contained in the ASA, NGrid agreed to provide any existing or new customers billed on General C&I G-02 or Large Demand Rate G-32 rate with a monthly bill discount that is based on a per KW credit set at the same rate as the applicable distribution demand charge.
- ii. This discount is intended to encourage the development of DCFC stations by lowering their overall operating costs.

VII. *OUTCOMES AND AUDITS OF NATIONAL GRID PROGRAM*

- The Division continues to monitor NGrid's performance and lessons learned under the plan.³⁹
- NGrid's electric transportation program Rate Year 1 Annual Report may be found at the link in the footnotes.⁴⁰
- NGrid's Response to the PUC's First Set of Data Requests regarding NGrid's ETI Rate Year 1 Annual Report may be found at the link in the footnotes.⁴¹
- See NGrid's ETI Rate Year 1 Annual Report, *supra*.

VIII. *POLICIES TO ENABLE RATEPAYER BENEFITS FOR ELECTRIFICATION OF TRANSPORTATION*

In its DPUC Report "Rhode Island Power Sector Transformation Phase I Report to Governor Gina M. Raimondo", November 2017 the potential for complimentary rate policies to enable ratepayer benefits to electrification of transportation were identified.

A. Time of Use Rates: National Grid Off-Peak Charging Pilot

- i. Under the ASA, NGrid agreed to offer a pilot to reward customers for charging their EVs during off-peak hours. Under this program, participating customers earn a rebate for every kWh charged between 9 p.m. and 1 p.m., 6 cents per KWh from June to September and 4 cents per KWh during all other months.
- ii. Evaluate the program: The Division has reviewed the "Off-Peak Charging Rebate Pilot" that was agreed to by the Settling Parties as part of the negotiated settlement of Docket Nos. 4770 and 4780, as well as reviewed the assessment of that program

³⁹ Significant further work has been performed by NGrid on the Program since the initial audit, including an assessment of Rate Year 2. The link to the Report is not yet on the PUC website.

⁴⁰[http://www.ripuc.ri.gov/eventsactions/docket/4770-NGrid-ElectricTransportation%20RY1%20Annual%20Report%20\(10-31-19\).pdf](http://www.ripuc.ri.gov/eventsactions/docket/4770-NGrid-ElectricTransportation%20RY1%20Annual%20Report%20(10-31-19).pdf)

⁴¹[http://www.ripuc.ri.gov/eventsactions/docket/4770-NGrid-DR-PUC1%20ETI%20\(12-23-19\).pdf](http://www.ripuc.ri.gov/eventsactions/docket/4770-NGrid-DR-PUC1%20ETI%20(12-23-19).pdf)

that is contained in NGrid's "Electric Transportation Initiative Year 1, Annual Report".

According to the report, the pilot is "well designed" and "implemented effectively". While NGrid did not propose a modification that would alter the discount amount or the period during which the discount is offered, the Division will continue to review the operation of the pilot and any proposals for further modifications in Years 2 and 3 of the ASA.⁴²

- iii. Encourage utilities to revise rate structures: Under the ASA, the Division believes NGrid continues to evaluate the Off-Peak Charging Pilot Program based on data obtained from monitoring devices on participants' EVs.

Moreover, under the ASA, NGrid is required to file with the PUC an annual evaluation report describing implementation of the EV initiative, documenting information gained through the program, and providing any recommendations to enhance the program. As part of this evaluation process, NGrid has committed to provide information regarding how it can integrate EVs with minimal impacts on the distribution system, including an understanding of the effectiveness of the Off-Peak Charging Rebate Pilot. In its Year 1 ETI report, NGrid implemented a process to ensure more effective installation of the devices that are used to monitor the vehicles of customers who have enrolled in the program.

B. Demand Change Reform

Under the "Discount Pilot for Direct Current Fast Charging Station Accounts" program contained in the ASA, NGrid agreed to provide any existing or new customers billed on General C&I G-02 or Large Demand Rate G-32 rate with a monthly bill discount that is based on a per KW credit set at the same rate as the applicable distribution demand charge. This discount is intended to encourage the development of DCFC stations by lowering their overall operating costs.

C. Energy Storage

The PUC has opened Docket No. 5000 entitled "Investigation into the Treatment of Storage as an Electric Distribution Resource". In Docket No. 5000, the Division has requested the PUC to define the term "storage" by undertaking a "technical assessment" of electromechanical, mechanical, thermal, electrical, and chemical technologies which would include hydrogen powered fuel cell storage technologies, among others. While the PUC has yet to act on the parties' preliminary comments, the Division is an active participant in the docket and believes Docket No. 5000 may be an appropriate proceeding to explore the uses of EV batteries for grid support regarding storage produced by renewables.

⁴² See footnote 37.

IX. EDUCATION AND OUTREACH

- A. Work with utilities to promote targeted outreach to homeowners and fleets with PEVs to ensure they are aware of existing electric rate options and the potential cost savings.

Under the ASA, NGrid has agreed to provide an advisory service through internal and third-party expertise to support electrification of customer fleets. Under the fleet advisory services program, NGrid agreed to conduct long-term fleet electrification studies of twelve fleet operators, including government light-duty, corporate light-duty, public transit, government medium/heavy-duty (on road and off-road), and municipal school buses. It is anticipated that the fleet advisory services program will drive participation in other EV programs, and, as the studies are completed, incent electrification of operators' vehicle fleets.

- B. Coordinate with electricity providers and PUCs/PSCs to explore opportunities to explicitly identify PEV electricity usage on consumers' utility bills to highlight savings compared to the use of conventional fuels.

The U.S. Dept of Energy maintains an eGallon tool on its website that provides the user with the ability to compare the cost of driving electric with the cost of fossil fuel-based driving in a state.⁴³

The U.S. Dept of Energy maintains another tool on its website that enables the user to compare the overall costs of driving one type of vehicle against another and can be used to compare the costs of owning fossil fuel powered vehicles and PEVs.⁴⁴

X. COMPLEMENTARY POLICIES

Complementary policies to remove barriers, reduce costs, protect consumers, and connect to renewable generation, storage, and interconnection upgrades related to PEVs.

- A. Establish policies to reduce costs and simplify the process for homeowners to install meters to access PEV-specific rates.

NGrid intends to file a proposal with the PUC to develop advance meter functionality (AMF) as part of its network infrastructure in Rhode Island.⁴⁵ In this filing, it is anticipated that NGrid will provide a timetable, a budget, and business case, among other data and information, to support replacing the automated meter reading technology currently used throughout its Rhode Island service territory with AMF technology. In connection with this proposal, NGrid has indicated the enabling functionality of AMFs to implement time-varying rates should reduce the overall costs of EV ownership. The filing should also provide data necessary to better inform, develop and implement EV transportation programs. The Division will review NGrid's proposal when it is filed and provide its recommendation to the PUC in accordance with a procedural schedule that is established by the PUC.

⁴³ <https://www.energy.gov/maps/egallon>

⁴⁴ <https://www.fueleconomy.gov/feg/savemoney.jsp>

⁴⁵ NGrid intends to file this proposal as of December 2020. This filing has been postponed a number of times due to the COVID-19 pandemic.

- B. Coordinate with electricity providers, PUCs, and state energy offices to explore opportunities to connect renewable generation with PEVs.

Under the ASA, for charging station energy supply, the site host is the customer of record, and therefore, can select competitive generation supply or standard offer service. The ASA precludes NGrid from having a say in the customer's decision as to its choice of energy supply. The PUC/DPUC website provides a link to a NGrid web page that provides a link to NGrid's GreenUp program. Under the program, residential or small business customers may access renewable energy suppliers to connect renewable generation with PEVs.

- C. Explore the implications of allowing for the purchase of stored energy back from EV owners (vehicle-to-grid) and changes to rates and standards that would facilitate this.

To the Division's knowledge, the Commission has not addressed this issue; however, the Division is aware that NGrid has initiated a "SmartCharge Rhode Island" program for the purpose of learning EV user charging patterns throughout the State. By obtaining data about EV users' charging patterns, NGrid will gain insight on how EVs impact its electric delivery system. NGrid could then design strategies to reward users for charging EVs at off-peak hours and/or selling stored energy back to the Company.

- D. Develop procedures for accelerated utility review and service upgrades related to PEVs.

Review of service upgrade requests are considered under procedures established by NGrid's Electric Tariff RIPUC No. 2217. The Division has not received any complaints from site host providers that these procedures are inadequate, or that reviews or service upgrade requests are taking too long to complete. The Division would work with NGrid to amend the existing procedures should circumstances indicate that they require revision.

- E. Ensure electric vehicle service providers or others that operate charging facilities for the sole purpose of providing electricity as transportation fuel are not defined as a "public utility" and therefore not subject to regulation as such an entity.

The General Assembly has vested the Division with jurisdiction to execute all laws relating to "public utilities" and "carriers" and all regulations and orders of the PUC. G.L. § 39-1-3(b). Subject to certain narrow exceptions not applicable to EV transportation or infrastructure, a "public utility" means and includes:

"every company that is an electric distribution company and every company operating or doing business in intrastate commerce and in this state as a railroad, street railway, common carrier, gas, liquefied natural gas, water, telephone, telegraph, and pipeline company..." G.L. § 39-1-2(20).

An "electric distribution company" is defined as "a company engaging in the distribution of electricity or owning, operating, or controlling distribution facilities..." G.L. § 39-1-2(12).

Under these definitions, a company that sells electricity as a transportation fuel at a charging station(s) and does not distribute electricity does not constitute a "public utility" as it does not engage in the *distribution* of electricity or own, operate or control facilities for the *distribution* of electricity. Accordingly, the Division believes it is unnecessary to request the PUC to open a proceeding to issue a declaratory ruling that these type of EV service providers are exempted from the definition of "public utility" in G.L. § 39-1-2(20).⁴⁶

- F. Determine the appropriate level of consumer protection and regulatory oversight for providers of charging facilities, including utilities and non-utilities.

While NGrid's service territory consists of virtually the entire State of Rhode Island, under the ASA, NGrid is not permitted to own Level 2 or DCFC ports developed as part of the Company's EV transportation program.⁴⁷ The Division, therefore, believes it is somewhat premature to determine the appropriate level of consumer protection and regulatory oversight of the Company as a provider of charging facilities.

The Division and the PUC have promulgated the following comprehensive set of regulations that govern the conduct of NPPs and inform consumers of their rights:

- Reliability Responsibility Regulations for Nonregulated Power Producers (810-RICR-40-10-2)⁴⁸
- Rules Applicable to Non-regulated Power Producers (815-RICR-30-05-1)⁴⁹
- Nonregulated Power Producer Consumer Bill of Rights (815-RICR-30-05-2)⁵⁰

XI. TNC AND AUTONOMOUS VEHICLE POLICIES

The fundamental business model in transportation is shifting from private ownership to shared "fleetification" through mobility-as-a-service. Transportation Network Companies (TNCs) have led this shift, and regulations that emerged for TNCs set a relevant precedent for regulations that are likely to emerge for Autonomous Vehicles (AV) as well.

The potential for AV regulation to build on TNC precedent has already been explored by California, the State with the most AV experience. In 2017 the CPUC became the first state to open a proceeding to regulate TNCs (Ruling 12-12-011). TNC's have petitioned the California Commission to open separate proceeding to authorize public testing and deployment of autonomous vehicles for passenger transportation. The California Commission will have something to say about pricing, access to low income markets, and the role of cities, and thus be a key factor in the future of transportation.

The DPUC has jurisdiction over TNC's and has asserted its jurisdiction. However, the DPUC currently does not have jurisdiction to obtain tracking data from TNC permit holders.

⁴⁶ This is DPUC's interpretation of [RI Gen L § 39-1-3](#).

⁴⁷ NGrid ownership of Level 2 and DCFC ports is only precluded through the end of the last rate plan that will be extended for 1 additional year. NGrid has requested to be able to own these facilities, presumably in the next plan.

⁴⁸ http://www.ripuc.ri.gov/rulesregs/commrules/810-RICR-40-10-2_NPPsRules.pdf

⁴⁹ http://www.ripuc.ri.gov/rulesregs/divrules/Rules_Applicate_NPP.pdf

⁵⁰ <http://www.ripuc.ri.gov/rulesregs/divrules/npp%20bill%20of%20rights.pdf>

A. Authority to Regulate TNC Operations in Rhode Island

The authorizing legislation governing the transportation of passengers via TNCs⁵¹ in pertinent part provides:

Every person operating a licensed TNC or operating as a licensed TNC operator is declared to be subject to the jurisdiction of the division of public utilities and carriers. The division may prescribe rules and regulations consistent with this chapter that are necessary to assure adequate, safe, and compliant service under this chapter. The division is further authorized to conduct investigations into complaints; conduct investigations initiated on its own; and to hold hearings as it deems necessary to fulfill the proper administration of this chapter.

R.I.G.L. § 39-14.2-1(8), which in pertinent part provides:

A TNC is an entity licensed by the division pursuant to this chapter that uses a digital network to connect transportation network riders to transportation network operators who provide prearranged rides. A TNC shall not be deemed to control, direct, or manage the personal vehicles or transportation network company drivers that connect to its digital network, except where agreed to by written contract.

B. The Rules and Regulations Governing the Transportation of Passengers via TNCs (815-RICR-50-10-5) is linked in the footnotes.⁵²

C. Data and tracking requirements from TNC operators if applicable.

The Division does not possess legal authority under Title 39, Ch. 14.2 to obtain data and tracking data from TNC permit/holders, and therefore, does not obtain or maintain such information in its custody or control.

⁵¹ <http://webserver.rilin.state.ri.us/Statutes/TITLE39/39-14.2/INDEX.HTM>

⁵² http://www.ripuc.ri.gov/eventsactions/docket/D_17_27_Final.pdf

Office of Energy Resources

I. OVERVIEW

A. Agency Scope and Mission

The Rhode Island Office of Energy Resources (OER) is the state's lead energy policy agency established pursuant to Rhode Island General Laws (RIGL) § 42-140. OER's mission is to lead the state toward a clean, affordable, reliable, and equitable energy future. OER develops policies and programs that respond to the state's evolving energy needs, while advancing environmental sustainability, energy security, and a vibrant clean energy economy. OER is committed to working with public- and private-sector stakeholders to ensure that all Rhode Islanders have access to cost-effective, resilient, and sustainable energy solutions.

Housed within the Executive Branch, OER is led by the Commissioner of Energy Resources, Nicholas Ucci, and a staff of committed professionals dedicated to advancing the energy, economic, and environmental interests of the Ocean State.

B. Core Functions: OER operates at the nexus of many ongoing efforts to transform the Ocean State energy system. Core functions of the office include:

- i. Developing, administering, and monitoring a variety of programs designed to promote energy efficiency, renewable energy, alternative fuels, and energy assurance.
- ii. Offering technical assistance and funding opportunities for end-users including residents, businesses, and municipalities.
- iii. Providing policy expertise and support related to strategic energy planning, energy assurance, and clean energy workforce development.
- iv. Leveraging, coordinating, and aligning inter-agency, public-private, regional, and federal efforts to reach and exceed energy goals.

C. Major Initiatives: OER is Rhode Island's lead state agency on energy policy and programs. Major Initiatives include:

- 100 Percent Renewable Electricity by 2030 Goal⁵³
- 1000 MW by 2020⁵⁴
- Supporting Development of Clean Energy Jobs⁵⁵
- Heating Sector Transformation⁵⁶

⁵³ <http://www.energy.ri.gov/100percent/>

⁵⁴ <http://www.energy.ri.gov/renewable-energy/governor-clean-energy-goal.php>

⁵⁵ <http://www.energy.ri.gov/cleanjobs/>

⁵⁶ <http://www.energy.ri.gov/HST/>

- State Lead by Example in Energy Efficiency and Clean Energy⁵⁷
- Power Sector Transformation⁵⁸
- State Energy Plan⁵⁹
- Zero-Energy and High-Performance Buildings⁶⁰

II. TRANSPORTATION SECTOR AND ENERGY

Transportation is the costliest energy sector in Rhode Island, accounting for about 40 percent of statewide energy expenditures. The sector also remains heavily dependent on petroleum-based fuels such as gasoline and diesel, with major implications for long-term environmental sustainability. Based on 2017 data, approximately \$970 million is spent annually on transportation-related energy costs, and the transportation sector releases 4 million tons of CO₂ into the atmosphere.

III. CLEAN TRANSPORTATION INCENTIVES AND PROGRAMS

A. Drive EV Rebate Program

Administered by OER, this first come, first served rebate program was designed to help kick start sales of electric vehicles (EVs) within Rhode Island. The program provided a rebate of up to \$2,500 for the purchase or lease of new electric vehicles, including battery electric and plug in hybrids. The program launched in January of 2016 and ended July 10, 2017 due to funding restrictions.

i. Funding/ Funding Source

1. Originally launched as a \$200,000 pilot program; the program was expanded due to high demand for a total of \$575,000 in funding.
2. DRIVE Funds utilized for the program:
 - \$276,000 from Petroleum Violation Escrow Account (Stripper Well Oil Overcharge);
 - \$100,000 AEP Settlement Funds from the RIAG's Office; and
 - \$200,000 - DEM RGGI Administrative funds.

ii. Rebates Issued by vehicle

Ultimately, the program issued rebates for 254 EVs in RI, expending a total of \$575,000 in the year and a half the program was active.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	1	14	16	12	7	18	14	11	14	11	15	24
2017	10	5	16	12	23	25	6					

⁵⁷ <http://www.energy.ri.gov/policies-programs/lead-by-example/>

⁵⁸ <http://www.energy.ri.gov/electric-gas/future-grid/>

⁵⁹ <http://www.energy.ri.gov/policies-programs/ri-energy-laws/state-energy-plan.php>

⁶⁰ <http://www.energy.ri.gov/high-performance-buildings/index.php>

Clean Transportation and Mobility Innovation Report

Make	AUDI	BMW	CADILLAC	CHEVROLET	FIAT	FORD	HYUNDAI	KIA	MERCEDES	MINI	NISSAN	PORSCHE	SMART	TESLA	TOYOTA	VW	VOLVO
Rebates #	3	36	0	91	0	17	0	1	0	1	9	3	0	27	17	46	3

iii. Outcomes: Increased EV's available; sales tax revenue and adoption by over 50%

1. The incentive program helped increase the sale of EVs at 15 different RI dealerships.
2. Generated over \$300,000 in new sales tax revenue for the state.
3. Increased EV adoption by over 50%.

B. Charge Up! Program

Charge Up! was a public-sector vehicle electrification program run by OER that offered incentives to state agencies and municipalities interested in installing electric vehicle charging stations (EVSE) and supported the purchase or lease of electric vehicles. The program began in July 2016 under the direction of Governor Raimondo's Lead by Example Executive Order. Charge Up! offered up to \$75,000 to qualified applicants for the purchase and installation of EVSE and the procurement of EVs.

i. Funding Source:

\$725,000 was allocated in RGGI Allocation Plans for the program. Funds were exhausted around the same time that Electrify RI launched.

ii. Deployment:

50 charging stations were installed, and 8 electric vehicles were purchased through the Program.

Agency	EVSE Location	# of Stations
DPUC	89 Jefferson Ave	2
Powers Building	1 Capitol Hill	3
Town of Coventry	1670 Flat River Rd	1
DCAMM/Capitol Hill	1 Capitol Hill (2) & Francis St Parking Lot (2)	4
RI Turnpike & Bridge Authority	33 Ferry Rd	1

Agency	EVSE Location	# of Stations
Providence Water Supply Board	125 Dupont St	1
Providence Water Supply Board	61 North Rd	1
DOT Warwick	360 Lincoln Ave	3
PUC	89 Jefferson Ave	4
Town of Burrville	Main St	4
Town of South Kingston	180 High St Wakefield RI + 394 Main St	4
RI Veterans Home	480 Metacom Ave	1
Town of Johnston	345 Cherry Hill Rd	4
Town of Middletown	35 East Main Rd + 700 West Main Rd	4
Narragansett Bay Commission	2 Ernest St	1
Narragansett Bay Commission	102 Campbell Ave	1
Roger Williams Park Zoo	1000 Elmwood Ave	2
Rhode Island College	600 6th St Providence RI 02911	5
Town of East Greenwich	111 Pearce St	3
University of Rhode Island	URI	1

iii. Usage Data:

Currently OER only has usage data for the ChargePoint stations registered in the state government portal. Specifically, those stations installed at State of RI departments/agencies. Usage data can be requested from other entities.

C. Electrify Rhode Island

Electrify RI is an electric vehicle charging station incentive program, administered by OER, that seeks to make more charging stations accessible to Rhode Island drivers. This \$1.4 million incentive program will help fund the installation of new EV charging stations – including Level II EVSE and Direct Current Fast Charging (DCFC) – at Rhode Island workplaces, multi-unit dwellings, state and local government properties, and publicly-accessible locations. Incentives will be offered on a first-come, first-served basis. Electrify RI Program Launched October 31, 2019.

i. Funding:

The funds for Electrify RI come from the Volkswagen Diesel Settlement (VW Settlement) Environmental Mitigation Trust and are being invested according to the state's Beneficiary Mitigation Plan (BMP) to achieve significant and sustained reductions in diesel emissions and expedite development and widespread adoption of zero emission vehicles.

ii. Budget and Spending:

OER BUDGET: \$712,000 – Level II EVSE

OER BUDGET \$725,000 – DCFC

As of December 2020:

Level II:

56 Charging Stations have been installed

4 Charging Stations in process

DCFC:

7 DCFC have been installed

4 DCFC in process

Remaining Funds:

Level II: \$101,044

DCFC: \$310,000

D. Public/Private EVSE in Rhode Island

Rhode Island (Public and Private Active) – Data obtained from the U.S. DOE Alternative Fuels Data Center as of December 2020.⁶¹ OER does not have data on the number of residential stations in RI.

Private:

Level I: 2 Charging Stations; 58 Charging Outlets

Level II: 9 Charging Stations; 20 Charging Outlets

DCFC: 0 Charging Stations; 0 Charging Outlets

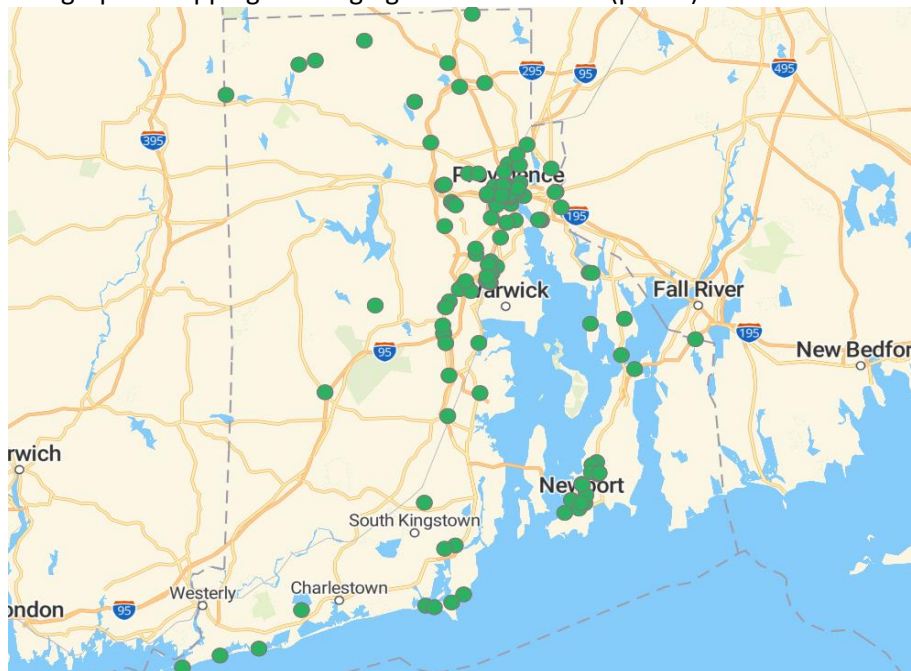
Public:

Level I: 2 Charging Stations; 21 Charging Outlets

Level II: 125 Charging Stations; 413 Charging Outlets

DCFC: 17 Stations; 38 Charging Outlets

⁶¹https://afdc.energy.gov/stations/#/analyze?region=US-RI&fuel=ELEC&ev_levels=1&ev_levels=dc_fast&ev_levels=2&access=public&access=private

Geographic mapping of charging station locations (public) in Rhode Island⁶²

IV. LEAD BY EXAMPLE

A. Lead by Example Executive Order 15-17:

- i. As of December 2020, there are currently 43 ZEVs in the state fleet.
- ii. To comply with the EO 15-17, 120 vehicles will need to be purchased by 2025.

B. Master Price Agreement 509 MPA 509:

- i. Prior to COVID-19, OER had been working with the Division of Purchases to evolve MPA 509 to a CR. It is the intent that once DOA is back to BAU OER will continue to work with the Division of Purchases to issue the CR.

V. EDUCATION AND OUTREACH EVENTS AND MARKETING PROGRAMS

A. National Drive Electric Week

- i. September 2020: OER partnered with Green Energy Consumer Alliance, and DEM to hold an EV 101, and Ask an EV Driver Webinar Series.

⁶² https://afdc.energy.gov/stations/#/analyze?region=US-RI&fuel=ELEC&show_map=true

- ii. September 2019: OER partnered with the DEM, Ocean State Clean Cities and Green Energy Consumers Alliance to hold the 2nd Annual Electric Car Ride & Drive at Roger Williams Park. Approximately 150 people attended the event and 37 people participated in Ride and Drives. There were four dealers (Toyota, Nissan, Tesla and Jaguar) in attendance. In addition, there were approximately 20 EV ambassadors that came to the event to showcase their vehicles and answer attendee questions.
- iii. 2018: OER participated in three events:
 - 1. 12th Annual Green Festival, September 8, 2018— Burrillville. Partners included Pascoag Utility District, DEM, DOH and Green Energy Consumers Alliance.
 - 2. 1st Annual Electric Car Ride and Drive at Roger Williams Park, September 2018.
 - 3. Ride and Drive Event – Crowne Plaza Warwick, May 30, 2018

B. Transportation Listening Sessions

OER along with DEM, DOT and EC4 was involved in the Clean Transportation Listening Sessions held in April 2018. EJ communities were invited to participate. No additional Transportation Listening Sessions are planned at this time.

VI. NATIONAL AND REGIONAL AMBITION AND GOALS IN CLEAN TRANSPORTATION

A. ZEV MOU:

In 2016 Rhode Island joined 8 Governors in the Northeast, California and Oregon and agreed to a collective target of at least 3.3 million zero emissions vehicles on the road by 2025.

- i. Rhode Island share of the 3.3M ZEV's: update on number of ZEVs.

The original number of vehicles was 43,000. However, that number is not accurate due to counting vehicles vs. credits earned by automakers for vehicles placed here in the state of RI.

According to RIDMV, as of June 2020, there were 3,078 ZEVs registered in RI (that is a conservative number). Several assumptions were made to come up with that count.

- ii. Calculate the Quantity of EVSEs Needed to Meet RI EV goals

To support 43,000 plug-in electric vehicles per the ZEV MOU Rhode Island would need:

1,008 Workplace Level 2 Charging Plugs
628 Public Level 2 Charging Plugs

86 Public DC Fast Charging Plugs

**Results Based on DOE Alternative Fuels Data Center information.*⁶³

B. Regional EV Charging Stations Deployment

Charging Stations (*Public and Private*) as of December 2020⁶⁴

	Level I	Level II	DCFC
Massachusetts	20	968	89
Connecticut	23	399	55
Rhode Island	4	134	17

C. Clean Energy Jobs

Rhode Island continues to show impressive job growth in the clean energy sector, as detailed in the 2020 Rhode Island Clean Energy Jobs Report. As of the 4th Quarter, 2019 (and prior to COVID), the sector provided 16,348 jobs, and Rhode Island's clean energy economy continues to grow. Since 2014, clean energy employment in the Ocean State has increased by an impressive 77.3% (prior to COVID). For more information on the Clean Energy Jobs Report, please visit the link provided in the following footnote.⁶⁵

⁶³ <https://afdc.energy.gov/evi-pro-lite>

⁶⁴ https://afdc.energy.gov/stations/#/analyze?region=US-RI&fuel=ELEC&ev_levels=1&ev_levels=dc_fast&ev_levels=2&access=public&access=private

⁶⁵ <http://www.energy.ri.gov/cleanjobs/>

Rhode Island Public Transit Authority

I. MISSION

RIPTA's Mission is to provide safe, reliable, and cost-effective transit service with a skilled team of professionals responsive to our customers, the environment, and committed to transit excellence.

Grants, Policies and Planning: Clean Transportation and Mobility

- A. In 2018, RIPTA was awarded an FTA Low-No Emissions Grant Program award of \$1.5M for the purchase of battery electric buses and chargers. This grant will be applied toward the purchase of 17 zero emission buses in the near future.
- B. In June 2020, RIPTA was awarded an additional \$5.076M in Low-No⁶⁶ funds toward the 17-bus purchase.
- C. RIPTA is partnering with renewable energy company Kearsarge on a remote net metering program that will allow RIPTA to source clean solar energy at a savings over current costs.
- D. For federal funding, grants, and local transit investment sources and uses, please see RIPTA's capital⁶⁷ and operating⁶⁸ budgets.

Transit Forward RI 2040: In 2018, RIPTA embarked on a 20-year advance planning effort, Transit Forward RI 2040, with the goal of ensuring optimal statewide mobility in the near, mid, and long terms. This planning effort is complete and was adopted by the State Planning Council in December 2020. A report of recommended action steps is available at the link provided in the footnotes below.⁶⁹

II. POLICIES, INITIATIVES, GRANTS AND/OR PROGRAMS RELATED TO MOBILITY AND/OR CLEAN TRANSPORTATION

- A. Between 2017 and 2019, RIPTA prepared a Sustainable Fleet Transition Plan to support decision-making around alternative fuels. The plan explores various propulsion systems and identifies pros, cons, and key issues associated with each. The current Battery Electric Bus pilot project is a recommendation of this plan.

⁶⁶ Lo-No is a discretionary grant program from FTA to provide transit agencies with funding for low or no emissions vehicles. It is highly competitive and has assisted in demonstration projects but is not a viable source for full fleet electrification.

⁶⁷https://intranet.ripta.com/stuff/contentmgr/files/0/02129ce5ecd68f0077c87078c64ce982/files/capital_budget_fy20_fy25_8_20_2019.pdf

⁶⁸https://intranet.ripta.com/stuff/contentmgr/files/0/9c9b19ed5599c1ff75fedd159f4878a7/files/fy_2020_revised_fy_2021_approved_operating_budget.pdf

⁶⁹<https://transitforwardri.com/>

- B. Through a partnership with eNOW and RI Commerce’s Renewable Energy Fund, RIPTA buses are outfitted with roof-mounted solar panels to optimize battery life performance, resulting in more reliability when buses are started and less strain on the alternator throughout the day as the vehicles operate auxiliary systems such as on-board electronics.

III. INVESTMENTS RELATED TO MOBILITY AND CLEAN TRANSPORTATION

- A. 100% of RIPTA’s annual budget is invested each year in providing essential mobility services to Rhode Islanders. (FY20 operating budget = \$123M, FY20 capital budget = \$57.9M)

Selected clean transportation investments:

- Sustainable Fleet Transition Plan – \$107,000
 - eNOW solar panels (33 buses) – \$65,000
 - Current/planned vehicle, infrastructure, and associated investments (with VW, LowNo, and State of Rhode Island support) – \$24.8 million
- B. RIPTA reports outcomes annually to the National Transit Database (NTD). The most recent RIPTA agency profile, for 2018, is available on the NTD website.⁷⁰

IV. FARE SYSTEM

- A. Earn as You go Fare System: Accessibility for Low Income Populations

- i. With the introduction of smartcard fare payment, RIPTA will also be able to introduce fare capping, which is also known as “Earn as You Go,” through which all riders will pay single trip fares up to maximum fare levels for daily, weekly, and monthly use.
- ii. Earn as You Go will make transit more affordable for lower income riders, provide more flexibility for all riders, and encourage the use of transit on a more spontaneous basis.
- iii. Fare capping generally works as follows:
 - 1. All riders will pay single ride fares for all trips with total costs that will max out at daily and monthly pass rates.
 - 2. On a daily basis and at current fare levels, riders would pay \$2 per trip until they spend \$6 which is the current cost of a daily pass. For the rest of the day, all subsequent rides would be free.
 - 3. Daily expenditures would also roll up to monthly pass costs. After spending \$6 per day for 11 days and \$4 on the 12th day, all subsequent trips for the rest of the month would be free. Earn as You Go will also be implemented for riders who use discount fares.

- B. Innovations to Fare System

- i. Fare study (2015) – to determine best approach to modernizing fare system

⁷⁰ https://cms7.fta.dot.gov/sites/fta.dot.gov/files/transit_agency_profile_doc/2018/10001.pdf

- ii. Fare changes (2016) – streamlining fare structure
- iii. Fare collection system upgrade (2016 - 2020) – including hardware and software installation on buses, branding of WAVE smartcard, establishment of retail network
- iv. WAVE smartcard in beta mode (2020) – The Wave smart card is a permanent, rechargeable card used to pay your bus fare that you can easily manage online. It is plastic and embedded with a special computer chip that keeps track of the value of the card. The Wave mobile app lets you quickly buy bus fares on your phone. When ready to board the bus, open the app, and scan it under the validator.

V. *FLEET ELECTRIFICATION*

- A. Sustainable Fleet Transition Plan (see above)
- B. Key considerations / challenges (unique to RI) for the successful integration of electric buses in fleet:
 - i. Battery range – How to schedule and deploy BEBs within feasible service blocks
 - ii. Replacement ratio – Due to range issues, 1:1 fleet replacement ratio is not possible
 - iii. Capital cost of vehicles – \$400K+ incremental cost above diesel buses
 - iv. Associated cost of chargers, power supply, design, and construction of improvements
 - v. Storage Space – Purchasing more vehicles will require storage space that does not currently exist.
 - vi. Campus planning, yard management, maintenance, and operations issues
 - vii. Electrical supply – National Grid has shared concerns with RIPTA regarding its ability to supply electricity sufficient to power BEB service beyond the current pilot
 - viii. Resiliency/redundancy – How will vehicles be powered when the grid goes down?
- C. Efforts to serve overburdened communities: Initial deployment of BEBs has been designed to serve Environmental Justice communities with high rates of respiratory illness and high need for public transit service.
- D. Current status of fleet:
 - i. 3 battery electric buses (40')

- ii. 62 diesel/electric hybrid buses, including 52 40' buses and 10 trolleys
 - iii. RIPTA is preparing to order 17 BEBs.
- E. Expenditures related to electric and/or hybrid buses:
- i. RIPTA projects that a diesel bus for delivery in 2022 will cost \$624,196 and a battery electric bus for delivery in 2022 will cost \$1,047,196.
 - ii. Total cost of ownership has not been calculated.
- F. Research and/or modeling regarding the potential electrification of the fleet:
- i. Sustainable Fleet Transportation Plan
 - ii. VW pilot project Key Performance Indicators
 - iii. Ongoing coordination with National Grid, DPUC, OER, DEM and others
 - iv. Ongoing participation in EC4 and TCI workgroups

VI. *INCREASING RIDERSHIP*

- A. Sustaining and increasing ridership is at the core of RIPTA's daily mission. Selected specific efforts in recent years include:
- i. Full implementation of 2013 Comprehensive Operational Analysis – route optimization.
 - ii. Ongoing fine-tuning of routes (three service adjustments per year) and bus stops (as needed).
 - iii. Transit Signal Priority planning and implementation – Round 1 (R Line, 2014) and Round 2 (multiple routes, installation 2020).
 - iv. Adoption and of implementation of Bus Stop Design Guidelines – in partnership with RIDOT and municipalities.
 - v. Real-time arrival information on mobile website and Transit app.
 - vi. UPass and EcoPass programs – ongoing outreach and incentives to commuters through RIPTA's Travel Demand Management (TDM) program, Commuter Resource RI.

- vii. Downtown Transit Connector – high-capacity trunk service through Downtown Providence, including Rhode Island’s first dedicated bus lanes and five-minute frequency linking the hospital, financial, and capital districts.
- viii. Transit Forward RI 2040 master planning initiative – launched in 2018 – to include frequent transit network, high capacity transit service development (light rail/bus rapid transit), and regional rapid bus investments.

VII. LAST MILE NEEDS

- A. The RIPTA network is designed to directly serve high-demand destinations throughout the State of Rhode Island including workplaces, shopping centers, medical centers, and population centers. This demand-based network seeks to maximize the percentage of RI population living and working within easy walking distance of a bus stop.
- B. RIPTA’s reservation-based Flex system serves lower density areas and connects riders to the fixed route network. This year RIPTA will prepare a Mobility on Demand implementation plan and acquire the necessary scheduling software to upgrade this service to an on-demand/TNC-type level of service.
- C. In addition, RIPTA provides first/last mile connectivity to commuter and regional rail services, working to coordinate schedules to maximize access and ease of transfers.

VIII. MICROMOBILITY AND TRANSIT

- A. Easy access to the transit network is essential to sustaining and growing ridership. Because most transit users access the bus on foot, RIPTA prioritizes partnerships with RIDOT municipalities controlling rights-of-way to ensure comfortable, inviting, and Americans with Disabilities Act (ADA) compliant pedestrian access to bus stops, especially in high-demand locations.
- B. A growing number of transit riders access the bus by bicycle or utilize micro-mobility services, and RIPTA supports these means of access through bus stop and hub design as well as an openness toward potential mutually supportive partnerships with micro-mobility providers.
- C. The Bus Stop Design Guidebook developed jointly by RIPTA and RIDOT provides specific guidance regarding appropriate levels of amenity at bus stops.
- D. All of RIPTA’s hubs provide bicycle and pedestrian amenities, and all RIPTA buses are outfitted with bicycle racks.
- E. The Transit Forward RI 2040 master plan recommends a variety of first/last mile and micro-mobility improvements, especially at mobility hubs.

Transit Forward RI 2040

A Network of Mobility Hubs Will Improve Connections Throughout Rhode Island

Mobility hubs are sites where multimodal transportation options, information resources, placemaking features, and traveler amenities are brought together in a well-designed, publicly accessible space to support a variety of different types of trips.

Transit Forward RI will develop a network of mobility hubs throughout the state. They will be the first point of entry into the regional public transportation network for many travelers, and connecting points for others. They will provide an enjoyable user experience and build a strong relationship between the community and transportation providers.

Mobility hubs vary in size and function based on the types of options available and volumes:

- Large **regional mobility hubs** such as Kennedy Plaza, Providence Station, and the Newport Visitors Center typically include services and amenities such as indoor shelter, restrooms, bicycle facilities, and staffed or technology-enhanced information kiosks. Regional mobility hubs are located at the ends of major transit lines and in downtowns and major regional activity centers.
- Smaller **community mobility hubs** that provide mobility services for their immediate surrounding neighborhoods are generally located in village centers and other activity centers in lower density suburban areas. Community mobility hubs typically include bus stops, outdoor shelters, real-time signage, bike/car share, and park and ride lots.



IX. EQUITY

A. Rhode Island Accessible Transportation Advisory Committee (ATAC) is expected to assist RIPTA's management with its compliance with all applicable provisions of the ADA and other civil rights laws as they apply to public transportation systems in Rhode Island.

B. Human Services Transportation Coordinating Council

Throughout the first year, working groups addressed specific challenges and opportunities – initially focusing on identifying sustainable funding for RIPTA's statewide free bus pass program for low-income seniors and individuals with disabilities and improving communications between agencies that provide transportation assistance. Now in its second year, the statewide Council continues to hold public meetings every other month and has started to pursue additional projects such as the creation of a One Call/One Click transportation resource, and development of a customer-focused approach to connecting riders with transportation services.

C. Human Services Planner

- i. RIPTA has hired a Human Services Planner; her role is to work with social service agencies to find transportation solutions to help meet their needs.
- ii. Her work includes staffing RIPTA's Accessible Transportation Advisory Committee and the RI Human Services Transportation Coordinating Council. Through this work, RIPTA has completed several listening sessions in Health Equity Zones and has completed subsequent travel training programs. In a couple of instances, we've seen noticeable ridership increases after this work (prior to COVID-19).

D. "Earn as You Go" fare policy

- i. "Earn as You Go" will allow people to earn fare products over time rather than paying for them outright. Therefore, higher value products like 1-Month Passes become attainable for people who may not have the resources at the start of the month.
- ii. WAVE also allows for a new partnership with social service agencies to help improve access to fare products for them and their clients.

E. As part of every service change RIPTA implements, RIPTA completes an analysis that is in accordance with Title VI of the Civil Rights Act. This analysis identifies any impacts to minority and low-income populations and allows RIPTA to mitigate any issues that might arise.

APPENDIX C: MODELING TECHNICAL NOTES

INTRODUCTION

This document describes key assumptions used in the assessment of clean mobility strategies and the overall evaluation of portfolio benefits for the Rhode Island Clean Transportation and Mobility Innovation Strategy. The analysis is conducted using the Investment Strategy Tool, version 3.0 (October 2020) developed by Cambridge Systematics (CS) for the Georgetown Climate Center as part of support for the overall Transportation and Climate Initiative (TCI). More complete documentation of the tool can be found in CS (2020). The tool was modified to include Rhode Island-specific assumptions to the degree that supporting data were available.

The analysis timeframe for clean mobility investments is 2022 – 2032, with benefits reported for 2032. This is consistent with the current timeframe for analysis of the overall TCI program by the participating TCI states. Figure 24 provides a description of the strategies considered in creating the clean mobility investment portfolios. Not all these strategies were included in every final portfolio.

Figure 24. Description of Clean Mobility Strategies

Electrification and Alternative Fuels

Light-duty electric vehicles (EVs)	Consumer incentives to purchase EVs, direct purchase for public fleets, development of public charging infrastructure, and grid improvements.
Electric transit buses	Direct purchase of public agency electric transit buses and/or charging infrastructure.
Electric school buses	Direct purchase or reimbursements to school districts to purchase electric school buses and/or charging infrastructure.
Electric trucks	Incentives for medium-duty truck fleet operators to purchase new battery-electric trucks and/or charging infrastructure; direct purchase for public fleets.
Hydrogen trucks	Investment in hydrogen refueling infrastructure; incentives for purchase of hydrogen fuel cell trucks.

Vehicle Travel Reduction

Shared ride incentives	Monetary incentives to encourage travelers to use shared-ride rather than solo-ride options for ride hail and taxi services.
Micromobility: shared e-scooters & e-bikes	Subsidies for shared electric scooter and/or electric bike programs (capital, operating, user-side subsidies).
Micromobility: e-bike ownership subsidies	Discounts or rebates for purchase of an electric bicycle.
Land use/smart growth	Investments, incentives, and technical assistance to encourage infill, compact development, and transit-oriented development.
Bicycle investment	Investment in bicycle infrastructure.
Pedestrian investment	Investment in pedestrian infrastructure.
Travel demand & mobility management	Education, outreach, and incentive programs to encourage alternatives to automobile travel.

Transit and Rail

Bus rapid transit (BRT)	Construction and operation of new bus rapid transit services (using mainly exclusive lanes and having stations).
Commuter/intercity rail	Construction and operation of new commuter or intercity passenger rail services.
Bus service: expansion	Additional vehicle trips to increase frequency or time of day coverage on existing routes.
Bus service: efficiency	Operational improvements that reduce run times and emissions, such as transit signal priority and queue jump lanes.
Electric microtransit	Subsidies or incentives for microtransit (app-enabled, flexible-route services using smaller vehicles than standard buses).

Traffic Efficiency

Traffic operations	Traffic management strategies, such as traffic signal coordination, to smooth traffic flow.
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Implementation of the overall TCI initiative could lead to additional changes in vehicle-travel, emissions, and other outcomes as travelers respond to changes in the price of transportation fuels. The effects of these changes are not included in this study. Instead, the focus is on a stand-alone program of clean mobility investments.

BASELINE DATA

POPULATION

Population forecasts are used in the evaluation of the land use/smart growth strategy to evaluate shifts in population among different area types (e.g., urban, suburban, rural), and to distribute certain investments (such as bicycle and pedestrian infrastructure) among different area types. Base year population data are from the U.S. Bureau of the Census, 2014-2018 American Community Survey. Overall state level forecasts are taken from state-specific forecasts compiled by the Weldon Cooper Center for Public Service, Demographics Research Group, as of December 2018.⁷¹

VEHICLE-MILES OF TRAVEL

Baseline estimates and projections of vehicle-miles of travel (VMT) are used to develop baseline greenhouse gas (GHG) emissions projections and as a point of comparison for relative changes in VMT and GHG as a result of clean mobility investment. Estimates of VMT for 2017 and forecasts for 2020, 2030, and 2040 were obtained from the Rhode Island Department of Transportation (RIDOT) in 2019 as part of the work conducted by CS under contract to the Georgetown Climate Center supporting the TCI. Intermediate years were interpolated. RIDOT provided forecasts for five vehicle types (motorcycle, light-duty auto and truck, bus, single-unit truck, combination truck). Total VMT is projected to grow from 7.7 billion in 2019 to 8.9 billion in 2032. The breakdown of VMT is 93.4 percent light-duty cars

and trucks (including motorcycles), 2.4 percent medium (single-unit) trucks, 3.6 percent heavy (combination) trucks, and 0.6 percent buses.

ENERGY PRICES

Energy prices affect the relative costs and benefits of different strategies by changing the net costs or costs savings associated with EV operation as well as the cost savings from reducing conventional vehicle travel. This may affect the level of deployment attained with a given level of investment, as well as the economic benefits of the investment.

Projections are from the National Energy Modeling System (NEMS)⁷² in illustrative TCI applications for a range of GHG caps (20 to 25 percent reduction) and various investment portfolios as applied to the TCI region. National or regional prices from NEMS are adjusted for state-specific cost differences. Rhode Island's gasoline and diesel costs are the same as the region average and electricity costs are 33 percent higher. Note that gasoline and diesel prices will vary depending upon the level of TCI carbon cap. Illustrative prices for RI are shown for a 20 percent GHG reduction 2022 – 2032:

- Gasoline rises from \$3.40/gal in 2022 to \$3.77/gal in 2032
- Electricity rises from \$12.6 c/kwh in 2022 to 13.4 c/kwh in 2032

ELECTRIFICATION STRATEGIES

ELECTRIC LIGHT-DUTY VEHICLES

The effects of light-duty electric vehicle consumer incentives in the Investment Strategy Tool are derived from modeling using NEMS in a TCI application for a range of GHG caps (20 to 25 percent reduction) and investment portfolios. Based on an

OnLocation under separate contract to Georgetown Climate Center in support of TCI. References to NEMS data in this document are to NEMS runs performed for the TCI region.

⁷¹ https://demographics.coopercenter.org/sites/demographics/files/2019-01/NationalProjections_ProtectedTotalPopulation_2020-2040_Updated12-2018.xls

⁷² NEMS is a multi-sector economic and energy model used to develop the U.S. Department of Energy's Annual Energy Outlook (AEO). NEMS was run by

illustrative scenario, the average incentive value per additional new EV sold is about \$6,300 over the 2022-2032 period.

ELECTRIC TRUCKS AND BUSES

Base year efficiency of a reference (internal combustion engine) vehicle is shown in Figure 25, measured in miles per gallon gasoline equivalent (MPGGE). Future year efficiencies are increased in proportion to the NEMS MPG forecast for trucks.

Figure 25. Base (Diesel) Vehicle Efficiency

Vehicle Type	MPGGE (2017)	Source/Notes
Transit diesel buses	3.1	Alternative Fuels Data Center
School buses	6.3	Alternative Fuels Data Center
Trucks – medium duty	7.8	AEO – 2019 Reference Case

Figure 26 shows the assumed energy efficiency ratio (EER), which represents the relative efficiency of the vehicle using the energy input into the vehicle (fuel tank or plug). It does not account for lifecycle emissions (e.g., electricity generating and transmission losses).

Figure 26. Energy Efficiency Ratio vs. Base Vehicle

Vehicle Type	EER	Source/Notes
Electric transit bus	3.5	Giuliano et al. (2018) reproduce data from California Air Resources Board (CARB) (2017) showing observed EER for MD/HD electric trucks vs. diesel ranges from ~3.5 – 4.0 at speeds above 20 mph, 4.0 – 5.0 for 10 – 20 mph, up to 7.0 for speeds below 10 mph. (Note – AEO shows somewhat lower ratios.) E.g., for Foothill Transit, “the BEB [battery electric bus] fuel economy was
Electric school bus	3.5	
Electric truck - MDT/urban	4.0	

Vehicle Type	EER	Source/Notes
		almost four times higher than that of CNG buses” (Hanlin, 2018). Recommended EERs are slightly lower than shown in CARB data to account for cold-climate inefficiencies.

Figure 27 shows the incremental vehicle cost, which is the incremental cost of the electric vehicle compared to the reference diesel vehicle. Intermediate year values of 2020 and 2025 are interpolated for calculation purposes, and values for 2030 are used for years beyond 2030.

Figure 27. Incremental Vehicle Cost vs. Base Vehicle

Vehicle Type	Incremental Cost – 2017 ^a	Incremental Cost – 2022	Incremental Cost – 2030	Source/Notes
Electric transit bus	\$ 315,000	\$241,000	\$ 172,000	Giuliano et al. (2018) citing CARB (2015b).
Electric school bus	\$ 200,000	\$153,000	\$110,000	NYSERDA and MassDOT provided estimates of 2017 costs for TCI. These were factored to 2030 based on Wood et al incremental cost for MDT. Also compare with VEIC (2018) bus cost of \$325k from

Vehicle Type	Incremental Cost – 2017 ^a	Incremental Cost – 2022	Incremental Cost – 2030	Source/Notes
				MA pilot compared to \$110k diesel bus cost cited in Casale and Mahoney (2018).
Electric truck - MDT/urban	\$ 110,000	\$84,000	\$ 60,000	Wood et al. (2017).

Figure 28 shows the estimated annual maintenance cost savings compared to an internal combustion engine vehicle.

Figure 28. Annual Maintenance Cost Savings vs. Base Vehicle

Vehicle Type	Annual Maintenance Cost Savings ^a	Source/Notes
Electric transit bus	\$ 0 – 2022 Increasing to \$5,000 - 2032	Using Wood et al. (2017) for long-term estimate, adjusted to be more conservative. Savings uncertain in short-term. Assuming that operation and maintenance (O&M) costs include midpoint battery replacement. ⁷³ Wide range of O&M costs reported. 46% of operators reported lower O&M costs for BEBs, 23% reported higher costs (Hanlin, 2018).
Electric school bus	\$ 0 – 2022 Increasing to \$2,000 - 2032	Scaled from transit bus costs based on miles/year. See also Casale, M., and B. Mahoney (2018).
Electric truck - MDT/urban	\$ 0 – 2022 Increasing to \$ 530 - 2032	Wood et al. (2017).

Figure 29 shows the assumed cost of a charging or refueling station on a per vehicle basis.

⁷³ Most battery electric bus (BEB) manufacturers are offering a standard 6-year warranty for the batteries to get operators through the midway point of bus life

and offering extended warranties up to 12 years to mitigate further risk (Proterra 2017).

Figure 29. Charging or Refueling Station Cost per Vehicle

Vehicle Type	Cost per Vehicle	Source/Notes
Electric transit bus	\$143,000 – 2022 \$120,000 – 2032	Depot – \$50k for charger, \$20k for installation, \$50k for infrastructure, divided 1 per 2 buses; \$500k for on-route charger, 1 per 6 buses. Infrastructure costs only applied to first 10 years. Estimates based on range of experience from Hanlin (2018) & Massachusetts DOT. For large scale applications, there may be additional upstream infrastructure costs (e.g., switchgear, transformers, substation upgrades) that are likely to be application specific.
Electric school bus	\$ 40,000 – 2022 \$ 25,000 – 2032	Add 100% to MDT charger cost for installation costs and infrastructure upgrades. See Wood et al. 2017, rough midpoint of a range cited.
Electric truck - MDT/urban	\$ 25,000	Wood et al. (2017). Range of \$9k – \$35k depending on rate of technology advancement.

Figure 30 shows the average annual miles driven per year per vehicle. Annual mileage of trucks varies depending on the age of the truck, and the average across all model years (computed as total miles driven divided by total vehicle stock in calendar year 2032) is taken from the Argonne National Laboratory VISION model v. 2019.

Figure 30. Miles Driven per Year per Vehicle

Vehicle Type	Miles per Vehicle	Source/Notes
Electric transit bus	26,000	MassDOT/MBTA. RIPTA – 2018 NTD reports 44,000 average for motor bus (MB). 36,000 if 12 hours/day of operation at 10 mi/hr, consistent with assumptions in EPA MOVES2014 model. Electric buses likely to be lower miles than diesel, at least for initial operations, due to range limits.
Electric school bus	10,000	Low end of national estimates considering limited range of BEBs. See EPA (2016) sourcing 1997 School Bus Fleet Fact Book, or 12,000 national average cited in VEIC (2018).
Electric truck - MDT/urban	18,387	VISION model (v. 2019) average across all vehicle ages for Class 3-6 trucks.

When determining the amount of subsidy needed per vehicle, the first three years of fuel and maintenance cost savings are considered. This is based on discussions with OnLocation staff that the NEMS model coefficients infer about three to four years of fuel savings are considered, as well as information from the literature that consumers typically consider three to five years of fuel savings in their purchase decisions. The same time period was used for public fleets (buses) for consistency.

FLEET TURNOVER MODELS

Fleet turnover models were used to convert sales of new electric vehicles in a given year to vehicle stock and VMT in future years. Models internal to the tool were only used for the heavy-duty vehicle categories, since light-duty vehicle turnover is accounted for in NEMS. The models use miles driven per year and survival rates by

vehicle age taken directly from the Argonne National Laboratory VISION model v. 2019, for Medium Trucks (Class 3-6). For transit buses, a mileage accrual rate of 26,000 miles per year is used as described above, with a survival rate from MOVES2014 for years 1-12, and no survival after year 12. For school buses, a mileage accrual rate of 10,000 miles per year is used with a 100 percent survival rate for 15 years. (Assumptions beyond 11 years are irrelevant for the current 2022-2032 analysis period.)

VEHICLE TRAVEL REDUCTION STRATEGIES

SHARED RIDE INCENTIVES

OVERVIEW OF METHODOLOGY

This strategy is assumed to represent subsidies for users of shared-ride ride-hailing services. Data from the Carbon-Free Boston study (Porter et al., 2019) was used to estimate the cost-effectiveness of this service. In the Carbon-Free Boston study, travel demand forecasting methods were used to estimate the trip and VMT changes resulting from a \$1.00 cross-subsidy from ride-alone to shared-ride services (\$1.00 fee on ride-alone trips, and \$1.00 subsidy for shared-ride). In the TCI tool it is assumed that only a subsidy for shared-ride services is provided, and no additional fee is collected on ride-alone services. The cost-effectiveness would therefore be based on the VMT shift from a \$1.00 reduction in the cost of a shared-ride trip.

KEY ASSUMPTIONS

- New VMT provided by shared mobility services is increased by 30 percent to account for “deadheading,” based on data from transportation network company (TNC) operations in several U.S. cities.
- Administrative costs are estimated at \$0.01 per transaction/trip.

MICROMOBILITY: SHARED E-BIKES AND E-SCOOTERS

OVERVIEW OF METHODOLOGY

Data from shared mobility systems on average cost per trip, trips per day, trip length, and prior auto mode shares are used for these strategies. Assumptions are also made about offsetting GHG emissions from equipment purchase and servicing, and about the relative amount of physical activity of a user compared to walking or biking. Data are mainly from NABSA (2020) and Portland Bureau of Transportation (2020).

KEY ASSUMPTIONS

- Investment split 50%/50% between shared e-bikes and shared e-scooters.
- Average cost per trip of \$3.00. This is assumed to fully cover the capital and operating costs of the system.
- Average of 2.6 e-bike and 3.2 e-scooter trips per vehicle per day, which results in an annual capital and operating cost of \$2,850 for an e-bike and \$3,500 for an e-scooter.
- Average trip length of 1.1 miles (e-scooter) or 1.4 miles (e-bike).
- Prior auto mode share (including drive, taxi, and TNC) of 40 percent based on MacArthur et al (2018), Buehler et al (2019), Mobility Lab (2019), NABSA (2020), and Ramboll (2020).
- Physical activity equivalency factor (relative activity per person-mile compared to biking or walking of 76 percent for e-bikes (Langford et al, 2017) and 20 percent for scooters (assuming 20 percent of trip is walk access/egress).
- Lifecycle GHG offset of 50 percent of gross GHG emissions reductions. This accounts for the relative life-cycle emissions (vehicle, operation, and service)

of an e-bike compared to a typical automobile. Values read from Figure 4 of ITF (2020).

MICROMOBILITY: E-BIKE OWNERSHIP

OVERVIEW OF METHODOLOGY

This strategy is evaluated like shared e-bikes but based on the cost per bike and with different parameters. This strategy appears more cost-effective due to a longer vehicle lifetime, no service costs, and lower lifecycle GHG emissions.

KEY ASSUMPTIONS

- Cost per new e-bike of \$2,000. Price elasticity is unknown, so it is assumed that \$2,000 investment or subsidy results in one new e-bike.
- Lifetime of e-bike: 6 years (ITF, 2020).
- Trips per bike per week: 6 (1 round-trip, 3 days a week), with an average trip length of 5 miles, results in 1,560 miles per bike per year (matches assumption from ITF, 2020).
- Prior auto mode share (including drive, taxi, and TNC) of 40 percent based on MacArthur et al (2018), Buehler et al (2019), Mobility Lab (2019), NABSA (2020), and Ramboll (2020).
- Physical activity equivalency factor (relative activity per person-mile compared to biking or walking of 76 percent (Langford et al, 2017).
- Lifecycle GHG offset of 8 percent of gross GHG emissions reductions. This accounts for the relative life-cycle emissions (vehicle and operation) of an e-bike compared to a typical automobile. Values read from Figure 4 of ITF (2020).

LAND USE/SMART GROWTH

OVERVIEW OF METHODOLOGY

Costs for administrative and planning activities are usually nominal compared to the capital investment costs required for most transportation strategies. However, additional costs may be incurred, such as infrastructure investment in targeted growth areas, or incentives to cities and towns to encourage rezoning.

The metric used is the cost to government to implement policies that result in the shift of one person or household from a dispersed land use type into a more compact land use type. The approach to this strategy is to shift population from lower-density area types into higher-density area types.

KEY ASSUMPTIONS

- Research was conducted in 2019 to look at program evaluation data on funding incentives and new housing units from state and metropolitan programs where such data were available, such as the Massachusetts Chapter 40R smart growth incentive program, as well as programs in Atlanta, Minneapolis-St. Paul, and California. Based on this review a value of \$25,000 per household shifted was selected.
- The model includes a three-year lag to reflect the time required for new incentives to have an impact on policy and development patterns. Therefore, funding incentives starting in 2022 first start to have an effect in 2025.
- VMT per capita varies by area type based on county level data in the emission inventory and forecast prepared for TCI (CS, 2015a), as shown in Figure 31. This table also shows how the assumptions under an illustrative scenario would result in population shifts by area type in Rhode Island.

Figure 31. Illustrative Land Use Scenario

Area Type:	Core	Urban	Suburban	Rural	Total
Density (Census Tract), persons per sq. mi:	>10,000	4,000 - 10,000	500 - 4,000	<500	
VMT per capita	3,168	8,864	10,553	13,672	
Funding (millions) - Cumulative 2022-2032					\$ 22
Population shifted (Cumulative)					2,165
Population					
2014	181,619	299,534	435,911	139,547	1,056,611
2032 BAU	183,232	302,194	439,782	140,786	1,065,994
2032 Scenario	184,314	303,276	438,700	139,704	1,065,994
% of Growth					
2032 BAU	17.2%	28.3%	41.3%	13.2%	
2032 Scenario	28.7%	39.9%	29.7%	1.7%	
VMT (millions)					
2014	575	2,287	3,672	1,908	8,442
2032 BAU	581	2,308	3,704	1,925	8,517
2032 Scenario	584	2,316	3,695	1,910	8,505
2032 Scenario vs. BAU					(12)

BICYCLE INVESTMENT

OVERVIEW OF METHODOLOGY

The approach in this analysis is to assume an increase in bicycle-miles of travel (BMT) per new facility-mile of investment. This increase varies by area type and facility type. Unit costs per mile by facility type are combined with a user-input investment mix by facility type and area type to determine the amount of new facilities that can be constructed at a given investment level.

KEY ASSUMPTIONS

- Growth in usage (new cyclists per day per mile by facility type) – The model assumptions equate to about 80 to 170 new utilitarian bicycle trips per day per mile of new facility (depending upon the facility type) in core urban areas; 40 to 90 new trips per day in urban areas; and between 5 and 15 new trips per day per mile in suburban and rural areas. Sources include Gu, Mohit, and Muenniq (2016); Buehler & Pucher (2012); and on Broach, Gliebe, & Dill (2012).
- Default cost per mile: bike lanes - \$25,000; at-grade protected lanes/bike boulevard - \$125,000; grade-separated protected lanes - \$500,000; shared use paths - \$1,000,000. Cost sources include Bushell et al (2013).
- Allocation of funding by facility type and area type is shown in Figure 32.

Figure 32. Default Bike Funding by Facility and Area Type

Facility Type	Core	Urban	Suburban	Rural
Bike lane	10%	10%	10%	10%
At grade sep lane/blvd	20%	20%	20%	0%
Grade-separated lane	50%	50%	0%	0%
Shared-use path	20%	20%	70%	90%

- New facility-miles: calculated from investment level, distribution of investment by area type and facility type (regionwide shown as example), and cost per mile of facility.
- Prior drive mode share of new bicyclists (includes taxi/TNC and auto driver) varies by area type with the same defaults as used for transit investment (low of 47% in core urban areas to 60% in suburban areas).
- Bicycle trip length = 2.3 miles from the 2009 National Household Travel Survey (NHTS).
- There is a one-year lag between investment and benefits to account for construction time.

PEDESTRIAN INVESTMENT

OVERVIEW OF METHODOLOGY

The approach is based on the approach used by the Massachusetts DOT (MassDOT) in a Congestion Mitigation and Air Quality Improvement (CMAQ) Program template for complete streets projects. The model is based on a hypothetical program of pedestrian improvements, estimates of the costs of these improvements, and estimated response based on literature linking pedestrian demand to “pedestrian environment factors” (PEF) that describe the quality of the pedestrian environment based on factors such as sidewalk completeness, street crossings, topography, etc.

KEY ASSUMPTIONS

- There is a one-year lag between investment and benefits to account for construction time.
- Key assumptions and sample calculations (based on MassDOT template) are shown in Figure 33.

Figure 33. Default Walk Funding by Facility and Area Type

	Core	Urban	Suburban	Rural	Units
Persons per square mile	>10,000	4,000 - 10,000	500 - 4,000	<500	
Facility Length (L):	1.0	1.0	1.0	1.0	Miles
Service Area Radius for Walking (RW):	0.25	0.25	0.25	0.25	Miles
Service Area of Community(ies) for Walking (SAW): $L * 2RW = SAW$	0.5	0.5	0.5	0.5	Sq. Miles
Population Density of Neighborhoods Served (PD):	15,000	7,500	2,000	500	Persons/Sq. Mile
Population Served by Facility for Walking (PW): $PD * SAW = PW$	7,500	3,750	1,000	250	Persons
Trips per Person per Day in Service Area (T):	4.7	4.7	4.7	4.7	Trips
Baseline Walk Mode Share in Service Area (MSW): ^a	30.2%	18.7%	3.6%	2.4%	Percent
Relative Increase in Service Area Walk Mode Share from Improvements (WI): ^b	7.5%	7.5%	7.5%	7.5%	Percent
New Walk Trips (WT): $PW * T * MSW * WI = WT$	798	247	13	2	1-Way Trips/Day

	Core	Urban	Suburban	Rural	Units
Average Walk Trip Length (LW): ^c	0.7	0.7	0.7	0.7	Miles
New Daily Walk Miles of Travel (BWM):	559	173	9	1	Miles per Day
Prior Drive Mode Share of New Walk Trips (MSD): ^d	47%	59%	60%	75%	Percent
VMTR Reduced per Day (VMTR): BWM * MSD = VMTR	264	103	5	1	Miles per Day
VMTR * Operating Days Per Year	96,387	37,421	1,945	397	VMTR Per Year
Incremental complete streets capital cost per mile ^e	\$ 900,000	\$ 850,000	\$ 750,000	\$ 250,000	
Incremental annual maintenance cost per mile ^f	\$ 63,000	\$ 59,500	\$ 52,500	\$ 17,500	

^aWalk mode shares based on default mode shares by density in the MassDOT tool, which are based on analysis of the 2011 Massachusetts Household Travel Survey. These are: 4.7% (<1,000 ppsm); 7.2% (1,000 – 7,500 ppsm); 30.2% (>7,500 ppsm).

^bRelative mode share increase of 7.5% is based on 0.15 PEF elasticity from Ewing and Cervero (2010) times assumed 50% increase in PEF as a result of improvements.

^cAverage walk trip length from 2009 National Household Travel Survey.

^dPrior drive mode share uses the same defaults as described in Appendix B.

^eIncremental cost of pedestrian improvements per mile is based on new sidewalk on 2 sides + 4 intersection curb extension retrofits + 16 new striped crosswalks + 8 new ped signals at 4 intersections, based on costs in Bushell et al., 2013.

^fAnnual maintenance costs estimated at 7% of capital costs, consistent with the transit investment analysis.

TRAVEL DEMAND MANAGEMENT

OVERVIEW OF METHODOLOGY

The basic approach for the TDM analysis assumes a tons per dollar effectiveness based on evidence from the literature on TDM programs. Unlike most strategies, which accumulate benefits over time as investment is made in infrastructure, clean vehicles, or land use change, the TDM strategy is assumed to result in benefits only in the year the money is spent.

A “two-tiered” cost-effectiveness scale is included.

- It is assumed that the first tier of spending is directed into employer outreach to achieve “low-hanging fruit” by working with employers and transportation management associations to offer information, incentives, and policies to support worksite vehicle trip reduction. For Rhode Island this is set to \$500,000.
- Once outreach efforts have achieved as much as they can, additional funding is placed into direct incentives (modeled as transit pass cost reductions) to workers, with a lower cost-effectiveness.

KEY ASSUMPTIONS

- The high cost-effectiveness investment is estimated to cost \$0.11 per VMT reduced reflecting expanded employer outreach programs, based on information on employer/worksite TDM and rideshare programs from a U.S. DOT Report to Congress (U.S. DOT, 2010), and evaluations of Metro Washington Council of Governments’ Commuter Connections program (LDA Consulting et al, 2009).
- A reduced cost-effectiveness of \$1.92 per VMT reduced is assumed for spending above the threshold. This is based on Moving Cooler study results (CS, 2009) from modeling of subsidized transit passes using EPA’s Commuter

Model, and are a function of baseline mode share by area type (higher non-auto share = higher cost-effectiveness) considering a typical “large metro” area (Providence).

TRANSIT AND RAIL

FIXED-GUIDEWAY INVESTMENT

OVERVIEW OF METHODOLOGY

Fixed-guideway transit investment may include bus rapid transit (BRT), light and heavy rail, commuter rail, and intercity rail. In this analysis, distinct factors are developed for each mode. The basic approach is to estimate the annual VMT reduced per dollar of capital investment. This information is taken from recent planning studies of projects in the TCI region.

KEY ASSUMPTIONS

- VMT cost-effectiveness (annual auto VMT reduced per cumulative \$millions invested) is based on data from 13 projects in CT, MA, MD, NY, and the region (Northeast Corridor), with data obtained from a combination of environmental documents, Federal Transit Administration (FTA) New/Small Starts submissions, agency capital plans, and CS calculations. BRT projects included the Silver Line Gateway in MA and the Woodhaven BRT in New York City.

- For scaling purposes (illustrative quantities), BRT is assumed to cost \$20 million per mile and commuter/intercity rail is assumed to cost \$50 million per mile.
- Annual operating costs are estimated at 7 percent of up-front capital costs, or 37 percent of the annualized capital cost over the TCI evaluation period.⁷⁴
- For rail investments, the increase in rail vehicle VMT is estimated to be 3 percent of the decrease in automobile VMT, based on data from a sample of nine projects applying for FTA New Starts funding.
- For BRT investments, the increase in bus vehicle VMT is estimated to be 22 percent of the decrease in automobile VMT, considering average load factors, operating cost per mile, and prior drive mode for an average “large” urbanized area (>1 million population) in the TCI region as taken from the 2014 National Transit Database (NTD).
- For new BRT service, 59 percent of new riders are assumed to be shifted from driving (or taxi/TNC) and 26 percent are assumed to be shifted from existing bus service.⁷⁵
- A one-year lag is built in between investment and benefits for BRT, and two years for rail, to account for construction time.

⁷⁴ The 7% annualization factor is based on CS analysis of a number of transit project applications for FTA New Starts funding that was conducted for Transit Cooperative Research Program (TCRP) Project H-41 (TCRP Web-Only Document 55, Assessing and Comparing Environmental Performance of Major Transit Investments, 2013). The factor is a composite reflecting a discount rate and useful life spans of different transit project elements from FTA’s Standard Capital Cost worksheets.

⁷⁵ Various available data from national and TCI region studies show a wide range of values that could be used for the “prior drive mode share” parameter. To obtain

the default values used in the TCI tool, the prior drive mode share for small urbanized areas (UZAs) for the transit strategies (or for the suburban area type for bicycling) was set at 60 percent for bus and urban rail transit and bicycling, and 75 percent for commuter and intercity rail. The mode share was then scaled for larger UZAs or for denser area types based on the ratios of drive alone commute percentages from the American Community Survey.

BUS OPERATING IMPROVEMENTS

OVERVIEW OF METHODOLOGY

The basic approach is to apply ridership elasticities (percent change in riders with respect to a percent change in service or fare levels) along with assumptions about avoided drive mode share and trip lengths.

KEY ASSUMPTIONS – BUS SERVICE EXPANSION

- Cost per vehicle revenue-mile (VRM) is based on 2018 NTD operating statistics for RIPTA (\$9.19 per VRM), to estimate the new VRM achieved with a given investment level.
- Ridership elasticities (percent change in ridership per percent change in service level) is 0.8. This is towards the high end of the range of 0.3 – 1.0 found in the literature (Pratt et al, 2004), and assumes that service is added where it is most effective at increasing ridership.
- Default values for prior drive mode share for transit riders are as described above for BRT.

KEY ASSUMPTIONS – BUS SERVICE EFFICIENCY

- Investment supports transit signal priority, queue jump lanes, curb extensions at stops, and stop consolidation. A hypothetical program using typical costs from the literature is developed, including annual maintenance at 10 percent of capital costs. The program works out to about \$21,000 per improved route-mile per year over the 11-year evaluation period. Costs are based on Danaher (2010).
- Deployed on routes with average 15-minute headways.
- Travel time reductions by strategy (if applied on entire route) are based on Danaher (2010). For the example investment level, this yields a total average travel time reduction (across all routes) of 2.8 percent.

- Change in ridership and reduced automobile VMT based on:
 - Ridership elasticity with respect to travel time of 0.4 based on midpoint of typical range of 0.3 to 0.5 found in literature (Pratt et al, 2004); and
 - Change in auto VMT based on assumed prior drive-alone mode share (as noted above) and average trip length of 3.1 miles (unlinked passenger miles/unlinked passenger trips from 2014 NTD for TCI region bus systems).

KEY ASSUMPTIONS – ELECTRIC MICROTRANSIT

- Investment supports capital and operating costs for smaller (12 to 15 passenger) vehicles providing app-enabled, flex-route service.
- Capital cost (vehicle + EVSE) of \$93,000 per vehicle, which is the average assumed for an electric medium-duty truck over the 2022 – 2032 time period. Vehicle has a 12-year lifetime.
- Operating cost of \$75 per vehicle revenue-hour, the cost for RIPTA demand responsive service as reported in the 2018 NTD.
- Average occupancy of 3.8 persons per vehicle, the average of RIPTA vanpool (6.2) and demand response (1.4) service as reported in the 2018 NTD.
- Average trip length of 10 miles, from RIPTA demand-responsive service as reported in the 2018 NTD.
- Average of 30,000 miles per vehicle and 1,500 VRH per vehicle per year, from RIPTA demand-responsive service as reported in the 2018 NTD.
- Prior drive mode share of 59 percent, similar to bus expansion assumptions.

ASSUMPTIONS FOR BENEFIT CALCULATIONS

Five benefit metrics are reported for individual strategies and for overall investment portfolios. Key assumptions (in addition to the strategy-specific assumptions described above) are provided in this section.

- GHG reduction
- Fine particulate matter (PM_{2.5}) emissions reduction
- New non-single occupancy vehicle (SOV) trips
- Jobs created
- Value of health benefits

GREENHOUSE GAS REDUCTION

GHG reductions are mainly based on changes in VMT by vehicle/fuel type and emission factors by fuel type. Key assumptions for emission factors include:

- For gasoline and diesel, emissions from biofuel blends (e.g., ethanol) are not included. This is consistent with the TCI program protocol which only caps carbon from gasoline and diesel. Considering TCI regionwide ethanol and biodiesel blends (7.1 and 1.5 percent, respectively), the carbon intensity of gasoline is 7.94 kg per gallon and the carbon intensity of diesel is 9.41 kg per gallon of gasoline equivalent.
- The carbon intensity of electricity emissions is 109.5 grams CO₂e per megajoule (g/MJ) in 2018 (per U.S. Environmental Protection Agency eGRID for Rhode Island), declining to 76.8 g/MJ in 2032, based on a continuing 2.5 percent annual rate of decline consistent with the current Regional

Greenhouse Gas Initiative (RGGI) program. The 2032 value is equivalent to 9.41 kg per gallon of gasoline equivalent.⁷⁶

FINE PARTICULATE MATTER (PM_{2.5})

Emission rates for PM_{2.5} in the TCI tool are taken from a representative run of the U.S. EPA MOVES2014 model for Fairfax County, VA for calendar year 2032. The rates by vehicle type (VMT-weighted average for gasoline and diesel vehicles) are shown in Figure 34.

Figure 34. PM2.5 Emission Rates (2032)

Vehicle Type	Rate (g/mi)
Light-Duty Auto & Truck	0.003
Bus	0.063
Medium Truck	0.019
Heavy Truck	0.026

NEW NON-SOV TRIPS

New non-SOV trips are either calculated directly from assumptions as described for specific strategies or are calculated from VMT changes and average trip lengths specific to a mode.

Some strategies can result in various changes to travel patterns that are not modeled explicitly. For example, worksite focused TDM may result in workers shifting to alternative modes and/or reducing trips (e.g., telecommuting). For this analysis it is assumed that all VMT reduced from TDM programs results in a non-SOV trip at an average trip length for a transit rider.

The land use/smart growth strategy can reduce VMT and emissions both from changes in vehicle-trips (by making it easier to travel by walk, bike, or transit) and

they use much less energy per mile than gasoline and diesel vehicles – see the previous discussion of energy efficiency ratios (EER).

⁷⁶ While this is higher than gasoline and similar to diesel, electric vehicles will still reduce emissions substantially because they are much more energy efficient, i.e.,

from changes in trip lengths. Data was not readily available on the balance of one factor vs. the other, so a change in non-SOV trips was not estimated for this strategy.

JOBS CREATED

Job creation impacts include direct and indirect impacts associated with constructing a project or operating a service. They also include benefits to the economy resulting from changes in business and consumer costs due to reduced vehicle operating costs, travel times, etc.

As part of the work for Georgetown Climate Center supporting the TCI initiative, the TCI regionwide economic benefits of clean transportation investment portfolios were analyzed using the Regional Economic Models, Inc. (REMI) Policy Insight (PI+) model. REMI is the premier economic simulation model in the U.S. and is a dynamic model, measuring interactions among all sectors of the economy over time.

The project team was not licensed to run REMI for the Rhode Island project, but did make use of some REMI runs performed for TCI to estimate job impacts per dollar of government investment and consumer and business cost savings (all of which are outputs of the TCI tool and provided for the RI strategies and portfolios). Specifically, the changes in jobs in year 2032 as a result of a unit annual change in government spending, consumer costs, or business productivity over the 2022 – 2032 time frame, as modeled in REMI for the TCI region, were multiplied by the change estimated for these factors from the TCI tool to estimate an overall change in jobs. This should be considered a very rough estimate as it does not account for the dynamic interactions over time and across sectors that would be captured in a REMI run. The 2032 change in jobs per unit of spending or savings from these REMI runs is shown in Figure 35.

Figure 35. Change in Jobs from Spending/Cost Savings

Annual Impact, 2022 – 2032	Change in Jobs, 2032
Business production cost change - \$1 million reduction	17.8

Consumer spending - \$1 million additional on non-transportation items	8.4
Government spending on infrastructure and services - \$1 million additional	8.1

This rough estimate also does not account for any industry effects specific to Rhode Island, or how the clean mobility strategies might be implemented in Rhode Island. Finally, it does not account for any economic effects related to fuel price changes from the TCI program, i.e., offsetting increases in business and consumer costs. As noted in the introduction, emissions, health and other benefits related to those fuel price changes are also not being considered.

The economic analysis considers the net economic effects from the following impacts:

- **Travel time savings** accruing to businesses, due to reductions in congestion and delay. These include time savings for truckers, other commercial vehicle operators, and other “on-the-clock” travel. Congestion and delay are reduced as a result of VMT reductions from travel reduction strategies that reduce congestion, and directly by system efficiency strategies (traffic flow improvements).
- **Savings in fuel and vehicle maintenance** (for businesses and consumers), as a result of strategies (such as investment in transit and nonmotorized infrastructure) that allow travelers to reduce VMT as well as shifting to electric vehicles.
- **Increased spending on vehicles** for electric vehicle purchases by businesses or consumers.
- **New government investment** in transportation infrastructure and services, made possible by the new funding mechanisms.

- **Net changes in consumer spending** on non-transportation goods and services. Consumers will pay more for electric vehicles but will save money on fuel and maintenance. The net of these two effects is an increase or decrease in money available to spend on other items.

Additional assumptions supporting the economic analysis (such as value of time, operating costs per mile, and other parameters) are documented in CS (2020).

To validate and corroborate the REMI results, a literature review was also conducted of the impact on jobs from the various strategies considered in this analysis. To the extent possible, data from the studies reviewed was converted into metrics of new jobs created per million dollars invested. Figure 36 shows the jobs metrics resulting from the TCI tool data as compared to estimates based on other sources. These estimates vary in their underlying methods and assumptions and what types of benefits are included. The TCI tool outputs were used for the estimates of jobs associated with the final portfolios. Additional notes for some sources are provided below.

Figure 36. Metrics of Jobs per Million Dollars Investment

Strategy	TCI Tool Estimate	Other Source Estimates	Comments
Light duty EVs	2	0.7 – 18	Based on multiple sources, see below.
Electric transit buses	7	5.7	Veeder (2020): “5.7 jobs are supported for every \$1 million invested in BEBs”
Electric school buses	10	5.7	
Electric trucks	13		Higher than other EV types because fuel & maintenance cost savings benefit business productivity.
Hydrogen trucks	7		

Shared ride incentives	1		
Micromobility – shared e-scooters & e-bikes	1	7 - 11	
Micromobility – e-bike ownership	4		
Land use/smart growth	13		
Bicycle investment	12	17	AASHTO (2012)
Pedestrian investment	10	17	
Travel demand management	11		
Bus rapid transit	10	36	Other: APTA (2009) for capital + operating average.
Commuter/intercity rail	10	36	
Bus service: expansion	9	41	Other: APTA (2009) for operating costs only.
Bus service: efficiency	17	41	
Electric microtransit	10		
System efficiency - traffic flow improvements	102	10	10 (AASHTO, 2012) = direct jobs associated with traffic management. TCI tool estimate is very high because on-the-clock travel time reductions directly benefit business productivity.

LIGHT DUTY EVS

Studies of the impacts of electrification could generally be used to derive estimates of new jobs per 1,000 new EVs. These estimates were converted to new jobs per

\$million investment using the \$6,100 average cost per new EV derived from the NEMS model as described previously.

UC - Berkeley (2009) evaluated a scenario in which U.S. EV sales increased to 10.6 million between 2010 and 2030. This would result in between 130,000 and 350,000 new jobs, or 12.3 – 33.1 jobs per EV sold in 2030. This converts to **2.0 – 5.4 jobs per \$million**. New jobs are created in the battery manufacturing industry and in the construction, operation, and maintenance of a domestic charging infrastructure network. The job gains outweigh modeled job losses among gas station attendants, mechanics, and parts industry manufacturers.

The **Electrification Coalition (2010)** evaluated a scenario in which U.S. EV sales increased to 17.1 million between 2010 and 2030. This would increase jobs in the auto and electrical components industries by 218,000 in 2030, or 12.7 jobs per EV sold in 2030. This converts to **2.1 jobs per \$million**. Total jobs considering benefits to the entire economy would increase by 1.9 million, or 111 per thousand EVs sold in 2030, or **18 jobs per \$million**.

The **New York State Energy Research and Development Authority (NYSERDA) (2011)** considered a scenario of 5 million new EVs sold cumulatively through 2030, or 600,000 in 2030. Using macroeconomic modeling they found an increase of 19,800 jobs for the low oil price case or 59,800 jobs for the high oil price case. These equate to 33.0 to 99.7 jobs per 1,000 vehicles sold in 2030, or **5.4 to 16.3 jobs per \$million**. The vast majority (85 to 95 percent) of employment impacts were generated by increased consumer spending, demonstrating the importance of household spending in non-petroleum sectors of the economy.

Pollin and Chakraborty (2020) studied the national impacts of infrastructure programs. For “clean energy – high efficiency autos” they found a direct impact of **1.4 jobs per \$million** in spending, as well as an indirect impact of 3.7 jobs and an induced impact of 3.5 jobs for a total of **8.6 jobs per \$million**.

MICROMOBILITY

NABSA (2020) found that in 2019 there were 157 million bikeshare or scooter share trips taken in the U.S. and estimated that 5,000 jobs were created to serve these trips. With a TCI tool-generated estimate of 330,000 trips per \$million, this would indicate a total of **10.5 jobs created per \$million**.

Portland Bureau of Transportation (2018), in a study of e-scooters, found that 700,400 trips were supported by 1,533 independent contractors earning a total of \$643,000 in wages. Assuming a \$20/hour wage rate and 2,080 hours per year per full time equivalent (FTE), this equates to 15.5 FTE jobs or 0.01 FTE job per contractor utilized. With a TCI tool-generated estimate of 330,000 trips per \$million, there would be 722 independent contractors utilized per \$million, or **7.3 FTE jobs per \$million**. Note that this estimate would not include jobs associated with managing the program, only servicing the scooters.

BICYCLE AND PEDESTRIAN INVESTMENT

Dowell and Petraglia (2012) conducted a study for the American Association of State Highway and Transportation Officials (AASHTO) on the economic impacts of infrastructure investment by analyzing data on job creation submitted by Recovery Act grant applicants. The study found that greenways, sidewalks, and bicycle facilities created about **17 jobs per \$million invested**. This compares with about 11-13 jobs associated with highway and bridge construction, and 10.3 jobs per \$million for safety and traffic management.

Pollin and Chakraborty (2020) studied the national impacts of infrastructure programs. For “surface transportation” they found a direct impact of **11.6 jobs per \$million** in spending, as well as an indirect impact of 3.3 jobs and an induced impact of 5.7 jobs for a total of **20.6 jobs per \$million**. They did not differentiate by type of infrastructure.

Some studies have also examined local economic benefits as a result of spending by travelers and tourists using shared-use paths and bike lanes. These effects are not included in this study because much of that additional spending would be localized and might have otherwise been spent by Rhode Island residents in other parts of the state, if not in the vicinity of the bike lane or path.

BUS AND RAIL

Weisbrod and Reno (2009) conducted a nationwide study on the economic benefits of transit. This study considered benefits to the economy from travelers’ time and vehicle operating cost savings and business productivity, as well as direct spending on capital and operations and associated indirect jobs. Capital investment resulted

in 23,800 jobs per \$billion; operating in 41,100 jobs per billion; and expenditures on an average mix of these in 36,000 jobs per \$billion.

VALUE OF HEALTH BENEFITS

The monetary valuation of health benefits consists of three components:

- Valuation of fatality and injury reductions related to reduced VMT (safety benefits).
- Valuation of avoided mortality due to increased physical activity (walking and biking).
- Valuation of avoided mortality and other health benefits from reduced air pollutant emissions.

SAFETY BENEFITS

- Fatality and injury motor vehicle crashes are assumed to be reduced in proportion to VMT reduced. Average rates of 0.013 fatalities and 0.195 injuries per million vehicle-miles are used, based on Fatality Analysis Reporting System (FARS) fatality data from 2000-2009 and injury rates reported by the Bureau of Transportation Statistics (BTS) in National Transportation Statistics (Table 2-17: “Motor Vehicle Safety Data”).⁷⁷
- Crash reduction benefits are valued at \$9.6 million per fatality based on the latest (2016) U.S. DOT guidance on value of a statistical life. Disabling injuries are valued at \$490,000 based on the value provided in Federal Transit Administration New Starts and Small Starts reporting templates for Fiscal Year 2021.
- The analysis does not account for any changes in fatal or injury crashes that may occur as a result of increased levels of bicycling and walking. Evidence

suggests that while total crashes will increase, crash rates will decrease due to the “safety in numbers” effect (c.f. Castro et al., 2018). These two effects offset to an unknown degree, which appears to vary depending upon the context.

PHYSICAL ACTIVITY BENEFITS

- Reduced mortality as a result of walking and biking was estimated using the World Health Organization (WHO) Health Economic Assessment Toolkit (HEAT) using data developed for a previous study done in Massachusetts. This analysis is more fully documented in CS (2020). The estimated rates are 1.7 deaths prevented per million new walking PMT, and 0.5 deaths prevented per million new bicycling PMT.
- Benefits are estimated for PMT from walking and biking, as well as PMT associated with accessing transit (0.5 mile walk per trip) and shared e-scooters (20 percent of trip length).
- Deaths prevented by physical activity were valued at the same \$9.6 million value of a statistical life used in the safety analysis.

AIR POLLUTION BENEFITS

- Emission factors (g/mile) were applied to changes in VMT by vehicle type to estimate changes in emissions of PM_{2.5}, oxides of nitrogen (NO_x), and volatile organic compounds (VOC).
- The monetary value of emissions changes, and the estimated deaths avoided, were estimated using national average factors, adjusted for the TCI region based on region-specific modeling done in 2020. The national damage values (\$/kg) are based on the U.S. EPA regulatory impact analysis for light-duty vehicle fuel economy and GHG standards (U.S. EPA, 2010). PM_{2.5} is responsible

⁷⁷ The latest reported rates, for year 2017, are 0.012 fatalities and 0.201 crashes per million vehicle-miles.

for the large majority of health effects from motor vehicle air pollution. Changes in premature deaths from PM_{2.5} emission reductions were estimated using information from the Regulatory Impact Analyses for the EPA/NHTSA joint rulemaking for Model Year 2017-2025 light-duty vehicle GHG emissions and fuel economy, and for the agencies' joint rulemaking for Model Year 2014-2018 heavy-duty vehicle GHG emissions and fuel economy (U.S. EPA & NHTSA, 2011, 2012).

- The resulting monetary values and deaths avoided were adjusted so that the results for a TCI regionwide analysis matched the results of TCI-specific health modeling (Harvard C-CHANGE, 2020) for the same regionwide scenario (25% GHG reduction, hybrid investment portfolio).

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APPENDIX D: MOBILITY INNOVATION WORKING GROUP MEETING AGENDAS AND MINUTES

Mobility Innovation Working Group Meeting Agendas and Minutes

The Mobility Innovation Working Group met virtually seven times between August 2020 and January 2021. The agendas and meeting minutes for those meetings can be found at <http://climatechange.ri.gov/state-actions/mobility-innovation.php>.

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