

New Visions 2050 Regional Transportation Plan

Environment & Technology White Paper

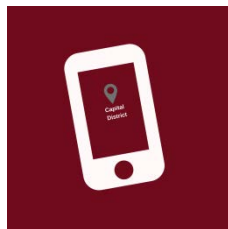
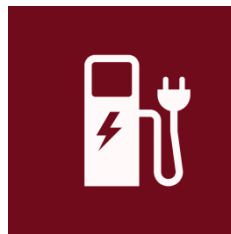


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Acknowledgments

The Capital District Transportation Committee (CDTC) established a Task Force consisting of a variety of stakeholders and local transportation experts to review draft documents and make recommendations. This document summarizes CDTC's accomplishments in working towards its New Visions goals related to protecting the Capital Region's natural environment and resources and adopting technology. While there is still plenty of work to be done, Capital Region residents enjoy a high quality of life, natural and cultural resources, and a reliable transportation system that has integrated innovative technologies and strategies. While all interest and public comments received are greatly appreciated, this effort particularly benefits from the participation and enthusiasm of the Task Force, whose members are listed below.

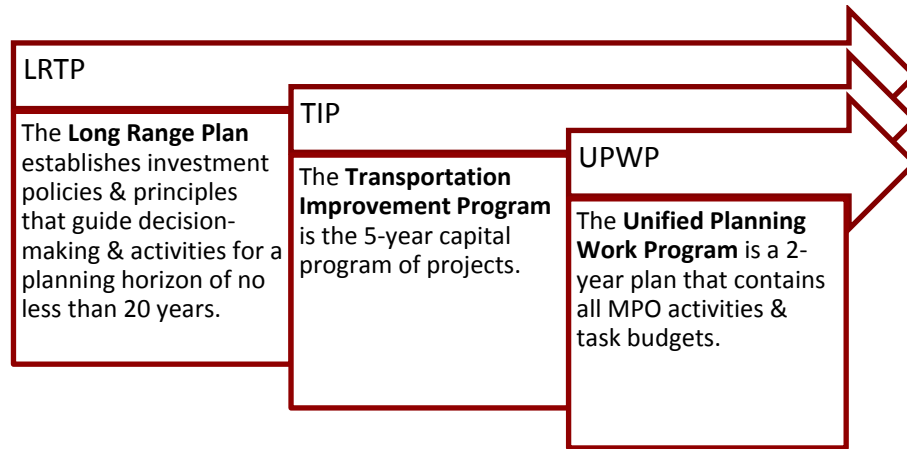
All errors or omission are the responsibility of the principal author, Jennifer Ceponis. All mapping was provided by Teresa LaSalle. Research, data collection, and general assistance were provided by Chris O'Neill, Teresa LaSalle and Jacob Beeman of the CDTC staff. The content and philosophy of this document is in large part a result of the contributions of the Task Force.

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Introduction

The CDTC is the designated Metropolitan Planning Organization (MPO) of the Albany-Schenectady-Troy and Saratoga Springs metropolitan areas. In accordance with federal transportation legislation, CDTC is required to provide a forum for cooperative transportation decision-making in a continuing, cooperative, and comprehensive manner. One of the main responsibilities of CDTC is the development and maintenance of a Long-Range Transportation Plan (LRTP) that meets the social, environmental, economic, and travel needs of the area. CDTC refers to its LRTP as *New Visions*. *New Visions* establishes investment policies and principles that guide decision-making and activities for a planning horizon of no less than 20 years. These policies and principles are woven through CDTC's evaluation and prioritization process of capital projects, a 5-year program called the Transportation Improvement Program (TIP). Furthermore, CDTC is required to develop and maintain a 2-year plan that contains all MPO activities and task budgets. This is referred to as the Unified Planning Work Program (UPWP). All of the activities and tasks included in the UPWP help achieve the goals of *New Visions*.

Figure 1. MPO Responsibilities



The ultimate goal of transportation is to provide access to goods, services, and activities. CDTC's approach to the metropolitan planning process is to develop programs and plans that build a safe, equitable, multi-modal transportation system for all residents of the Capital Region. Creating a flexible environment that can adapt to new mobility services and emerging technologies will maximize air quality, safety, and congestion benefits. Infrastructure investments today must ensure a resilient and equitable system for the next generation.

How'd We Get Here?

CDTC's *New Visions 2040* Environment and Technology White Paper was last updated in 2015. Topics discussed in the paper included fuel economy, alternative fuels, greenhouse gas emissions (GHG) and energy conservation, technological impacts, travel demand management, signal technology, natural resources and environmental systems, and Smart Growth. It also proposed increasing consideration of environmental impacts of transportation projects in the Transportation Improvement Program evaluation methodology. While these are all topics that CDTC has consistently supported and pursued in its planning initiatives, *New Visions* strengthens and reinforces the region's commitment to them.

The paper and its recommendations were structured around two investment principles:

Preserve the Environment – transportation choices should improve our environment, not harm it.

Environmental stewardship is crucial to the success of and quality of life in this region. Transportation investments must improve or preserve the region's cultural and natural environment. Transportation investments will not encourage development in environmentally sensitive areas and will help to preserve rural character. Transportation investments will support alternative fuel vehicles and greenhouse gas reduction. Environmental best practices will be incorporated into all projects.

Leverage Technology – we must plan for new, smarter, better, rapidly-changing transportation technology. Advancements in technology, such as self-driving cars, self-adjusting traffic signals, smart phone apps, ridesharing, carsharing, and bikesharing will have tremendous and wide-reaching impacts on future transportation. These impacts include, but are not limited to, decreasing congestion, providing transportation to more seniors and people with disabilities, reducing traffic crashes, and more.

These principles frequently influence CDTC tasks and planning initiatives. Environmental stewardship is reflected in CDTC's advocacy for sustainable development and design, urban reinvestment, investments in alternative modes and shared mobility services, and demonstrated leadership in alternative fuels and advanced vehicle technologies through its involvement in the U.S. Department of Energy Clean Cities program. The CDTC Smart Communities Task Force was established to initiate a regional discussion about the region's readiness for autonomous vehicles and other emerging technologies.

New Visions 2040 identified several performance measures for tracking progress in meeting environmental and sustainability goals. These measures are:

1. GHG emissions by municipality
2. Energy consumption by municipality
3. Percent of programmed projects with a positive impact on GHG emissions
4. Volatile Organic Compound Emissions
5. Nitrogen Oxide Emissions
6. Petroleum Displacement

Similarly, strategies and programs for moving each measure in the preferred direction were outlined. The following section will review each performance measure and which direction it is trending. CDTC

initiatives and tasks that are related or influenced the trend are discussed as well as new, innovative ideas and concepts that are consistent with the planning and investment principles that could be pursued in the short- and long-term in the Capital Region. This paper then explores four potential future scenarios. The purpose of the proposed scenarios are to demonstrate how investments in transportation projects and programs can perpetuate or impede an efficient, sustainable, multimodal transportation system and support the recommended actions and implementation plan.

Performance Measures

The long-range transportation plan has established performance measures within each topic area. The *New Visions 2040* Environment & Technology White Paper put forth six performance measures which serve as benchmarks for advancing sustainability and conservation principles and technology adoption in the Capital District. The objective of *New Visions 2040* is to establish policies and principles that guide transportation infrastructure investments. These policies are used to prioritize projects, develop and assess design alternatives, and set standards.

Federal Law established a performance- and outcome-based transportation program in MAP-21 and later the FAST Act. The law sets performance measures for safety, pavement conditions, freight performance, on-road mobile source emissions, bridge conditions, National Highway System reliability, and transit asset conditions. The objective is for States and transit agencies to invest resources in projects that collectively make progress toward the achievement of national goals. CDTC, as a MPO, is required to coordinate with the state and transit agencies through its planning and programming activities to assist the state in meeting its goals.

CDTC has agreed to plan and program projects that contribute toward the accomplishment of NYSDOT targets for on-road mobile source emissions. This measure uses data from the Congestion Mitigation and Air Quality (CMAQ) Public Access System to measure the amounts of criteria pollutants that are reduced statewide for states with nonattainment areas that have funded projects with CMAQ funds. These targets can be found in **Error! Reference source not found.**

Table 1. On-Road Mobile Source Emissions Targets

Target Year	VOC (KG)	CO (KG)	NOX (KG)	PM10 (KG)	PM10 (KG)
2020	22,979	437,781	58,591	9,312	3,920
2022	42,765	839,633	107,713	18,132	7,482

On January 18, 2017, FHWA published the system performance, freight, and CMAQ Performance Measures Final Rule in the Federal Register. This third FHWA performance measure rule (PM3), which has an effective date of May 20, 2017, established six performance measures to assess the performance of the NHS, freight movement on the Interstate System, and traffic congestion and on-road mobile source emissions for the CMAQ Program. The performance measures are:

For the National Highway Performance Program (NHPP)

1. Percent of person-miles on the Interstate system that are reliable, also referred to as Level of Travel Time Reliability (LOTTR);
2. Percent of person-miles on the non-Interstate NHS that are reliable (LOTTR);

For the National Highway Freight Program (NHFP):

3. Truck Travel Time Reliability Index (TTTR);

For the CMAQ Program:

4. Annual hours of peak hour excessive delay per capita (PHED);
5. Percent of non-single occupant vehicle travel (Non-SOV); and
6. Cumulative two-year and four-year reduction of on-road mobile source emissions for CMAQ funded projects (CMAQ Emission Reduction).

The three CMAQ performance measures listed above are applicable only to designated nonattainment areas or maintenance areas for National Ambient Air Quality Standards by the Environmental Protection Agency. The CDTC meets all current air quality standards and is not subject to establishing targets for these performance measures. The remaining performance measures are described below.

CDTC's performance measures are aligned and consistent with Targets adopted in coordination with New York State Department of Transportation (NYSDOT) to comply with the FAST Act. Both aim to enhance the performance of the transportation system while protecting and enhancing the natural environment.

1. Greenhouse Gas Emissions from transportation

Related Tasks:

- Capital District Clean Communities
- Energy, Climate Change Initiative, & Air Quality
- GHG Reduction Analysis Tool Grant
- Smart Communities Task Force
- Transportation & Community Linkage Program
- Regional Travel Demand Management Effort
 - iPool2
 - Capital CarShare
 - CDPHP *Cycle!*

TREND: INCREASING (SLIGHTLY)

Transportation is the largest source of greenhouse gas emissions (GHGs) in New York State. GHGs trap heat in the atmosphere and are the main driver of climate change. These include carbon dioxide, methane, nitrous oxide, and fluorinated gases. GHGs are generated by transportation, but also from the production of electricity, industry, businesses and homes, agriculture, and land use and forestry.

A 2010 Capital District Regional GHG Inventory measured 12.8 million MTCDE (metric tons Carbon Dioxide Equivalent), or 15.2 MTCDE/person for the region. Transportation fuels dominate in all counties in the CDTC area and account for 40% of the region's GHG emissions. Development patterns also impact GHG emissions, with households in compact neighborhoods in close proximity to jobs and retail generating less than households in rural towns which often require long commute distances.

Table 2. 2010 GHG Emissions by County¹

County	MTCDE	GHG Emissions %
Albany	6,404,578	50%
Rensselaer	1,681,270	13%
Saratoga	3,160,107	25%
Schenectady	1,528,096	12%
Grand Total	12,774,051	100%

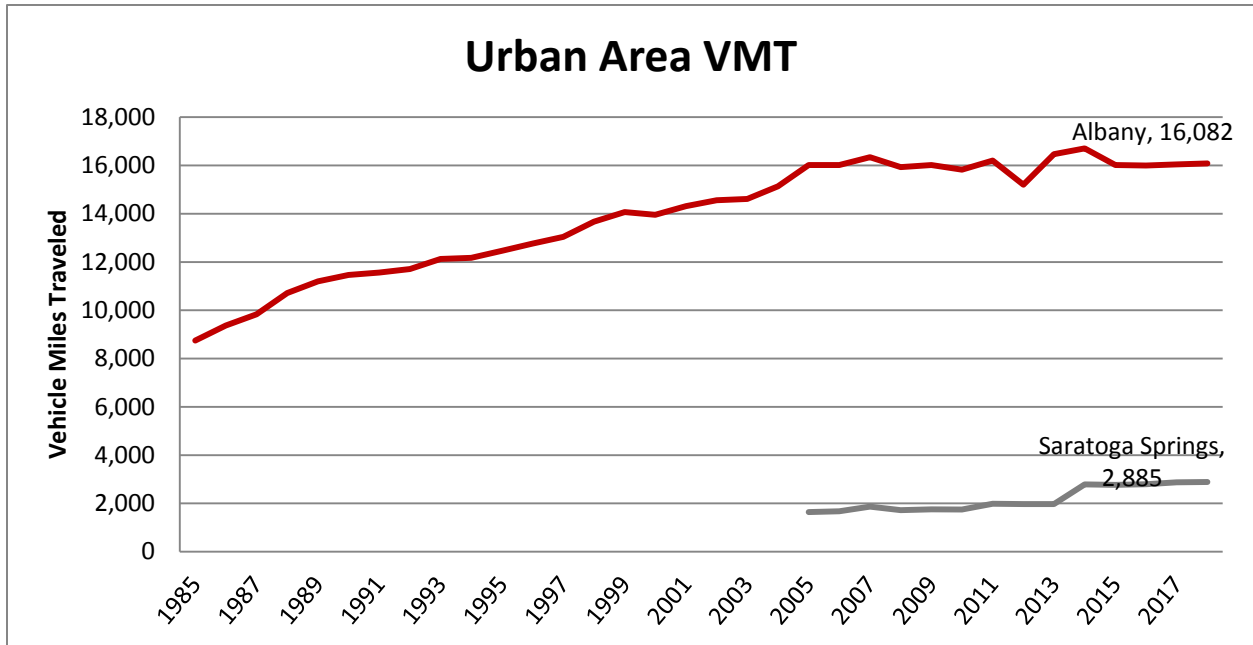
CDTC provides technical assistance and funding to municipalities to develop plans that are consistent with Smart Growth principles, or more compact design. Support for walking and bicycling infrastructure and mixed-use and transit-oriented development is common in communities throughout the Capital District and growing in demand as the need to reduce GHGs and transportation costs become more urgent, globally. The 2010 GHG Inventory estimated that the Capital District pays \$1.75 billion more per year for petroleum-based gasoline, diesel, and fuel oil than it did 10 years ago, which is a rise of \$1,600 per person.

In addition to land use planning, other strategies to reduce the use of petroleum fuels in the region have included education and outreach related to alternative fuels and advanced vehicle technologies, and prioritizing infrastructure projects that are estimated to reduce energy use. The Capital District Clean Communities Coalition (CDCC), a United States Department of Energy (USDOE) Clean Cities program, is hosted by CDTC and coordinates training, events, and other educational opportunities for fleets and the

¹ CDRPC Capital District Regional GHG Inventory

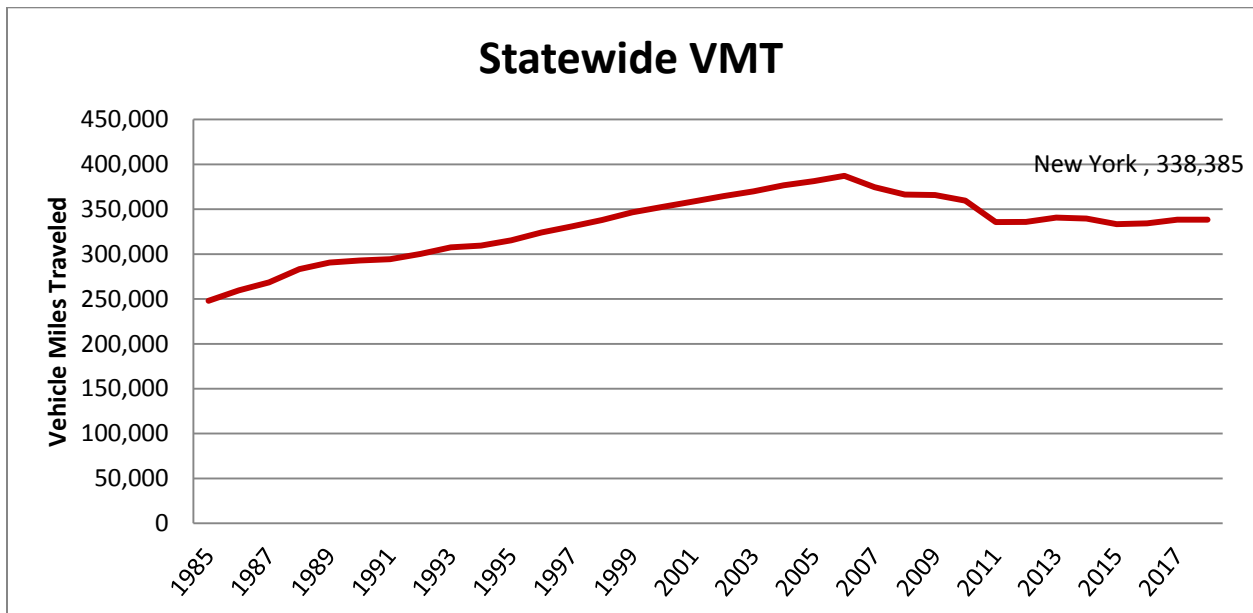
public throughout the year on available alternative fuels, advanced vehicle technologies (ex. electric vehicles), and fueling infrastructure.

Figure 2. Urban Area VMT*



*VMT from all roads in the Albany-Schenectady-Troy and Saratoga Springs urban areas.

Figure 3. Statewide VMT



While a comprehensive inventory of GHG emissions in the Capital District has not been conducted since 2010, the slight increase in vehicle miles traveled (VMT) would suggest that emissions have increased, but slightly. VMT in New York peaked in 2006 then declined by 11% as the effects of the 2010s Great

Recession influenced travel behavior. Since then, VMT statewide has mostly flattened and has never recovered to pre-recession levels.

While VMT was declining nationwide, new Corporate Average Fuel Economy (CAFE) standards were announced in 2012 which required automakers to achieve an average of 54.5 miles per gallon (mpg) for all vehicles by 2025. The Safer Affordable Fuel Efficient (SAFE) Vehicles rule was proposed in 2017 that established new standards, freezing fuel economy requirements at the 2020 level through model year 2026. Because of this change, the projected overall industry average required fuel economy in model years 2021-2026 is 37.0 mpg compared to 46.7 mpg under the 2012 rule. Since 2017, there have been indications that the rule may be softened due to automaker pushback, but the SAFE rule is still a significant weakening of the previous 2012 rule.

In addition to the environmental impacts of GHG emissions, worsening air quality impacts human health. These health impacts from emissions burden low-income and minority populations disproportionately. CDTC supports the reduction of GHG emissions and investment in GHG reduction strategies and projects that lower the exposure and health risk in all communities, especially low-income and minority communities.

Fuel Economy Standards

U.S. fuel economy standards are overseen by two agencies. CAFE standards are set by the Department of Transportation's National Traffic Safety Administration (NHTSA). The Environmental Protection Agency (EPA) creates GHG emission standards for cars and trucks, set in grams of emitted carbon dioxide, or the CO₂ equivalent of another GHG, per mile traveled. EPA suggests real-world GHG emissions are about 25% higher than the CO₂ standard, and on-the-road fuel economy is about 20% lower than the listed CAFE standard.

The standards do not require every vehicle to achieve 54.5 mpg. Each vehicle has a specified fuel economy target based on its size and class. Manufacturers can sell underperforming cars and make up the difference by selling other cars that outperform their targets. So long that all cars across a given fleet have an average that meets CAFE standards (McDonald, 2019).

California, the largest market for light-duty vehicles, has long set its own standards. California has received waivers under the Clean Air Act since 1968 to set stricter air quality rules than the federal government. Because California is 20% of the light-duty vehicle market, automakers either had to build cars to different standards for different states, or effectively let California govern pollution rules for the rest of the country. The federal government is currently challenging California's ability to set its own emission rules.

2. Performance Measure: Energy use in Transportation

Related Tasks:

- Capital District Clean Communities
- Energy, Climate Change Initiative, & Air Quality
- GHG Reduction Analysis Tool Grant
- Smart Communities Task Force
- Regional Travel Demand Management Effort
 - iPool2
 - Capital CarShare
 - CDPHP Cycle!

TREND: INCREASING (SLIGHTLY)

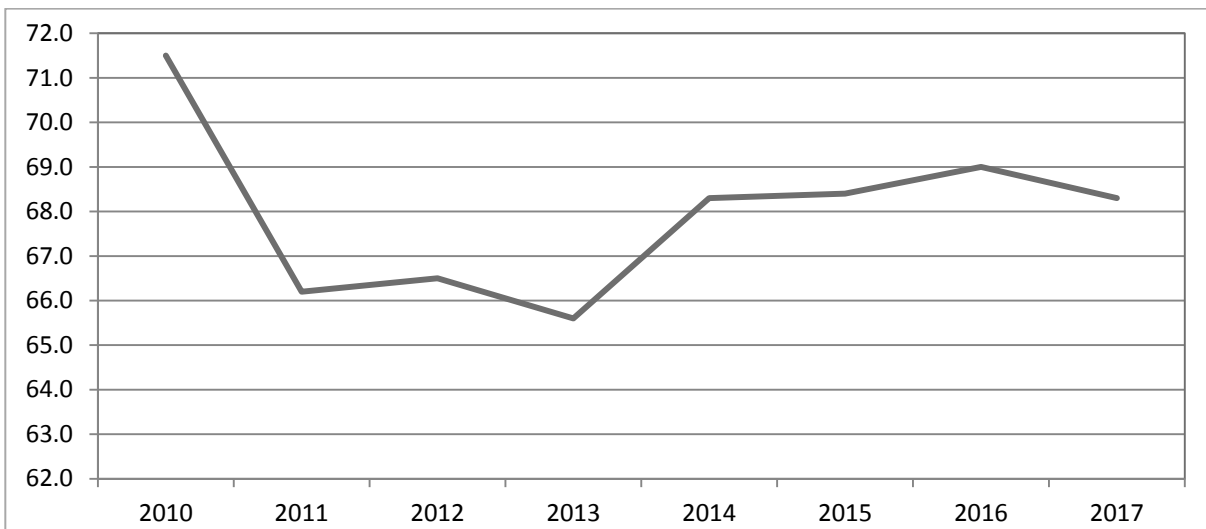
Millions of gallons of petroleum are consumed every day in the United States. Gasoline is the most dominant transportation fuel in the United States, followed by diesel and jet fuel. Burning of petroleum fuels like gasoline and diesel have contributed to the climate crisis. Dependence on petroleum reduces national security and increases the amount of money households most pay for transportation. While the shift to alternative fuels and advanced vehicle technologies like hybrid and plug-in electric vehicles; have helped displace petroleum in the transportation system, it is still the main source of energy for transportation.

Community land use patterns, proximity to work, and accessibility of transit all contribute to the amount of petroleum households consume. The 2010 Capital District Regional GHG Inventory estimated that Capital District households consume at the national average rate of 132 MMBTU/household. This is measured directly through fueling of personal vehicles or indirectly through use of transit.

Figure 4 shows per capita petroleum consumption in New York State. According to the U.S. Energy Information Administration (USEIA), petroleum products accounted for about 92% of the total U.S.

transportation sector energy use in 2018. Biofuels contributed about 5%, natural gas accounted for about 3%, and electricity provides less than 1% of total transportation sector energy use and nearly all of that in mass transit systems.

Figure 4. New York Petroleum Consumption Per Capita (2010-2019)

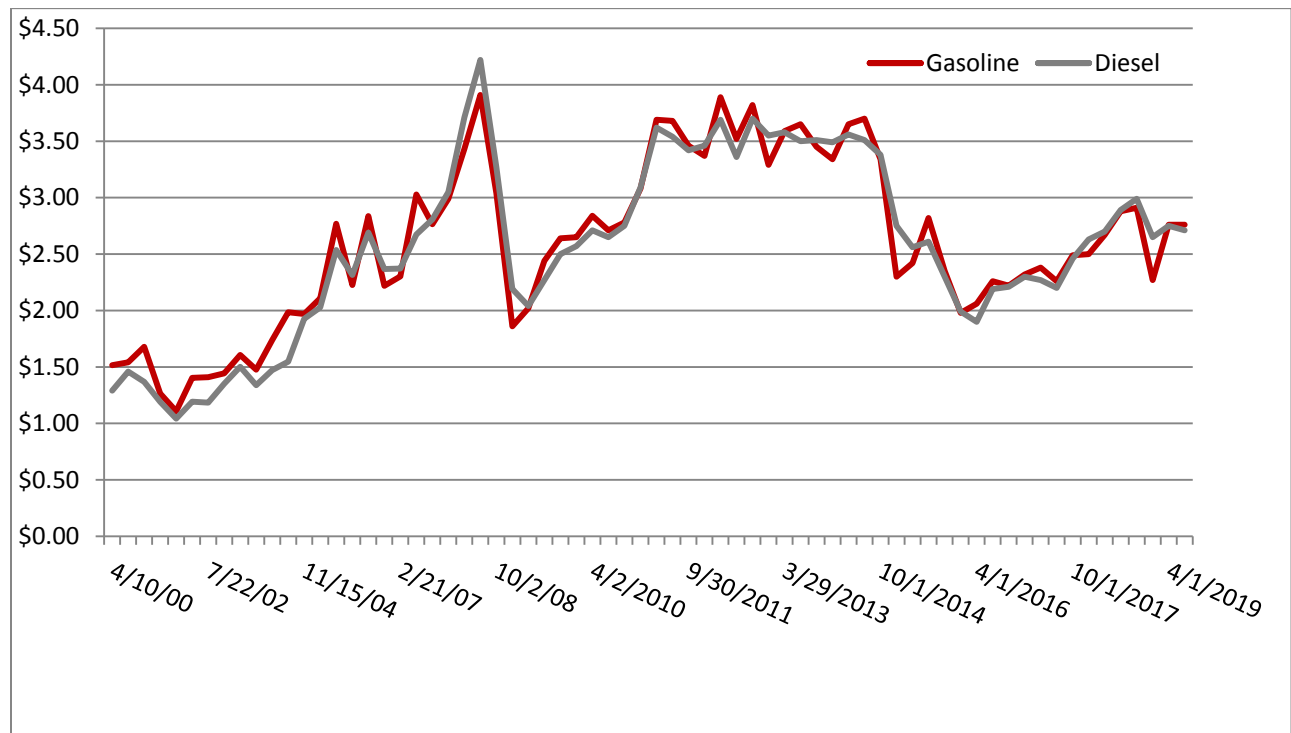


Source: U.S. Energy Information Administration State Energy Data System (SEDS), 2019

Reducing petroleum is consistent with other CDTC goals of reducing GHG emissions and energy use from the transportation sector. CDTC's involved in the US Clean Cities program has helped bring national resources to the Capital District to encourage fleets and residents to adopt alternative fuels as well as hybrid and plug-in vehicle technologies. Over the last 25 years, Clean Cities has grown to a network of nearly 100 coalitions and displaced a cumulative 8 billion gasoline gallon equivalents through more than 1.1 million alternative fuel vehicles on the road and nearly 13,000 stakeholders across the country.²

The cost of on-road gasoline and diesel is very volatile. Their prices are mainly affected by crude oil prices and the level of gasoline supply relative to gasoline demand. However, prices can change rapidly if something disrupts oil supplies, refineries, or pipelines, like natural disasters, weather, terrorism and other hazards. Figure 5 displays the changing cost of on-road gasoline and diesel since 2010 nationwide. The volatility and increased cost of petroleum fuel compared to natural gas and electricity mean households are paying significantly more on an annual basis and as a percent of income, to power their homes and vehicles than they did in the early 2000s. The Capital District is a mix of urban, suburban, and rural communities, but rural and less compact suburban towns are experiencing higher vehicle fuel bills because they rely on gasoline to travel long distances for goods, services, and employment. This has a depressive effect on local economies.

Figure 5. Average Gasoline & Diesel Prices in the U.S. (2000-2019)



Source: U.S. Department of Energy

² <https://cleancities.energy.gov/accomplishments/>

3. Performance Measure: Percent of programmed projects with a positive impact on GHG emissions

Related Tasks:

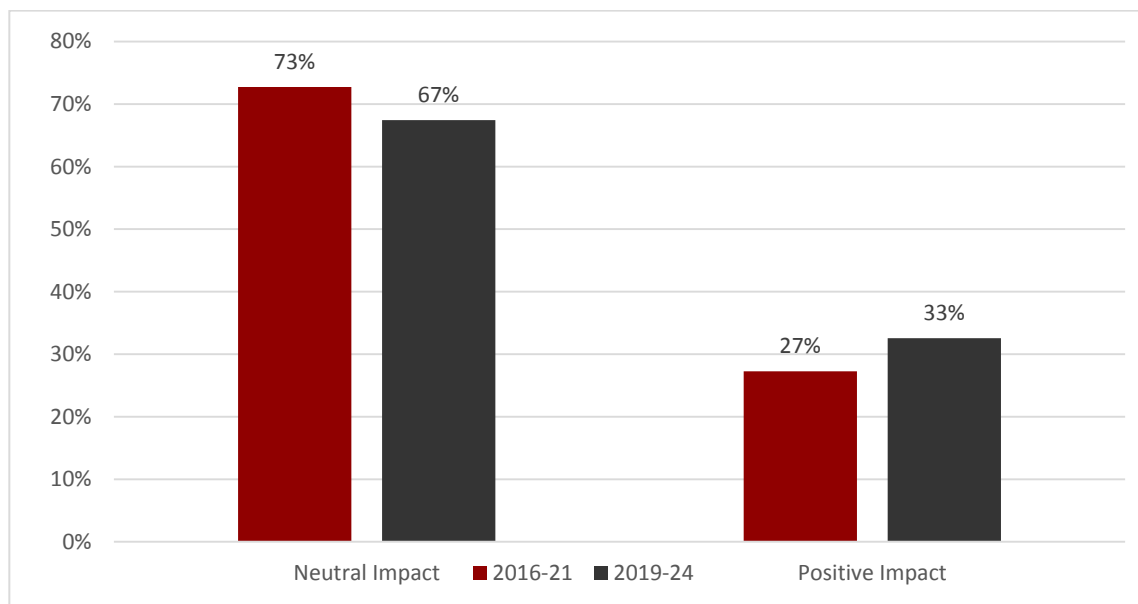
- Capital District Clean Communities
- Energy, Climate Change Initiative, & Air Quality
- GHG Reduction Analysis Tool Grant
- Smart Communities Task Force
- Regional Travel Demand Management Effort
 - iPool2
 - Capital CarShare
 - CDPHP Cycle!

TREND: INCREASING

The Transportation Improvement Program (TIP) is the 5-year list of capital projects that implements the vision and goals described in *New Visions*. Projects receive points and are prioritized based on several evaluation criteria, including estimated GHG reductions. CDTC adopted a new TIP project evaluation methodology with the adoption of *New Visions 2040*. This methodology was utilized first in the 2016-21 TIP and most recently for the 2019-24 TIP, with minor modifications.

Figure 6 shows the percent of TIP projects with a neutral or positive impact on GHG emissions. While the percent of projects estimated to have a neutral impact decreased, the percent estimated to have a positive impact, increased. This means the projects supported alternative modes or reduced congestion.

Figure 6. Percent of programmed projects with a positive impact on GHG emissions



4-5. Performance Measure: VOC & NOx Emissions from transportation

Related Tasks:

- Capital District Clean Communities
- Energy, Climate Change Initiative, & Air Quality
- GHG Reduction Analysis Tool Grant
- Smart Communities Task Force
- Regional Travel Demand Management Effort
 - iPool2
 - Capital CarShare
 - CDPHP Cycle!

TREND: NO CHANGE

Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. They include a variety of chemicals, some of which may have short- and long-term adverse health effects. VOCs can be found in household products and building materials but are also emitted from transportation. Nitrogen Oxides (NOx) are a family of poisonous, high reactive gases that form when fuel is burned at high temperatures.

Particulate matter (PM) refers to the mixture of solid particles and liquid droplets found in the air. There are two types – PM₁₀ and PM_{2.5}. Both are inhalable but PM₁₀ are generally 10 micrometers and smaller while PM_{2.5} are 2.5 micrometers or smaller. VOCs, NOx, and PM contribute to smog and poor air quality, which have negative impacts on health. According to the Environmental Protection Agency (EPA), less than 10% of VOCs, over 55% NOx, and less than 10% of PM_{2.5} and PM₁₀ emissions in the U.S. are from the transportation sector. NOx has been tied specifically to asthma and heart disease and PM can get into lungs and bloodstream, posing a great risk to public health.³

There are various national programs and standards for fuels and vehicles to reduce air pollution including smog, soot, and toxic pollutants to protect public health. These programs also encourage investments in clean vehicle and engine technology. EPA programs aimed at reducing emissions from transportation have resulted in less soot and smog and better air quality. It is projected that by 2030, EPA air quality emissions standards for vehicles will annually prevent:

- 40,000 premature deaths
- 34,000 avoided hospitalizations
- million workdays lost

EPA sets stringent standards for passenger vehicles and has a variety of standards to reduce emissions from heavy duty diesel vehicles and engines. Some programs available to heavy-duty vehicle fleets are:

- National Clean Diesel Program
- SmartWay
- Ports Initiatives

According to the U.S. EPA Air Quality Index Report for Albany-Schenectady-Troy there were no “unhealthy” or “very unhealthy” air quality days between 2015-2019. There were also no days of

³ www.epa.gov

notable nitrogen dioxide, sulfur, or PM₁₀ measured.⁴ However, according to the American Lung Association's 2018 State of the Air Report, statewide and regional air quality have both worsened. Based on a press release from April 2018 the Albany-Schenectady metro area fell to 94th most polluted ozone from 136. Albany County fell from a grade of A to a B and Saratoga County from a B to a C. The City of Albany was one of four New York cities to rank as one of the cleanest cities for short-term particle pollution, but the effects of a changing climate have created greater urgency for the region and state to protect residents from emissions and unhealthy air because warmer temperatures contribute to worsening air quality.⁵

The CDTC area is considered to be in "attainment" for air quality since 2012 for the 2008 ozone standard. Because the area still does not meet the 1997 8-hour ozone standard is also considered a "maintenance" area and must comply with the Transportation Conformity rule requirements for the 1997 ozone National Ambient Air Quality Standards (NAAQS). CDTC recently completed the conformity determination process for the 2019-24 TIP and a new conformity determination will be completed for *New Visions 2050*.

⁴ <https://www.epa.gov/outdoor-air-quality-data/air-quality-index-report>

⁵ <https://www.lung.org/local-content/content-items/about-us/media/press-releases/new-york-sota.html>

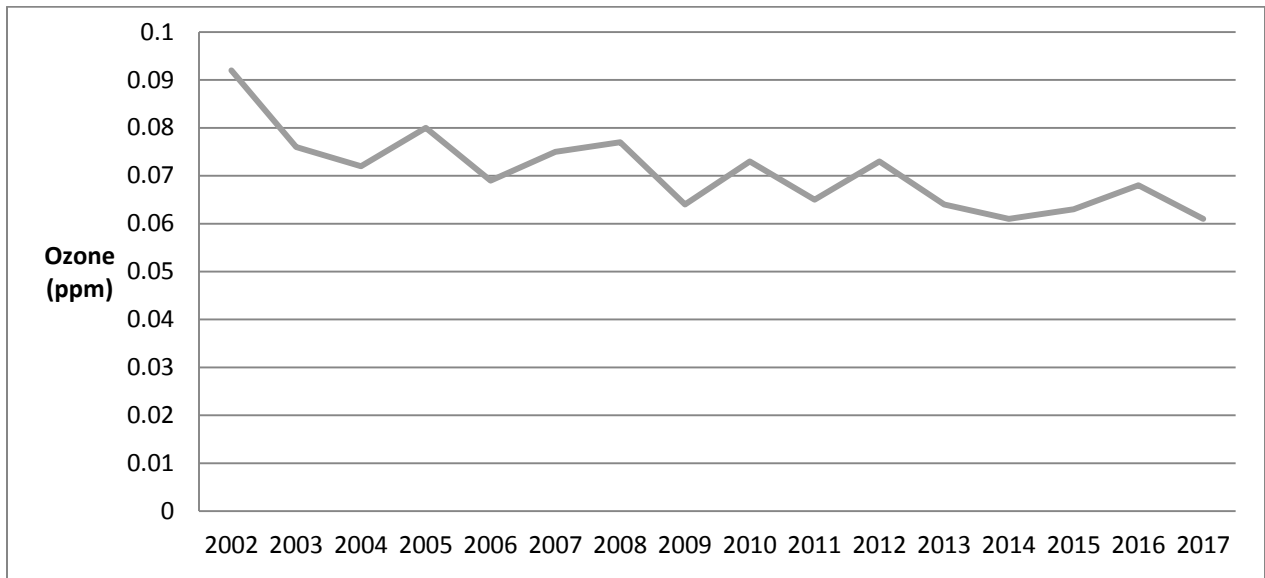
Accomplishments: NV2040 Strategies & Programs

Energy, Climate Change Initiative, & Air Quality

The CDTC area was part of a non-attainment area for air quality for many years. In 2012, the Capital region's non-attainment status changed to attainment for the 2008 ozone standard. This is good news for the Capital District, because it is based on data that has shown that air quality has been steadily improving, and the region now has air quality conditions that are acceptable even under the newer, stricter standards for ozone. However, national court rulings have indicated that because the Capital District area is still non-attainment for the 1997 8-hour ozone standard, beginning February 16, 2019, a transportation conformity determination for the 1997 ozone NAAQS is now required in 1997 ozone NAAQS nonattainment and maintenance areas, including the Albany-Schenectady-Troy, NY area.

While the Albany-Schenectady-Troy, NY area consisting of Saratoga, Schenectady, Albany, Rensselaer, Montgomery, Greene, and Schoharie Counties is still officially a non-attainment area for the 1997 8-hour ozone standard (0.08 parts per million), ozone concentrations in the region have improved. Because of Clean Air Act requirements, including vehicle emission standards, air quality in the Capital District continues to be good. The results of ambient air monitoring data collected by the New York State Department of Environmental Conservation for our region are shown below.

Figure 7. 4th Highest Daily Maximum 8-Hour Average



The conformity determination process was completed for the 2019-2024 A/GFTC and CDTC TIPs, the A/GFTC 2040 Ahead MTP, the CDTC New Visions 2040 MTP, and the Capital Program of Transportation Projects in Greene, Montgomery and Schoharie Counties. It demonstrates that these planning documents meet the Clean Air Act and Transportation Conformity rule requirements for the 1997 ozone NAAQS. A new conformity determination will be completed for the New Visions 2050 Plan.

Project Evaluation Methodology

CDTC updated its TIP project evaluation methodology ahead of the 2016-21 TIP. The new project scoring criteria provides a direct link between New Visions principles, recommendations, and funding priorities and the TIP project selection. It was designed to allow for adjustments as policies and principles change while providing an explicit, transparent, and easily understood evaluation system that better reflects the whole project value. By whole project value, CDTC is referring to both quantifiable benefits and non-quantifiable, or qualitative, benefits of each project.

The methodology maintains the cost / benefit ratio employed in TIP updates previous to 2016-21. CDTC's cost/benefit ratio uses potential market for bicycle/pedestrian travel, cost-effectiveness, and potential safety benefits (e.g. accident reduction or avoidance). The cost/benefit ratio captures the benefits of projects well, but additional scoring criteria are necessary to ensure programmed projects are consistent with the principles and goals of New Visions.

To encourage municipalities to employ innovative design and engineering techniques in their project planning and designing process, there are up to 8 additional points that can be earned within the "Environment & Health" section of the methodology. This section of the evaluation awards points to projects that incorporate sustainable features (i.e. green infrastructure), protect natural resources and habitats, reduce greenhouse gas emissions, support alternative fuels, or have other environmental and public health benefits (i.e. using recycled materials). The evaluation criteria details can be found in Figure 10.

Figure 8. TIP Project Evaluation Sheet

PROJECT NAME:		
MERIT CATEGORIES		
COMMUNITY QUALITY OF LIFE & EQUITY (10 POINTS POSSIBLE)		
Land Use Compatibility	SCORE	-1 to +3
Smart Growth	SCORE	-1 to +3
Environmental Justice	SCORE	-1 to +2
Accessibility / ADA / Universal Design/Human Services Transport	SCORE	-1 to +2
APPROPRIATE INFRASTRUCTURE (10 POINTS POSSIBLE)		
Preservation/Renewal of Existing	SCORE	-2 to +5
Complete Streets	SCORE	-2 to +5
MULTI-MODALISM (10 POINTS POSSIBLE)		
Transit	SCORE	-2 to +5
Pedestrian	SCORE	-1 to +3
Bicycle	SCORE	-1 to +2
ENVIRONMENT & HEALTH (8 POINTS POSSIBLE)		
Sensitive Area Preservation/Mitigation	SCORE	-1 to +2
Greenhouse Gas Emissions Reduction	SCORE	-1 to +2
Alternative Fuel Support	SCORE	-1 to +2
Other Health Benefits	SCORE	-1 to +2
REGIONAL BENEFIT (5 POINTS POSSIBLE)		
Benefit beyond project to transportation system or quality region	SCORE	-2 to +5
ECONOMIC DEVELOPMENT (5 POINTS POSSIBLE)		
Economic Impact	SCORE	-2 to +5
SAFETY & SECURITY (5 POINTS POSSIBLE)		
Additional Safety Benefit Beyond Crash History	SCORE	-1 to +3
Security and Resiliency to Natural Hazards and Human Caused Events	SCORE	-1 to +2
OPERATIONS & TECHNOLOGY (5 POINTS POSSIBLE)		
Traffic Operations & Reliability Improvements	SCORE	-1 to +3
Use of Beneficial Advanced Technologies	SCORE	-1 to +2
FREIGHT (5 POINTS POSSIBLE)		
Freight and Goods Movement	SCORE	-2 to +5
PERFORMANCE (3 POINTS POSSIBLE)		
Anticipated Effect on all Performance Targets	SCORE	-1 to +3
INNOVATION (2 POINTS POSSIBLE)		
Innovative Solutions	SCORE	0 to +2
PROJECT DELIVERY (2 POINTS POSSIBLE)		
On Schedule/On Budget	SCORE	-2 to +2
PROJECT MERIT CATEGORY SUB TOTAL		
Total from Line Items Above	SUBTOTAL	-29 to +70
Scaled to 50 points		0.0
B/C RATIO		
B/C Ratio Value (Imported from separate analysis)	SUBTOTAL	0 to +50
PROJECT TOTAL (UP TO 100 POINTS)		
Merit Categories + B/C Value	TOTAL	-21 to 120
		0.0
ENVIRONMENT & HEALTH (8 POINTS POSSIBLE)		
Sensitive Area Protection/Mitigation (2 points)		
Project includes a significant sustainable feature (SSF) is not within 1/4 mile of an environmentally sensitive feature. (See lists below.)		
Significant sustainable features include:		
• retention/detention ponds		
• new or improved wetlands		
• green infrastructure (bioswales, porous pavement, etc.)		
• native plant species planting		
• invasive plant species removal		
• historic building restoration		
• stream restoration		
• wildlife crossing structures		
• other environmental mitigation strategies or significant sustainable features		
Environmentally sensitive features include:		
• state parks and lands		
• federal parks and lands		
• state parks and forests		
• state wildlife management areas		
• county forests and preserves		
• municipal parks and lands		
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Capital District Clean Communities

CDTC is the only MPO in New York State that hosts a U.S. Department of Energy (USDOE) Clean Cities program. The program is a voluntary, locally based government/industry partnership. Capital District Clean Communities (CDCC) was designated in 1999 primarily to take advantage of the environmental, public health, energy, and economic benefits that the Clean Cities program offers. CDCC's goal is to advance the energy, economic, and environmental security of the U.S. by supporting local actions to reduce petroleum use in transportation. Clean Cities is "fuel neutral" which means it equally supports biodiesel, electricity, ethanol, hydrogen, natural gas, and propane in addition to idle reduction technologies and strategies.

Since 2011, CDCC has displaced nearly 21 million gallons of petroleum and reduced more than 194,000 tons of GHG emissions. These goals align with CDTC's goals of reducing emissions and energy use from transportation. Alternative fuels and advanced vehicle technologies can benefit the region by creating by improving air quality and creating new economic opportunities from fuel cost savings and new commercial enterprises.

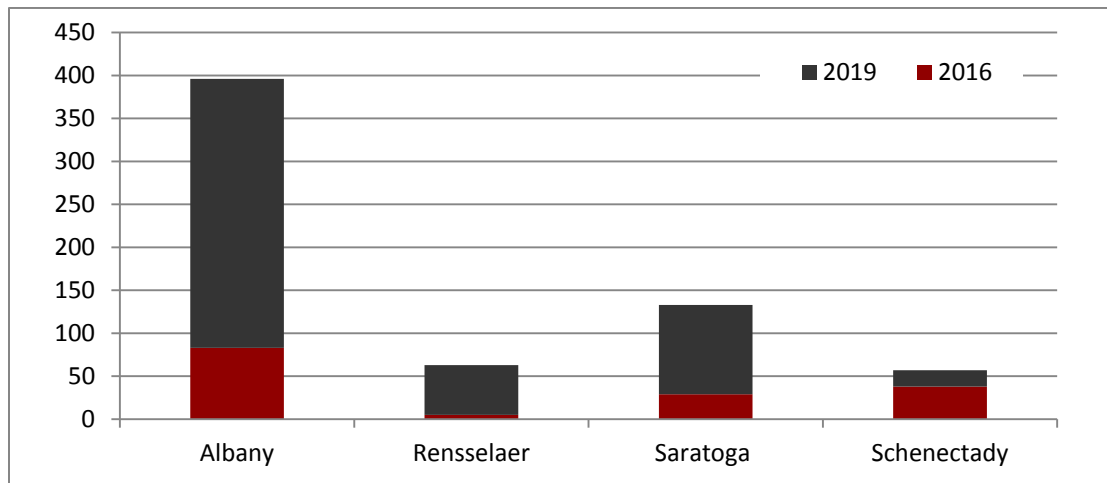
CDCC holds quarterly meetings in addition to planning, coordinating, and hosting several events, trainings, and workshops every year. Part of the Clean Cities contract requires the ongoing collection and reporting of fuel prices, alternative fuel infrastructure costs, new alternative fuel and electric vehicle (EV) charging station locations, and local fleet information. The next section highlights some of the CDCC's education and outreach initiatives since 2015.

EV-Readiness Planning

CDCC was part of the Northeast EV Charging Network project that began in 2012. This initiative marked the beginning of the Coalition's extensive EV Planning work. The CDCC released the first Capital District EV Charging Plan in 2016. The plan was part of the *I-90 Charging Plan* that was funded through NYSERDA's Cleaner Green Communities program. The Plan identified strategic locations to expand Level 2 and DC fast charging to the public. CDTC staff then worked with several local governments to install new Level 2 stations at sites identified in the plan.

New York State has two ongoing EV initiatives - *Charge NY* through NYSERDA and *Evolve NY* through the NYS Power Authority. NY has a goal of increasing the number of EVs on the road to approximately 850,000 by 2025 and 2 million by 2030. To promote EVs, NY has provided incentives and rebates for vehicles and infrastructure, as well as education and certification programs for local governments. These statewide efforts were complemented by CDCC's ongoing EV planning activities, including a Workplace Charging initiative, several ride and drive events, and an annual National Drive Electric Week social media campaign. In 2019 CDCC partnered with NYSDOT to plan a Fleet Electrification Workshop targeted at local government and public organization fleets. It also hosted two EV listening sessions for EV drivers and EV fleet managers. And lastly, it completed a Zero Emission Vehicle (ZEV) Plan, which was an update to the 2016 regional plan and can be found in Appendix A.

Figure 9. The Capital District's Expanding EV Charging Network (No. of plugs)



Alternative Fuel Corridors

Section 1413 of the FAST Act requires FHWA to designate national EV charging, hydrogen, propane, and natural gas fueling corridors. The FHWA has been working with other federal agencies, as well as state and local officials and private industry to plan and promote an Interstate network of stations that will fuel vehicles powered by alternative fuels so that commercial and passenger vehicles can reliably travel between cities and regions, and across the entire nation. The first Alternative Fuel Corridors Convening was held in November 2016 at RPI and CDTC and CDCC were involved in helping to plan the event. The first rounds of designations were announced at the November meeting.

Since 2016, three rounds of Alternative Fuel Corridor designations have been made, including much of the I-87 and I-90 corridors that go through the CDTC area. Below, Table 2, lists the different designations along I-87 and I-90. A corridor that's "ready" means there are a sufficient number of facilities on the corridor to allow for corridor travel using one or more alternative fuel and "pending" means there are an insufficient number of facilities currently on the corridor to allow for corridor travel using one or more alternative fuels, but there is a vision or plan to expand infrastructure there. Maps of the Corridors and EV stations can be found in Appendix B.

Table 3. Designated Alternative Fuel Corridors that traverse the CDTC area

Corridor	Designation	From	To
I-87	EV-Ready	New York City	Lake George
	EV-Pending	Lake George	Canadian Border
	CNG-Ready	New York City	Saratoga Springs
	CNG-Pending	Saratoga Springs	Canadian Border
	LPG-Pending	New York City	Canadian Border
I-90	EV-Ready	Massachusetts Border	Albany
	EV-Pending	Albany	Utica
	CNG-Ready	Massachusetts Border	Buffalo
	LPG-Pending	Massachusetts Border	Rochester

In order to support a vision of a National Interstate network of stations that will fuel vehicles powered by alternative fuels, meet the FAST Act requirements, and identify standardization needs, FHWA has highlighted priorities. These include developing branded signage to catalyze public interest, encouraging regional cooperation and collaboration among states for planning and developing corridors, fostering public-private partnerships and infrastructure investments, and continued collaboration between federal agencies (i.e. FHWA and USDOE) to promote alternative fuels. As part of the ZEV Plan, CDCC will identify potential new corridors for designation as “EV-Ready.” As technology advances, these corridors must adapt and facilitate travel of plug-in and other future ZEVs not just within the region but between regions.

Alternative Fuels Outreach & Education

CDCC has planned and hosted several alternative fuels workshops and trainings. In 2016, staff coordinated with Saratoga Eagle, a beverage distributor located in the Grande Industrial Park in Saratoga Springs, to plan a Compressed Natural Gas (CNG) 101 Workshop. The workshop featured professionals from the natural gas industry and covered everything from fuel cost to required building modifications. Public and private fleet managers attended to learn how their, mainly heavy-duty, fleet could begin to shift to CNG. The event complemented the opening and ribbon cutting at the American Natural Gas CNG station in the Grande Industrial Park.

Centering alternative fuels into resiliency and emergency management plans is increasingly becoming best practice. In 2018, CDCC worked with the National Association of State Energy



Photo Credit: NYSDOT

National signage & branding has been installed along recently designated corridors to help catalyze public interest, like this sign on I-495 on Long Island.



American Natural Gas ribbon cutting for their CNG Station at the Grande Industrial Park in Saratoga Springs (2016)

Officials (NASEO) to develop a resiliency planning workshop agenda for fleets. The workshop, which was attended mainly by emergency management agencies from local and state agencies, presented case studies of recovery efforts that credit their success to alternative fuels and provided a demonstration of NASEO's iREV (Initiative for Resiliency in Energy through Vehicles) tool. This tool is a mapping application meant to help emergency managers and decision-makers visualize where alternative fuel vehicles and infrastructure are located within their communities. CDCC continues to work with emergency management agencies to integrate these resources into their emergency plans.

NYSDOT EV Activities

NYSDOT Light-Duty Fleet

To meet Governor Cuomo's goal for a light duty fleet that is 25% electric by 2025, NYSDOT has acquired 98 Toyota Prius Plug-in Hybrid Vehicles (PHEV) for its light duty fleet. To support these vehicles, NYSDOT has installed five electric vehicle chargers (supporting up to 10 vehicles) at its Albany office. NYSDOT has also deployed these vehicle in other locations throughout the State. It continues to expand its PHEV purchases and charging footprint to the extent possible.

EV Chargers at NYSDOT Rest Areas

To support expanded use of electric vehicles, NYSDOT has installed DC fast chargers at three recently constructed gateway rest areas: the Long Island Welcome Center in Dix Hills; the Southern Tier Welcome Center in Binghamton; and the Adirondacks Welcome Center in Glens Falls. These chargers are currently free to the public as federal law (49 USC 111) prohibits NYSDOT from charging motorists for alternative refueling technologies at rest areas constructed with federal funds.

New York Truck Voucher Incentive Program

Since 2012, NYSDOT has provided Congestion Mitigation and Air Quality Improvement Program (CMAQ) funding to support incentives for public and private fleets to purchase medium and heavy duty all electric trucks and buses. The New York Truck Voucher Incentive Program,⁶ administered by NYSEDA has recently been renewed and includes \$11 million in CMAQ funding. The renewed and expanded program will be implemented along with voucher incentives for alternative fueled buses and trucks funded with VW Settlement funds managed by DEC.

Collaboration with NYPA on Demand Charges

One of the major obstacles to adoption of electric vehicle fast charging is the cost of demand charges, a fee charged by a utility based on the maximum amount of power that a customer uses in any interval (typically 15 minutes) during the billing cycle. Utilities impose demand charges to cover electric utilities' fixed costs of ensuring sufficient energy availability to their customers. Demand charges can be very expensive if the draw of the fast charger(s) is significantly higher than the typical peak draw at a location. To overcome this obstacle, NYSDOT, DEC and the Thruway Authority supported NYPA in its petition to the Public Service Commission to reduce the impact of demand charges. The new incentive provides an annual declining per-plug incentive for certain utilities payable to qualifying public DCFC

⁶ <https://www.nyserda.ny.gov/All-Programs/Programs/Truck-Voucher-Program/About-NYTVIP>

operators for up to seven years (2019-2025). If fully subscribed, the program would cover 1,074 DCFC plugs across NY State

Collaboration

NYSDOT participates in a number of interagency and interstate collaborations that are seeking to address greenhouse gas emissions and support further adoption of zero emission vehicles. These include: The Zero Emission Vehicle (ZEV) MOU, where New York and eight other states are working towards a goal of at least 3.3 million ZEVs operating on their roadways by 2025; the Transportation and Climate Initiative, which is exploring a Cap & Invest program for transportation; and the US Climate Alliance, a group of 25 states and territories which is committed to reducing greenhouse gas emissions consistent with the goals of the Paris Agreement to lower greenhouse gas emissions by at least 26 percent below 2005 levels by 2025. NYSDOT also coordinates with NYPA on the [EVolue NY program](#) which will develop a fast charging network at sites on key corridors, at JFK Airport and in urban centers such as Albany, Syracuse and Rochester among others.

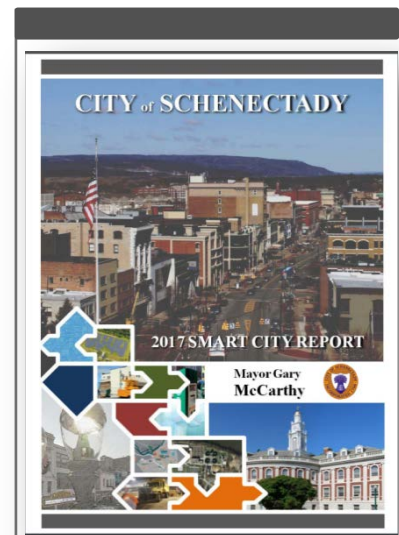
Smart Communities Program Launch

In March 2016, CDTC worked with our 4 major cities (Albany, Saratoga Springs, Schenectady, and Troy), the NYS Department of Transportation, and the CDTA to develop the Capital District application for the U.S. Department of Transportation (USDOT) Smart City Challenge. The application focused on Connected and Automated Vehicles, Smart Street Lights, Comprehensive Emergency Routing/GPS/Navigating systems, and State-of-the-Art Interactive Transportation Data Systems.

For that application the key proposed Smart Communities Challenge project elements included:

- Use of Intelligent, Sensor-Based Infrastructure and Intelligent Transportation Systems (ITS)
- User-Focused Mobility Services based on Complete Streets and Transit Oriented design
- Connected Vehicles and Electric Fleet Vehicles, and
- Connected, Involved Citizens utilizing the improved transportation systems

Though our region was not selected as 1 of the 7 finalists, the application process did develop many exciting Smart City strategies for our communities, and influenced CDTC to launch a “Smart Communities” Task Force in 2018. The objective of the Task Force is to develop guidance for municipalities on the adoption and use of



These Smart City plans are examples of how Capital District communities are taking advantage of emerging technologies and integrating them into their operations to provide better services to residents.

new technologies to improve operations and reduce energy use in transportation. The Task Force met several times and has discussed the MPO role in autonomous vehicle (AV) readiness, brainstormed what purposes AVs could serve in the region that is currently a transportation or social gap/barrier (e.g. delivering food and medical services to homebound populations), and developed goals for developing an AV-Ready region. The Smart Communities summary document can be found in Appendix C.

In addition to assembling the Task Force, CDTC made funds available to assist municipalities in implementing or developing Smart City plans. A competitive solicitation received several project proposals and an evaluation committee chose a consultant-led effort to develop a SMART LED Guidebook for Saratoga Springs. This guidebook is meant to explain the different streetlight ownership models and their benefits, and recommend appropriate LED streetlight technology that helps Saratoga Springs achieve its goals outlined in their Smart City Roadmap 1.0.

Two cities in the region have spearheaded their own Smart City plans – Schenectady and Saratoga Springs. Through these initiatives, Schenectady has implemented routing analytic technology to manage fleet vehicles, partnered with National Grid to pilot smart LED streetlights, and is developing an open data portal. Saratoga Springs has implemented several multi-modal transportation projects, installed electric vehicle charging, and constructed a 2.5 megawatt solar park. These are just a few of these cities initiatives and CDTC continues to work with both as they implement their vision for a more connected and sustainable community.

Travel Demand Management

Travel demand management (TDM) refers to strategies and policies that reduce travel demand, or redistribute the demand in space or in time. Successful TDM approaches reduce congestion, GHG emissions, and transportation costs. CDTC works with regional and state partners to coordinate and manage several TDM programs, such as the iPool2 rideshare matching program, vanpool, and guaranteed ride home. Since *New Visions 2040*, new shared mobility services have also been deployed, including car sharing and bike sharing. As technology and increasing connectivity create markets for new mobility services, support for shared mobility and transit, as strategies to discourage single-occupancy vehicle travel are more important. In response to the increasing need and demand for TDM programs, CDTC has launched a Mobility Management Task Force and will cover ongoing TDM efforts and recommendations for creating a network of robust mobility choices in the Travel Demand Management/Mobility Management chapter.

Smart Growth and Land Use Planning

New Visions 2040 strongly states support for sustainable development patterns and site design, urban reinvestment, and community-based land use planning. CDTC has prioritized transformative transportation projects in urban centers for investment as a strategy for encouraging reinvestment and regional equity. CDTC also provides ongoing technical assistance to municipalities on land use planning matters and delivers funding to municipalities, through competitive solicitations which is called the Community and Transportation Linkages Program. This program makes funding available on an annual basis to cities, towns, and villages to support implementation of innovative transportation and land use concepts.

To date, the Linkage program has funded 89 collaborative, jointly-funded studies over the past 19 years. Study sponsors have included 40 separate urban, suburban and rural municipalities and counties as well as not-for-profits and other public entities. Roughly \$6.5 million in federal, state and local funds have been committed to the Linkage Program since its inception in 2000. This program has been recognized as a national best practice in livability planning and is the cornerstone of CDTC's public outreach efforts. Examples of types of plans that have been funded include strategic zoning code changes, development of complete streets design guidelines, and strategic master plans.

As part of the Linkage Program, CDTC reviews and identifies environmental systems and features. CDTC policies encourage the protection of natural resources and preservation of open space and agricultural lands. Features included as part of this review are (see the five regional level maps of natural and cultural resources in Appendix B):

- Sole source aquifers
- Aquifers
- Reservoirs
- Water features (streams, lakes, rivers)
- Wetlands
- Watersheds
- 100 year flood plains
- Rare animal populations
- Rare plant populations
- Significant ecological sites
- Significant ecological communities
- State historic sites
- National historic sites
- National historic register districts
- National historic register properties
- Federal parks and lands
- State parks and forests
- State unique areas
- State wildlife management areas
- County forests and preserves
- Municipal parks and lands
- Land trust sites
- NYSDEC lands
- Adirondack Park
- Agricultural districts
- NY Protected Lands
- Natural community habitats
- Rare plant habitats
- Class I & II soils

Clean Energy Communities

The New York State Energy Research and Development Authority (NYSERDA) created the Clean Energy Community program to provide local governments assistance in building more sustainable communities. The program is available to all municipalities, at no cost. The Capital District Regional Planning Commission (CDRPC) serves as the manager of the Eastern Upstate New York Territory, which includes the CDTC area. CDRPC has assisted X municipalities in implementing the following clean energy actions:

- Benchmarking – Adopt a policy to report the energy use of buildings
- Clean Energy Upgrades – Achieve 10% reduction in GHG emissions from buildings
- LED Street Lights – Convert streetlights to energy efficient LED technology
- Clean Fleets- Install electric vehicle charging stations or deploy alternative fuel vehicles
- Solarize, Clean Heating & Cooling, or Solar for All Campaigns
- Unified Solar Permit – Streamline the approvals process for solar
- Energy Code Enforcement Training – Train compliance officers in energy code best practices
- Climate Smart Communities Certification – Get certified by the NYSDEC
- Community Choice Aggregation – Put energy supply choices in your community’s hands
- Energize New York Finance – Offer energy upgrade financing to businesses and non-profits

CDRPC also provides assistance to municipalities to develop and prioritize clean energy goals, guidance for developing legislation, procurements, and contracts, and advises municipalities on how to take advantage of available funding and technical assistance opportunities. As communities in the Capital District have implemented these actions, the region, as a whole, has moved closer to sustainability and achieving the goals of New Visions 2040.

The local governments who have completed the “Clean Fleets” high impact action are:

- | | |
|----------------------------|----------------------------|
| • Albany County | • City of Troy |
| • City of Albany | • City of Saratoga Springs |
| • New Scotland | • City of Troy |
| • Guilderland | • City of Schenectady |
| • Village of Voorheesville | • Schenectady County |

These local governments have adopted the Climate Smart Communities Pledge:

- | | |
|---|---|
| • City of Albany (Bronze Certified) | • City of Troy |
| • Albany County | • East Greenbush |
| • City of Cohoes | • Village of East Nassau |
| • City of Watervliet (Bronze Certified) | • City of Saratoga Springs |
| • Bethlehem | • Clifton Park |
| • Colonie | • Village of Schuylerville |
| • Guilderland | • City of Schenectady |
| • Knox | • Schenectady County (Bronze Certified) |
| • New Scotland | • Glenville |
| • Village of Green Island | • Niskayuna |
| • City of Rensselaer | |

Driving Forces

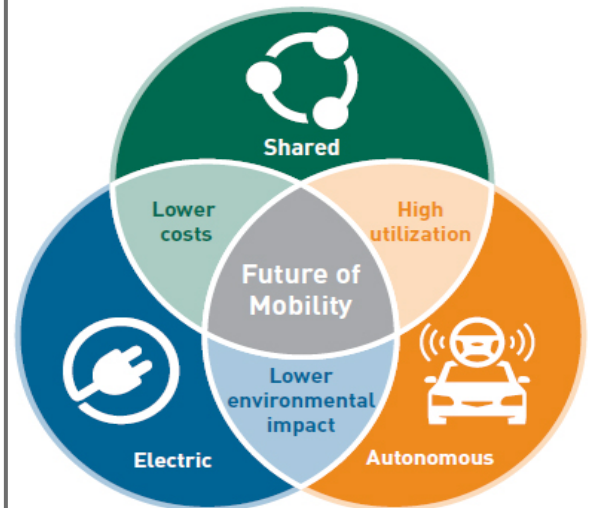
Shared Mobility, Electrification & Automation

Shared mobility, electrification and automation are considered to be the “three transportation revolutions” of the 21st Century. According to the National Association of City Transportation Officials (NACTO), people took 84 million trips on Shared Micromobility in the United States in 2018. That was more than double the number of trips taken in 2017. “Shared micromobility” refers to all shared-use fleets of small, fully or partially human-powered vehicles like bikes, e-bikes, and e-scooters.⁷ Other types of shared mobility include carsharing and Transportation Network Companies (TNCs). There are at least 400 cities with carsharing services currently operating and over 600 cities where TNCs operates in North America.⁸

Shared mobility took hold in the Capital District on a regional scale beginning in 2014 with the launch of Capital CarShare in the City of Albany. Shortly after, *CDPHP Cycle!* rolled out in Albany, Saratoga Springs, Schenectady, and Troy. These services have expanded and grown over time as the Capital District Transportation Authority (CDTA) has supported and started to manage a portfolio of mobility services with the goal of creating an integrated system of transportation *services*. With increased interest and demand for shared mobility services, the Capital District should expect growth and plan for streets and separated facilities like trails and bike lanes to accommodate them safely.

Electrification refers to the shift to EV technologies from petroleum-based fuels. In recent years battery electric and plug-in hybrid EVs have increased in numbers in the Capital District. As EVs have deployed, property owners and municipalities have installed charging infrastructure to support them. Similar to battery technology, charging technology continues to improve and evolve to be faster and more seamless. Inductive charging could transfer electricity to vehicles wirelessly. This research and technology development is occurring concurrently with automation. Tesla, which is exclusively battery electric vehicles, is the first to make self-driving capabilities available to the public.

Anticipating C/AVs is a major theme in long range transportation planning. They are the most significant transportation technology on the horizon. There are six levels (0-5) of vehicle automation according to the National Highway Traffic Safety Administration (NHTSA). Level 0 requires the driver to perform all driving tasks and Level 1 includes features like parking assistance, which has existed for several years. The second level includes lane centering and adaptive cruise control, which are all available on most new vehicles today. Level 3 is self-driving functions that still requires a high level of driver control. Level 4 technology is available in some new, advanced, luxury vehicles (e.g. Tesla). The Automated Driving System (ADS) can perform all driving tasks and monitor the driving environment in certain circumstances but the vehicle still requires a driver. The last level, 5, is full self-



Source: Pinebridge.com

⁷ <https://nacto.org/shared-micromobility-2018/>

⁸ <https://sharedusemobilitycenter.org>

driving, automated technology that performs all driving functions and does not require a driver or occupants at all.⁹

The C/AVs that are being tested in controlled and real-life conditions are mostly electric or hybrid. Major automakers and mobility providers are choosing EVs because they are cheaper to fuel and maintain and engineered better for computer control than other vehicles, which are more mechanical. Lastly, C/AV companies foresee a future that doesn't require a human to recharge an EV. The combination of these social, technological, and economic forces make "ACES" (Autonomous, Connected, Electric, and Shared Vehicles) the preferred mobility future because of their ability to reduce greenhouse gas emissions and costs and increase productivity, or utilization. C/AVs create an opportunity to expand mobility and access by reallocating street space to other modes and shifting away from burdensome private vehicle ownership model to "Mobility as a Service" (MaaS).

Social

Millennials and Baby Boomers are shifting lifestyle choices which are driving development and changes in the housing market. According to building permit data from the Capital District Regional Planning Commission, multi-family housing is outpacing single family housing construction unit-for-unit, in the Capital District.¹⁰ There are many factors influencing change but some of the major reasons are that millennials are not buying homes in part due to student loan debt and they are more nomadic as they move around the country for career and job opportunities.¹¹ Aging Baby Boomers are trading suburban single-family homes for apartments, condominiums, and homes in denser neighborhoods that require less maintenance. Additionally, both Millennials and Baby Boomers want to be in close proximity to amenities like transit, entertainment, and recreation. There are other influences on housing and lifestyle choices driven by the larger economy, but demand for multi-family housing is the most significant indicator in the Capital District.

Technology

The rise of shared mobility and MaaS has been enabled by increased connectivity. Smartphone technology and applications allow people to hail rides, reserve a car for short-term use, unlock a bike, or check the status and schedule of their bus. Travel information is easily accessible and integrated with trip planning, payment, and a managed user experience, creating a market for more travel options than ever before.

"Smart" technology refers to a range of initiatives and applications that improve mobility within communities, from technology infrastructure like sensors and payment systems to services that help consumers make transportation choices. These technologies can manage traffic and reduce congestion at intersections, manage parking more efficiently, and provide shared mobility services like car share and bike share. Smart technology that helps monitor and analyze operations within a city can save local governments money and improve efficiency in the delivery of services. These have been applied to assist with snow removal and stormwater system maintenance in cities across the U.S.

Other automated vehicles include aerial and sidewalk drones. E-commerce, or



Source: CDTA.org

⁹ <https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety#topic-road-self-driving>

¹⁰ <https://cdrpc.org/data/housing>

¹¹ <https://www.citylab.com/life/2019/05/urban-living-housing-choices-millennials-move-to-research/590347/>

commercial transactions made via the internet, have already activated changes to the transportation system and land uses. For example, 24-hour delivery and courier services have increased VMT and greenhouse gas emissions in some U.S. cities. As retail and commercial activity is increasingly conducted online, brick and mortar stores are closing or consolidating. Land uses like shopping malls are gradually becoming centers for entertainment, with storefronts being converted into bowling alleys, restaurants, and even day spas. Automation means drones can save businesses money by removing the human labor required to sell and deliver some goods. Items like prescription drugs, fast food, and other small items can be delivered within a few hours of being ordered.

Environmental

Research such as the ClimAID report and the National Climate Assessment has shown that a variety of climate change impacts have already been observed in New York and across the northeastern U.S. Annual average temperatures have risen and precipitation has increased. In addition to an increase in the overall amount precipitation, the number of downpours has increased significantly and demonstrated the inability of our current infrastructure to handle the impacts of climate change. The Capital District has experienced severe flooding which has resulted in washouts and other damage in the last several years. A combination of aging infrastructure and a changing climate can make the region vulnerable. A number of cities are currently undertaking mitigation projects, like rebuilding sea walls, with assistance from the Federal Emergency Management Administration (FEMA) because of damage from recent storms and heavy rain events.

Based on estimates from the ClimAID report, by the 2050s, sea level is expected to be as much as 30 inches (2.5 feet) higher in New York's coastal area, as compared with sea level averaged by 2000-2004. By 2100, New York's cost could see up to 6 feet of sea-level rise. The Capital District is not a coastal area, however, sea level rise will cause the Hudson and Mohawk Rivers and their tidal wetlands to rise and making the region vulnerable to severe flooding and other hazards.¹² Climate change is predicted to have a significant impact on agriculture and natural resources. In addition to environmental health, climate change poses a risk to the health of people, including respiratory conditions from air quality and diseases spread by pests.

Economic

The *Capital District Regional Indicators* (2016) report by the Capital District Regional Planning Commission uses American Community Survey (ACS) data to examine and compare the Capital District metropolitan statistical area with its peer groups as it relates to social welfare, education, housing, economics, transportation and health. The report illustrates the stability of the regional economy due to its large base of government, education, and healthcare institutions that provide employment and generate economic activity in cities and towns throughout the region.¹³ However, urban areas still struggle with reducing poverty. While many economic factors are beyond the control of CDTC and the transportation system, access to transportation and connectivity to employment and activity centers can create economic opportunities.

¹² <https://www.dec.ny.gov/energy/94702.html>

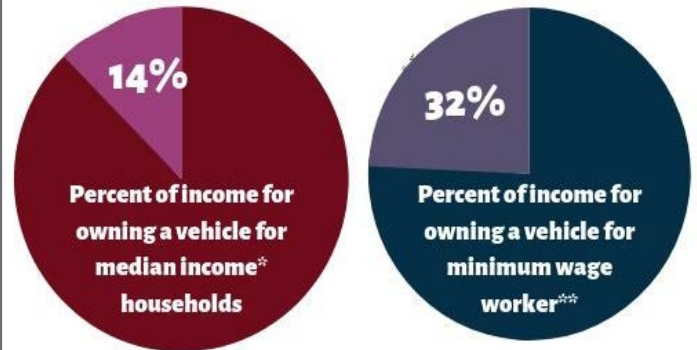
¹³ <https://cdrpc.org/wp-content/uploads/2016/11/FINAL-Capital-District-Regional-Indicators-2016-LANDSCAPE-FORMAT.pdf>

Despite the high cost of private vehicle ownership, cheap energy has historically created demand for large single-family home development and kept most consumers dependent on their vehicles for mobility. A map of Zero Vehicle Households is in Appendix B. Communities where zero-vehicle households is high, are typically dense urban areas within the region's cities with access to transit and sidewalks. There are some rural and village communities in the region where households do not have access to a vehicle and are not served by transit or sidewalk facilities. Oil and gas prices have been relatively low, but, as shown earlier, volatile. In a global economy, disruptions from extreme weather events, wars, trade disputes, and other political conflicts can significantly impact supply and cause dramatic price spikes.

Similarly, natural gas, has provided cheap and abundant energy for much of the U.S., including throughout New York state. While the U.S. has become more energy independent, states and communities have had to balance the trade-offs of providing energy and disrupting natural resources. These pressures on natural resources, compounded by a changing climate, have created demand for improvements in energy efficiency as well as alternative energy sources like solar, wind, and hydrogen. Increasing demand for efficiency and alternatives also puts pressure on towns and cities to invest in infrastructure that supports walking, bicycling, and access to transit and other mobility services.

Similar to their changing preference in lifestyle, Millennials, lean to access over ownership. The "Sharing Economy" has increased access to mobility in the same way libraries expanded access to books. Technology has removed barriers to entry like cost and availability of bicycles, cars, and most recently, electric-scooters and mopeds. As the sharing economy revolutionizes mobility, it is uncertain if a shared ownership model will, at any point, overtake personal vehicle ownership. Other emerging technologies like automation and electrification could be paired with MaaS to transition to a shared fleet of vehicles which will have significant impacts on land use and the transportation system.

The Cost of Owning a Vehicle



According to AAA, the average annual cost of vehicle ownership is \$8,964.25, based on driving 15,000 miles per year.

*Median household income in the Capital District is \$63,213 (Source: U.S. Census Bureau)

**The percent was estimated assuming that the worker earned \$13.50/hour (minimum wage in New York State was \$13.50 at the end of 2018), worked 40 hours/week and worked 7 days/week for 52 weeks.

Policy

FAST Act

The Fixing America's Surface Transportation (FAST) Act was signed in December 2015 authorized \$305 billion through 2020 for transportation funding. The FAST Act was the first long-term surface transportation bill enacted in a decade, which brought relative funding certainty for surface transportation. The bill continues requirements for a long-range plan and a short-term TIP, with the long-range statewide and metropolitan plans now required to include facilities that support intercity transportation, including intercity buses. These plans must also describe the performance measures and targets that States and MPOs use in assessing system performance and progress in achieving the performance targets. Additionally, the FAST Act requires the planning process to consider projects/strategies to: improve the resiliency and reliability of the transportation system, stormwater mitigation, and enhance travel and tourism.

Included in the FAST Act was \$4.3 billion from the Surface Transportation Block Grant Program for Transportation Alternatives. These funds include all activities that were eligible under the Transportation Alternatives Program (TAP). Transportation Alternatives, is a set-aside for "smaller-scale transportation projects such as pedestrian and bicycle facilities, recreational trails, safe routes to school projects, community improvements such as historic preservation and vegetation management, and environmental mitigation related to stormwater and habituate connectivity."¹⁴ The FAST Act also includes \$12 billion for the Congestion Mitigation and Air Quality Improvement (CMAQ) program. CMAQ eligible projects must help meet the requirements of the Clean Air Act and reduce congestion and improve air quality. Bicycle and pedestrian projects are eligible for funding under this program, which also provides funds to alternative fuel vehicles and infrastructure and intersection projects that reduce congestion like traffic signals and roundabouts.¹⁵

The Highway Trust Fund is the source of funding for most of the programs in the FAST Act. The source of funding for the Highway Trust Fund are motor fuel taxes, however the FAST Act transfers additional funds from other sources into the Highway Trust Fund in order to keep it solvent through 2020.¹⁶ As fuel efficiency standards increase and electric vehicles increase in numbers, the future of the Highway Trust Fund is more uncertain than ever. Future funding for the federal highway trust fund remains a critical issue for transportation reauthorization.

New York State Climate Leadership & Community Protection Act

In 2019, the New York State Climate Leadership & Community Protection Act (CLCPA) was passed into law. It has been called "one of the world's most ambitious climate plans." Among other provisions, the law establishes a goal of 85% reduction in GHG emissions from 1990 levels by 2050, codifies ambitious clean energy targets, including 70% renewable energy by 2030 and 100% carbon free electricity by 2040, and calls for the development of a plan within two years to achieve net zero emissions in all sectors of the economy. The law also includes significant commitments to environmental justice and a just transition. The Climate Action Council, established as part of this legislation, is charged with developing the plan to meet the goals of the Act, and will begin its work in 2020.

Transportation & Climate Initiative Regional Proposal for Clean Transportation

In addition to state efforts, New York participates in the Transportation and Climate Initiative (TCI), a group composed of the transportation, energy and environmental agencies of 12 northeast and mid-Atlantic states and the District of

¹⁴ <https://www.fhwa.dot.gov/fastact/factsheets/transportationalternativesfs.cfm>

¹⁵ <https://www.fhwa.dot.gov/fastact/factsheets/cmaqfs.cfm>

¹⁶ <https://www.fhwa.dot.gov/fastact/summary.cfm>

Columbia. TCI was founded in 2010 with a goal of reducing GHG emissions from the transportation sector. Among the TCI efforts, the group is working to develop a regional low carbon transportation policy proposal. CDTC has participated in various “listening sessions” related to this policy development. Implementation of a cap-and-invest system, as is proposed in the policy framework could reduce GHG emission through both capping regional GHG emissions from transportation, and providing resources that could be used to invest in electrification, transit service expansion, new mobility services, active transportation projects and programs or other efforts. These initiatives are consistent with New Visions goals and principles and would lead to an even greater reduction in GHG emissions and fuel use from shifts to plug-in electric vehicles.



TCI Listening Session

Where Are We Headed?

Planning for 2050

Scenario planning is a process that evaluates the effects of alternative policies, plans, and/or programs on the future of the region. Scenario planning cannot tell you what *will* happen, because there are an infinite number of possibilities, and social, political, economic, technological, and environmental forces are rapidly changing. Effectively planning for change requires the cultivation of a participatory and informed decision-making process that regularly considers what is *likely to happen*, what *could happen* and what the community *wants to happen* in the future. For *New Visions* purposes, CDTC is using scenario planning to provide a framework, or a way to consider the issues and opportunities of different futures so that the region can plan accordingly.

The rapidly changing cultural trends, emerging technologies, and economy have upended traditional long-range planning. New mobility services and technologies have had a disruptive effect on transportation systems and the economy. These are forces that the region has little control over, but it needs to understand and prepare for their potential impacts so it can adapt. The following are four basic scenarios identified by CDTC:

A) Base-Year 2050 Trend. This scenario uses the population, employment, and land-use forecasts that are incorporated in CDTC's travel demand model, which was used in the LRTP update. In this scenario, the gradual adoption of Connected and Automated Vehicle (C/AV) technologies would not change land use trends and development patterns. Mobility as a Service would increase without dramatically changing travel behavior. Adoption of electric vehicles would continue through 2050 at the trend pace predicted by national forecasts.

B) Sprawl Development. This scenario assumes that adoption of C/AV technologies will encourage development further from urbanized areas. Some commentators suggest this will be the case, as people traveling in C/AVs will view commuting travel time as potentially productive. Private ownership of vehicles would remain similar to current ownership rates, and Mobility as a Service would be limited and concentrated in cities. The result would be increased sprawl development patterns beyond trend. This land-use pattern would run counter to the New Visions Plan goals. Provision of transit service would become more challenging. Adoption of electric vehicles would continue through 2050 at the trend pace predicted by national forecasts.

C) Compact Development. This scenario assumes that urban living will be made more attractive through new transportation options like Mobility-as-a-Service (MaaS) and C/AV technologies. In addition, this scenario assumed a high level of urban reinvestment and transit investments that encourage construction of transit-oriented development in the region's urbanized areas. New paradigms would increase the importance and success of transit. Success of Mobility as a Service and C/AV technologies could lead to reduced private ownership of vehicles. This land-use pattern furthers the New Visions Plan development goals. Adoption of electric vehicles would continue through 2050 at the trend pace predicted by national forecasts.

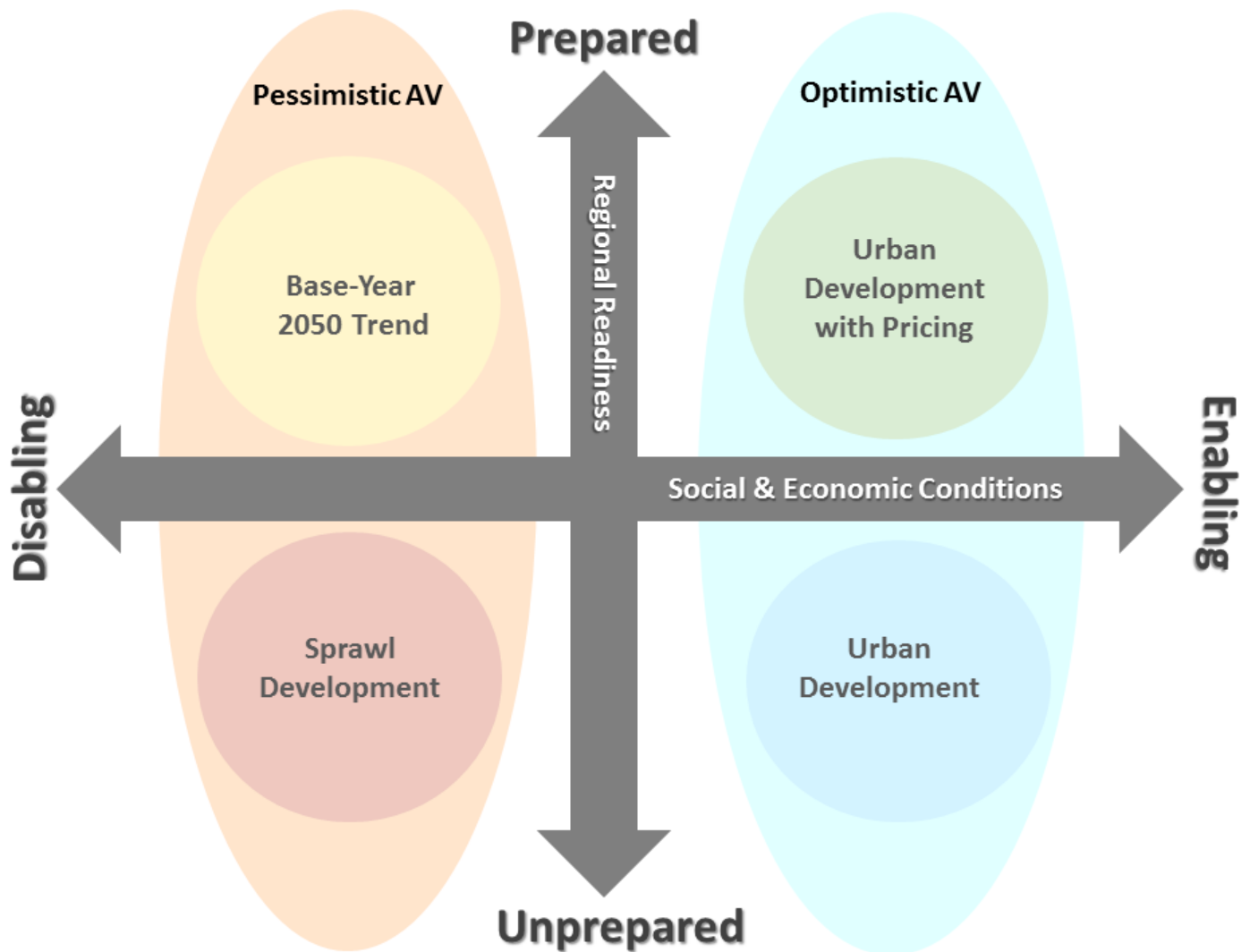
D) Compact Development with Incentives. This scenario uses the land-use assumptions from the Urban Development Scenario to explore the impacts of increasing household transportation costs. This could result from instituting several pricing options, including a carbon tax, a VMT tax or fee structures to encourage ridesharing in MaaS. Many commentators predict that without the support of fee structures to encourage ridesharing with MaaS, congestion could increase because of increased vehicle miles of travel. Adoption of electric vehicles would continue through 2050 at the trend pace predicted by national forecasts.

Two Overlay Scenarios which could happen in combination with other scenarios:

Optimistic AV. This scenario assumes that automated vehicles will be well integrated into the land use and transportation system with pricing and policy structures that encourage ridesharing and transit use. Under this scenario, empty self-driving cars on the road will be minimal and vehicle miles of travel will be less than trend. Increased efficiency of self-driving allows greater real capacity on expressways, and traffic incidents will be rare. The potential safety benefits of AV's will be fully realized.

Pessimistic AV. This scenario assumes that the availability of AV's result in significant increases in vehicle miles of travel due to empty cars circulating or returning to the car owner's home. Increased congestion results from inadequate facilities for AV's dropping off passengers. Transit service declines dramatically.

Figure 10. New Visions 2050 Scenario Planning



We Can Do Better

- The location of jobs, transportation options, and workers have not always aligned, creating concentrations of poverty in urban and rural areas of the region.
- Emissions from vehicles are up 17% in total and 7% per capita since 1990 while population grew at a much slower rate¹⁷
- As an increasing number of Capital Region residents age in place and become unable to drive, they lack transportation options.
- The average car is 80% empty when its being driven by a single person
- There are 2 billion parking spaces for about 250 million cars, which is 8 parking spaces for each car in the U.S.¹⁸
- Cars are parked 95% of the time
- Up to 30% of traffic in urban areas is looking for parking
- 80% of people commute alone
- Owning a car costs \$9,000/year
- Capital District households are spending 14-32% of household income on transportation



Goals

Get Smarter

Smart Land Use – GHG emissions from transportation come from vehicles but the cumulative effect of them is influenced by land use decisions. As documented in the Capital District 2010 Regional GHG Inventory report, compact cities and towns generate fewer emissions per capita than more spread out, rural towns and villages. Concentrated development creates benefits for the transportation system and regional quality of life by supporting transit and other transportation choices, and reducing the length of distances people are required to travel for work, services, and goods.

Coordinated planning and land use decisions can also protect vital environmental resources and systems. “Smart growth” policies will also help preserve rural community character, open spaces and agricultural lands. CDTC regularly

¹⁷ <https://www.nytimes.com/interactive/2019/10/10/climate/driving-emissions-map.html>

¹⁸ Shoup, Donald, *Parking and the City*

reviews and maps natural and cultural resources throughout the region and consults with federal, state, and local agencies on environmental issues as an important part of the environmental mitigation process. Additionally, environmental impacts are considered and evaluated in the TIP project evaluation process.

In support of urban reinvestment and regional equity, CDTC has programmed significant funding for transportation projects in the cities. As mentioned earlier, programs like CDTC's Transportation and Community Linkage Program, provide funding for municipalities to prepare and implement community-based transportation and land use plans that are consistent with New Visions principles. Smart growth strategies are:

- Mix of land uses
- Compact building design
- Housing opportunity and choice
- Walkable neighborhoods
- Foster a strong sense of place
- Preserve open space and natural resources
- Direct new development towards existing communities, employment, and retail
- Consider transportation choices and accessibility
- Make development decisions predictable, fair and cost effective
- Encourage community and stakeholder collaboration and input in the development

Smart Data Use – With increasing connectivity and advanced technology, data collection has become ubiquitous in our daily lives. Cameras, sensors, smartphones and the mobility services individuals are using are collecting information on the environment, the people, and the trips being made. The data collected can be used to help make cities more efficient, safer, and higher functioning while also supporting emerging technologies such as autonomous vehicles. But there are also security and privacy concerns when data is being collected in public spaces and governments often lack policy frameworks for privacy and data use.

In order to evaluate proposed transportation projects based on their performance and to implement forward-looking transportation policies, data collection is necessary. Transportation behaviors and systems are rapidly changing due to sociodemographic factors, emerging technologies, and shared mobility services. These rapid changes sometimes create a disconnect between projects that were identified as priorities 3-5 years ago and projects and infrastructure that is needed now. Current data helps planners identify these changes and better match today's preferences with planning priorities. And despite growing needs, available funding has not increased and is not anticipated to increase in the near future, therefore making it more critical for transportation plans to be based on accurate forecasts and models that use the most up-to-date information.

*What does it mean to be a
“Smart Region?”*

A region that uses data, applications, & technology to help people & goods move more efficiently.

As technology and data needs change, local governments need to adapt quickly. The need for assistance in collecting, maintaining and analyzing data is increasing and MPOs can assist municipalities with this important task. Exploring current data standards and collection practices must be part of CDTC's ongoing data collection program. Cybersecurity is another concern that must be addressed.

Intelligent Transportation Systems – The next generation of traffic signals is a system that continuously monitors, learns, predicts, and responds to traffic demands and conditions. Intelligent Transportation System (ITS) technology includes communications with drivers as well as communications within the transportation system. ITS is the “first generation” of digital transportation infrastructure and includes variable message signs, cameras, adaptive traffic signals, incident management programs, ramp metering, variable speed limit signs, and other technologies designated to improve information about traffic conditions. ITS helps provide real-time route alternatives and can smooth traffic flows.

CDTC has long recognized the value of using ITS to improve travel for all modes. Some innovative applications of ITS in the Capital District include traffic signal priority for CDTA’s BusPlus, which connect on-bus technology with traffic signals that allow transit vehicles to “jump the queue” at crowded intersections and trigger a green light for buses only. CDTC has also recommended adaptive signal controls for the Adirondack Northway / Route 9 Corridor in the I-87/US Integrated Corridor Management Plan (2015).

As emerging technologies like C/AVs develop, these first generation ITS technology will probably be phased out and replaced with an “**Internet of Things**” (IoT) infrastructure. IoT uses physical objects and sensors to capture and exchange data. Like mentioned earlier, cameras, smartphones, and sensors embedded in transportation infrastructure are continuously collecting data on travel behaviors, environmental data, and other conditions which can be shared between vehicles, drivers, and infrastructure. This enables vehicles, traffic signals, roads, and transportation agencies and authorities to receive data and respond in real-time.

The result of IoT makes managing existing infrastructure more cost-effective and feasible than increasing capacity. Imagine if vehicle-to-infrastructure communications could stop a car from running a red light or prevent a vehicle from speeding? C/AVs make a future of zero crashes achievable. IoT can deliver information on parking location and availability directly to drivers to reduce congestion, while also pricing parking based on current demand.¹⁹ Further into the future we can see the same technology enable the pricing of curb use as self-driving vehicles and ride hailing replace privately owned vehicles and the need for parking. CDTC encourages municipalities and transportation authorities in the region to adopt emerging technologies to improve operation of the transportation system but must identify which available and developing technologies will solve congestion and access problems specific to the region.

Leverage technology – It is difficult for local governments to shift funding and other resources at the same rate as technological and travel behaviors change in the 21st century. These rapid changes require regional coordination and consensus on how to adopt technology and what data, IoT, and/or mobility technology can be harnessed to reduce congestion, improve pedestrian safety, enhance transit services and improve quality of life in the region. CDTC staff has researched and developed resources for municipalities on emerging technology and will continue these efforts through the Smart Communities program. As the MPO, CDTC is in a unique position to guide and assist municipalities through planning to implementation and management. The following are some technologies that could be adopted on the local and/or regional level that improve network efficiency and reliability while also reducing GHG emissions.

Dynamic Pricing – Dynamic pricing which is sometimes referred to as “value pricing,” and is a way of utilizing supply and demand to reduce waste associated with traffic congestion. The price to enter or park in certain

¹⁹ David Zax, “A World Without Car Crashes,” The Atlantic CityLab, February 11, 2014, <https://www.citylab.com/transportation/2014/02/world-without-car-crashes/8353/> (accessed November 2019).

parts of an urban area is priced based on the traffic flow and demand at that time. They may be set in advance or dynamic, responding to real-time traffic data. Congestion pricing is set to go into effect in New York City by 2021. The Saratoga Springs Smart City Roadmap proposes congestion pricing as a future use of technology to manage downtown traffic.

Telematics – Telematics are used by fleet managers to monitor vehicles and reduce costs and GHG emissions. This technology collects data through GPS and sensors and can report and evaluate how driving behaviors impact GHG emissions. The data collected can also help fleet managers identify when and if they should shift to EV technology. This technology is being used by some local government fleets but there is potential for wider implementation.

Adaptive signal control & Variable Speed Limits– This is a strategy where the signal controller makes adjustments to cycle length and speed limit in real-time based on changes in the traffic characteristics on a particular arterial or corridor. This is a great tool during incents on major roadways where first responders and/or emergency management organizations may want to divert traffic to alternative routes. This technology would require video cameras, sensors and other communication networks to monitor traffic and communicate with signals and other hardware.

Real-time travel info – There are a number of smartphone applications and other services that are collecting traffic data in real-time. Some of this is through probe and other technology but a lot is “crowdsourced,” or gathered from a large number of people, voluntarily. This data can help provide insight into causes of crashes and other incidents at peak commute times, identify safety issues, and develop better traffic management systems. Justifying the cost of purchasing large datasets from the private sector is difficult for local governments with limited resources. However, there are examples of regional and statewide organizations that have found value in this data and are actively using it for congestion management (see Table 14).

Integrated mobility – The foundation of integrated mobility is typically transit. When a transit provider collaborates and promotes multiple transportation services as a unified service, like CDTA has with bike share and bus service, it links options together and makes them more accessible. Continuing to connect mobility providers under a single service will be a key strategy for increasing access to transportation choices and reducing single occupancy vehicle trips. Its innovative and reduces congestion and GHG emissions. CDTA’s Navigator card can allow for this integration so that customers can access more modes.

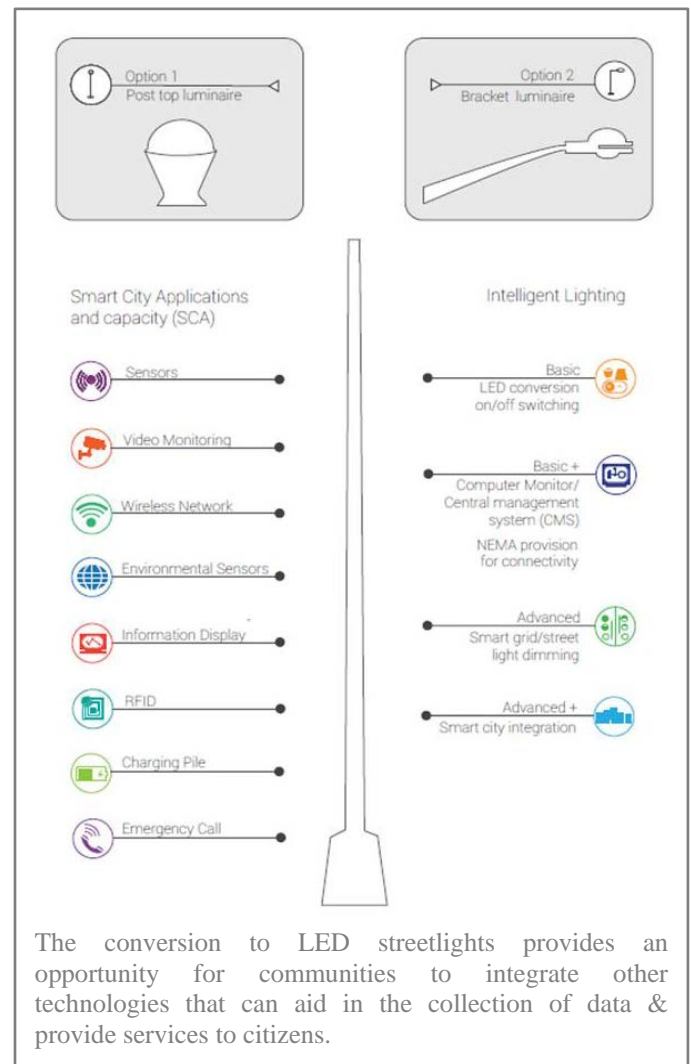
Figure 11. Sample of Agencies Using Crowdsourced Data

Data	Application	Peer Contact
Waze Event Data	Early detection of hazards & events	Massachusetts and Florida Departments of Transportation (DOTs)
Waze Navigation Guidance	Agency “pushes” road closures, detour routes, or preferred routes to the crowd to control and influence traffic.	Port Authority of New York and New Jersey
Citizen Reporting Apps (ex. SeeClickFix)	Early Detection of maintenance issues	Utah and New Hampshire DOTs
Twitter Messages	Pre-event planning. Pre-event warnings. Social sentiment analysis.	Metropolitan Area Transportation Operations Coordination Program (National Capital Region), Iowa, and D.C. DOTs.
911 Phone Calls	Event detection, responder deployment, and quick clearance support.	California, Virginia, & Wisconsin DOTs.

Source: Considerations of Current and Emerging Transportation Management Center Data, FHWA

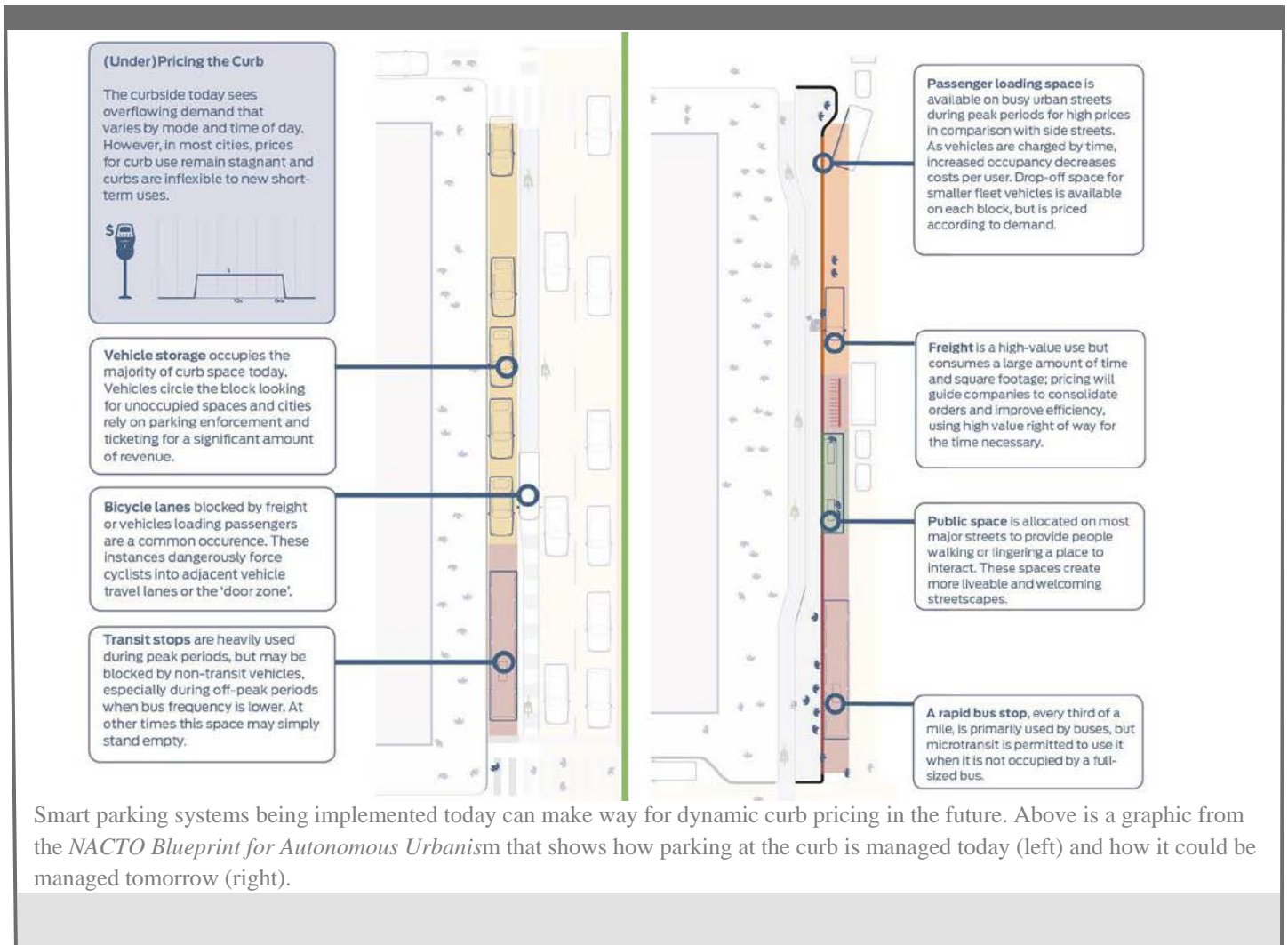
Smart parking – Smart parking strategies utilize technology to direct customers to parking, facilitate easy payment, and assist with enforcement. A global parking study commissioned by IBM found that 30% of a city’s traffic is caused by drivers actively search for a parking spot²⁰ These extra vehicle miles create congestion and GHG emissions but also create bad experiences for drivers. Integrating new technology into parking strategies can help with wayfinding and eventually create opportunities to implement dynamic pricing based on demand. This could transition into dynamic pricing of the curb as travel behaviors change and transition to MaaS.

LED Streetlights – As municipalities look to cut costs and reduce their carbon footprint, they have replaced conventional street lights with energy efficient LED technology. LED streetlights reduce energy use by as much as 65% which generates significant cost savings and emissions reductions. They also require less maintenance and can incorporate dimming functions, parking management and other smart, connected technologies that improve operations and reduce GHG emissions. CDTC is currently working with the City of Saratoga Springs to develop a Smart City Street Light Conversion & Evolving Technology Guidebook that will



²⁰ <https://www-03.ibm.com/press/us/en/pressrelease/35515.wss>

provide an overview of lighting and technology options available to municipalities as they make decisions related to replacement of streetlights. CDTC can work with communities to utilize LED technology to improve traffic safety, particularly for pedestrians, collect traffic data, and connect to traffic signals and vehicles.



Connect

The Capital District is unique in that instead of a central city, the region has 4 medium-size cities and 4 small cities, which are surrounded by a number of suburban and rural towns and villages. The region is connected socially, culturally, and economically but this geography can make the region *feel* disconnected. An ongoing theme in transportation planning is developing connections – connections to jobs, connections to recreation, and connections to each other. Infrastructure projects provide physical connections between communities and people, but identity, experience, and relationships are what make people *feel* connected to each other. Creating and fostering a regional identity and connection can be facilitated by institutions. In addition to planning and programming infrastructure projects, the MPO can facilitate connections through technology and promoting relationships between local governments, institutions, and the private sector.

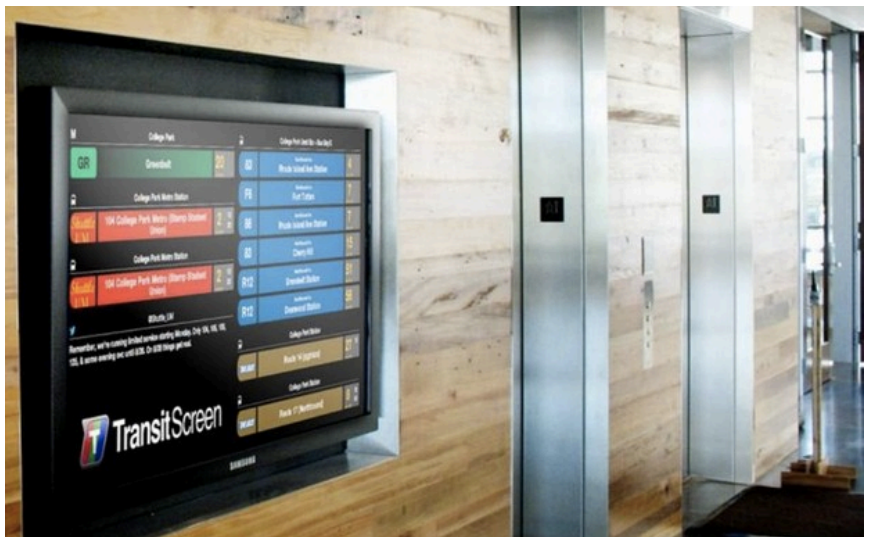
Information – Rapid technological change is increasing connectivity but can sometimes alienate individuals who lack access or skills to utilize it. A holistic vision for how technology can help residents move better and access opportunity is demonstrated in the USDOT Smart City Challenge finalist, SMART Columbus project. A key part of this is providing better access to healthcare, through connected vehicles, multimodal trip planning and a common payment system, mobility assistance for people with cognitive disabilities, smart mobility hubs, and prenatal trip assistance. Capital District Commuters use trip planning technology frequently and smartphone application technology has enabled new mobility services like ridehailing (i.e. Uber) and bike share to operate in the region. There is no doubt that these technologies make it easier to get around and can take some people further than they may typically be able to travel without them, but some people are still excluded.

Multi-modal trip planning applications and websites, like 511NY, allow people to more easily access different travel options based on preference, price, convenience, and destination. Improving information within the website and integrating more travel options, like shared mobility services, will attract more users and promote alternatives to single occupancy vehicle travel. Applying this technology to screens at major activity and employment centers and transit hubs could connect more commuters, especially those without smartphones, to more transportation choices. This emerging technology helps overcome the problem of most travel applications that only show users one mode at a time and are limited to people who have access to smartphones and computers.

Integrating travel is the only way to develop a truly multi-modal system. The Capital District has taken the first step in this direction with the implementation of CDTA's Navigator card. This new fare media rolled out in 2017 as a way to make travel easier, save transit riders money, and provide better overall service. This system creates an opportunity to streamline household transportation costs by integrating payments for mobility services like bike share, smart parking, and taxicabs, with transit. Integrated travel connects more people with more travel options in a secure, convenient, and cost-effective way.

While the rise of smartphone use has enabled new mobility services and has improved access to travel information, there are still people within the region without internet access. Bridging that digital divide is essential to getting more people to ride transit and choose alternative modes. Public wireless internet or "wi-fi" has been deployed in cities across the country, including in areas of the Capital District. Public wi-fi could be a prerequisite to implementing future projects or programs like smart parking, and C/AVs. Ensuring that all residents can connect with transportation options is essential to ensuring an equitable system that allows everyone to access opportunity and services if they want to.

Connect commuters with information so that they can consider & compare all their mode choices & make better travel decisions.



A web-enabled computer or television can broadcast real-time local travel information in lobbies, at transit stops, & other activity centers.

Source: Citylab.com

Technology is increasingly being utilized by transportation planning organizations and local governments to communicate project details, events, and other information to the public. “Social media” websites and applications like Facebook and Twitter have become spaces for people to interact with each other and sources of information, with billions of active users worldwide. They can help organizations reach a broader audience and expand public outreach and participation opportunities. Using graphics, photos, and even videos can improve an organization’s image and provide vital information about projects and programs, travel advisories, and safety information. Strategically incorporating social media tools into the transportation planning and public outreach process can connect people to better information about what their municipality or other government entity is building or doing to address congestion, safety, and accessibility in the transportation system.

People & institutions –As technology advances, the public has become more suspicious of how government agencies harness it. Local governments and organizations must be thoughtful in how they use and deploy new technology in the region. They must be transparent about the planning, implementation and management processes and be able to communicate the long-term goals and vision related to adopting and integrating technology into the built environment and public spaces. CDTC can play an important role in facilitating coordination between government agencies and communications with the public. These connections and a consensus on how technology can benefit the region, how government organizations are protecting privacy and public safety, are crucial to implementing any long-term vision.

Despite there being a broad array of tools and tech-enabled means of connecting governments with people and governments with private sector organizations, there continues to be a reluctance to share information. As more private sector transportation providers enter the market, the data being collected on trip destinations and travel behaviors is less accessible to local governments and planning organizations. The private companies and the government organizations have different but not opposite interests in the data being collected bottlenecks and congestion are just as bad for mobility companies as for cities and towns. But the public and private sectors must continue to work together and cultivate relationships to turn this private data into a public good that can help government respond to changing travel preferences and infrastructure needs and demonstrate that public interests are a priority.

The Smart Communities Task Force and Capital District Clean Communities Coalition are examples of how CDTC provides a forum for public-private sector coordination and collaboration. These forums can be expanded to include a more diverse range of stakeholders and industries. As transportation intersects with so many aspects of our daily lives, planning must cast a wide net and welcome more public input, industry partnerships, and coordination. This will save resources while addressing a wider extent of the region’s challenges.

Technology change often leaves some segments of the population behind. New programs and projects that integrate advanced technologies, whether its sensors for data collection or C/AVs, must be sensitive to how these might exclude, discriminate, or harm vulnerable and disadvantaged communities. Shifting to electrification is good, but where is the energy being produced? Automation will expand mobility for many, but what about those who need assistance boarding and getting off a bus or taxicab? These are just a few questions that must be asked before the region pursues new, unproven technologies.

Be Ready

EV-Readiness – Electric vehicles (EVs) present an opportunity to significantly reduce GHG emissions from transportation in the Capital District. New York depends on natural gas, nuclear, and hydroelectric generators for most of its electricity generation, making its grid uniquely clean compared to the rest of the U.S. Recently passed legislation requires the state to achieve 100% carbon-free electricity production by 2040 which means even great air quality benefits as more vehicles shift to electric.²¹ A recent analysis using the VisionEval Rapid Assessment Tool (VERPAT) estimated a more aggressive investment in EVs could lead to a 47% reduction in 2050 GHG emissions.

In addition to tremendous GHG reductions, EVs have significantly lower maintenance costs, making their total cost of ownership more comparable with regular internal combustion vehicles. As battery costs decrease, EVs can be a more affordable vehicle option for more Capital District households. In the meantime, federal tax incentives and point-of-sale rebates provided by NY are helping to aid EV sales by lowering the cost-of-entry for many car buyers.

CDTC staff, in cooperation with NYSERDA, developed multiple scenarios that depict how New York's new climate change legislation could impact future VMT and GHG emissions using the VERPAT modeling software. Using employment and land-use forecasts that are incorporated into CDTC's travel demand model, a current trend, optimistic EV and pessimistic EV scenarios were all evaluated to gauge how future EV market penetration could impact GHG emission reductions. The pessimistic EV market share scenario considered approximately 40% EV market share by the year 2050 which could result in GHG reductions of up to 61% (compared to 1990). The optimistic EV market share scenario considered 100% EV market share by 2050. This scenario showed the potential to result in GHG reductions of up to 85% (compared to 1990 values) pushing NYS towards the goals of the CLCPA. Figures 12-14 show the impact of EVs on GHG emissions and Vehicle Type Market share by year for the pessimistic and optimistic EV scenarios.

The expanding network of EV charging stations indicates increasing demand of and readiness for EVs in the Capital District. CDTC, through the Capital District Clean Communities Coalition, has been at the forefront of EV-Readiness planning. The most recently updated ZEV Plan shows the region has both a policy and infrastructure framework already in place to support EV deployment on a large-scale. There is a current need for fast charging infrastructure to support



A member of the Capital District EV Drivers Group demonstrates EV charging technology at the Honest Weight Food Coop in Albany where charging stations have been installed to support EV deployment (2017)

²¹ <https://www.eia.gov/state/analysis.php?sid=NY>

inter-regional travel and prospective EV owners in multi-family housing and dense neighborhoods that lack private parking where vehicles can charge overnight. Coordinating electric utility upgrades with the expansion of the EV network and other vehicle technology can guarantee compatibility in the near and long term.

Figure 12. GHG Emissions & EV Scenarios

Scenario/Year	VERPAT VMT	GHG Emissions	Reduction from 1990	Reduction from 2015	Reduction from 2030	Reduction from 2050
1990	14,673,091	15,509,305	None	None	None	None
2015	17,476,681	13,960,139	-10%	None	None	None
2030 Trend	18,442,823	8,269,093	-47%	-41%	None	None
2050 Trend	18,708,916	4,275,491	-72%	-69%	-48%	None
2050 Optimistic EV	18,540,313	2,275,467	-85%	-84%	-72%	-46.80%
2050 Pessimistic EV	18,694,324	5,976,415	-61%	-57%	-28%	39.80%

Figure 13. Vehicle Type Market Share: Pessimistic EV Scenario

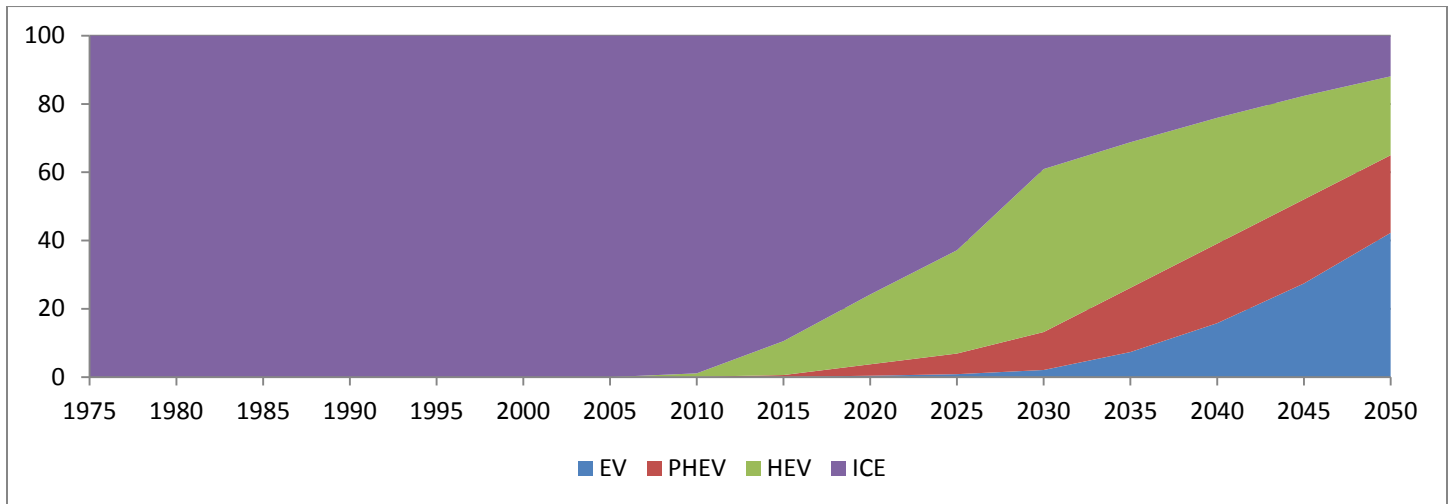


Figure 14. Vehicle Type Market Share: Optimistic EV Scenario

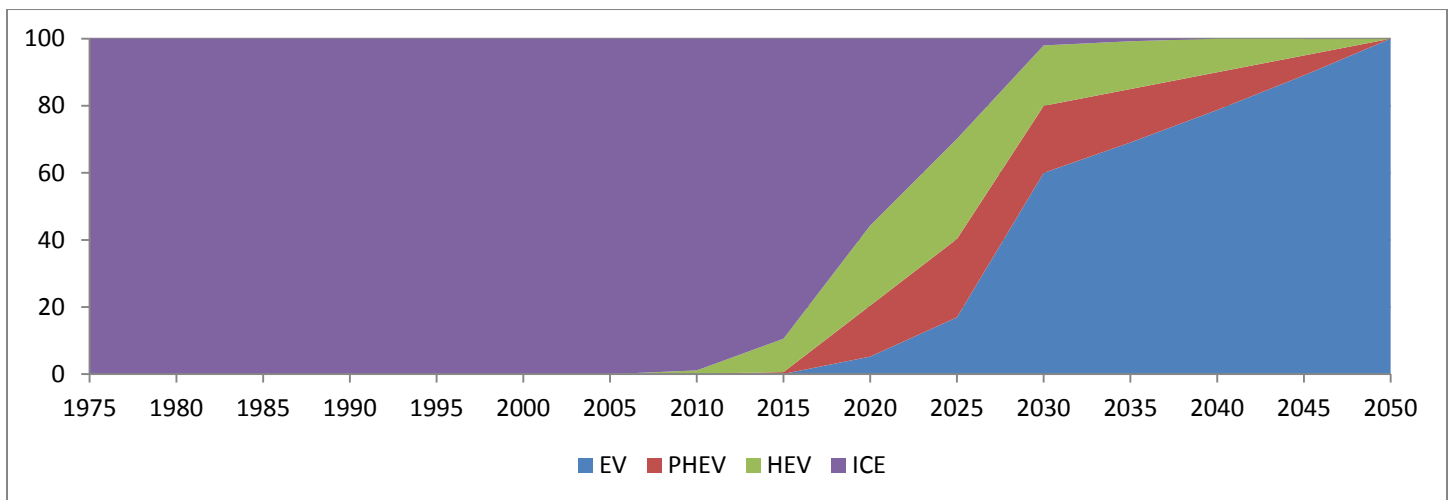


Table 4 shows how much of Level 2 and DC Fast Charging infrastructure is required to support a market share of just 10% EVs in the urban areas of the Capital District. Continuing to promote EV-Ready building, zoning, and parking codes will ensure that municipalities can support EVs now and into the future. Requiring new parking facilities be built EV-ready and coordinating streetscape projects and redevelopment with utility upgrades at the curb to accommodate on-street charging are two ways municipalities can plan for EVs. Anticipated improvements in battery technology and charging will lead to even larger numbers of EVs and the need for advanced infrastructure to support them.

Table 4. EV Infrastructure Projections

	Albany-Schenectady		Saratoga Springs		New York	
	As of 2016	10% EV Market Share	As of 2016	10% EV Market Share	As of 2016	10% EV Market Share
Light-Duty Vehicles (as of 2016)	540,900	54,000	115,100	11,000	11,437,800	1,000,000
Workplace Level 2 Plugs Needed	*	1,189	*	271	*	21,716
Current Public Level 2 Plugs	307	744	62	166	3,199	13,602
Current DCFC Plugs	39	90	0	27	496	1,801

* Workplace charging includes private stations which are not tracked

Source: U.S. Department of Energy EVI-Pro Lite

The next generation of alternative fuel and advanced vehicle technology that has not yet been deployed in any large numbers in the region is fuel cells. Hydrogen is an alternative fuel that can be produced from diverse domestic resources and is emissions-free. Since Hydrogen is stored in water (H₂O) and other organic matter (i.e. methane, CH₄), it is abundant in our environment. While the market is in its infancy as a transportation fuel, government and industry are working toward clean, economical, and safe hydrogen production and distribution for widespread use in fuel cell electric vehicles (FCEVs). Fuel cells are manufactured in the Capital District and have been piloted locally in a partnership between FedEx and PlugPower. As EVs become more ubiquitous, fuel cell technology will be essential for power back-up and peak demand shifting as vehicle charging strains the grid.²²

AV-Readiness – Evolving vehicle technologies have the potential to alter all aspects of mobility and change how drivers interact with the transportation network. The most anticipated vehicle technology is C/AVs. Vehicle technology is expected to progress through six levels of automation (see Figure 15) – from connected features to fully automated vehicles, or “self-driving cars.” A fully automated vehicle does not require a driver and could present opportunities as well as threats to existing transportation infrastructure and users. Connected vehicles are different in that technology allows vehicles to communicate with each other and the world around them. An example of an existing connected vehicle feature is GPS navigation systems that receive information on congestion in the road ahead through cellular signals and suggest alternative routes, parking assist, and adaptive cruise control.

²² https://afdc.energy.gov/fuels/hydrogen_basics.html

Figure 15. Six Levels of Automated Vehicle Technology



Federal and state government agencies can help guide the adoption and application of this vehicle technology, but all transportation agencies will need to slightly change or shift their roles as C/AVs are tested and deployed. The MPO role in AV-Readiness is to develop a regional vision for the transportation system and identify how technology fits into it. How does the region maximize the benefits of C/AVs? What are the local barriers to testing and deploying C/AVs? How will the region prevent and mitigate adverse impacts of C/AVs? And most importantly, MPOs must develop policies for how C/AV infrastructure will be prioritized.

Figure 16. New Roles for Policymakers

Policy Level	Traditional Roles	Example New Policy Needs
Federal	<ul style="list-style-type: none"> • Provide transportation funding • Regulate the safety of the vehicle – issue guidance to achieve national safety goals, enforce compliance with safety standards, and communicate/educate the public about safety issues 	<ul style="list-style-type: none"> • Define jurisdictions. Support modernization of transportation funding. • Regulate the “driver” when it is the vehicle.
State	<ul style="list-style-type: none"> • Set rules for operation, driver licensing, insurance, & liability • Enacting & enforcing traffic laws & regulations 	<ul style="list-style-type: none"> • Testing, registration & use of automated vehicles • Set operation rules, incentives for pooling & efficient operation • Modernize insurance & liability rules
City & Regional (MPO)	<ul style="list-style-type: none"> • Build & maintain infrastructure • Manage transit systems • Planning & policy • Program funding • Collect & analyze data 	<ul style="list-style-type: none"> • Modernize transit • New parking management considerations • Set rules for data sharing & use

C/AVs have the potential to bring incredible benefits, like near zero crash fatalities or injuries, increases in highway capacity, reduced vehicle size and weight, and increased access for seniors and people with disabilities. But their precise impacts on infrastructure, travel behavior, land use, vulnerable road users, and equity are highly uncertain. A 2016 study from the US Department of Energy²³ found smart mobility solutions such as connected, electric, AVs have the potential to reduce energy consumption in the transportation sector by 90%, or increase it by 200% by 2050 if thoughtful policy is not put in place to mitigate the effects of people abusing this technology.

C/AVs may reinforce auto-oriented sprawl, increase VMT and emissions, and undermine *New Visions* goals. Policy and planning decisions now will determine which way the scales tip. Policies will need to be enacted to prevent cars from driving around without occupants, additional economic incentives will need to encourage shared use of vehicles and make it expensive to ride as a single occupant. If not, it is highly likely that our roads will see an increase in traffic as our single occupant cars are replaced by single occupant AVs which do not park, but circle or run errands while owners are at work, school, restaurants, movies, etc. new ways of funding transportation will become increasingly important as electricity replaces gasoline as the fuel of choice, and usage is decoupled from our current method of funding road projects, the gasoline tax.

²³ U.S. DOE SMART Mobility Initiative White Paper

The timeline for full integration into the vehicle fleet is uncertain. There is also debate about some of the potential impacts of full implementation of this innovation. However, the following statements about potential impacts can be made:

Potential for near zero crash fatalities, near zero crash injuries- The safety impacts of totally automated vehicles potentially could be more significant than near-term crash avoidance technologies already emerging in the market place. By removing driver error, experts have suggested all vehicle crashes could be prevented, including vehicle/pedestrian crashes and vehicle/bicycle crashes. However, the first recorded case of a pedestrian fatality involving a self-driving car was in 2018 in Arizona. This crash has generated more skepticism of the technology and has given planners and engineers insight into the technology's shortcomings. Because the pedestrian was not in a marked crosswalk, the vehicle did not recognize a woman as a pedestrian and failed to slow or stop. Safety of vulnerable users like bicyclists and pedestrians must be a priority in roadway design but especially when considering C/AVs.

Significant increase in highway capacity- On Interstate highways and expressways, narrower lanes, higher speeds, and closer spacing between cars may become feasible and safe. This would mean higher capacities on highways. Crash related incidents could be essentially eliminated, and congestion could be dramatically reduced without widening facilities. While it is possible that increases in speed could induce more traffic and longer distance driving, offsetting the benefits of increased capacity, these potential effects are unknown. Reduction in congestion would seem to be the most likely outcome in the Capital District. Capacities on arterials would also increase, without increasing speeds, due to more efficient traffic flow at intersections.

Potential for light vehicles- electronically crash-proofing vehicles could mean that, in the future, it may be possible to make vehicles lighter—which will make them less expensive and more energy efficient.

Seniors & people with disabilities may experience increased mobility- Fully automated vehicles (Level 5) would mean that the driver is not needed to be in control of the vehicle but would simply tell the vehicle where to go. Younger people could potentially “drive” as well, with parental supervision. However, some mobility impairments may preclude some from being able to take advantage of the technology, as they cannot board and disembark without assistance.

Potential Impacts on Transit- The impacts of C/AVs on transit are unknown. It is possible that in some markets, totally automated vehicles could make transit less competitive, but it is also possible that in some markets, transit could become more competitive and attractive. For example, automated shuttles could bring people to main line transit stops. In addition, totally automated transit vehicles could increase transit viability.

Potential Impacts on Smart Growth- It is difficult to predict the impact of totally automated vehicles on development patterns. It is possible that commuting a longer distance will become more stress-free and more attractive, encouraging development further away from urban centers. However, auto use will still have a cost that will increase with distance. Totally automated vehicles could also make urban centers more attractive and more accessible. The increasing market appeal of urban living may counterbalance the attractiveness of driving longer distances hands free.

Totally Automated Trucks- Freight movement can also be impacted in many ways that are difficult to foresee with certainty. In the relative near term, trucks may be able to operate on Interstate highways without a driver,

so that a driver would only be needed once the truck leaves the Interstate. This could allow a driver to rest while the truck is in operation, increasing the number of hours a driver can spend safely operating the vehicle, and therefore leading to significant reductions in cost.

Potential Disadvantages – These include privacy concerns of users, equity, safety, and how the system will transition from a mixed fleet to 100% C/AVs. Increased connectivity of the transportation system and travel information requires MPOs and DOTs to make cybersecurity a priority. This includes smart data policies and protecting the privacy of individuals. Another important issue will be equitable access to technology for low-income and disabled individuals. A third concern is the transition period when totally automated vehicles will be mixed with vehicles operated by human drivers.

Technological Convergence: Vehicle Automation, Electrification, and MaaS

Automation is not an all or nothing proposition. Different automakers are pursuing a variety of paths to a fully self-driving vehicle, with some choosing to focus driver assistance features to begin the transition while others are pursuing level 4 or 5 from the beginning.

As mentioned, C/AV technology already exists and has been integrated into vehicles that are already traveling on public roads. Some Automakers have set targets to deploy C/AVs like GM which plans to roll out a vehicle in 2020 and Volvo in 2021. These will be the first commercially available AVs operating outside of controlled pilot projects, but the transition to a fully autonomous future will take some time. However, most projections agree that by 2045, the vast majority of all types of vehicles will have achieved level 5 autonomy, meaning the vehicles control themselves 100% of the time through artificial intelligences (AI), LIDAR, radar, cameras, 3-D mapping, connectivity with other vehicles, and connected infrastructure.

As automakers are designing and building C/AVs, they are also investing heavily in EVs to meet fuel efficiency standards and mandates in some countries that have planned to ban internal combustion engines by 2040 (i.e. France). Banning internal combustion engines by 2040 is an extremely ambitious goal, however many experts believe EVs will be so advanced and so much cheaper to own and maintain by 2040, no one will be manufacturing internal combustion engines by that date²⁴. As EVs and AVs converge, the result will be vehicles capable of moving people and goods in more efficient ways. This potential efficiency refers to energy, usage, physical space, individual productivity, and travel time.

Table 5 explores a number of scenarios under a C/AV future, their impact on the transportation system, and what the consequence for GHGs they might have. There are an infinite number of scenarios of C/AV impacts and many competing narratives and theories on how C/AVs will reshape the transportation system, and the table only highlights a few.

²⁴ <https://www.bloomberg.com/news/articles/2017-07-26/the-market-will-kill-oil-before-the-government-does>

Table 5. Potential Impacts of C/AVs on GHG Emissions

AV Scenario	Upshot	Impact on GHGs
Shared AV Fleet	VMT is significantly decreased	↓
Electrified AVs	Low to no emissions	↓
Expanded mobility	Seniors & people with mobility impairments can drive more and VMT increases	↑
Platooning vehicles	Road capacity & VMT increase	↑↓
Denser development	Walking, bicycling, & transit increase & VMT decreases	↓
Sprawl Inducing	Increased VMT	↑
Equitable access	Enhanced mobility options in underserved communities may increase VMT but may also benefit transit modes, leading to net VMT decrease	↑ ↓
Reduced demand for parking	AVs could operate without ever parking & increase VMT or parking spaces and lots could be redeveloped to support dense development & multimodalism, which could reduce VMT	↑ ↓
Increased highway speeds	AVs can travel faster, safer, which uses more energy	↑
Vehicle right-sizing	The average vehicle occupancy is 1.67 ²⁵ , but on-demand mobility could match individuals to a vehicle sized to match the needs of the trip, therefore reducing vehicle size which would use less energy.	↓
Increased long distance travel	Less driver burden could transfer trips typically taken by rail, intercity bus, or air to AVs	↑

Predictions on how long the transition to a full level 5 AV fleet will take vary wildly with many people believing the transition will take at least 30 years. However, recent report from RethinkX, an independent think tank which analyzes and forecasts the speed and scale of technology driven disruption and its implications predicts much faster transition enabled by MaaS business models. Under a scenario in which MaaS becomes the default, replacing the current dominant structure of individually owned cars, a much faster transition to an autonomous future is possible.

When highways were introduced, we were promised faster travel, less traffic, and fewer collisions, greater personal mobility, and so much more. Many of these benefits are promised again with AVs. Much like the highway system of the last century, AVs have fantastic potential and will most certainly bring tremendous benefits to society. Also like the highway system, they have the potential to exacerbate existing problems like sprawl, and create new, unforeseen challenges. If the policies governing these technologies are not carefully thought out, leveraging the best practices and heard learned lessons learned from the past century of transportation planning around personal automobiles, the many benefits these technologies promise could easily be outweighed the negative aspects of these innovations.

Assessing the potential future impacts of C/AVs with certainty is not possible as demonstrated earlier. The concept of scenario planning is useful for dealing with uncertainty in forecasts of the future. Transportation infrastructure

²⁵ Davis, S.C., Diegel, S.W., Boundy, R.G., 2012. Transportation Energy Data Book: Edition 31. Oak Ridge National Laboratory, ORNL-6987. July, 2012

investments have long lasting impacts, and for this reason New Visions principles must provide a policy and programming framework that improve safety and mobility for all residents now and beyond 2050. Given this uncertainty, but based on what we do know about C/AVs, CDTC proposes the following policy:

Potential for totally Level 5 C/AVs to impact highway and bridge design - In designing for new capacity projects, intersection projects, and other infrastructure projects, 20-year traffic forecasts are considered, and for bridge projects, 30-year traffic forecasts are considered. The New Visions Plan has strong policies against the addition of physical highway capacity except under certain conditions. The design process currently seeks to provide level of service “D” or better in the design year (either 20 years from now or 30 years from now). The New Visions Plan asserts that future potential congestion is a lower priority than existing congestion, which in many locations is worse than level of service “D”. The potential for future increased capacity resulting from totally automated vehicles should be strongly considered in highway and bridge design. Designing a larger footprint to anticipate 2040 or 2050 traffic conditions may be totally unnecessary if automated vehicles are fully established in the fleet by then. Designing a larger footprint that is unnecessary is not only prohibitively expensive but can work against the New Visions policies to encourage complete streets and demand management. The NYSDOT should consider if changes to the current design approach are needed to reflect potential changes in future demand as well as potential changes in the congestion threshold that triggers a need for increased capacity. Further, as C/AVs and other technology changes emerge, the NYSDOT should work with its partners within the American Association of State Highway and Transportation Officials (AASHTO) and the FHWA to consider implications to design standards such as lane and shoulder widths.

Climate Resiliency & Readiness –The safety, reliability and sustainability of transportation infrastructure in the Capital District is threatened by a range of climate change impacts. These disruptions to the system can have cascading impacts to the economy, public health, and quality of life. The region can build resilience by bolstering existing infrastructure and planning ahead for new conditions in 2050 and beyond. Research shows that for every \$1 spent on mitigation, an average \$6 is saved. Committing resources to mitigating the impacts of hazards that occur due to the climate crisis, in the planning process can save both local and state governments money and avoid injuries, death, and losses to private property.²⁶

Areas of New York are in areas that are prone to hazards, such as flooding and landslides. Certain types of soils have a higher risk of landslide susceptibility. In the Capital District, locations in the Hudson and Mohawk River Valleys, with steep slopes, are prone to landslides. Landslides have occurred in the region as recently as 2018, when a broken water line caused a hillslope to fail and mud to rush into the first floor of a Schenectady home. The aftermath was the demolition of multiple homes. Two previous landslides had occurred on the same ridge since 1996. There have been similar incidents in Albany County. While the Department of Homeland Security and Emergency Services (DHSES) and the Federal Emergency Management Agency (FEMA) provide hazard mitigation funding for eligible mitigation planning and projects, better planning and investing in resilient infrastructure is needed on the local level.

²⁶ <https://mitigateny.availabs.org/>

The threat of such hazards highlights the importance of environmental mitigation mapping and promotion of smart land use. The ongoing climate crisis means more unpredictable weather patterns and an increase in frequency of extreme rainfalls, which can be directly correlated to an increase of landslides, as well as other events like flooding. Changing forest and vegetative cover, another cause of landslides, will also be affected by the climate crisis, as well as development, stormwater (or rainfall) management, and land use decisions. Infrastructure failures and flooding can have a crippling impact on the region and necessitate a change in the way we plan, design, construct, operate and maintain critical infrastructure elements in order to build a more resilient Capital District.

The 2019 *NYS Hazard Mitigation Plan* provides up-to-date risk data for regions and communities to assist with local mitigation planning. Some MPOs, like the Genesee Transportation Council in the Rochester metropolitan area, have developed tools to assess the vulnerability of transportation infrastructure to natural and man-made hazards and provide guidance on how to implement resiliency planning efforts. CDTC maintains maps of the location of bridges, culverts, and other vulnerable assets in the region in relation to the continually updated FEMA floodplain maps (See maps in Appendix B). The Capital District must continue to incorporate this data and hazard mitigation strategies into local transportation planning efforts.

Landslide in Schenectady in 2018



Photo credit: The Daily Gazette

Impervious surfaces, like asphalt and concrete on roads, bridges, sidewalks, and trails, create stormwater runoff, which pushes contaminants into water resources and damages the built environment through erosion. Cities throughout the region have incorporated strategies like green infrastructure into their planning and design process for transportation and other infrastructure in order to reduce stormwater runoff and mitigate the impacts of heavy rainfall events. “Green infrastructure” refers to water management practices that mimic the natural water cycle. This can include reducing impervious surfaces by incorporating porous pavement and other sustainable materials into construction of roads and streetscapes, but it can also mean integrating plantings and gardens that allow rain and runoff to infiltrate the soil rather than ponding or pushing large amounts of water away from the ground.

Protecting and improving the water quality of the two major water bodies in the region – the Hudson and Mohawk Rivers – is a major regional priority. Water quality and the region’s connection to these important waterfronts should be a consideration in planning and design of transportation infrastructure. Similarly, thinking about how infrastructure can be designed and constructed to prevent flooding and other hazards during heavy rainfall must be a priority now and into the future. Mitigation can interrupt the cycle of disaster damage, reconstruction and repeated damage. Table 6 below

shows how costly flood damage can be, but it doesn't account for other economic losses, like long-term business shutdowns and decreased revenues from sales and tourism, or the impact to lives and health.

Table 6. Reported Losses from Flooding Events in the Capital District*

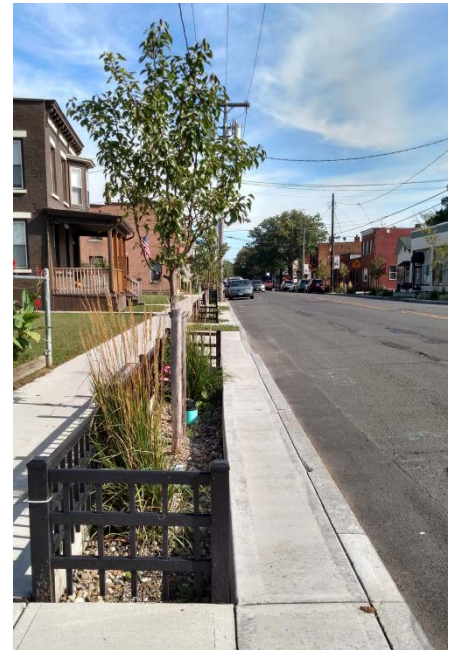
County	Damage (\$M)		No. of Events		Severe Events	
	1996-2017	Annualized	1996-2017	Annualized	1996-2017	Annualized
Rensselaer	\$ 6.89	\$ 0.31	47	1	2	0
Albany	\$ 3.75	\$ 0.17	87	1	1	0
Schenectady	\$ 3.02	\$ 0.14	37	0	1	0
Saratoga	\$ 0.89	\$ 0.04	63	1	0	0
Total	\$ 14.55	\$ 0.66	234	3	4	0

*does not include losses from floods resulting from Hurricanes

Source: <https://mitigateny.availabs.org/>

Resilient infrastructure can help mitigate the impacts of the climate crisis but will not fix or slow the damage caused to the environment from GHG emissions. Reducing GHG emissions from transportation is the most effective resiliency strategy. As mentioned earlier, the Capital District is in a good place for EV adoption and deployment, but transportation choices are not available to all residents. Being able to move around the region, even without access to a private vehicle, supports individual's ability to thrive and pursue opportunity. Reducing vehicular trips, by linking residential, employment, and retail areas and developing a network of alternative transportation infrastructure improves the region's resiliency and significantly reduces GHG emissions.

Trails and sidewalks are important transportation facilities that can provide low cost opportunities to integrate green infrastructure into the transportation system. They are essential to supporting zero emission modes like walking and bicycling and create links to transit and parking facilities. Related to resiliency, a robust alternative transportation network and variety of energy sources (petroleum, biofuels, electricity, etc.) improves security and ensures that in the case of a long-term power outage or need to evacuate, people can continue to move throughout the region as necessary.



Route 32, Watervliet

Equity Considerations

CDTC's Equity Advisory Committee works to ensure CDTC's conformance with Title VI regulations and Environmental Justice. It makes certain that CDTC takes reasonable steps to secure access to opportunities that ensure no person is denied benefits of CDTC's planning process on the basis of minority and/or low income status, and to identify and address disproportionately high and adverse human health or environmental effects of CDTC's programs, policies, and activities on minority and low-income populations. It accomplishes this in part by promoting collaborative problem solving on issues related to Environmental Justice and Title IV, and providing input on the most effective methods to engage and respond to Environmental Justice and Title VI populations.

The Equity Advisory Committee reviewed the major components of the *New Visions* technical papers and provided feedback on recommendations. While CDTC maintains the Equity Advisory Committee, the purpose is not to make equity a stand-alone topic, but a lens in which all program areas, services, and projects are evaluated, debated, and considered.

EVs

- While EVs have the potential to significantly improve air quality and reduce GHG emissions, the source of the electric used to power them may not. Siting of electricity generating facilities must not create undue burdens on minority and low-income populations/communities.

C/AVs

- C/AVs will expand mobility for some people with disabilities, such as the visually-impaired, however people with disabilities who require assistance from the driver won't be able to use driverless cars.
- C/AVs have the potential to significantly increase VMT and it will be important to prevent the impacts of this increase in traffic from disproportionately affecting disadvantaged communities.
- The cost of owning or using a C/AV could be more expensive than it currently is to own a private vehicle and more people will be without reliable transportation if other modes and services aren't expanded and well-funded (e.g. transit).
- C/AV technologies could be leveraged to improve access to transportation for rural populations, but may require subsidies or additional services for low-income rural residents.
- While potential safety benefits of C/AVs are documented throughout New Visions 2050, it is important to note that this is conjecture and there is still no definitive conclusion about whether C/AVs are in fact safer than human drivers.
- If C/AVs increase VMT, there will be more conflicts with bicyclists, pedestrians and non-automated modes.
- C/AV competitiveness with transit is a concern and there is a fear that transit service will shift to the subsidization of C/AVs, particularly in lower ridership areas.
- Social, emotional, and economic impacts of C/AVs are also still unknown and of concern. Automation has had a significant impact on jobs and the economy and C/AVs will deepen that impact while also crating negative societal and interpersonal impacts as people spend more time by themselves, if rides are not shared and transit service degrades.

CDTC is sensitive to these concerns and has proposed planning and investment principles that take a proactive approach to transportation and land use planning to minimize impacts to disadvantaged populations.

Getting There

The metropolitan planning process is continuing, collaborative, and comprehensive. The goals laid out in the long-range plan can only be achieved through a performance-driven process that evaluates and prioritizes strategies and plans, based on feedback on an ongoing basis. This "feedback" includes data collection, policy change at the state and federal levels, the driving forces mentioned earlier, budgets, and extensive public outreach and involvement. CDTC provides guidance to local governments in coordinating their planning initiatives with the goals and principles laid out in New Visions. Guidance comes in the form of competitive grant programs, technical assistance, training, resource development, and networking.

CDTC implements the priorities and principles in New Visions through the TIP and UPWP. Projects proposed to be programmed on the TIP must be consistent with New Visions principles, which are woven through the project evaluation process. The UPWP outlines the planning activities and initiatives through which CDTC promotes the priorities and principles of New Visions. The following section recommends strategies, concepts, and initiatives to be integrated into the CDTC metropolitan planning process. They consider the four basic and two overlap scenarios that will influence land use and personal mobility but reflect the goals, which prefer a future transportation system that prioritizes the movement of people in a way that reduced GHG emissions and preserves a high quality of life in the region.

The CDCC is a resource that is unique to NYS MPOs. The program is funded through the U.S. Department of Energy and provides opportunities and support to CDTC to do outreach and education not just related to transportation systems, but also to alternative fuels and vehicle technologies and their required infrastructure. Some recommended actions contained in the long range plan might fit better into the CDCC Operating Plan or crossover between Coalition and MPO activities.

A Toolbox Readiness Strategies for the Capital District

Action: Build a Virtual Forum for Cross-Disciplinary Coordination & Networking

The CDTC Smart Communities Task Force is a forum for the public and private sector to meet, network, and coordinate the integration of technology in the transportation system. The rapid changes brought about by technology impact a diverse array of sectors and organizations in the Capital District. The multi-dimensional nature of these impacts requires coordination and integration among these groups in order to maximize available resources and develop a shared vision and framework for how technology can improve mobility, accessibility and equity, and what metric should be used to evaluate the region's progress.

The Task Force is the in-person forum for implementing a Smart Communities program. CDTC should expand upon this network by developing a virtual forum that supports research being conducted locally and elsewhere and help circulate or deliver resources related to emerging technologies meant for non-expert audiences. The forum should help facilitate connections and coordination between public and private sector stakeholders and serve as a central location for data, guidance, tools, and resources.

Subtask: A virtual forum can lay the groundwork for the development of a Smart Mobility Innovation Lab that supports region wide events, pilots, and public engagement and works with colleges, universities, and Cyber security experts to build a framework for implement energy efficient mobility systems in the Capital District.

Subtask: Explore the feasibility of developing an open data portal. A public platform for exploring and downloading transportation-related spatial and other data as well as datasets of our partner agencies would be a valuable tool for CDTC members and other entities within the Capital District. A key component to "Smart" Communities is the use of data to solve complex challenges communities are facing and/or anticipate.

Action: Develop a Climate Resiliency Plan & Vulnerability Assessment Tool

While there are federal and state level resiliency tools and guidance, local assessments of vulnerable transportation infrastructure and the impact of potential hazards and climate stressors (urban flooding, changes in freeze/thaw, etc.) is needed. Additionally, guidance on maintenance and construction of infrastructure in the face of the climate crisis will reduce vulnerabilities and make the region more resilient. This might include strategies for integrating green infrastructure into federally-funded local transportation projects and/or innovative construction techniques and materials.

Action: Identify & Prioritize “Smart Corridors”

Integrating and implementing new mobility and emerging technology requires the consideration of all modes of transportation, adjacent land uses, and connections within the street network(s). The corridor approach that CDTC promotes through the Transportation and Community Linkage Program can be modeled to identify and plan for connected, smart corridors that respect and enhance the natural and human environments, are consistent with *New*

Visions goals, and support mobility. For example, the region might identify a frequently congested major arterial that could benefit from smart signals and other technology & mobility concepts discussed in this paper to move people faster and easier. This might be an existing or potential bus rapid transit route.

Action: Develop AV-Readiness Guidance for Municipalities

The transportation revolution is at the Capital District’s doorstep. The combination of electrification, automation, and MaaS could be the key to reducing GHG emissions and slowing the impacts of the climate crisis. It is exciting and full of both opportunity and potential as it opens up mobility solutions to populations who have long been excluded from driving like the disabled, elderly and youth. But the uncertainty of a timeline or actual impacts leave transportation planners and decision-makers with more questions than answers as they plan for and invest in transportation infrastructure and programs. Additionally, AI and automation could lead to job losses which could mean more households and individuals living in poverty. Managing the changes required in the next three decades will be an immense challenge, but a century of transportation planning has given us the tools we need to guide our communities through this time of change.

CDTC must develop a regional vision for how C/AV technology will be adopted and supported. This vision should identify existing transportation gaps that create barriers to jobs, services, and other opportunities, and explore how C/AV technology can address them. How can towns, cities, and villages working to pass or implement Complete Streets legislation consider C/AVs and what policies are needed to ensure they are safe, efficient, and help achieve regional sustainability, economic, and safety goals. What policies and programs should be explored to achieve a preferred

In early 2019, multiple ships broke loose on the Hudson River, slamming into the Livingston Avenue Bridge. The incident was caused by rising waters & ice jams from rapidly fluctuating temperatures (cold to warm & back to cold) in the region.



Photo credit: WNYT Albany

scenario? Table 7 lists recommendations from the University of Florida’s Transportation Institute for MPOs in planning for C/AVs and advanced technologies.

Table 7. University of Florida's Transportation Institute Recommendations for MPOs in AV-Readiness Planning²⁷

AV-Readiness Planning Recommendations for MPOs	
1	Define organizational roles & responsibilities, establish leadership, engage new stakeholders, & support a continuous program to facilitate efficient transition to new practices.
2	Establish a program of continuing education & knowledge sharing focused on planning implications of C/AVs.
3	Explicitly include C/AVs in transportation plans.
4	Undertake scenario planning exercises.
5	Undertake exploratory modeling/forecasting exercises & use pilot studies to inform enhancement of forecasting models.
6	Start data collection initiatives to monitor emergent trends in technology/services adoption & shifts in travel behavior patterns.
7	Establish potential “dates of decision” for making policy changes to planning/forecasting procedures.

Action: Adopt new technologies & tools for virtual public involvement

As the region experiences the impacts of rapid technological change, it still struggles to adapt to social and cultural change. Public involvement is a critical component in the transportation decision-making process. It allows for meaningful input from individuals that use the transportation system daily. Good public engagement strategies can accelerate project delivery by addressing public concerns early in the planning process and reducing delays from previously unknown interests late in the project delivery process. A thoughtful public engagement plan also builds trust between the public and the government agencies implementing projects. The traditional town hall meeting is not convenient or accessible to everyone and the obligation to communicate plans and projects is on government, therefore agencies like CDTC must find alternative, innovative ways to connect with people and engage them in the transportation planning process.

Virtual public involvement (VPI) includes a host of tools and platforms that can efficiently be made accessible to communities, at a low cost, to communicate essential project information and collect comments. CDTC should research and evaluate available VPI tools and how they can be used to develop quick videos, crowdsource data and information, conduct polls, visualize projects, and build a social media following. Better public engagement also means cultivating relationships with unconventional partners and stakeholders, such as local bloggers and media that can help expand CDTC’s reach.

Action: Compile GHG Emissions Data from Transportation

There is currently no single source of GHG emission data from transportation for the Capital District. In 2010, CDRPC commissioned a regional inventory that compiled GHG data for each sector (buildings, waste, transportation, etc.) by municipality. The information provided a baseline for many communities as they began to implement clean energy and sustainability projects in response to residents’ demands that their local governments help combat the climate crisis and

²⁷ University Of Florida, The Florida Department Of Transportation
Research Office, *Surveying Florida MPO Readiness To Incorporate Innovative Technologies Into Long Range Transportation Plans*, August 2016

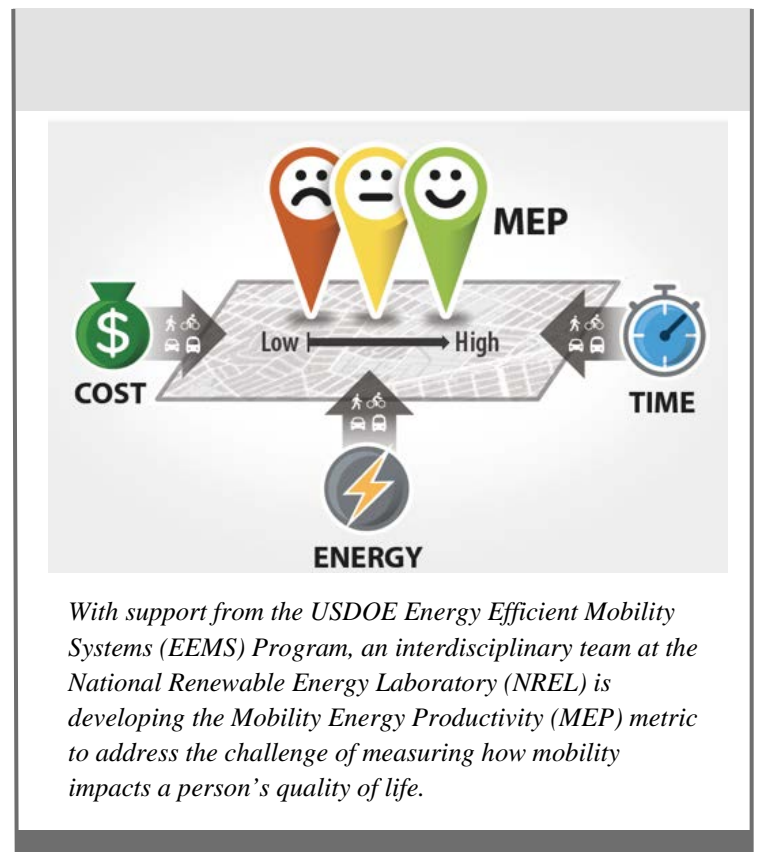
build more sustainable and resilient communities. Since then there has been no known effort to compile the same data to compare and evaluate progress the region has made. CDTC should coordinate with CDRPC to compile GHG data, at least for transportation, regularly.

Action: Adopt the MEP Metric

Emerging technology has fueled a new era in transportation planning. Changing mobility services, transportation information, and travel behaviors have changed traditional ways of thinking about how infrastructure investments impact the mobility of a place or a region. Cities and towns are wrestling with a wide range of issues – resiliency, congestion, and sustainability – but measuring success in how these places and region are making progress on resolving these has been difficult. Most commonly used metrics measure or address a single mode and overvalue trip time over overall performance, trip costs, and energy consumption.

The U.S. Department of Energy has developed a metric to these challenges. The metric is referred to as “Mobility Energy Productivity (MEP)” metric and its intent is to primarily track changes in mobility within a single city, location, or place over time. According to the USDOE, “the metric can measure current levels of mobility at a specific location, and then test how various technological advancements, services (e.g. scooters, ride hailing, C/AVs) and infrastructure investments (e.g. bike lanes, mixed-used development) may impact the mobility of that location over time.” The MEP metric considers transportation options, cost, energy, and even the total number of opportunities accessible from a given location within a certain time frame. Unlike traditional measures, MEP assesses a place or region based on mobility options at a given location regardless of whether an individual has access to a private vehicle.

The MEP methodology combines land use and other data with the regional travel demand model. The output is geographic data (a map) that indicates a location’s MEP based on how far an individual can travel within a certain time boundary (15-, 30-, 45-, and 60-minutes). The time to reach a destination is weighed against the number of available travel options, the cost, and the amount of energy required to get there. This metric is useful in evaluating and comparing infrastructure investments, such as adding a lane to a congested roadway versus dedicating a lane to an express transit route. It’s also useful in comparing the cost of building new infrastructure to accommodate vehicles (cars, buses, or bikes) to subsidizing transit or bike share trips.²⁸ A MEP Fact Sheet developed by USDOE can be found in Appendix D.



²⁸ USDOE NREL, Measuring Mobility Potential, October 2019

The uncertainty of the impacts of new mobility services and C/AVs requires the metropolitan planning process to employ new planning and programming strategies. CDTC should evaluate whether the MEP metric is useful in implementing the New Visions 2050 principles. This will require connecting and collaborating with NREL and other USDOE laboratories.

Funding the Plan

Funding levels will dictate the pace at which CDTC can initiative programs and municipalities can implement infrastructure projects. A decrease or flattening of funding will likely lead to the continuation of a car-centric, petroleum-based system. Current federal transportation legislation, the FAST Act, is funded through the end of 2020. A 21st century transportation system will require investments in technology, mobility services, and resiliency strategies. Some of the concepts discussed in this paper may be excluded from federal funding eligibility requirements, which can slow or hinder a transition to a modern transportation system unless alternative funding sources are available.

The TIP Project Evaluation Methodology prioritizes projects that meet New Visions principles. Proposed projects and programs that estimate GHG emission reductions should continue to be prioritized. Projects that increase GHG emissions should not be recommended for funding, or debated to explore alternatives and compromises where possible. If CDTC adopts the MEP metric, it should be considered for incorporating into the TIP project evaluation methodology.

- Balance the investment in alternative modes of transportation with ongoing maintenance and preservation needs of other infrastructure.
- Support shared mobility services, or MaaS, through transportation planning initiatives, programming, outreach, and education
- Leverage partnerships to attract private investments and sponsorships of transportation plans and projects.
- Participate in the development of the Northeast Low Carbon Transportation Network framework to encourage the investment in projects and programs that reduce GHG emissions with anticipated revenues.
- Research the feasibility of local congestion pricing.
- Encourage municipalities to adopt dynamic parking pricing and curb management. Collected fees can be invested in alternative modes, smart technology, and other programs.

Smart Community Indicators

How will CDTC measure progress in developing a transportation system that achieves the goals outlined in New Visions 2050? Below is a framework of suggested performance measures or “indicators” that will help gauge the region’s progress in developing a transportation network that meets the goals mentioned earlier. The indicators require collecting, analyzing, and reporting information regarding the performance of the transportation system and environment.

Social, economic, environmental, and especially technological changes will affect the progress of meeting New Visions goals. Transportation was revolutionized by railroads, canals, then roads in the early 1900s but today is being transformed by shared mobility, electrification, and automation. Technology and new mobility services are disrupting the transportation system in ways we haven’t experienced. In order to support the continued improvement and development of Capital District communities and maintain a high quality of life, issues of traffic congestion, accessibility, and emissions must be addressed. These 21st century revolutions create an opportunity for CDTC and local governments to approach planning and programming proactively and systemically instead of fragmented and reactionary.

Table 8. New Visions 2050 Performance Measures

Measure	Data Source
Greenhouse Gas Emissions from Transportation	TBD
Energy use from Transportation	TBD
Percent of TIP that invests in projects with a positive impact on GHG emissions	TIP/STIP
Volatile Organic Compounds (VOCs) & Nitrogen Oxide (NOx)	NYSDEC
Petroleum Displacement	CDCC Annual Fleet Survey

Community-readiness will shape how the region allows these forces to affect them. It is important to consider the potential impact of each of these scenarios on the suggested performance measures in order to select strategies and investment priorities for the long-term preservation and adaptability of the regional transportation system. Scenario planning helps to capture the potential influence of policy or regulation to encourage movement towards a preferred future. Decision-makers can select a preferred scenario and identify appropriate strategies and actions that will lead toward that vision. Figure 17 illustrates how the different scenarios could affect the suggested performance measures.

A key indicator of environmental health in relation to the transportation system is the amount of GHGs from transportation. If VMT increases at a disproportionate rate to population growth and if the vehicle fleet does not shift to electric over time, GHGs will continue to increase. However, if investments in alternative transportation infrastructure and mobility programs and EV infrastructure are effective, GHGs from transportation should decrease. Because of the direct relationships between GHGs and how people move around the region, this will be a primary indicator that CDTC monitors to track progress in the adoption of technology and stewardship of the environment.

Figure 17. Anticipating the Impact of Scenarios on Environment & Technology

Measure	Scenario			
	A	B	C	D
Greenhouse Gas Emissions from Transportation	↔	↑	↓	↓
Energy use from Transportation	↔	↑	↓*	↓*
Percent of TIP that invests in projects with a positive impact on GHG emissions	↔	↓	↑	↑
Volatile Organic Compounds (VOCs) & Nitrogen Oxide (NOx)	↔	↑	↓	↓
Petroleum Displacement	↔	↓	↑	↑

*Assumes the successful implementation of the Climate Leadership & Communities Protection Act which requires NY to get all of its electricity from carbon-free energy sources by 2040 & then reach net zero emissions by 2050.

Conclusion

This plan outlines how CDTC has moved the region forward through its support for environmental stewardship and adoption of emerging technologies. However, obstacles like funding availability and education still remain. As social, environmental, economic, and especially technological conditions change, policymakers must have the dexterity to adapt, through policy and investment decisions. In its role as the MPO for the Albany-Schenectady-Troy and Saratoga Springs metropolitan areas, CDTC will continue to promote environmental stewardship and smart technology to develop a sustainable and resilient transportation system. CDTC will develop tools and programs that assist communities as they prepare, design and maintain an accessible and safe transportation system for the next generation.

