Transportation

CLIMATE ACTION FACT SHEET

Promote residential adoption of electric vehicles

STRATEGIES TO ENCOURAGE RESIDENTS TO CONVERT PERSONAL VEHICLES TO ELECTRIC

Description and purpose of strategy: This fact sheet will help municipalities understand the economic and equity implications, best practices, and state of practice of encouraging adoption of electric vehicles (EVs) for residents and Cape visitors. This includes insights about the return-on-investment of EV adoption, adding public and private EV chargers, encouraging EV rentals, and updating zoning to encourage EV spaces.

Content of fact sheet: Overview of the costs and benefits to individuals in Barnstable County switching from internal combustion engine vehicles to EVs, overview of the current state of EVs in Massachusetts and the county, and information on the current incentives for switching to EVs.

Implementation support: This fact sheet expands upon strategies and actions from the Climate Actions Database, which can be found at: capecodcommission.org/climate.

BENEFITS

- ☑ Greenhouse gas (GHG) emissions reductions or sequestration
- ☑ Health improvement from reduced pollutants
- ☐ Increased recreation
- ☑ Lower maintenance/operational costs
- ☐ Environmental enhancement/protection
- ☐ Less damage to infrastructure
- ☐ Higher property values
- ☐ Increased resilience
- ☐ Job and economic growth

COSTS

- ☑ Higher capital costs
- ☐ Higher maintenance costs
- ☐ Higher operational costs
- ☐ Additional time for municipal staff to implement

KEY FINDINGS

Equity: Strategies to reduce potential economic burdens, such as ensuring accessibility to charging, could help maximize potential benefits to underserved populations and contribute to equitable distribution of outcomes.

Financial benefits: Encouraging adoption of EV technology, together with affordable public transit, can be cost-effective for EV adopters and reduce vehicle emissions.

Non-market benefits: Improvements in health from reduced local criteria air pollutants like NO_x, SO_x, and $PM_{2.5}$ and reduced use of fossil fuels are major benefits of increased EV adoption.

GHG reductions: Replacing internal combustion vehicles with EVs can reduce the amount of fossil fuels needed while also eliminating tailpipe emission.

Ease of implementation: Supporting increased adoption of EVs will require parking policy reform, zoning updates, and infrastructure investments in public charging stations. Vehicle owners may also need to invest in residential charging, though there are often incentives from utility.

BENEFIT COST ANALYSIS

Switching to EVs, particularly sedans, can be cost-effective while reducing emissions from vehicles.

EVs cost about half as much to maintain as internal combustion engine vehicles (ICEVs): $0.031 per mile for EVs compared to $0.061 per mile for ICEVs (Burnham et al., 2021). They also have lower fuel costs, especially when charged at home. Both reduced fuel and maintenance costs increase the benefits of driving an EV over time, so the more miles consumers drive their vehicles, the more financial benefits they will see. EVs also use fewer moving parts and often have better warranties, many offering eight years/100,000 miles (McKinsey, 2016). Finally, much of the additional cost for EVs is for batteries—but battery costs decreased from $1,000/kilowatt hour (kWh) in 2010 to $227/kWh in 2016 (McKinsey, 2016). They decreased for several more years before increasing in 2022, to $152/kWh, for the first time in a decade (Bloomberg, 2022). Due to supply chain issues during COVID-19 battery prices may have seen a short-term increase but may again experience a decreasing trend as supply increases and technology advances. The owner of a Chevrolet Bolt (an EV) will save over $12,000 over 10 years compared to a conventional Toyota Camry based on the up-front cost, as well as the annual fuel and maintenance costs.

Meanwhile, the emissions benefit of switching a single-passenger transit vehicle from gasoline-powered to electric-powered is over 77,000 pounds of carbon dioxide equivalent emissions, nearly 10 pounds of NO_x, over 2 pounds of PM, and over 0.5 pounds of SO_2. This reduces the societal cost of emissions by over $3,500 per vehicle over 10 years.

An important cost factor is the number of chargers needed to sustain EVs in an area. The table below shows the results of an analysis that used the EVI-Pro Lite tool to determine the number and type of chargers needed to support EVs in Barnstable County, based on the estimated number of light-duty EVs on the road in the county between 2021 and 2050. The tool estimated the number of workplace level 2 chargers, public level 2 chargers, and public direct current (DC) fast chargers needed, while taking into consideration the proportion of individuals who have access to home chargers. For two scenarios—the sustained policy (SP) scenario and an aggressive electrification (SER1) scenario—the table shows the year of each scenario, the number of EVs, and the number of each type of charger needed to sustain the estimated EVs in the county.

CHARGERS NECESSARY TO SUSTAIN EVS IN BARNSTABLE COUNTY

YEAR (SCENARIO)	LIGHT-DUTY EVS	WORKPLACE LEVEL 2	PUBLIC LEVEL 2	DC FAST
2030 (SP)	13,998	358	230	40
2040 (SP)	67,596	1,698	1,002	126
2050 (SP)	117,766	2,953	1,725	206
2030 (SER1)	69,269	1,740	1,026	128
2040 (SER1)	167,507	4,196	2,441	286
2050 (SER1)	214,025	5,359	3,110	360

SP = sustained policy, SER1 = aggressive electrification

In the SER1 scenario, the cost of chargers in Barnstable County in 2030 would total $10,781,000 for all 2,894 chargers. As the number of chargers increases to 6,923 in 2040 and 8,829 in 2050, the costs would rise to $25,252,000 and $32,104,000, respectively. The SER1 scenario reduces transportation emissions, resulting in a reduction of 0.78 million metric tons (MMT) of CO_2 in Barnstable County by 2030. This increases to 3.43 MMT by 2040 and 6.21 MMT by 2050.

While public chargers are necessary to fuel vehicles while traveling, home chargers are cost-effective, providing electricity at utility rates compared to public chargers that may charge additional fees. Utilities in Massachusetts currently offer incentives for purchasing and installing residential chargers (see the table of resources under "Implementation" below). Public chargers will often charge an access fee (a flat rate for a charging session), a station- or time-based fee (a certain cost per amount of time spent charging), and/or an energy fee (the cost of the energy) (Cape Cod Commission, n.d.).

In addition to reducing annual costs on fuel and maintenance, a shift to EVs would boost jobs in the automobile sector as well as create jobs installing charging stations in Barnstable County. An analysis by the Economic Policy Institute (EPI) found that 150,000 jobs would be created if the country moved to 50% EVs by 2030. Nationally, based on existing statistics, Black workers and those without four-year college degrees are likely to see the greatest benefit from these jobs (EPI, 2021). Additionally, the Institute for Energy Economic and Financial Analysis (IEEFA) found switching to EVs was a large driver in solar investments, thereby creating additional solar energy jobs (IEEFA, 2019).

EQUITY

Switching vehicles in Barnstable County can reduce emissions in the area most responsible for them: transportation. The up-front cost of EVs is steadily decreasing, and they are becoming more affordable with the addition of tax credits and incentives. Further, EVs cost much less for maintenance and fuel than gasoline-powered vehicles, especially when charged at home. The following are items to consider when creating programs to encourage residential EV adoption:

- **Financial accessibility.** EVs often cost more up-front than gasoline-powered vehicles, but their operation costs are much lower. Including incentives and tax credits can drastically bring down the cost of new vehicles and reduce overall vehicle ownership costs.
- **Geographic accessibility of charging.** It is important to ensure that chargers are equitably spread geographically and that they are easily accessible in lower-income areas. Funding programs such as the National Electric Vehicle Infrastructure (NEVI) Program require that a portion of funds be allocated to vulnerable communities.
- **Providing incentives for used vehicles.** Ensuring that incentives are not exclusive is essential to creating equity in the EV market. The Biden administration included tax credits for buying used EVs in the Inflation Reduction Act. Additionally, the Green Energy Consumers Alliance, a Boston-based nonprofit, helps educate consumers about the EV market and can help them find and purchase new and used EVs.

Optimizing Equity for Implementation

Ensuring benefits and costs are fairly distributed through the community is essential for equitable outcomes of EV adoption programs. Key concerns relating to EV supply and charging infrastructure include a project's affordability, accessibility, reliability, location, safety, and economic benefits. The U.S. Department of Transportation has compiled resources and recommendations for incorporating equity into EV adoption strategies. Key recommendations include supporting meaningful community engagement, conducting an outcome-focused community needs assessment, investing in transit and affordable mobility services (as part of a broader strategy for low-carbon mobility), and dedicating funding to address needs of traditionally underserved populations.

Nevertheless, there are significant barriers to EV adoption for vulnerable communities in terms of affordability and accessibility. In recognition of barriers and history of communities exposed to high-traffic areas, the NEVI Formula Program requires that 40% of charging funds be used in disadvantaged communities as identified in the Justice40 Initiative. Additionally, electric utilities in Massachusetts have proposed to offer rebates for the cost of charging infrastructure as well as the labor to install them. The rebates would be given out on a sliding scale, with low-income residents qualifying for higher rebates (Green Energy Consumers Alliance, 2023). These rebates will amount to nearly $400 million over the next 5 years throughout Massachusetts.

Examples of equity considerations in siting EV supply equipment were documented in a recent white paper by the American Council for an Energy-Efficient Economy. The Cape Cod Commission (CCC) developed a model municipal EV bylaw meant to encourage EV charging infrastructure and awareness of EV options. This bylaw includes EV-ready parking space calculations for single and multifamily homes.

Historically, low-income communities and communities of color are most exposed to pollution from high-traffic roads (Demetillo et al., 2021). Reducing emissions from gasoline-powered vehicles would improve air quality in high-traffic corridors. Special consideration for rural areas and EV infrastructure needs is essential.

Meaningful community engagement to identify local barriers to adoption, charging, and maintenance that acknowledges historical and cultural trauma and dynamics can help generate restorative solutions. Working with local trusted partners, leveraging data, and involving the community throughout plan development can improve program success and equity. Once charging sites are identified, collecting data on their utilization, reliability, and pricing is essential. The National Renewable Energy Laboratory has published a guide to energy justice relevant to transportation projects with more information.

STATE OF PRACTICE

General State of Practice

EVs are growing in popularity and becoming more affordable as battery prices decrease. Sales of plug-in EVs (including battery EVs and plug-in hybrid EVs) nearly doubled from 2020 to 2021 (U.S. Department of Energy, 2022). The federal government just instituted the first incentives to buy used EVs in the form of a tax credit. Additionally, several states—including Massachusetts—have either adopted or have begun rulemaking to adopt the Advanced Clean Cars II regulations, which require all new light-duty vehicles sold in the state to be zero-emission vehicles by 2035.

Cape Cod Context

As of early 2023, there are a total of 160 public charging stations in Barnstable County, including 136 level 2 chargers and 24 DC fast chargers (EERE, 2023). As shown in the "Benefit Cost Analysis" section above, more charging stations will need to be installed to keep up with the demand of the current trajectory of EV adoption. Transportation accounts for 55% of GHG emissions in the county and 42% in the state (Cape Cod Commission, 2021). This means that EV adoption will have a large impact on total emissions.

IMPLEMENTATION

While there is a social shift toward EV adoption, local government should take the following actions to increase the rate of adoption, ensure thoughtful infrastructure planning, and achieve strategic benefits. The actions include municipal actions, incentives, and advocacy (Friedman et al., 2021).

- **Municipality adoption of EVs.** Leading by example can show the residents of Barnstable County that EVs are reliable and affordable. This step involves purchasing EVs as well as purchasing and installing the charging infrastructure to fuel the municipal fleet.

REQUIRED EXPERTISE

Internal: Zoning boards can update codes to make them EV-friendly

External: Utilities can work with government to install chargers

CASE STUDY: ACTON, MA

Eastern Research Group analyzed the number and costs of public EV chargers to match demand at different proportions of EV ownership in Acton. With current EV ownership (1.6%), the town only needed eight public chargers. If the proportion of EVs were to increase to 20%, the town would need to install 78 more chargers (72 level 2 and two public DC fast chargers) at a cost of $400,000. At 50% EV ownership, the town would need 109 workplace chargers (level 2), 88 public level 2 chargers, and 17 public DC chargers. At 100% EVs, it would need 218 workplace chargers, 176 public level 2 chargers, and 34 public DC fast chargers, at a total cost of just over $2 million.

- **Expanding charging infrastructure.** One of the main deterrents of EV adoption is range anxiety. Regions can address this by installing adequate charging infrastructure. This involves a mix of workplace and public level 2 chargers and public DC fast chargers. Installing chargers in on-street parking spaces can increase visibility, encouraging use. In addition to public charging, increasing ease of installing residential or multi-unit dwelling chargers can further incentivize EV adoption. In its model bylaw, the CCC created three levels of recommendations to encourage EV charging infrastructure.
- **Establish EV-friendly zoning requirements.** Installing EV charging infrastructure can be complicated for residential, workplace, and local governments. Amending regulations so that installing charging infrastructure is easier and creating EV-friendly zoning requirements will support adoption. Governments and business owners can designate certain parking spots to be EV-only to allow as many EVs to charge as possible. One part of the CCC's model bylaw is encouragement for EV-ready parking spaces to meet the anticipated needs of EV-owning residents. The bylaw includes calculations to figure out the necessary number of EV-ready parking spaces in single-family and multifamily homes.
- **Incentivize EV purchases.** EVs still cost more to buy than ICEVs. Providing tax credits or rebates can encourage EV purchases. Local government can also help residents navigate the state or national programs available to them, as well as offering discounted EV parking or charging additional fees for ICEV purchases.
- **EV advocacy.** EVs have changed drastically since their inception, and there are still misconceptions and unknowns for residents. Local governments can play a role in educating residents through online material, public forums, and presentations. Additionally, they can adopt climate and health goals that involve EV adoption and explain how they will be achieved. Finally, municipalities can host/support EV showcase events to promote the technology.

There are many incentives for governments, workplaces, and residents to help defray costs and make EV adoption easier.

FINANCIAL AND TECHNICAL SUPPORT	
Siting Electric Vehicle Charging Stations on Cape Cod	Planning tool from the Cape Cod Commission to assist in identifying locations that could support EV charging infrastructure.
Massachusetts Offers Rebates for Electric Vehicles (MOR-EV) Program	Massachusetts program that provides a rebate for EV leases or purchases, up to $3,500.
Federal EV Tax Credit	Describes a federal tax credit, up to $7,500, for new plug-in EV or fuel cell EV purchases. There are qualifications: for example, SUVs, vans, and pickup trucks must cost under $80,000 and other vehicles must cost under $50,000.
Massachusetts EV Incentive Program (MassEVIP) Workplace and Fleet EV Charging Station Grants	Provides grants to non-residential establishments for 80% of the cost, up to $50,000, to buy and install level 2 charging stations. Provides grants for 60% of the cost, up to $50,000, for level 1 and 2 charging stations installed on educational campuses and at multi-unit dwellings.
Eversource Incentives	An example of the incentives various utility companies offer for buying and installing chargers in residential, workplace, and fleet locations.
Green Energy Consumers Alliance	Nonprofit that seeks to educate individuals and help them move to EVs. Offers an EV shopping tool that lets you test drive vehicles and take advantage of incentives.

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