



EV-SOLAR PURCHASE PROGRAM

A TRANSPORTATION ELECTRIFICATION CONCEPT

by

Alexander Walsh

Nick Nigro

Atlas Public Policy

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ABOUT THIS CONCEPT STUDY

The Transportation Electrification Toolkit helps Connecticut municipalities develop strategies to encourage transportation electrification through the pairing of electric vehicles and residential solar photovoltaic systems and electric shared-use mobility solutions. The toolkit consists of summaries of each transportation electrification concept, a case study of the concept from outside Connecticut, and potential approaches to deploy the concept for policymakers. The toolkit also consists of a resource library and interactive data dashboards that provide quick access to relevant information on transportation electrification in Connecticut.

The toolkit is a joint effort of Atlas Public Policy, Connecticut Green Bank, and the Connecticut Department of Energy and Environmental Protection.

In 2016, Atlas Public Policy began working with the Connecticut Green Bank and the Connecticut Department of Energy and Environmental Protection on the Green Bank's strategy to accelerate alternative fuel vehicle deployment in the state. Atlas began with a market potential assessment of various alternative fuels and vehicles tailored to local conditions in Connecticut. Atlas then identified promising electric mobility concepts, including electric vehicle shared-use mobility, the pairing of electric vehicles and residential solar, and high-powered electric vehicle charging infrastructure. Atlas evaluated the suitability of these concepts as part of a strategic planning process for the Connecticut Green Bank to help the Green Bank define its role in growing the alternative fuel vehicle market in the state.

CONCEPT SUMMARY

An EV-Solar Purchase Program encourages the combined use of solar PV technology and EVs. A partnership between a lead financing organization and local vendors would draw on the aligned interests and pooled resources of stakeholders to accelerate the adoption of both EV and solar PV technologies. A program that deploys solar and EVs together can help consumers realize the economic and environmental value of powering a home with solar and driving an EV.

The program is a community-based marketing and financing campaign that seeks to scale-up solar and EV deployment statewide. Local partners engage and educate consumers about the benefits of charging EVs with solar compared to driving conventional gasoline vehicles. Solar vendors would play a key role in engaging their customer base and spreading knowledge of EVs.

The Connecticut Green Bank has significant experience designing and executing successful community-based campaigns to encourage the adoption of clean energy technologies. The Green Bank can use its working relationships with leading companies in the solar PV industries and the Connecticut Automobile Dealers Association to advance new and innovative approaches to EV and solar technology deployment.

GOALS OF THE JOINT SOLAR-EV PROGRAM

Solar PV and EVs can offer the most cost effective solution for vehicle owners to reduce greenhouse gas emissions given current vehicle and solar incentives available in Connecticut. With existing incentives, EVs charged with solar PV is the most affordable choice for drivers in the state. Without any vehicle incentives and with Connecticut's solar incentives, EVs can still have lower abatement costs than the social cost of carbon [1].

A Solar-EV Purchase Program could help address three key barriers to EV adoption:

- **Higher upfront cost:** EVs often cost more upfront than comparable gasoline vehicles, but they can have a lower total cost of ownership. Consumers often have difficulty internalizing a vehicle's lifetime cost at vehicle purchase time.
- **Environmental and energy security benefits:** EVs can have significantly lower greenhouse gas emissions compared to gasoline vehicles on a lifecycle basis in Connecticut, especially when the vehicles are recharged with renewable energy.
- **Information access:** EVs are a transformative technology resulting in a different purchase and ownership experience from gasoline vehicles, requiring significantly more time to complete a vehicle purchase.

MAKE EVS MORE ACCESSIBLE AND AFFORDABLE TO CONSUMERS

EVs must overcome market externalities, including consumers' dampened value of fuel savings and a missing market signal for greenhouse gases and other pollutants. And like other clean technologies, business model and financial innovation combined with creative approaches to consumer engagement and marketing could play a vital role in enabling EVs to reach mainstream car buyers.

A Solar-EV Purchase Program could help overcome the key barriers of higher upfront costs of EV purchases, environmental and energy security benefits, and information access by:

- Marrying solar PV and EV technologies in a way that leverages experience from solar vendors and the unique relationship they have with their customers to overcome EV deployment barriers (see Box 1);
- Improving the EV purchase process for consumers through aggregation and other means with the aim of attaining more attractive and sustainable terms from automakers and auto dealers; and
- Lowering fuel costs and reducing emissions using clean renewable energy sources.

Box 1. Solar Vendor Partnership

Solar vendors are in a unique position to overcome one of the largest barriers to EV adoption: consumer education. Solar installers have developed captive relationships with their customer base that can help bypass costs associated with acquiring new customers. Solar installers have also overcome adoption barriers related to the total cost of ownership by touting the economic and environmental benefits of solar. These installers are a trusted messenger that can educate consumers about similar benefits related to EV adoption and the complementary nature of the technology. For solar PV, vendors show their customers that the upfront cost of a system is paid back through lower electricity costs yielding considerable lifetime savings. EVs are an addition to these vendors' existing portfolio and will improve the value proposition of residential solar systems by also lowering transportation costs for their customers.

Solar vendors can also help develop innovative outreach and engagement approaches with thousands of homeowners and can help develop the potential for powerful synergies between solar PV and EV adoption. For example, vendors can help customers who pursue EV ownership are leasing (or owning) solar PV systems properly sized to handle the added load of the vehicle.

EXPANDING THE EV MARKET IN CONNECTICUT

Greater EV adoption in Connecticut offers economic and environmental benefits at the local and state level. EV deployment is the most promising way to reduce emissions from the transportation sector in Connecticut [1]. Programs that target both solar PV and EVs can help lower greenhouse gases from the two largest sectors in Connecticut simultaneously.

When considering current federal and state policies, EVs offer lifetime cost savings over gasoline vehicles resulting in more discretionary funds for drivers and potentially increased consumer spending. When paired with solar, EVs can be the most affordable choice for Connecticut drivers. In addition, Connecticut

has extensive local electricity generation capacity, which increases the likelihood that funds spent fueling with electricity will remain in the state's economy [1].

A Solar-EV Purchase Program can complement existing programs in Connecticut aimed at encouraging EV and renewable energy deployment, including the CHEAPR EV rebate program, the Zero Emission Vehicle program, and the Connecticut Solar Lease program. A critical consideration in the design and execution of these programs is that carbon or other credits are only counted once.¹

TARGET LOCATIONS IN CONNECTICUT

SELECTION CRITERIA FOR TARGET LOCATIONS

1. **Identify EV and solar PV markets with above average deployment:** Deployment in areas where EVs and solar PV have been successful in the state can help improve the success of EV-solar deployment and the joint use of the technologies. This criterion includes communities that have above average deployment of EVs, publicly available charging, and residential solar PV.
2. **Identify areas where drivers have longer commutes to maximize the amount of EV miles traveled on solar and emissions reduced per dollar of funds invested:** A program should balance the goal of increasing electric miles traveled on solar and the need to conserve public funds. An ideal deployment would be in a community where drivers travel more than average, using drivers' distance to work as a proxy.
3. **Leverage existing relationships with auto dealers, solar vendors, and local stakeholders:** The program must engage existing technology partners, especially auto dealer "champions" that have been leaders in the CHEAPR rebate program, to capture the value of collaborative marketing strategies between solar PV companies and auto dealers. Local partners affiliated with the U.S. Department of Energy, such as Clean Cities Coalitions and Workplace Charging Challenge Partners can also provide local stakeholder support to motivate co-marketing of solar and EVs.

Below are the key parameters for identifying target locations in Connecticut communities:

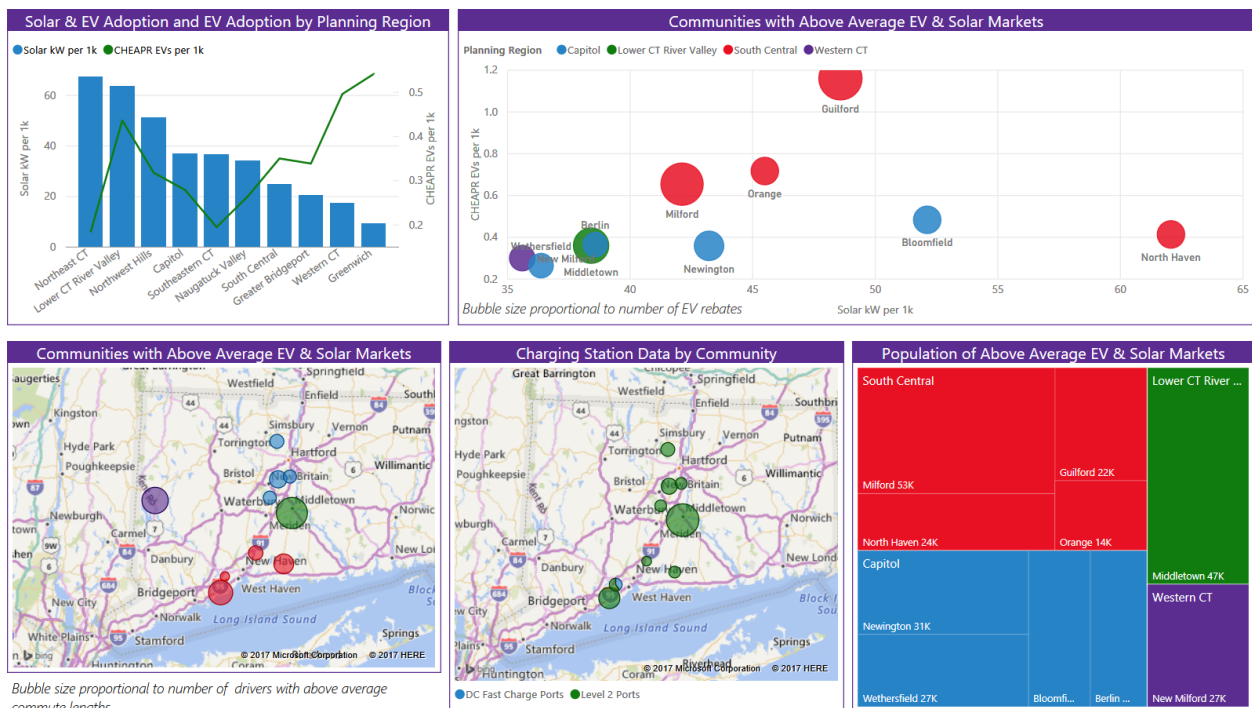
1. Above average solar and EV markets:
 - a. Average population by ZIP code: 13,000 or greater
 - b. Average statewide solar capacity installed per 1,000 people: 32.60 kW STC (Standard Test Conditions) or greater
 - c. Above average EV markets:
 - i. Average statewide CHEAPR rebate usage per 1,000 people: 0.33 rebates or greater
 - ii. Average statewide charging station deployment per 1,000 people: 0.10 charging stations or greater

¹ A key requirement for any carbon credit program is that they must be unambiguously owned, meaning the rights to the credits should be clearly based on domestic and international law and emission reductions must not be double counted.

EV-Solar Purchase Program

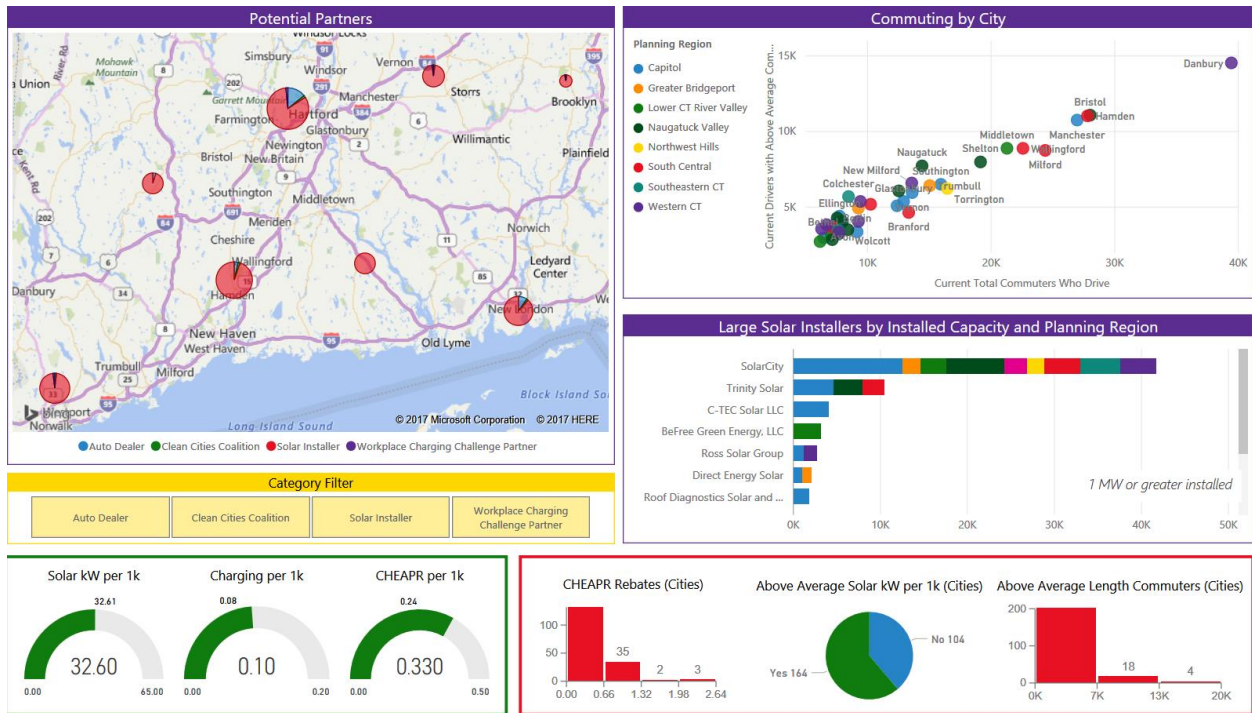
2. Longer than average drive time to work:
 - a. Average statewide time commuting by car: 25 minutes or greater
 - b. Average drivers statewide with longer than average commutes (per 1,000 people): 166 people or greater
3. Potential partners:
 - a. Solar vendors that have installed systems
 - b. Local presence of one or more of the following potential partners:
 - i. Auto dealer that has participated in Connecticut Green Bank's C-PACE program
 - ii. U.S. Department of Energy Workplace Charging Challenge Partner
 - iii. Clean Cities Coalition

FIGURE 1: SOLAR AND EV MARKETS



Source: <http://atlaspolicy.com/rand/transportation-electrification-toolkit-for-connecticut>

FIGURE 2: POTENTIAL PARTNERS



Source: <http://atlaspolicy.com/rand/transportation-electrification-toolkit-for-connecticut>

KEY INSIGHTS FROM GEOSPATIAL ANALYSIS

EV AND SOLAR MARKETS

- The Northeast CT planning region has the highest per capita solar adoption and the lowest EV adoption per capita, whereas the Western CT planning region has the lowest per capita solar adoption and the highest EV adoption per capita in the state. The Northeast CT region has less than 3 percent of the state’s population, but the Western CT region accounts for almost 17 percent. There is also low solar adoption relative to EV adoption in the South Central and the Bridgeport regions.
- The South Central region has the most communities with above average EV & solar markets. Together, these four South Central communities represent over one third of the total population of communities with above average EV & solar markets. Milford, Orange, and Guilford in the South Central region have the highest EV adoption, while North Haven in the South Central region has the highest solar adoption, but lower EV adoption than Milford, Orange, and Guilford.
- Planning regions with above average EV and solar markets:
 - South Central: 4 communities
 - Capitol: 3 communities
 - Western CT: 1 community
 - Lower Ct River Valley: 1 community

- Naugatuck Valley: 1 community
- When examining communities with strong solar and EV markets, there are only publicly available charging ports in towns just outside of Hartford and New Haven, with most stations located in New Haven.
- Installed solar capacity is concentrated in the Capitol region. Nearly two thirds of communities in the state have above average solar deployment per capita.

DRIVE TIME TO WORK

- Looking at the histogram of communities with drivers with long commutes, only four communities in the state fall in the largest bracket (13,000 to 20,000 drivers). When considering only communities with above average solar adoption, the highest bracket drops to a range of 8,000 to 11,000. Only three communities (Bristol, Milford, and Middletown) with above average solar adoption have 8,000 drivers or more with long commutes.
- For communities with above average solar and EV markets, the top three communities with the drivers with long commutes are in the Lower CT Valley, the Naugatuck Valley, and Western CT.
- Communities where there are higher than average shares of drivers with long commutes generally have above average solar deployment.

POTENTIAL PARTNERS

- Solar City, Trinity Solar, and C-Tec Solar LLC are the top three solar installers in Connecticut by installed capacity. Solar City has installed capacity in all nine planning regions.
- Most Workplace Charging Challenge Partners and auto dealerships are in communities with above average solar deployment.
- Dealerships are most heavily concentrated in Hartford County, New London County, and New Haven County. Five of eight total potential dealer partners are in counties with below average solar adoption.
- New Haven, Hartford, Fairfield, and New London Counties have the highest number of solar installers.

COMMUNITIES WITH ABOVE AVERAGE EV AND SOLAR ADOPTION

- **The communities that surround New Haven have strong solar and EV markets, two potential auto dealer partners in New Haven County, one Clean Cities Coalition, and 55 solar installers.** Guilford, Orange, and Milford surround New Haven and have the highest EV adoption rates in comparison to other communities with above average EV and solar adoption. Nearby, North Haven has the highest solar adoption but lower EV adoption than Guilford, Orange, and Milford. Milford, which is between New Haven and Bridgeport, has the highest population and has 8,700 drivers with long commutes.
- **Shelton in Fairfield County has the lowest solar and EV adoption when compared to other communities with above average EV and solar adoption, but there are 22 solar installers with local installations and one Clean Cities Coalition that could help to move the market forward.** Shelton has a population of 40,000 and nearly 8,000 drivers with long commutes.
- **New Milford is the only community in Western CT with above average markets for solar and EVs and could serve as exemplary community in the region.** The Western CT region has the highest EV adoption rate across all planning regions, but the lowest solar adoption per capita. In New Milford,

approximately 7,000 drivers have long commutes. Thirteen solar installers have operated in New Milford and the closest potential auto dealership partner is in nearby Watertown.

- **Middletown has a high number of drivers with long commutes and is located just outside of Hartford County, which has a high concentration of potential auto dealer partners.** For communities with above average solar deployment, the Middletown has the third highest number of drivers commuting longer than average to work. Twenty-four solar installers have completed projects in the community.
- **In tandem with the presence of local solar and auto dealer partners in Hartford, the existing charging infrastructure in Newington could be leveraged to increase EV adoption.** Of communities with strong solar and EV markets, Newington has the most publicly available charging infrastructure but relatively low EV adoption when compared to other communities with above average EV and solar adoption.

COMMUNITIES WITH BELOW AVERAGE EV ADOPTION, BUT ABOVE AVERAGE SOLAR ADOPTION

- **Bristol (west of Hartford) could use its strong solar market to advance EVs by engaging its four auto dealerships, one Clean Cities Coalition, and 18 solar installers operating nearby.** For communities with above average solar deployment Bristol has the highest number of drivers with long commutes. Bristol has lower than average EV and charging deployment.

PROGRAM DEPLOYMENT CONSIDERATIONS

DESIGNING THE PROGRAM

- What is the cost of conducting a group purchase program?
 - How much staff time is going into each phase of the program?
 - What are the advertising costs?
 - What level of funding could the state provide and in what form (e.g., rebates)?
 - How do potential tax revenue sources for EVs and charging infrastructure differ from gasoline vehicles and fueling stations?
- Who are the key stakeholders to engage while creating the program and before its launch?
 - Who should serve as the “face” of the program?
 - How can the case be made to solar vendors that trying to sell EVs will benefit their business?
- What additional strategies can be implemented to maximize emissions reductions?
 - How can this program complement other state programs (e.g., RGGI and CHEAPR)?
- Which dealers have sold the most EVs in the state?
 - How can this program complement any ongoing efforts to market EVs in the state?
- What time of year will the program be run?
 - Will a program that is run later in the year (when consumers are mindful of their tax situation) be more successful due to the federal tax credit?
- How will the program be evaluated?
 - What are the expected and desired outcomes of a program?

CONDUCTING OUTREACH

- What are the likely demographics of program participants?
- Who are the trusted community voices that could contribute to outreach?
- What forms does the outreach take? (e.g., press releases, workshops, and social media)

PROCURING CONSUMER DISCOUNTS

- Is there a competitive bid process for getting the best prices on buying or leasing selected models of EVs?
- Are discounts available for a limited amount of time to motivate near-term action from consumers?

INTERVENTIONS TO COORDINATE EV AND SOLAR DEPLOYMENT

The following summarizes potential points of intervention in EV and solar businesses that help coordinate the joint deployment of these technologies. These interventions can improve the customer bases for both businesses and draw support from advocacy groups whose mission aligns with the greater deployment of these technologies.

FIGURE 3: EV AND SOLAR BUSINESSES

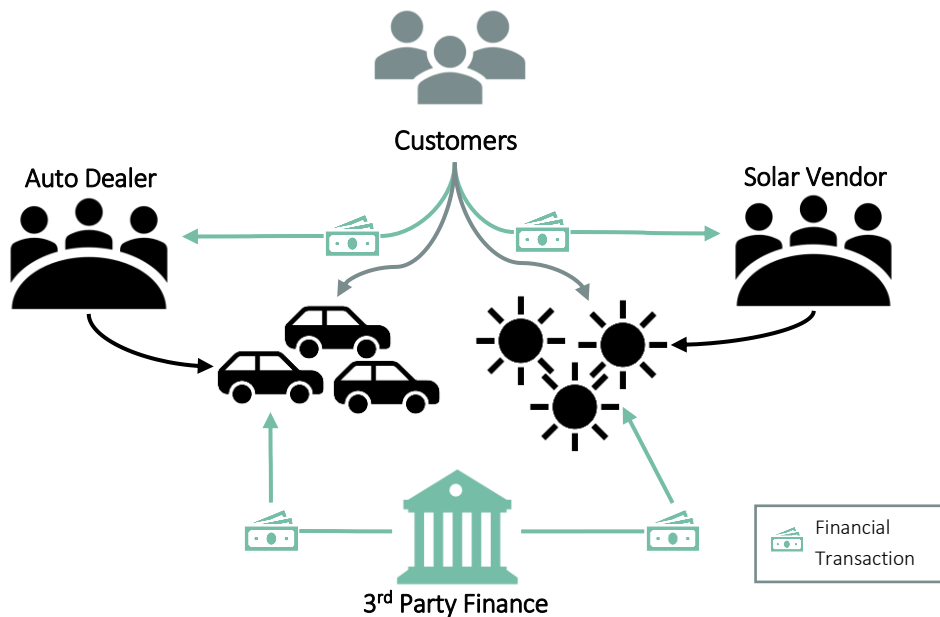


TABLE 1: POTENTIAL INTERVENTIONS IN A CARSHARING OR RIDE-HAILING BUSINESS

Intervention	Private Sector Target(s)	Public Sector Lead	Potential Elements	Expected Outcomes	Implementation Challenges
Stakeholder Recruiting & Education	Solar vendors, Auto dealers, Environmental and Social Justice Groups	Green Bank, State Agency	Informational materials; in-person or online training	Increased awareness of benefits of joint EV-solar ownership; Lowering customer acquisition cost for solar vendors and auto dealers	Potential lack of interest from private sector partners
Financial Incentives	Solar vendors, Auto Dealers	Green Bank	Financial incentive for joint EV-solar purchase for individuals through community-based offers	Increased purchases of solar and/or EVs	Potential lack of interest from private sector partners
Low-Cost Financing	Solar vendors, Auto dealers	Green Bank	Low interest loans or financing subsidies for joint EV-solar purchase	Increased purchases of solar and/or EVs	Potential lack of interest from private sector partners

PROGRAM EVALUATION METRICS

EV-Solar purchase programs supported by state agencies or green banks could result in emission reductions and increased access to low-carbon transportation. The following are metrics that could be used in evaluating program success:

- **Gather Community and Stakeholder Feedback:** Conduct satisfaction surveys from program participants and general surveys in targeted communities to gauge program effectiveness. The surveys could gather feedback on the value of program elements, additional needs, and ideas for improvement.
- **Measure Increased Deployment of Solar and/or EVs in Target Communities:** Measure the deployment of EVs and solar in target communities. Comparing deployment in target communities can improve the efficiency of resource allocation and highlight program successes and challenges.
- **Estimated Greenhouse Gas Mitigation Cost:** Estimate the cost of mitigating greenhouse gas emissions on a dollars-per-ton basis for different program elements. Elements could be weighed against each other to identify priority investments. These mitigation costs can be compared to other methods to reduce emissions from the transportation sector.

REFERENCES

- [1] N. Nigro and G. Morrison, "Moving Forward with Green Energy: Market Potential Assessment for Alternative Fuel Vehicles in Connecticut," September 2016. [Online]. Available: <http://www.ctgreenbank.com/wp-content/uploads/2016/09/CTGreenBank-Market-Potential-Assessment-Alternative-Fuel-Vehicles-090816-FF.pdf>. [Accessed 11 October 2016].



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