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Town of Chapel Hill
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Duke Energy Carolinas
Durham City/County
Durham Chapel Hill Metropolitan Planning Organization (DCHMPO)
ElectriCities
Town of Hillsboro
Michael Jordan Nissan
NC State University
NC State Employees’ Credit Union
NC Historic Preservation Office
Town of Pittsboro
Progress Energy Carolinas
City of Raleigh
Research Triangle Foundation
Siemens
STEP Program
Triangle Clean Cities Coalition
Triangle Transit Authority
UNC Chapel Hill
Veritas Economics
Wilson Community College
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GREATER TRIANGLE PLUG IN ELECTRIC VEHICLE (PEV) READINESS PLAN
### COMMON TERMS

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<td>ADA</td>
<td>Americans with Disabilities Act</td>
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<td>COG</td>
<td>Council of Government</td>
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<td>CPM</td>
<td>Community Planning Matrix</td>
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<td>EPRI</td>
<td>Electric Power Research Institute</td>
</tr>
<tr>
<td>EVSE</td>
<td>Electric Vehicle Supply Equipment, commonly referred to as Charging Station</td>
</tr>
<tr>
<td>ICE</td>
<td>Internal Combustion Engine</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt Hour</td>
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<tr>
<td>MPO</td>
<td>Metropolitan Planning Organization</td>
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<td>NCDOT</td>
<td>North Carolina Department of Transportation</td>
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<td>NCDMV</td>
<td>North Carolina Division of Motor Vehicles</td>
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<tr>
<td>NCSEO</td>
<td>North Carolina State Energy Office</td>
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<td>NCSU</td>
<td>North Carolina State University</td>
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<tr>
<td>NEC</td>
<td>National Electric Code</td>
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<tr>
<td>PEV</td>
<td>Plug-in Electric Vehicle</td>
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<tr>
<td>RPO</td>
<td>Rural Planning Organization</td>
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<td>TCCC</td>
<td>Triangle Clean Cities Coalition</td>
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<td>TJCOG</td>
<td>Triangle J Council of Governments</td>
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<table>
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<tr>
<td>Charging Station</td>
<td>Device that transfers power to a PEV while providing proper grounding, shock protection, overload protection and general communication.¹</td>
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<td>Electric Vehicle Supply Equipment (EVSE)</td>
<td>The official term for electric vehicle charging infrastructure, more commonly referred to as charging stations.</td>
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<td>Internal Combustion Engines</td>
<td>Engines that generate mechanical power by burning a liquid fuel (such as gasoline, diesel, or biofuels) or a gaseous fuel (such as a compressed natural gas). They are the dominant engines used in on-road vehicles today.²</td>
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<tr>
<td>Plug-in electric vehicles</td>
<td>Derive all or part of their power from electricity supplied by the electric grid. Common examples include the Chevrolet Volt and Nissan LEAF.</td>
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¹ Advanced Energy, Charging Station Installation Handbook (December, 2011).
² U.S. DOE, Clean Cities, Plug-In Electric Vehicle Handbook for Electrical Contractors
MISSION STATEMENT
Provide a resource for the Greater Triangle, N.C. region, in coordination with state-level planning efforts, to address the barriers to the adoption of plug-in electric vehicle (PEV) infrastructure as part of a broader sustainable transportation strategy by leveraging the collaboration of local public and private organizations (developed by the Triangle PEV Readiness Steering Committee for this plan).

ACKNOWLEDGMENT
This material is based upon work supported by the U.S. Department of Energy under Award Number DE-EE0005583.

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

The NC PEV Readiness Initiative: Plugging in from Mountains to Sea (M2S) planning project with funding provided by the U.S. Department of Energy’s Clean Cities Program through Centralina Council of Governments. Project collaborators include: Advanced Energy, Land-of-Sky Regional Council, NC Solar Center/NC State University, Piedmont Triad Regional Council and Triangle J Council of Governments.

TEMPLATES AND PROCESSES FOR COMMUNITY PLAN
The templates for the Community Planning process were provided through modifications to previously developed tools from the North Carolina Get Ready program administered by Advanced Energy. Funding from the U.S. Department of Energy for the North Carolina PEV Readiness Initiative: Plugging in from Mountains to Sea (M2S) was used to customize the tools including the Community Planning Matrix, the PEV Initiative Paper and other documents for the Community PEV Readiness Plans. All planning tools used during the development of the Community Plan are included in the appendix of this document.
EXECUTIVE SUMMARY

The Greater Triangle region has already received national recognition for its efforts in plug-in electric vehicle (PEV) readiness. Plug-in electric vehicle readiness initiatives have been taking place in the Greater Triangle for more than 10 years, however, this plan marked the first effort to bring all stakeholders together to document existing conditions and to collaboratively plan for future activities. With leading local government entities such as the City of Raleigh, City and County of Durham, Town of Chapel Hill, Orange County, and the Town of Cary, the Greater Triangle has worked to position itself as a PEV-ready community. In addition to progressive local government leadership, the Greater Triangle has key stakeholders which are helping to boost readiness. A few examples include: The Triangle J Council of Governments, which houses the Triangle Clean Cities Coalition, electric utility Duke Energy, which includes Duke Energy Carolinas and Progress Energy Carolinas, The NC Solar Center and Advanced Energy, which is a North Carolina based non-profit organization.

The boundaries for the Greater Triangle PEV Readiness Plan included the seven county region for the Triangle J Council of Governments which includes the counties of Moore, Lee, Chatham, Orange, Durham, Wake and Johnston. The planning process also included a focus area which considered the portions of the seven county region which were more likely to have accelerated electric vehicle adoption.

Existing Conditions

Through communications with the state-level NC PEV Taskforce, the Triangle was able to verify the number of registered electric vehicles and confirm the number of charging stations installed in the Triangle. Data collected from the NC Department of Motor Vehicles (NCDMV) revealed that as of August 2012, there were 291 registered plug-in electric vehicles in the seven county regional boundary. When compared with the total number of registered PEVs for the entire state, 719, it can be noted that PEVs in the Triangle make up around 40% of the total number of these vehicles in the state (see map below titled- Registered Plug-in Electric Vehicles and Public Charging Sites in North Carolina).

Collecting the data for registered electric vehicles helped Triangle stakeholders to justify estimates for the number of installed charging stations. As of the writing of this plan, there were a total of 288 public and private non-residential charging stations (each cord counted separately) including 85 level 1, 202 level 2, and one DC Fast Charging Station. The 288 public and private non-residential charging stations account for roughly 54% of the 531 charging stations in the entire state.
Unique Findings
The Greater Triangle PEV Readiness Plan was created in conjunction with the NC PEV Roadmap (state-wide readiness plan) and three other community plans in the Greater Asheville, Greater Charlotte and Piedmont Triad areas. Although many of the community plans covered similar topics, there were a few unique findings that were recognized in the Greater Triangle.

- **Polycentric Metropolitan Centers** - Unlike many other metropolitan areas, the Triangle has multiple centers of population and workplace concentrations. These development patterns required different considerations for PEV planning from an area with a concentrated population center. This finding was considered when planning for electric vehicle charging infrastructure.
- **State-wide Focus** - Many key stakeholders in the Greater Triangle community bring both a state-wide and local focus to PEV planning because of their proximity to the state capital.

**Key Recommendations**
Recommendations were created for each of the focus areas of this plan including, vehicles, infrastructure, policy, codes and standards, education and outreach and incentives. A full list of recommendations for implementation is located at the end of this plan, however some of the key recommendations are listed below:
Vehicles:
- Communicate the benefits and total cost of ownership of PEVs to public and private fleet managers.
- Provide authoritative third party information about PEVs to dealerships to help them respond to prospective PEV driver concerns.

Infrastructure:
- Develop or identify business models for localities to recoup charging station costs (i.e., the cost of providing electricity).
- Create an ongoing Triangle EVSE coordinating council that can continually revise/update EVSE locations and forecasts.

Policies, Codes and Standards:
- Update local historic district regulations and educate local historic district commissions on electric vehicle and charging station considerations.
- Work with Local Governments to educate and encourage updating local codes by presenting at industry events, workshops and conferences.

Education and Outreach
- Work with local schools to incorporate PEV considerations into their curriculum through initiatives such as the STEP Program.
- Work with local community colleges, universities, and other workforce training centers.

Incentives
- Encourage local partners to develop monetary and non-monetary incentives (Chambers of Commerce, retail businesses, etc).
- Work through dealerships and other local partners to communicate available incentives using local media and social media.

Conclusion
The Greater Triangle PEV Readiness Plan served to help document some of the existing initiatives, and collaboratively provide focus for implementation. An implementation chart is included at the end of the plan to provide guidance for stakeholders when implementing or replicating the plan. Currently, the Triangle is still in the beginning stages of PEV adoption with current estimates showing that the Greater Triangle community will be home to over 158,000 PEVs in 2030. This plan recommends continuing to move forward with collaborative efforts to ensure a more seamless integration of these vehicles and to maintain its position as a leader in plug-in electric vehicle readiness.
1 INTRODUCTION
This plan is intended to serve as the Plug-In Electric Vehicle (PEV) Readiness Plan for the Greater Triangle Region in North Carolina.

1.1 Purpose of the Triangle PEV Readiness Plan
The Triangle is both nationally and internationally recognized for its readiness efforts for PEVs. This plan highlights the existing readiness efforts and provides recommendations for readiness actions for the entire community.

An Overview of the Greater Triangle Region
Anchored by North Carolina State University, Duke University, the University of North Carolina at Chapel Hill, and cities of Raleigh, Durham and Chapel Hill, the Research Triangle Park was built through public/private cooperation and a smart vision of the future. Research Triangle Park, NC State’s Centennial Research Campus and universities combine to employ a number of highly-trained, environmentally and socially conscious citizens who embrace new technologies and represent the term “early adopters.” These same citizens represent the ingenuity that can revolutionize transportation.

The boundaries of the Greater Triangle community can vary. For the purpose of this plan, the boundary consisted of the seven county region for Triangle J Council of Governments (TJCOG) can be found in Table 1.

| Table 1. Population for Triangle J Council of Governments Region³ |
|-----------------|-----------------|
| Chatham         | 63,505          |
| Durham          | 267,587         |
| Johnston        | 168,878         |
| Lee             | 57,866          |
| Moore           | 88,247          |
| Orange          | 133,801         |
| Wake            | 900,993         |
| **TOTAL**       | **1,680,877**   |

**Transportation and PEV Technologies in the Triangle**

The transportation sector is established as a leading segment of the nation’s gross domestic product (GDP), fueled heavily by imported petroleum and ripe for change. The Triangle earned its worldwide reputation for technology leadership and innovation by challenging established business models and segments. Challenging and perhaps revolutionizing the transportation and energy supply sector represents phenomenal future economic development opportunities. Research, manufacturing and PEV supporting services are among the visions of opportunity as we enter the age of PEVs.

The recently formed Triangle Cleantech Cluster, is one of many examples of how the Greater Triangle is not only leading in PEV readiness but is benefitting through economic development.

The Research Triangle Cleantech Cluster

“North Carolina’s Research Triangle Cleantech Cluster (RTCC) was formed to market and expand the region’s presence in cleantech, particularly smart grid, advanced transportation, water technologies, renewable energy and energy efficiency. The RTCC’s three-fold mission is to: innovate to make the Research Triangle region’s clean technology companies more successful, accelerate the growth of the region’s clean technology economy, and sustain and grow a world-class clean technology cluster. The RTCC’s work plan focuses on building global networks for research and business development, supporting and connecting the region’s burgeoning entrepreneurship community, talent attraction and targeted workforce development, and facilitating industry-led discussion of effective public policies. The RTCC works closely with partners around the world - including Singapore and regions in France, Germany, Austria, Denmark, Italy and Spain - to showcase the Research Triangle Region’s cleantech assets and facilitate connections between our local experts and cluster contacts worldwide.”

**Need for the Triangle PEV Readiness Plan**

With North Carolina listed as one of the hotspots that PEV manufacturers have chosen to lead the way, and with PEVs now available for purchase at dealerships across the state, now is a critical time to prepare our infrastructure and policies to take advantage of the building momentum of this sustainable transportation option.

**Plug-in Electric Vehicles are Coming to the Triangle**

Most major vehicle manufacturers have announced their plans to add PEVs to their product lines, and several new start-up companies have entered the auto industry with the express purpose of producing PEVs. According to current projections from the Electric Power Research Institute (EPRI), the Greater Triangle is expected to have more than 22,000 PEVs in service by the end of 2020 and more than 158,000

---

such vehicles on its roads by 2030\textsuperscript{5}, making it a necessity for local stakeholders within the Triangle to be prepared for this new technology.

EPRI’s market projections appear to be higher than what would be expected by simply scaling the national goal to the local population, due to several key factors. First, data from the N.C. Department of Motor Vehicles (NCDMV) indicates a high density of local hybrid vehicle ownership, a leading indicator for consumer interest in PEVs which is reflected in manufacturer market surveys. The Triangle’s PEV market also benefits from having:

- A well-educated citizenry, supported by multiple colleges and universities;
- Local electric utilities and electric cooperatives which are highly engaged with the PEV industry; and
- Proactive municipal local governments that are supported by multiple local technical advisors.\textsuperscript{6}

**The Benefit of Community-Wide Planning in the Greater Triangle**

The Triangle PEV Planning process, documented in this readiness plan, represented the first time stakeholders in the Greater Triangle gathered to discuss PEV readiness at a community-wide level. Individually, many of the Triangle stakeholders had already made great strides towards PEV readiness process. The benefits from readiness planning at a regional level included:

- **Best Practices and Lessons Learned**: Triangle stakeholders were able to share their individual experiences in local PEV readiness planning including best practices and lessons learned. This sharing of information spawned additional conversations and key topics for the stakeholders to explore and consider in the development of the Triangle Readiness Plan.

- **Public Health**: The North Carolina Department of Health and Human Services indicated in the State’s health plan *Healthy North Carolina 2020: A Better State of Health* that they encourage individual, community and public policy actions to improve public health through taking action to reduce congestion and improve air quality\textsuperscript{7}. Planning for PEV integration at a regional level helped to achieve this goal of public health.

- **Air Quality**: Air quality in the Triangle has been maintained above regulatory standards, but with the population increases expected in the coming years, the region should make it easier for people to replace their standard internal combustion engine (ICE) vehicles with a low or zero-emission PEV. Additionally, several local government have air quality policies and plans designed to reduce

\textsuperscript{5} EPRI, *NC PEV and EVSE Penetration Estimate*, 2012  
\textsuperscript{6} City of Raleigh, “Project Get Ready” Brochure, 2010  
vehicular emissions (examples include the City and County of Durham, Chapel Hill and Raleigh).

- **Social Equity**: Triangle Stakeholders wanted to ensure planning for the adoption of PEVs considers all stakeholders in the Triangle, not just early adopters and key demographics. This included exploring additional demographics such as various levels of household incomes, education attainment and all races.

- **Availability of Charging Stations**: Many prospective buyers of a PEV are concerned about the limited availability of vehicle charging stations combined with the limited range of an all-electric vehicle. While the number of charging stations has increased dramatically over the past few years, it will take proactive planning to keep pace with the number of PEVs that will be entering our roads. If we do not plan to optimize the type, location and ease of installation for these charging stations, consumer frustrations may slow the expected market penetration of these vehicles.

In addition to planning for all stakeholders, the Triangle Steering Committee considered the benefits that electric vehicles may provide to underrepresented demographics of the Triangle and looked at various ways to make them more accessible including:

- **Used Vehicles**: One of the biggest barriers to lower and moderate income stakeholders is the upfront cost of the electric vehicles currently on the market. However, now that the vehicles have been available for a full year in N.C., they will soon be back on the market as used cars, which may allow them to become more attainable.

- **Public Investment for PEV Adoption**: Some argue that providing public subsidies for PEV adoption is not a good use of tax payer dollars because the cost for the technology is too high at this time and the only typical purchasers of the technology are those stakeholders with high incomes. However, there is a long history of public subsidies involved with a new technology that are now considered commodities that are affordable to mainstream consumers including:
  - Wireless and broadband communications; and
  - Aviation

  With worldwide competition to advance the development of PEV technologies, the United States is only one of many countries that are investing because of the benefits that they provide.\(^8\)

---

What Will Happen if We Don’t Plan

Without planning at the state, community, and local levels, the adoption of PEVs may be hindered. Some consequences include:

- Continued dependence on petroleum as the primary source of fuel;
- Limited public awareness;
- Complications due to a lack of updated local codes and permitting processes; and
- Limited-to-no consideration for social equity issues.

1.2 History of PEV Readiness in the Triangle

The Triangle has a long history in electric vehicle and alternative fuel vehicle use. Examples of the most notable accomplishments for PEVs include:

- 1990s: The City of Raleigh leased its first electric Ford Ranger fleet vehicle.
- 2008: Triangle Region’s first public PEV charging station was unveiled at Cary, N.C.’s “Green” McDonalds.
- 2009: The Rocky Mountain Institute’s *Project Get Ready* was launched to help prepare the nation for PEVs; Raleigh joined the effort as one of the first three cities.
- 2010-2011: The Carolina Blue Skies & Green Jobs Program and other Recovery Act funding allowed for installation of 132 charging stations and the purchase of 40 PEVs in N.C. 2011:
  - NC Electric Utilities, Duke Energy Carolinas and Progress Energy Carolinas began a commercial and residential PEV Pilot program (see Chapter 8: Electric Utilities for details);
  - Statewide M2S PEV Planning effort began the development of the Triangle’s first PEV Readiness Plan;
  - Raleigh hosted the national Plug-in Conference, the first time this major industry conference had been held on the East Coast; and
  - The NC PEV Taskforce formed and hosted its first meeting at North Carolina State University’s McKimmon Center in October 2011.
- The City and County of Durham began installing charging stations, vetting permitting processes and created the state’s first publicly adopted Electric Vehicle and Charging Station Plan (adopted by the City and County elected officials).
2012:

- The Triangle hosted its first ever Electric Vehicle Awareness Week (October 1-6);
- First Responders in Durham, N.C. received hands-on training focusing on PEVs; and
- Advanced Energy and TJCOG established the Triangle Steering Committee to help formulate the Triangle’s PEV Readiness Plan.

1.3 NC PEV Readiness Initiative: Plugging In from Mountains to Sea

The Triangle PEV Readiness Plan was developed under the NC PEV Readiness Initiative “Plugging-in from Mountains to Sea” (M2S) funded through the U.S. DOE with cost match provided through Advanced Energy. The plan is intended to be both publicly available and replicable. The M2S project is one of 16 electric vehicle community readiness planning initiatives awarded by the U.S. DOE in an effort to increase awareness and actual consumer usage, as well as to help communities develop plans for the infrastructure needed to support the expected influx of PEVs. The M2S project includes multiple initiatives consisting of the development of a statewide PEV Roadmap (through the NC PEV Taskforce) and four local PEV readiness plans for Asheville, Charlotte, the Piedmont Triad and the Triangle. The four community readiness plans will serve as a guide to strengthen existing local and state initiatives to help North Carolina communities’ address their specific needs, including:

- Updating permitting processes;
- Revising codes;
- Training appropriate personnel;
- Assessing infrastructure needs;
- Promoting public awareness; and
- Evaluating and developing incentives.

Project collaborators included: Centralina Council of Governments, Advanced Energy, Land-of-Sky Regional Council, NC Solar Center/NC State University, Piedmont Triad Regional Council and TJCOG. Advanced Energy and TJCOG served as the lead project partners in developing the Greater Triangle PEV Readiness Plan.

1.4 North Carolina PEV Taskforce

The NC PEV Taskforce is an initiative of the North Carolina Department of Commerce and Advanced Energy. The Taskforce was formed in the spring of 2011 and held its kick off meeting in the Fall 2011. Stakeholders include local, regional and state government entities, PEV industries, electric utilities, academia, non-profits, local chambers of commerce and more.
**How does the NC PEV Roadmap work with the Triangle PEV Readiness Plan?**

The NC PEV Taskforce received an infusion of funding through the M2S grant, which allowed the taskforce to create a Statewide PEV Readiness Plan called the *NC PEV Roadmap*. The state roadmap was created in conjunction with the Greater Triangle PEV Readiness Plan and the three other plans in the Charlotte, Asheville and Piedmont Triad areas. This plan contains references to the NC PEV Roadmap for general or state level items related to PEV readiness. During the process of developing the Triangle PEV plan, stakeholders referred state-wide issues to the NC PEV Taskforce for consideration. The Triangle PEV Readiness Plan contains research and recommendations specific to the Greater Triangle Community.

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**1.5 How the Greater Triangle PEV Readiness Plan is to be Used**

The Greater Triangle PEV Readiness Plan was created at the community level and applies to the seven county region of the TJCOG. Local counties and municipalities are encouraged to support this plan by passing a resolution of support. A sample resolution can be found in Appendix 7.

*Vision, Policy, Implementation*

The Triangle Community Readiness Plan is intended to be **publicly available** and **replicable**, meaning local government leaders are encouraged to support the plan through:
Adopting the Vision of the Plan in the Local Community: Local governments within the TJCOG are encouraged to pass resolutions of support for this PEV readiness plan.

Developing Local Policies in Support of PEV Readiness: Local governments are encouraged to review the recommendations of this plan and update the local policies and ordinances to allow for the increased adoption of electric vehicles.

Implementing PEV Recommendations in the Local Jurisdictions: In order to have the maximum effectiveness, it is recommended that local governments and organizations review and implement the recommendations of the plan when possible and to report back the implementation actions to TJCOG for monitoring purposes.

1.6 Organization of this Plan
The Triangle PEV Readiness Plan incorporates all elements suggested by the U.S. DOE for PEV planning and a few additional elements specific to the Triangle. Each section of this plan addresses a specific element of PEV readiness. The Community PEV Readiness Planning process involved engaging community stakeholders to explore five different focus areas associated with preparing for PEV adoption:
1. Vehicles (Chapter 3)
2. Infrastructure (Chapter 4)
3. Incentives (Chapter 5)
4. Policy, Codes and Standards (Chapter 6)
5. Education and Outreach (Chapter 7)

The Triangle PEV Readiness Plan also considered economic development implications for the Triangle community. AE and TJCOG found that economic development considerations greatly overlapped with each of the focus areas, so it is discussed as a component of each focus area, rather than being separated out as an individual section.

Work Areas for The Triangle PEV Readiness Plan

- **Vehicles:** The Vehicles Work Area addressed goals related to increasing the number of PEVs in operation. Stakeholders engaged in this area explored questions about the suitability and cost-benefit comparison of PEV use versus the use of conventional ICE or hybrid vehicles.

- **Infrastructure:** While research shows that PEV owners will do the vast majority of their vehicle charging at home, the availability of workplace and public charging stations is expected to have a significant impact on market adoption of PEVs. In all cases, selecting the proper features, locations, communications with and ownership of PEV charging stations is important and must be
addressed. The primary focus of the stakeholders engaged in the Infrastructure Work Area was to define a plan for deploying residential, workplace, private, and publicly available charging infrastructure in the community.

- **Education and Outreach:** The Education and Outreach Work Area explored the identification of existing or needed resources for electric vehicle knowledge, and developed a plan for disseminating that knowledge to appropriate partners and the public through outreach, training and marketing.

- **Policy, Codes and Standards:** The Policies, Codes and Standards Work Area consisted of stakeholders such as municipal planning and inspection departments, electrical contractors, electric utilities and businesses that have a large impact on a community’s successful adoption of PEVs.

- **Incentives:** Utilizing incentives is an important way to support the level of early adoption necessary to make PEVs a common consumer choice. The Incentives Work Area covered efforts to define and evaluate various benefits that could be provided to encourage community members to become PEV owners or drivers.

**Community Planning Matrix**

Advanced Energy and TJCOG used the Community Planning Matrix (CPM) to navigate through the readiness planning process. The CPM is a spreadsheet originally developed by Advanced Energy for the PEV planning process and customized through the M2S PEV readiness planning process.

The CPM was used to identify tasks, prioritize items and track completion of the readiness planning process. Tasks that were a lower priority or that were not completed were identified and noted. These tasks will be continually evaluated for ways to address the specific barriers during the plan implementation phase.

**1.7 Defining the Plan’s Boundaries**

The Greater Triangle PEV Readiness Plan’s boundary largely depended on where the vehicles in the community will travel on a daily basis. Most all-electric vehicles do not have the range to travel long distances and are better suited for the daily travel patterns of the average Triangle commuter (the average vehicle miles traveled per day in the Triangle is roughly 32 miles). In order to understand the travel patterns, a survey was conducted with the area Metropolitan Planning Organizations (MPOs) staff.

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are two MPOs located within the Triangle region, the Capital Area Metropolitan Planning Organization (CAMPO) and the Durham Chapel Hill Metropolitan Planning Organization (DCHMPO).

![Figure 3. CAMPO and DCHMPO Planning Boundaries, Source: CAMPO, 2035 Long Range Transportation Plan, 2011](image)

**PEV Planning Boundary Survey**

Partners in the M2S project created a “PEV Planning Boundary Survey” to standardize interviews with staff representatives from the Metropolitan Planning Organizations (MPO) in the Triangle region (see Appendix 2). There were two primary reasons that the Triangle reached out to the MPO representatives:

1. Defining the focus area based on pre-established criteria, such as data used by the MPOs (traffic pattern data, workplace densities, and other considerations), would assist with the justification of the boundary delineations; and
2. Involving the local MPOs as stakeholders early in the process, as it is their purview to plan for long-term regional mobility.
Steps for Defining the Planning Boundary Survey

In order to represent the entire project area, the planning boundary for the PEV readiness plan was divided into two parts:

1. **The Planning Area**: Covers the seven county region of TJCOG, following the county boundary lines of Johnston, Wake, Durham, Orange, Chatham, Lee and Moore Counties. All local government stakeholders within the planning area were invited to participate in the development of the Community PEV Readiness Plan.

2. **The Focus Area**: Considers the areas within TJCOG’s region that are most likely to consider the early integration of PEVs. As such, the highest workplace density within both the CAMPO and DCHMPO areas were identified, and a 30 mile radius was mapped out around each. Work place data was chosen as the indicator instead of residential data because of the nature of the plan (which is to look at daily travel patterns).

![Planning Area Map](image)

**Figure 4. Planning Area**: The planning area for the Triangle PEV Plan covered the seven county region for Triangle J COG
Figure 5. The Plan’s Focus Area was created using data collected from MPOs. The focus area boundary was overlaid on top of the planning boundary for the plan.
1.8 Goals of the Triangle PEV Readiness Plan
The goals of the Triangle Community PEV Readiness Plan were developed using Steering Committee input and guidance from the U.S DOE.

**Goal 1**
Identify and distribute local municipal best practices in permitting and installation of PEV charging stations that address concerns around optimal charging location decisions, built environment impacts on charging behavior, and installations at multi-family dwelling units.

**Goal 2**
Promote open information exchange with charging providers as well as training opportunities for the PEV workforce by working with existing programs, employment centers and community colleges.

**Goal 3**
Identify and address the unintended consequences of promoting and incentivizing PEVs at the expense of other traditional and alternative transportation options.

**Goal 4**
Explore ways to sustain the momentum created by this planning collaboration beyond the current grant by engaging the regional political leaders to work towards plan endorsement and adoption.
2 STAKEHOLDERS AND WORK AREAS

As PEVs continually become more available to North Carolina consumers, and charging stations appear in greater numbers statewide, the opportunity to generate PEV-related economic development also increases. In order to fully take advantage of these opportunities, North Carolina and the Triangle must work to continue to be a leader in PEV readiness. This vision requires coordination between a wide range of stakeholders throughout the community to become reality, including the Steering Committee, Content Experts and Stakeholders.

2.1 Steering Committee

The first group of stakeholders were invited to serve as Steering Committee members to guide the development of the plan. Advanced Energy worked with TJCOG to identify and invite representatives from each local government within the COG’s regional boundaries. A second part of the Steering Committee involved identifying “categories” of stakeholders whose engagement would be important to the plan. At least one representative from each of the following categories was invited to join the Steering Committee:

- Fleets and Utilities
- Transportation Demand Management
- Regional Transportation Organizations
- Economic Development
- Municipal Sustainability
- Universities and Community Colleges
- Municipal Codes and Inspections
- Corporate Business
- State Air Quality Protection

The goal was to have a Steering Committee of approximately 20 people; therefore, efforts were taken to invite those who may have more than one perspective and could represent multiple categories.
2.2 Content Experts
The second group of stakeholders included technical and subject matter experts. It was a crucial part of the planning process to bring in opinions from these stakeholders; however, many of the content experts were not available to attend monthly meetings. Instead they were invited to attend specific Steering Committee meetings which covered topics for which they could contribute their knowledge. An example of contributions from content experts included inviting building code inspectors to attend a Steering Committee meeting to speak on their processes for inspecting the installation of charging stations. The inspectors, who served as content experts, were able to educate the Steering Committee members and engage in a discussion on areas that should be addressed.

2.3 All Stakeholders
The third category of stakeholders included all existing and potential stakeholders in the community. Advanced Energy and TJCOG compiled a list of all stakeholders in the Triangle. These stakeholders were engaged in a two stage process:
1. Complete an opinion survey to identify barriers to and general perceptions of PEVs.
2. Host a PEV “rally” for the greater Triangle community to show the results of the Steering Committee’s research, and to create a sense of excitement within the general public.

2.4 Stakeholder Selection Process
The Steering Committee, content experts and all stakeholders were identified based on the focus areas for the Triangle PEV Readiness Plan. These categories included the following:

**Municipalities and Counties:**
Addressed the state and local government and the department of public works and transportation fields, including employees of any municipal or county governments within the Triangle.

Members on the Steering Committee identified within this category were selected to:
- Contribute knowledge of municipal requirements; and
- Help to discern common concerns local governments have over the increase of PEVs.

**Fleets and Utilities:**
Represented any individuals who worked with either a local utility or fleet. Several stakeholders from different organizations were included, such as Progress Energy Carolinas, Duke Energy Carolinas, ElectriCities, and the NC Electric Membership Cooperatives. Additionally several local fleets managers were invited including representatives of UNC Chapel Hill and local municipalities.
Members on the Steering Committee identified within this category were selected to:

- Help discern the common concerns for fleet managers in their decision to adopt PEVs;
- Contribute knowledge of the ways local utilities are preparing for PEVs; and
- Help decipher the impact of mass adoption PEVs will have on the electric grid, and how to manage this by influencing charging behavior.

**Regional Organizations:**
Represented regional planning organizations addressing the state and local government, clean cities coalitions and fleet categories suggested as part of the U.S. DOE’s PEV readiness planning. Several representatives were identified including all Triangle-based MPOs, regional transit authorities and transportation demand management professionals.

Members on the Steering Committee identified within this category were selected to:

- Contribute knowledge of local policies and ordinances that could affect the installation of charging stations; and
- Contribute population data in the area relevant to the estimation of PEV adoption.

**Familiarity with Codes and Inspections:**
This category was created to help recruit stakeholders who had an in-depth knowledge of codes and inspections in the Triangle area of North Carolina. Members on the Steering Committee identified within this category were selected to be able to contribute knowledge of local codes and inspections criteria that could affect the installation of charging stations.

**Universities and Colleges:**
Several Triangle area universities and colleges were invited to participate. Representatives from these institutions also provided knowledge about fleets, departments of public works and transportation, and owners/operators of property where publically available charging stations can be placed. Placing PEVs on local campuses can also create publicity and training opportunities. Seven individuals from four different entities were identified and invited, from associate professors to sustainability directors and fleet managers to transportation-demand management coordinators.

Members on the Steering Committee identified within this category were selected to:

- Contribute an academic perspective on land use, planning, economic development and other issues surrounding the adoption of PEVs; and
- Relay concerns university fleets have over adopting PEVs into their fleets.
**Relevant Businesses:**
Relevant businesses in the area were also identified as having an influence and interest in PEV planning. Members on the Steering Committee identified within this category were selected to be able to relay concerns local businesses have about installing charging stations on their property (whether public or for employee access only).

Aside from these six categories other individuals relevant to the specific topical areas of this project were invited to participate in key meetings as guest speakers. The main organizations or individuals sought for participation included car dealers, credit unions, transit organizations, transportation officials, property/parking deck managers, code officials and education and outreach specialists.

**2.5 Work Areas**
The Steering Committee used the CPM and content collected from the technical and content experts to address the five work areas for the development of the Community Readiness Plan:

1. Vehicles
2. Infrastructure
3. Education and Outreach
4. Policy, Codes and Standards
5. Incentives

Content experts were invited to individual steering committee meetings to assist with and share their knowledge with the group and to help identify strategies and recommendations for the plan. For a full description of the work completed in each work area and the content experts who attended the meeting, please visit the chapter associated with the specific work area.

**2.6 The PEV Planning Process**
Monthly meetings were organized to discuss in detail the focus areas (described in section 2.4). Preliminary meetings introduced the stakeholders to the topic of PEVs and PEVs specifically in the community. Subsequent meetings included discussions of work area topics.
2.7 Public Engagement for the Triangle Plan

To help engage stakeholders in the various work areas and the overall PEV Readiness Plan, different tactics were used to best draw out the ideas of stakeholders, and gather their opinions to be incorporated into the plan.

**Work Sheets**

Worksheets were created for the five focus areas of the plan. They included a brief summary of the topic areas, and three- to- four pointed questions asking the stakeholders opinions. The worksheets were handed to stakeholders following the presentation of the topic area, and stakeholders were given approximately five minutes to respond to the questions. Discussions followed the completion of the worksheets, allowing time for stakeholders to project their ideas and play off of the ideas of others. (See Appendix 3 for worksheet examples.)
Feedback Surveys
A survey was created to help obtain feedback from key stakeholders in the Triangle regarding the Community Readiness Plan. The survey was sent to 60 key stakeholders and consisted of four sections:
1. Ratings of familiarity in regards to specific aspects of PEVs
2. Ranking what stakeholders consider to be the most vital issues related to charging infrastructure, vehicles, purchase and ownership of PEVs
3. Most interesting PEV subject area
4. Identifying factors for the survey taker including business/industry type and optional contact information

A full copy of the survey can be found in Appendix 2.

Several factors, including summer schedules and abundance of other surveys around the topic of PEVs led to a response rate that was lower than desired for the Triangle stakeholder survey. It is recommended that the survey be administered again in the future to capture feedback and opinions on PEVs.

Community PEV Readiness Planning Blog
Steering Committee members were also engaged through updates to the Triangle PEV Readiness Planning blog. These updates generally included information on both past and future events and infrastructure installations. Steering Committee members who missed meetings could refer to the blog to read an overview of the meeting and view agendas and photographs.

The Triangle PEV Readiness Planning blog was housed under the NC PEV Taskforce website along with blogs for the Asheville, Charlotte, and Piedmont Triad PEV Readiness Planning efforts. Visit www.advancedenergy.org/transportation/ncpev/blog/triangle/index.php to view the blog.

Public Awareness Events to Gather Feedback for the Plan
The PEV Awareness Week (October 1-6, 2012) showcased different communities throughout the Triangle and served to boost awareness of PEVs and their benefits. The events also increased awareness about the PEV readiness plan for the Triangle. More information on PEV Awareness Week can be found in Chapter 6: Education and Outreach.

NC PEV Taskforce Meetings
The leaders of the Triangle Readiness plan reported community updates at each quarterly statewide taskforce meetings (including a statewide teleconference and two in-person meetings in the Piedmont Triad and Charlotte). At the September Taskforce meeting the each of the community readiness plan members
for the Asheville, Charlotte, Piedmont Triad and Triangle regions participated in breakout sessions with stakeholders from across the state. Stakeholders discussed three unique topics for the Triangle including:

1. **Permitting**: Discussed in Policies, Codes and Standards Section of this plan
2. **Polycentric Metropolitan Centers**
3. **Stakeholders**: Discussed Below

For more information about these discussion topics and the feedback received, please visit the associated chapter in the plan.

**Community Breakout Session from NC PEV Taskforce Meeting, September 2012**

**Question 3**

Question posted to NC PEV Taskforce breakout session participants: “Stakeholders: the Triangle has the key demographics that cause the area to be an early adopter community. We would like to discuss how to better involve these key stakeholders including research and technical institutions, local universities, and the local governments. Additionally, we would like to discuss how to ensure social equity among the planning considerations. How do we plan for and involve all stakeholders?”

Recommendations from the group included items such as targeting key demographics and working with stakeholders including the public and vehicle dealers to provide information on PEVs. Table 2 provides paraphrased responses from the Community Break Out session.
<table>
<thead>
<tr>
<th>Table 2. Paraphrased Responses, NC PEV Taskforce September 2012 Meeting, Community Break Out Session: Stakeholder Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use public opinion surveys</td>
</tr>
<tr>
<td>Work with local dealer surveys</td>
</tr>
<tr>
<td>Concentrated population areas generally have charging infrastructure, concentrate on very visible bridging locations; host PEV cruise-in events w other community events</td>
</tr>
<tr>
<td>Social equity: enroll more banks in reduced into rates on auto loans for &quot;clean vehicles,&quot; such as PEVs/PHEVs, including used vehicles; locate PEV/PHEV, We Car/Zip Car stations/vehicles in some economically less affluent areas of cities/towns; promote PEVs and charging stations with old media (billboards, posters, newspapers) which don’t require smart phones/computers</td>
</tr>
<tr>
<td>Issue w/ 240 volt outlet installs; no tie to charging stations; use w/ plug-in chargers</td>
</tr>
<tr>
<td>Census: there must be an ideal demographic of EV buyers; maybe those purchasers are also doing solar panels. Look at other census community information; use block group with income/age.</td>
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<tr>
<td>Ask PEV owners driving patterns, start with Prius owners</td>
</tr>
<tr>
<td>Add a checkbox to electric permit</td>
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<tr>
<td>Auto registration records</td>
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3 VEHICLES

3.1 Introduction to Vehicles Work Area
PEVs have continued to gain in popularity in North Carolina and in the Triangle as new models, and even new vehicle manufacturers have come to the market or will in the near future. With this influx of new electric vehicle technologies, it has become increasingly challenging for buyers to be able to understand their options.\(^\text{10}\)

The Vehicles Work Area of the Triangle Readiness Plan covers goals related to tracking the number of PEVs in operation in the Triangle community and making information about PEVs available to both governmental planners and potential PEV drivers. The information contained in this topic area helps to define the context for other topic areas of this plan as it shows the current extent of PEV deployment as well as future projections. Stakeholders involved in this part of the planning gave feedback about the suitability and cost-benefit comparison of PEV use versus the use of conventional ICE or hybrid vehicles. They also helped develop strategies to keep local fleets and other stakeholders informed and interested in PEV adoption. This topic area takes national and state-level information and translates it into local implementation strategies suitable for the Triangle.

3.2 The Triangle Background on PEVs

Market Introduction
As of December 2012, the PEVs available for purchase and in use in NC were:

- Chevrolet Volt
- Nissan Leaf
- Mitsubishi i-Miev
- Several other small-production models by Tesla, Fisker, Coda and Think.

Ford has also released a PEV with the all-electric version of the Focus. Despite initial announcements in November of 2011 that Raleigh-Durham, NC would be among the first markets for a rollout in late 2011\(^\text{11}\), it has currently only been distributed to dealerships in California, New Jersey and New York with plans to add another 13 states to that list in 2012.\(^\text{12}\)

Several other models are expected to be deployed soon. (For a full discussion of the current and near-future model availability, please refer to the NC PEV Roadmap or to the “Plug-in Vehicle Tracker” at http://www.pluginamerica.org/vehicles.)

**Triangle PEV Stakeholders**

Individuals in the Triangle have a long history of enthusiasm for PEVs. By 2009 the Triangle Electric Auto Association had signed its bylaws\(^\text{13}\) to become a chapter of the national EV enthusiast group called the Electric Auto Association (EAA), but their members have been converting their cars to PEVs since 1975\(^\text{14}\). For years, this group has helped make PEVs more accessible to interested individuals, and now that interest is growing among individuals as well as the private sector and government. Dealerships from across the region were engaged in this planning process and offered key advice to inform our discussions of the barriers to electric vehicle adoption. They also supported our outreach and education efforts by providing vehicles and staff at regional ride-and-drive events which in many ways are unparalleled in their power to convince people that PEVs are available, affordable and fun to drive (see Chapter 6: Education and Outreach).

The utilities are also engaged in this process and have played a crucial role. While they are conducting their own PEV vehicle study programs and have not yet released their results, they were able to help gather advice and feedback from vehicle manufacturers as well as the Electric Power Research Institute (EPRI) that is relevant to the Triangle and useful for planning.

The U.S. DOE promotes alternatives to petroleum usage in vehicles through the Clean Cities program. There are currently nearly 100 Clean Cities Coalitions in the country\(^\text{15}\) and for more than 10 years the Triangle Clean Cities Coalition (TCCC) has been active in this region. Through forming a central point for technical assistance and collaboration on grants, the TCCC brings together stakeholders from the public and private sectors and has displaced millions of gallons of petroleum that would otherwise have been burned in the region. The TCCC is housed in the TJCOG, which “promotes collaboration among local governments, stakeholders and partners, tackling challenges that cross jurisdictional lines\(^\text{16}\).”

Working on a statewide level, the N.C. State Energy Office (NCSEO) and the NC Solar Center have also helped stakeholders in the Triangle through creating or coordinating vehicle purchase grants, and other

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\(^{14}\)Triangle Electric Auto Association, (2012), retrieved from Local EVs. Retrieved from http://www.rtpnet.org/teaa/TEAA/Local_EVs.html
programs and projects designed to increase the use of alternative fueled vehicles such as PEVs. There are also several research organizations that are based in the Triangle and are dedicated to improving the knowledge and technologies that PEVs and their infrastructure depend upon. Two of these are the Advanced Transportation Energy Center (ATEC) which is focused on developing vehicle battery and power electronics technologies\textsuperscript{17}, and Advanced Energy’s Electric Transportation program which is committed to helping people “understand, plan for and implement electrified transportation.” Advanced Energy has led this arena with several groundbreaking initiatives like the Plug-in Hybrid School Bus (PHESB) Project, assistance with leading communities such as Raleigh and Durham, development of PEV readiness guides and handbooks and the PEV Usage Study\textsuperscript{18}. Additionally, Advanced Energy is a co-author of this plan.

3.3 NC PEV Taskforce: Vehicles Working Group

Members

Most members of the NC PEV Taskforce volunteered to be a part of the Vehicles Working Group at the launch meeting on October 27, 2011. Several others joined the Working Group over the course of the successive months of plan input. The final member list is included in the NC PEV Roadmap.

Members of this Working Group included representatives from private vehicle, equipment and technology firms as well as public educational, governmental and planning organizations from across the state.

Goals

During the first Working Group meeting, the group identified several possible goals, and many of the initial ideas for this topic area overlapped with those of other NC PEV Workgroups. Finding effective ways to promote vehicles, for instance, would fall under the Outreach Workgroup and figuring out which incentives work for first-time adopters would fall under Incentives. While it was possible for the Vehicles Working Group to merge or partner with these groups to pursue these aims, it was decided it would remain an independent group while pursuing the following more fundamental goals and then join in with other workgroups if time allowed.

1. Goal 1: Reduce the barriers to PEV adoption in NC that pertain to the vehicles themselves.
2. Goal 2: Increase the available information about PEVs in the state, both now and on an ongoing basis, as a foundation for other PEV planning efforts.
3. Goal 3: Predict the future of PEV deployment in NC in terms of the number, type, and uses of PEVs.

\textsuperscript{17} \textsc{FREEDM Center. ATEC} (2012). Retrieved from \url{http://www.freedm.ncsu.edu/index.php?s=15}
\textsuperscript{18} \textsc{Advanced Energy, Transportation Initiatives}, (2012). Retrieved from \url{http://www.advancedenergy.org/transportation/}
Focus Areas
This working group decided to align its focus areas with those of the U.S. DOE sample plan, and then to add in other focus areas as needed to tailor the plan to the Triangle community.

- Assess and propose reductions to barriers to PEV adoption in NC that pertain to the vehicles themselves, such as vehicle availability, battery life, vehicle range, vehicle performance and total cost of ownership.
- Establish regular communications with the NCDMV to collect information on the number, type, and location of registered PEVs in the state, both now and on an ongoing basis.
- Collect information from the Original Equipment Manufacturers (OEMs) on their plans for further PEV deployment in N.C.
- Assess current usage of PEVs in public and private fleets in N.C. and estimate future usage.
- Collect information on the usage patterns of current PEV users.

3.4 Triangle: Vehicles Work Area

Content Experts
Significant contributions were made by several local experts to direct the work of the Triangle Steering committee in exploring the Vehicles topic area. Representatives from local dealerships, utilities and transit agencies provided expert perspectives on the obstacles and opportunities to PEV adoption in the Triangle.

Focus Areas
Tasks in the Vehicles Work Area included developing a plan for PEV deployment in the Triangle consisting of:

- Estimating the number of PEVs anticipated to be privately-owned for personal use, or privately- or publicly-owned for fleet use, and an analysis of usage patterns of vehicles in the Triangle.
- Assessing and proposing any barriers to PEV adoption specific to the Triangle that pertain to the vehicles themselves, such as vehicle availability, battery life, vehicle range, vehicle performance and total cost of ownership.

Subtasks for the Vehicles Work Area also included working with area dealerships, fleet managers and purchasers to keep them informed and also understand what their needs and interests are related to PEVs.
3.5 Plug-In Electric Vehicles (Deployment Estimates and Usage Patterns)

Triangle Steering Committee
The Steering Committee for the Triangle PEV readiness Plan met on May 8, 2012 to discuss the Vehicles focus area of the plan. The discussion was organized around three central questions:

1. Who are key partners needed to expand the use of PEVs in the Triangle?
2. What are some approaches to increasing the use of PEVs in the Triangle?
3. What are the best ways to communicate the benefits of PEVs?

Discussion on the first question led to the recommendation to establish key partnerships with fleet managers, local governments and dealerships to expand the use of PEVs in the Triangle. Among the other important partners listed by the Steering Committee (beyond those already included in this planning effort) were:

- News media – to help increase the coverage of PEVs and normalize them as a part of our transportation infrastructure
- Major companies/businesses – to increase the availability of workplace charging
- Regular customers/drivers – to provide testimonials about the PEV driving experience
- Universities – to fill the dual roles of early-adopter for PEV usage in fleets and PEV car sharing to provide opportunities for students to experience PEV driving
- AAA – to continue developing their PEV roadside assistance and mobile charging program
- First responders – to ensure that first responders are aware of the unique aspects of PEVs that are involved in accidents in order to reduce any associated risk to the responder.

The second question, asked about approaches to increasing the use of PEVs in the Triangle. This led to a wide-ranging discussion that led to significant overlaps with the education and outreach and incentives focus areas of this report. Encouraging the use of monetary and non-monetary incentives was of particular interest to the Steering Committee, but this is covered in Chapter 7: Incentives. In the end, the discussion relevant to the Vehicles section could be summarized into a recommendation to increase the use of PEVs in the Triangle by increasing their visibility in the media and at existing events and confronting misinformation that leads to perceived barriers.

The third question, regarding communicating the benefits of PEVs, led to discussions which provided input related to the best ways to communicate the benefits of PEVs in the Triangle. Again, the news media was cited as a crucial channel to reach the broad audiences in the Triangle, but other more direct and personal communications methods were also prioritized. Social media was highlighted as a free medium to reach targeted audiences, especially younger audiences that might be part of the early-adopter group. Word-of-mouth testimonials from current owners was also listed as a very effective means of answering questions and allaying fears of the new technology on an individual level. In all, this discussion leads us to the
recommendation to distribute information about the benefits of PEVs broadly through news media and in a more targeted way through social media and owner testimonials.

**Estimate of Personal and Fleet PEV Deployment**

One of the main focus areas of the vehicles workgroup of the NC PEV Taskforce was to work with the NCDMV to identify the number of PEVs currently registered in the state on a county-by-county basis. Once the data on the current number of PEVs in the state was collected, it could be delivered out to the four community planning areas for their use as well. While straightforward on its surface, this process was complicated by several factors including the number and size of transportation administration and planning organizations in North Carolina, as well as the necessary privacy protections associated with vehicle registration information.

The first data the workgroup received was from the NCDOT. Because it was based on a query that pulled all of the registered vehicles coded with an “electric” fuel type, it included what appeared to be small low-speed neighborhood electric vehicles (NEVs) and golf carts, as well as vehicles known to be gasoline-powered. Since the vehicle registrations and title applications data that form the basis for this data can be entered by NCDMV employees at more than 100 Vehicle and License Plate Renewal Offices throughout the state, as well as by any automobile dealer through an on-line form, it is not surprising there was some variability in the way vehicles were classified by fuel type. The work group did not think it was an accurate representation of the current numbers of PEVs in the state and began looking for another source. A second dataset from NCDMV provided the workgroup with a much more filtered set of results, yet this report was unofficial and limited to only a few counties.

Finally, with the help of Advanced Energy, the workgroup found that the Data Control Unit of the Traffic Records Branch of the NCDMV is the entity responsible for determining eligibility and responding to requests for information on registered vehicles. Eligible entities are defined by general statute. Once the workgroup contacted the Data Control Unit, the process for proving eligibility and requesting the registered vehicles data was clearly and professionally explained and managed.

Through this channel, workgroup leads at TJCOG were approved to receive a free government-to-government download of all of the PEV models that were then available in the state (July 2012) on the address level.

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20 Delores Farmer, dfarmer@ncdot.gov, DMV Traffic Records Branch, Data Control Unit, 3105 Mail Service Center, Raleigh, NC 27699-3105 (2012).
As of mid-August 2012 there were 291 registered PEVs in the Triangle. Of these, 263 (90 percent) were privately-owned or leased, 22 (eight percent) were operated as a part of a public or commercial fleet, and six (two percent) were of unknown ownership.

(For a full discussion of the process followed in attaining this count, please refer to the NC PEV Roadmap).
Projected Future Personal and Fleet PEV Deployment

EPRI has modeled the growth of the PEV market at the county level in the U.S. over the next 20 years. This model has a high degree of error (of somewhere around a factor of ten), but it can be used as a starting point for discussions about what we can expect future PEV deployment to look like in the Triangle.

As with the overall market in the state, analysts seem to agree that the PEV market in the Triangle will grow slowly over the next few years, but it is expected to pick up dramatically. Uncertainty in the degree of this increase grows when factoring in the possible impacts of increases in the costs per gallon of petroleum, but the increase itself is not often questioned.

By 2020, EPRI estimates that there will be over 22,000 total PEVs in the Triangle, and this number increases to over 158,000 by 2030. Assuming that the percentage of PEVs owned by individuals instead of fleets will remain constant at 90 percent, the estimate of personal use PEVs in 2020 is expected to be more than 20,000 and in 2030 more than 142,000.

Validation of this model can be achieved only within its large given error range. That said, the model predicts that there would be 1,289 PEVs in North Carolina by the end of 2012, which is relatively close to what was expected given there were 719 PEVs as of August 2012, which left the entire last quarter of 2012 for further growth.

Fleet adoption of PEVs may be expected to grow faster if the business case can be made to them. If EPRI’s total cost of ownership study is correct and PEVs can have a two-to-six year payback period, then they can be expected to save a fleet a significant portion of their operations maintenance costs over a ten year duty cycle (For a full discussion of the total cost of PEV ownership, please refer to the statewide NC PEV Roadmap). With their economies of scale, fleets may find it easier than individuals to overcome the higher initial purchase price for PEVs in order to take advantage of overall savings. Some of the largest commercial fleets, such as Frito Lay and FedEx, are already using PEVs for medium-duty delivery trucks. With 275 and 87 all-electric trucks deployed respectively in the US by the end of 2012\(^1\), these two companies are helping to make that business case for all commercial fleets. In one dramatic and recent example from the public sector, the Pentagon has announced plans to purchase 1,500 Chevrolet Volts\(^2\) over the next few years.

Responses to a survey of fleet managers in North Carolina conducted by the NC Solar Center show that N.C. fleets may have begun to see this business case already. Out of 242 respondents, close to 40 percent


said that they either had a high level of interest in purchasing PEVs or that they already had purchased them. Only 12 percent had no interest\textsuperscript{23}.

**Projected Usage Patterns of PEVs**
North Carolina will learn about usage patterns of PEVs through PEV Consumer Usage Study conducted by Advanced Energy. This multi-year study launched in 2011 intends to leverage both of the DOE/Blue Skies and North Carolina State Energy Office consumer adoption initiatives. The study will build upon the strong momentum created through the implementation of these initiatives, which helped deploy public and workplace charging infrastructure across North Carolina and incentivized the purchase of 40 PEVs. The vehicle usage data obtained through this program will help determine how typical drivers use PEVs and evaluate any changes in operating behaviors over time. This study will quantify how, when and where PEVs are used and how they impact the electrical grid. Results from the study will support planning activities related to charging, usage clustering, and electrical load characteristics. This study will also provide information that will highlight changes in ‘range confidence’ as consumers become more familiar with their vehicles and the availability of charging infrastructure within their usage corridors.

As of November, 2012 the study has collected 10 month of data and produced over 300,000 electric miles driven, two billion data points collected and displaced over 10,000 gallons of gasoline. Preliminary results find that over 67% of participants are charging both at work and at home. Additionally the maximum daily miles traveled has increased as users become more comfortable with the range of their vehicles. The study has also found that that there are distinguishable differences in charging patterns between those with and without home charging stations.

Additional data will be released as the study continues. For more information on the PEV Consumer Usage Study visit [www.AdvancedEnergy.org/transportation/programs_and_initiatives](http://www.AdvancedEnergy.org/transportation/programs_and_initiatives).

**Lithium Production and Battery Recycling**
North Carolina has a long history with the lithium needed to manufacture the batteries used on most production PEVs. In the early 1950s, and for most of the following 50 years, a mine in Kings Mountain, North Carolina produced most of the world supply of Lithium\textsuperscript{24}. The original company that owned the Kings Mountain mine is now owned by Rockwood Holdings of Princeton, N.J., which continues to mine lithium around the world. Representatives from Rockwood Lithium presented to the NC PEV Taskforce on June 19, 2012 and affirmed that lithium mining in N.C. is still possible, depending on the future price of the material. Raleigh is also home to Umicore – a branch of an international materials technology firm. Among

\textsuperscript{23} Survey. NC Solar Center, NC PEV Roadmap. (2012)

other interests, Umicore recycles the large lithium batteries used in PEVs\(^{25}\). With this kind of internationally significant trade in new and recycled lithium, the Triangle and N.C. may be well-placed for economic development as PEV markets increase around the world.

### 3.6 Conclusions

In many ways, the barriers and opportunities to PEV adoption in the Triangle are the same as those experienced by communities across the country: range anxiety that is being offset by advances in battery technology and the proliferation of charging stations, high initial costs of ownership but lower costs over time, etc. There are, however, a few key differences to the challenges and opportunities present in the Triangle that make it unique.

The Triangle has multiple large urban centers clustered near the center of the region: Raleigh, Durham, and Chapel Hill, among others. This polycentric urban spatial structure has commute patterns which are far more complex than for a single-centered metropolitan area like Charlotte. With the daily movement of multiple centers of population to various areas of workplace concentration it can be difficult to determine where the concentrations of PEVs will be at a given time of day. This makes it more difficult for local governments to plan for public EVSE locations and for utilities to predict for local energy loads as PEVs increase. The detailed information that will be provided by studies such as the Advanced Energy PEV Usage Study should provide invaluable insights into the current transportation and charging patterns of PEV users in the Triangle’s complex network.

The Triangle population also has a good share of the key demographics of youth, technological acceptance and disposable income that help make it an early adopter community. Future outreach efforts by research and technical institutions, local universities and the local governments can be targeted to further involve these key stakeholders. At the same time, care must be taken to plan for and involve all stakeholders in the PEV readiness process. Especially when considering the provision local government incentives aimed at early adopters, these must be balanced by benefits to the larger public welfare in order to preserve social equity. The case must be made that these incentives and planning efforts are necessary and that through them there will be an increase in the adoption of PEVs that will create local jobs, improve air quality and reduce our dependence on foreign energy sources.

Lastly, the NCDMV and other state-level offices are located in the Triangle. This creates an opportunity for regional efforts to catch the attention of the state as well as the local leadership. The Vehicles Work Area is currently working with the NCDMV to track the number of PEV in the region and statewide by make and model. This may become more difficult as the number of makes and models for electric vehicles increase in

North Carolina, and we may consider switching to a system that decodes VINs from the records we receive on registered vehicles. These VINs vary slightly by OEM, but once decoded they will indicate if the vehicle is a PEV, as well as providing several more potentially useful attributes.

### 3.7 Recommendations

Table 3 provides recommendations derived from the individual and group feedback of the Triangle Steering Committee and the discussions that followed.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Time Frame*</th>
<th>Priority Level**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Establish key partnerships with fleet managers, local governments, and dealerships.</td>
<td>Ongoing</td>
<td>High</td>
</tr>
<tr>
<td>1.2 Correct misinformation that leads to perceived barriers to PEV adoption.</td>
<td>Long term</td>
<td>High</td>
</tr>
<tr>
<td>1.3 Increase visibility and knowledge of the benefits of PEVs broadly through news media and in a more targeted way through social media, and owner testimonials.</td>
<td>Medium term</td>
<td>Medium</td>
</tr>
<tr>
<td>1.4 Communicate the benefits and total cost of ownership of PEVs to public and private fleet managers.</td>
<td>Medium term</td>
<td>High</td>
</tr>
<tr>
<td>1.5 Provide authoritative third party information about PEVs to dealerships to help them respond to prospective PEV driver concerns.</td>
<td>Short term</td>
<td>High</td>
</tr>
</tbody>
</table>

*Term Lengths for Recommendations

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-Term</td>
<td>1 to 2 years</td>
</tr>
<tr>
<td>Mid-term</td>
<td>3 to 5 years</td>
</tr>
<tr>
<td>Long-term</td>
<td>6-10 years</td>
</tr>
<tr>
<td>On-going</td>
<td>No set start or end time</td>
</tr>
</tbody>
</table>

**Priority Levels for Recommendations

<table>
<thead>
<tr>
<th>Priority Levels</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>
4 INFRASTRUCTURE

4.1 Introduction to Infrastructure
While research shows that PEV owners will do the vast majority of their vehicle charging at home\textsuperscript{26}, the availability of public charging stations can significantly increase range confidence for battery electric vehicle drives and can accelerate the return on investment for plug-in hybrid electric vehicle drivers. Thus, a community’s decision to install public charging stations is a strong indicator of support for PEVs. The presence of workplace charging for employees, customers and fleet applications can also significantly impact PEV adoption. In all cases, selecting the proper features, locations, communications and ownership for these stations is important and must be addressed. \textsuperscript{27}

The primary focus of the Infrastructure Work Area is to:

1) Identify existing charging infrastructure and/or existing plans to deploy infrastructure.
2) Define a plan for fully deploying residential, workplace, private and publicly-available charging infrastructure in the community.

The following discuss the process for addressing charging infrastructure in the Triangle region, including the region’s background in infrastructure deployment, planning activities on the state level that have regional applications, and the Triangle region’s own community planning activities for infrastructure deployment. Recommendations for future activities are presented at the conclusion of this section.

4.2 Triangle’s Background in Infrastructure
Organizations in the Triangle region have been working to deploy charging stations since 2009. As of this writing, 152 stations have been installed at publicly available locations, and 112 have been installed at private corporations for employees. Maps in following sections depict the locations of these stations.

The following organizations are examples of the Triangle’s forward thinking. They have proactively installed charging stations in anticipation of the projected increase in PEVs in the Triangle region. Each example demonstrates leadership in PEV planning, and each organization has plans in place which positioned them to take advantage of grant funding and other revenue sources to install infrastructure.

\textsuperscript{27} U.S. DOE Sample Plan Outline
\textsuperscript{27} Advanced Energy, Community Planning Guide for Plug-in Electric Vehicles (December, 2011).
**City of Raleigh**

The City of Raleigh is a leader in implementing charging stations. Through its early adoption of PEV technologies and its proactive engagement with key partners and citizens, Raleigh is taking advantage of the many benefits that accompany the use of PEVs as they become increasingly available in the region. In 2009, Raleigh was chosen by the RMI to join “Project Get Ready.” Through Raleigh Project Get Ready, the City of Raleigh, Progress Energy Carolinas, Advanced Energy, and RMI collaborated to begin mapping pre-existing charging locations and coordinating the installation of new stations. In 2011, the Triangle Clean Cities Coalition assisted the City in developing a PEV Implementation Plan.

Since 2009, Raleigh has installed 29 charging stations with 11 of those reserved for their fleet and 18 open to the public. There are seven Level 1 only charging stations and five Level 2 only charging stations. The remaining 25 charging stations are dual – equipped with Level 1 and Level 2 plugs. Two of the Level 2 charging stations are solar powered and used in conjunction with Progress Energy and Advanced Energy to assess the viability of solar power as a charging source. There are no current plans to add more public charging stations. However, Raleigh will install three inductive chargers, for City fleet electric vehicle use only, in early 2013 as part of the Apollo Program, a nationwide initiative aimed at encouraging the adoption of electric vehicles through the use of wireless charging technology.

The City of Raleigh collects usage data including total kilowatt-hours used, the number of charging sessions, and CO₂ offset using their “Periscope” software package. This software had already been collecting energy usage information for all other municipal operations, and Raleigh required all charging stations to be able to communicate with this existing software. To do so, the prospective installers had to ensure their stations were equipped with JACE technology from Active Logic, Inc.

This showed excellent foresight on Raleigh’s behalf in avoiding not only being required to purchase a separate software package to manage the charging station information, but also the monthly fees that are often associated with these packages. At this point, Raleigh’s municipal government pays nothing except for the cost of the power.

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*Data collected from the communications system called “Periscope” for the City of Raleigh’s charging stations indicated that as of October 2012 more than 3,600 separate charge events have occurred leading to a total CO₂ Offset of 6.70 (Information provided by City of Raleigh)*
City and County of Durham

The City and County of Durham are also leading the community in infrastructure adoption. In January 2012, the Durham City Council and the Durham Board of County Commissioners officially adopted the “Durham City-County Electric Vehicle and Charging Station Plan” — the first publicly adopted plan in North Carolina (See Appendix 9). In their objective to provide charging infrastructure to their citizens, the City and County will identify locations for future charging stations around Durham County, focusing on locations where people tend to spend at least an hour and that draw visitors from at least 25 miles away. The City and County will incorporate charging stations or conduit for charging stations in construction of new public facilities and parking facilities, including public streets, when budgets permit and when locations meet site selection criteria established in their plan.

Finally, the City and County will install conduit for future charging stations sites when performing regular maintenance/construction of roads, sidewalks, parking lots, etc. when budgets permit and when locations meet site selection criteria. This includes conduit for electrical and data collection infrastructure.

The City has installed two stations in the City Hall Annex parking garage for fleet vehicles and has installed two at Golden Belt for fleet vehicles and public use. The County has installed four public stations at the Justice Center Parking Deck, and two each at Main Library, Human Services, South Library and North Library.

Research Triangle Institute (RTI)

RTI installed the first two PEV charging stations in Research Triangle Park on its main campus for staff member use. RTI is a leader in science and technology and is committed to using that knowledge and expertise to also be a leader and role model for implementing sustainability practices and ensuring environmental responsibility. The RTI charging stations were funded by RTI corporate funds, as well as through a grant from North Carolina’s Clean Fuel Advanced Technology Project.

Duke Energy

Duke Energy, including Duke Energy Carolinas and Progress Energy Carolinas have conducted a pilot study on charging station usage. More information on that study is available in Chapter 8: Utilities.
4.3 Projections

EPRI has developed a model related to future PEV and charging station adoption. This model is an update to estimates published in October 2010; the updates result in a lower prediction of future adoption based on assumptions that vehicle purchases are not as aggressive as originally expected.

The adoption scenarios for the seven-county greater Triangle Region, and are based on the following updates and assumptions:

- The previous version of the forecast applied to light-duty vehicles as well as “lighter” heavy-duty vehicles up through Class 4. The updated forecast only applies to light-duty vehicles. EPRI is working on a forecast for heavy-duty PEVs; in the current forecast the adoption rate for all heavy-duty vehicles is set to zero.
- The new forecasts have been calibrated to nationwide PEV sales for 2010 and 2011, and EPRI has updated the ground-up forecast based on expected sales through 2015. The 2010 and 2011 sales have not been calibrated locally because EPRI does not have access to localized actual sales data.
- The updated low forecast is higher than the October 2010 low forecast through 2017, due to actual past sales and near-term expected sales falling closer to our medium forecast. Beyond 2017, the low forecast is unchanged compared to the October 2010 forecast.
- The updated medium forecast is lower than the October 2010 medium forecast through 2022, and unchanged beyond 2022.
- The updated high forecast is the same as the October 2010 high forecast after 2012, but delayed by one year.

4.4 NC PEV Taskforce: Infrastructure Working Group

Members and Backgrounds

In late 2011, the NC PEV Taskforce Infrastructure Working Group was formed to address questions and issues related to providing adequate charging infrastructure in the state of North Carolina to support plug-in electric vehicle adoption. The team included volunteers across a wide span of industry, non-profit, and governmental entities with representation from all four of the state’s regional readiness teams. Many of the deliverables of this working group are equally valuable and applicable at the state or community level. Rather than repeat much of the same information within each community readiness plan, it’s recommended that interested parties reference the NC Statewide Roadmap for the full range of infrastructure work products.
**Goals**
The objective of NC PEV Taskforce Infrastructure Working Group was to develop recommendations, best practices, and forecasts related to electric vehicle charging infrastructure deployment to enable widespread plug-in vehicle adoption in the state of North Carolina. The following goals were outlined to support the team's objective:

- Pull together educational information and resources regarding charging technology/vendors.
- Develop educational information and resources regarding the installation of charging infrastructure including best practices, flowcharts, and guides for all customer types.
- Develop ideal charging location considerations, macro and micro, to meet customer needs.
- Assess current market deployment of charging infrastructure and forecast future market needs along with ideal ratios of public stations related to future vehicle adoption.
- As available, collect current costs of installing charging infrastructure and provide recommendation to reduce costs as needed.
- Assess future grid impact along with providing recommendations to reduce future grid impact concerns.
- Identify range of infrastructure solutions and business models along with any recommendations to improve the marketplace.

**4.5 Triangle: Infrastructure Work Area- Steering Committee Considerations**

**Focus Area**
The Steering Committee considered the following questions for deployment of charging infrastructure:

- Who are the key partners needed to develop and implement local PEV infrastructure?
- What are some approaches to establish effective PEV charging infrastructure?
- What are the best ways to communicate best practices about PEV infrastructure (charging station availability, multi-family charging installation, smart grid compatibility, etc.)?

The Steering Committee concluded that many partners are needed in the effort to deploy infrastructure. Table 4.1 lists the partnerships important to the Triangle Region for infrastructure implementation. These partners all have a presence in the Triangle region, and many have already been engaged in the process either as part of the steering committee or in practical application of developing and installing infrastructure. The steering committee recognized community colleges as having particular importance in the development and installation of infrastructure. It is critical to train community college students in this field as they are the most likely workers to remain in the region and move into the work force with the specialized skills needed to install and maintain the charging units.
### Table 4.1 Key Partners for Charging Station Deployment

<table>
<thead>
<tr>
<th>Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community colleges</td>
</tr>
<tr>
<td>Business/industry</td>
</tr>
<tr>
<td>Malls/Shopping centers</td>
</tr>
<tr>
<td>Workforce development offices</td>
</tr>
<tr>
<td>Local governments</td>
</tr>
<tr>
<td>Local economic development boards</td>
</tr>
<tr>
<td>Component manufacturers</td>
</tr>
<tr>
<td>Software designers</td>
</tr>
<tr>
<td>Electrical installers/contractors</td>
</tr>
<tr>
<td>PEV manufacturers</td>
</tr>
<tr>
<td>Charging station manufacturers</td>
</tr>
<tr>
<td>Smart grid manufacturers</td>
</tr>
<tr>
<td>Museums</td>
</tr>
<tr>
<td>Schools/Universities</td>
</tr>
<tr>
<td>Banks/Credit Unions/Lenders</td>
</tr>
<tr>
<td>Hotels</td>
</tr>
<tr>
<td>Car rental companies</td>
</tr>
<tr>
<td>Airports</td>
</tr>
<tr>
<td>Repair garages</td>
</tr>
<tr>
<td>Chambers of Commerce</td>
</tr>
<tr>
<td>Churches</td>
</tr>
<tr>
<td>Fleets</td>
</tr>
<tr>
<td>Triangle Chapter of the Green Building Council</td>
</tr>
<tr>
<td>Building associations</td>
</tr>
<tr>
<td>Community Development Organizations</td>
</tr>
<tr>
<td>Commercials Real Estate Brokers</td>
</tr>
<tr>
<td>Electric Utilities</td>
</tr>
</tbody>
</table>

Table 4.2 lists approaches recommended by the Steering Committee to establish infrastructure. The Committee listed incentives (both financial and non-financial) as the most important approach, particularly in regards to keeping products made in the USA cost-competitive. Other approaches focus on outreach activities and workforce development and are discussed in greater detail in Chapter 6: Education and Outreach and Chapter 7: Incentives.
4.2 Approaches to Establish Effective Infrastructure

| Incentives (including financial and non-financial, and including incentives that allow products made in the USA to be cost competitive) |
| Universal signage, payment policies, and usage rules |
| Local media involvement |
| Promotion of certificate level workforce training programs and other workforce development activities |
| Evaluation of existing businesses to determine potential PEV scenarios |
| Car dealer involvement |
| Local events to promote PEVs |
| Streamlined installation processes |
| Streamlined permitting processes |
| Stress importance of the industry to NC |
| Publicize success stories |
| Low cost loans for charging stations |

The Steering Committee provided the following recommendations in order to best communicate successes and best practices of installing PEV infrastructure. Of particular importance to the Steering Committee was creating a central website and using media outlets to publicize success stories and jobs created, promote the Triangle as a national leader and communicating through social media. Creating outreach campaigns and working with chambers of commerce and other business associations, car dealerships, manufacturers, industry partners and politicians were also listed as important strategies to communicate best practices. These recommendations are discussed further in Chapter 6: Education and Outreach.

4.6 Infrastructure Installation Guidance

The state-wide Infrastructure Working Group put together an overview of installation guidance for the stakeholders of North Carolina. This guidance was based on the Charging Station Installation Handbook for Electrical Contractors and Inspectors and the Residential Charging Station Installation Handbook for Single and Multi-Family Homeowners and Renters written by Advanced Energy.

The following elements should be considered when installing charging stations:

1. Determine the best location for the charging station installation;
2. Select an appropriate charging station technology, based on the location selection; and
3. Decide the details of equipment ownership and operation.
Charging stations are the source of power for PEVs and range in style, charging speed, cost and installation complexity. To ensure proper technology selection and charging station placement, consumers need to understand the intended use of the charging station. While public and workplace charging stations are necessary for PEV owners to overcome concerns about where and when they may be able to charge, residential (or home) charging is likely to be the main charging selection for PEV owners. Figure 13 demonstrates the expected distribution of charging station locations across various vehicle user types.  

4.7 Charging Scenario Estimates

There are specific considerations for each charging scenario, which are discussed below. However, in all cases, the following principles of parking location and electric service accessibility apply:

Parking Location

Whether at a single-family or multi-family residence, the workplace or a public park, parking location must be considered when analyzing the best location for a charging station. Single-family residential parking scenarios can also vary from private garages and driveways to detached carports or on-street parking. Multi-family residential parking scenarios can vary greatly, from private garages, carports and driveways to on-street parking, parking lots and decks. Workplace parking scenarios can vary from on-street parking to expansive parking lots and/or multi-level decks as well. To identify the best-fit installation location:

1. Assess available vehicle charging options
2. Consider the planned parking scenario and proposed time of use.

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**Electric Service Accessibility**

Electrical requirements will vary, depending on the charging level selected. Level 1 charging is the simplest and most easily accessible method for home charging. Vehicles can be charged from a standard three-prong (120 volt) household outlet using the cord provided by the vehicle manufacturer. However, it is important to confirm the electrical panel has adequate load capacity for the supplied circuit to avoid tripping the circuit breaker while charging. Level 1 does not require installation of specialized charging equipment, but charging times can vary from two hours to up to 18 hours depending on your travel distance between charges.

Level 2 charging requires specialized charging equipment for vehicle charging. It requires an electrical supply of 208/240 volts (typical of larger household appliances such as a dryer or refrigerator) and an electric vehicle charging station. Equipment and installations can cost between $300 to $3,500 depending on the manufacturer, charging station model and features, and complexity of the installation at the selected location. Level 2 charging stations can be wall mounted as a plug-in appliance (allowing for simple removal of the unit) or hard-wired for a more permanent installation. Choose the option that works best for the installation, whether it is at a municipality, commercial/retail property or residence. Local electricians or electrical contractors can provide more information on the type of power supply available at any given location.

In some cases, an upgrade to the existing electrical service may be required for the addition of a vehicle charging load. Work with the company’s facilities manager to determine the building’s electrical capacity. If an electrical service upgrade is needed, installation costs can be significant.

**Estimates of Residential Charging Infrastructure**

As of August 2012, there were 281 electric vehicles in the Triangle. Every consumer must have access to residential charging of some type, whether it is Level 1 or Level 2. Additionally, residential charging allows users to actively manage vehicle charge times that take advantage of potential time-of-use electrical rates or qualify for a special utility PEV electrical rate.

Anyone who acquires a PEV will be offered some sort of home charging solution by their dealer/automaker. Alternatively, charging station hardware is also available on the internet and any licensed electrician can install; therefore, PEV owners should have “access.” Note: those who live in multi-family units may experience some issues in terms of charging station location selection, installation, who pays for the cost of...

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29 Local electricians will provide information on electrical load for private residences; often, municipalities, corporations, and commercial/retail locations will employ or contract directly with electricians.


the installation and obtaining approval from property managers. A more thorough discussion for single and multi-family units is provided below.

**Multi-Family**

In the greater Triangle Region (i.e., the seven counties in the Triangle J region), the 2010 US Census reports 728,268 housing units, 174,017 of which are multi-family units (at least two units). Table 5 lists the breakdown by housing type.

<table>
<thead>
<tr>
<th>Total housing units</th>
<th>453,835</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-unit, detached</td>
<td>50,113</td>
</tr>
<tr>
<td>2 units</td>
<td>15,825</td>
</tr>
<tr>
<td>3 or 4 units</td>
<td>23,072</td>
</tr>
<tr>
<td>5 to 9 units</td>
<td>39,155</td>
</tr>
<tr>
<td>10 to 19 units</td>
<td>53,193</td>
</tr>
<tr>
<td>20 or more units</td>
<td>42,772</td>
</tr>
<tr>
<td>Mobile home</td>
<td>50,303</td>
</tr>
</tbody>
</table>

Currently, a national guideline for multi-family installations does not exist, but the issue is being targeted in areas like San Diego\(^{32}\) and Sacramento\(^{33, 34}\) and through Advanced Energy. Multi-unit dwellings (also known as multi-family residences) are a classification of residential housing where multiple housing units are contained within one building, or several buildings within a complex, such as townhomes or apartment buildings. Some multi-unit residences may contain condominiums where one or more units are owned individually rather than rented or leased from a single building owner.

In addition to the considerations common to all charging scenarios, it is important for the user in multi-family units to consider the following:

- **Identify the owner** of the power supply, and develop an agreement that allows for the supply to be used. If the user does not own the parking location or power supply, it is important to gain approval

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from all applicable groups, such as property/building owner and/or home owner associations, prior to any installation work.

- **Electrical Metering**

  The question of who pays for the electricity used for vehicle charging and how it is paid can be very complex. There are several different methods for metering electricity use in multi-family residences and determining the amount of electricity used per vehicle can be challenging.

- **Residential Metering**

  Each tenant's electricity is metered by a dedicated electrical meter. Often the meters are grouped together in one location to make meter reading easier for the electric utility. Residential metering may make it easier to navigate the complexities of charging station installations at multi-unit dwellings; however, this is not always the case. It may not be cost feasible to route the electricity supplying your charging station through your dedicated electric meter.

- **Master or Group Metering**

  This metering type is a single meter that measures electricity usage for an entire building or area without distinguishing amongst the included areas/units. In this metering scenario, it will be difficult to determine the electrical consumption for a single tenant's charging station.

- **Common Area Metering**

  This metering measures the electricity usage in common areas, such as parking lots, laundry rooms and pool areas. It may be more cost feasible to connect a charging station to a common area meter, but as with master or group metering, it will be difficult to determine the electrical consumption for a single tenant's charging station.

With any of these metering cases, it is very important to consult with both the building or property owner and your electric utility to determine the best metering option for your charging station. In some instances, residential electrical loads can be sub-metered to capture usage and facilitate proper allocation of charges and billing; however, sub-metering in this manner is not always permitted.

- **Third-Party Approvals**

  If the residence is governed by a property manager or Home Owners Association (HOA), it is recommended they become involved early in the process to decide which changes can and cannot be made to the property. Come prepared to discuss the benefits of PEVs and how they can benefit the community and environment. Also, check your state’s laws and civil codes for information about installing charging stations. (For example, California Senate Bill 880, which went into effect in January 2012, restricts a home owners association’s ability to prohibit the installation of charging stations. However, this does not mean that associations cannot control or regulate installations.)

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Estimates for Workplace Charging Infrastructure

Workplace charging has been identified as a critical component to wide-spread PEV adoption. While the majority of vehicle charging is expected to occur at the owner’s residence, workplace charging can reduce driver range “anxiety” and support development of range “confidence.” Additionally, workplace fleet applications can lower overall business operating costs and assist compliance with government transportation emissions policies.

As employees begin to adopt PEV technologies, employers will be asked to provide workplace vehicle charging opportunities. In these instances, employers will need to:
- Consider the full anticipated charging need;
- Select the appropriate installation locations and equipment; and
- Develop an employee charging policy and procedure.

Employers offering workplace charging also need to consider employee parking policies and procedures. Some common questions regarding workplace charging are:
- Will there be parking restrictions? If so, how will they be enforced?
- Will users require a parking permit or pay a charging fee? If so, how will the fee be collected or permit assigned?
- Will vehicle charging be viewed as an employee benefit? If so, what are the implications (employee equity, tax reporting)?

It is possible to add charging access to any workplace, but it all depends on whether the employer is willing, the installation costs are reasonable and policies are developed.

Many employers in the Triangle have already installed charging stations based on employee demand and using both grant and corporate funding. In order to determine the number of stations at workplaces, the Station Locator application in the Alternative Fuel Data Center was used, as well as communication with Triangle employers.

Estimates of Publicly Available Infrastructure

Public charging stations serve the function of promoting range confidence. Drivers will have more confidence in purchasing a PEV if charging infrastructure is within range of their typical destinations. Availability of public charging may also increase visitor-ship and improve customer retention; however, it is important to note that public charging infrastructure should not be planned to serve as the primary means for vehicle charging.

In the Triangle, the following general assumptions may be used in determining charge length and therefore the locations of publicly available infrastructure:
The current industry standard estimates approximately one hour for every 10-15 miles of range. The average daily one-way commute in the triangle is 23 miles; therefore, two-three hours should be sufficient to fully charge a typical commuter vehicle.

Occupying a charging station space for more than the amount of time necessary to charge the vehicle reduces the capacity of that station to serve other users. Unless the region moves to a model of charging a premium for parking spaces that include charging stations, the most efficient stations will be located in areas where cars are naturally only parked for two-to-four hours. High-traffic locations that fit this description include some parking lots/decks, schools, libraries, service yards, fire and police stations, cultural venues and parks. As demonstrated above, both the City of Raleigh and the City/County of Durham have located public charging stations at such facilities.

**Municipal Charging**

Municipalities may provide greater benefit to citizens by installing infrastructure in locations where private parking is not located nearby, such as museums, parks, libraries and other high-traffic areas. Level 2 charging or faster is recommended for public charging applications.

- Sites should be evaluated for existing power capacity within the nearest panel as well as at the supplying transformer.
- Many locations, including parking decks, may have limited capacity beyond one or two charging stations.
- Planned parking locations and those under construction will greatly benefit by planning for excess power capacity and laying conduit for future charging infrastructure.

In some cases, an upgrade to the existing electrical service may be required for the addition of a vehicle charging load. It is recommended to work with the site facilities manager to determine the building’s electrical capacity. If an electrical service upgrade is needed, installation costs can be significant.

**Policy and Procedures**

Municipalities that offer vehicle charging opportunities also need to consider public parking policies and procedures. Some common questions regarding workplace charging are:

- Will charging locations be reserved for PEV parking only? If so, how will this be enforced?
- Will there be parking restrictions? If so, how will they be enforced?
- Will users require a parking permit or pay a parking fee? If so, how will the fee be collected or permit assigned?

---

**Commercial and Retail Charging**

Charging availability at commercial and retail locations allows users to charge while they shop or dine. Availability of vehicle charging opportunities at commercial locations may increase customer visits and lengthen their time of stay.

Level 2 charging, or above, is recommended for public charging applications.

- Sites should be evaluated for existing power capacity within the nearest panel as well as at the supplying transformer.
- Many locations, including parking decks, may have limited capacity beyond one or two charging stations. Planned parking locations and those under construction will greatly benefit by planning for excess power capacity and laying conduit for future charging infrastructure.

In some cases, an upgrade to the existing electrical service may be required for the addition of a vehicle charging load. It is recommended to work with the site facilities manager to determine the building’s electrical capacity. If an electrical service upgrade is needed, installation costs can be significant.

Retailers and commercial offices that offer vehicle charging opportunities need to also consider customer parking policies and procedures. Some common questions regarding commercial public charging are:

- Will charging locations be reserved for PEV parking only? If so, how will this be enforced?
- Will there be parking restrictions? If so, how will they be enforced?
- Will customers pay a fee for parking? If so, how will the fee be collected?  

In order to estimate the number of publicly available stations both in the Triangle region currently, and those that might be needed in the region in the future, several strategies were employed. As with workplace charging, the Station Locator provided a list of known charging stations. Communication among existing networks (such as the Triangle Clean Cities Coalition) identified stations that were not yet in the national database. Stakeholders were then encouraged to report the stations to the Station Locator website.

**Estimates of Privately Funded Charging Stations on Private Property**

It is difficult to estimate the cost of private charging stations; however, if property owners were willing to share information, it would be captured either by submitting it to the Station Locator or through communicating with existing stakeholder networks. Future needs were projected using the EPRI data.

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Workplace charging may fall into the category of private charging; however, most workplace charging offers at least limited access to the public. There are several cases of infrastructure reserved for fleet vehicles both in municipal settings and corporate settings, though these are more often not accessible to the public.

**Fleet Charging**

PEV fleets can dramatically reduce business operating costs and assist compliance with government transportation emissions requirements. For fleet charging, it is recommended to determine the number of charging stations required by estimating the size and electrical requirements of your PEV fleet over the next few years.

Common charging station installation challenges for fleet charging include:

- **Parking Location**
  
  To identify the best-fit installation location:
  
  o Assess the available vehicle charging options
  o Consider the planned parking scenario and time-of-use

  If considering eventual expansion of a PEV fleet, consider adding extra capacity to support future charging station locations. It is usually less expensive to install extra capacity during initial construction than to modify the site later.

- **Electric Service Accessibility**

  Level 2 charging, or above, is recommended for fleet charging applications as it can minimize fueling time and maximize vehicle utilization. Level 2 charging requires 208/240VAC power and typically a 40A dedicated-circuit. Sites should be evaluated for existing power capacity and proximity to the nearest electrical supply panel.

**4.8 Communications**

In the Triangle, municipalities, private companies and retail/commercial locations that own charging stations use various methods of data collection and communication to capture usage data. The City of Raleigh has enabled automatic data collection through their Periscope software system, and they required this communication setup as part of their request for bids at the beginning of the process. This type of software has the ability to capture:

- Total number of PEV stations in use at a given time
- Total power delivered
- Total carbon dioxide offset
- Average power per charge
- Median time of use
Other organizations have plans to incorporate automatic data collection, but are currently manually reading meters for aggregate kilowatt-hours used at all charging stations combined. Durham City/County, for example, is working towards a comprehensive energy management system that will incorporate charging stations and consider the above factors. In order to collect accurate and complete data, it is recommended that prospective charging station owners incorporate automated data collection in any installation.

4.9 Cost of Deployment and Sources of Funding

The cost to incorporate data collection software is highly variable, and depends on the type of data collection system, the brand of charging station and an organization’s existing technology infrastructure. Some software systems can cost hundreds of dollars per unit, and in other cases this software is included as part of an overall energy management system. However, some or all of the cost could be covered by grant funds, especially if the grant includes a data collection requirement. Additionally, if an organization is planning to implement a system-wide energy management system, it is important to include scenarios and consider costs of incorporating energy management for existing or planned charging stations. A full discussion of costs of installation charging stations can be referenced in the NC PEV Roadmap.
4.10 Charging Locations

Registered Plug-in Electric Vehicles and Public Charging Sites in North Carolina
August 2012

4.11 Conclusion

The Triangle region is a leader in the state in terms of charging station deployment. Many local government and private organizations have developed PEV plans and/or have deployed charging stations already. Remaining areas in the Triangle that have not yet been addressed include multi-family residences, and local government and private organizations that have not developed at least informal PEV and charging station deployment plans. Future efforts may be targeted to these subject areas.

4.12 Recommendations

Table 6 provides recommendations from the Triangle Steering Committee’s Infrastructure Work Area.
### Table 6. Recommendations from the Infrastructure Work Area

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Time Frame*</th>
<th>Priority Level**</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Create an ongoing Triangle EVSE coordinating council that can continually revise/update charging station locations and forecasts</td>
<td>Short-Term</td>
<td>High</td>
</tr>
<tr>
<td>2.2 Prioritize key locations, including workplace and retail locations, and concentrate public installations on very visible bridging locations</td>
<td>Mid-Term</td>
<td>High</td>
</tr>
<tr>
<td>2.3 Coordinate with the Triangle Clean Cities Coalition to help municipalities and private organizations deploy charging infrastructure</td>
<td>Mid-Term</td>
<td>High</td>
</tr>
<tr>
<td>2.4 Work with local higher education and government partners to develop protocols to track which 240v electrical outlet installations are tied to EVSE.</td>
<td>Mid-Term</td>
<td>Medium</td>
</tr>
<tr>
<td>2.5 Establish an ongoing relationship with NC DMV to correlate PEV ownership with home installations. Communicate PEV owner data locally as allowed in order to track home installation correlations.</td>
<td>Mid-Term</td>
<td>Low</td>
</tr>
<tr>
<td>2.6 Work with the Triangle Transportation Demand Management program (TJCOG) to survey major employers locally and ask if they have now or plan to have charging access in the future.</td>
<td>Short-Term</td>
<td>Low</td>
</tr>
<tr>
<td>2.7 Identify channels and methods to communicate charging station considerations to large, multi-family operators (HOA groups, building managers, etc.).</td>
<td>Short-Term</td>
<td>Low</td>
</tr>
<tr>
<td>2.8 Conduct local surveys of plans to install charging stations utilizing templates and information developed by Advanced Energy.</td>
<td>Mid-Term</td>
<td>Low</td>
</tr>
<tr>
<td>2.9 Develop or identify business models for localities to recoup charging station costs (i.e., the cost of providing electricity)</td>
<td>Mid-Term</td>
<td>High</td>
</tr>
<tr>
<td>2.10 Update projections of EVSE and PEV adoption scenarios as they are available from EPRI and other sources</td>
<td>Short-Term</td>
<td>High</td>
</tr>
</tbody>
</table>

*Term Lengths for Recommendations

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-Term</td>
<td>1 to 2 years</td>
</tr>
<tr>
<td>Mid-term</td>
<td>3 to 5 years</td>
</tr>
<tr>
<td>Long-term</td>
<td>6-10 years</td>
</tr>
<tr>
<td>On-going</td>
<td>No set start or end time</td>
</tr>
</tbody>
</table>

**Priority Levels for Recommendations

<table>
<thead>
<tr>
<th>Priority Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>
5 POLICIES, CODES AND STANDARDS

5.1 Introduction to Policies, Codes and Standards Work Area
Local policy, codes and standards can either help to ensure a more seamless adoption of PEVs into the Triangle market or hinder the process. This chapter explores the various local policies which may need to be reviewed or modified for PEV readiness. Community stakeholders who were engaged to address the Policy, Codes and Standards Work Area focused on two overarching goals:

1. To identify processes or requirements that may unintentionally inhibit the adoption of PEVs or the installation of charging stations while exploring options that foster adoption of PEVs and installation of PEV charging infrastructure.\(^{38}\)
2. To educate, discuss and gather feedback from local stakeholders in various policy positions.

Local Example: Importance of Codes
Permitting is an important part of the PEV adoption process. In the 1990s one major obstacle to the adoption of PEVs was the amount of time it took to install a charging station – almost three months! Customers who purchased a PEV were unable to charge their vehicles at home until they installed their residential charging station, which required a permit. This made adoption of PEVs much less attractive and PEV manufacturers want to avoid dealing with the same situation again. As such, they are targeting communities for early launch that are actively addressing the permitting process as well as related local building codes.\(^{39}\)

Today, many PEV purchasers will be installing charging stations in their homes. It is important the local governments not only develop streamlined and effective permitting processes, but that they also coordinate with key stakeholders, such as electric utilities, so that they can monitor the local impact to the grid.

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5.2 Existing PEV Policies, Codes and Standards in the Triangle

Table 7 provides examples of existing community policies, codes and standards in the Triangle region.

<table>
<thead>
<tr>
<th>Table 7. Existing Community Policies Codes and Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Raleigh:</td>
</tr>
<tr>
<td>➢ Streamlined permitting (24-48 hours)</td>
</tr>
<tr>
<td>➢ Comprehensive Plan: encouraging PEV adoption in the Comprehensive Plan</td>
</tr>
<tr>
<td>➢ Developed Greenhouse Gas Emission Reduction Standards</td>
</tr>
<tr>
<td>City/County of Durham:</td>
</tr>
<tr>
<td>➢ Developed first strategic plan in N.C. to cover PEV adoption in the city and in fleets</td>
</tr>
<tr>
<td>➢ Developed best practices and lessons learned for responding to Americans with Disabilities Act (ADA) requirements related to charging station installations</td>
</tr>
<tr>
<td>Town of Cary:</td>
</tr>
<tr>
<td>➢ Developed streamlined permitting process for residential permitting of charging stations. Also developed a one page permitting guide (see Figure 15).</td>
</tr>
<tr>
<td>Advanced Energy</td>
</tr>
<tr>
<td>➢ Worked with local governments in North Carolina to identify best practices</td>
</tr>
<tr>
<td>➢ Developed Community Planning Guide</td>
</tr>
<tr>
<td>➢ Developed Charging Station Installation Handbook for Electrical Contractors and Inspectors</td>
</tr>
<tr>
<td>➢ Developed Residential Charging Station Installation Handbook for Single- and Multi-Family Homeowners and Renters</td>
</tr>
</tbody>
</table>
5.3 NC PEV Taskforce: Policies, Codes and Standards Working Group

The NC PEV Taskforce Policy, Codes and Standards Working Group reviewed applicable policy considerations for the entire state. Below is the list of items covered at the State Level:

- American Disabilities Act (ADA)
- Signage
- Building Codes
- Permitting
- Zoning Codes & Ordinances
- Technical Training (coordinate w/ Education & Outreach working group)
- Legislative Considerations
- Model Plans
5.4 Triangle PEV Plan: Policies, Codes and Standards Work Area

Content Experts
The following content experts were invited to attend and participate in the Steering Committee meeting which covered policies, codes and standards:

- Permitting officials for local jurisdiction (including permitting office managers and inspectors)
- Planning Directors and Zoning Officials
- Americans with Disabilities Act (ADA) officials
- Historic District Representatives
- Transportation Department Representatives

Focus Areas
The Triangle Steering Committee considered the following for developing readiness efforts related to policies, codes and standards:

- Permitting Process
- Electrical Code
- Zoning Ordinances
- Historic Districts
- Parking Enforcement
- Signage
- Encroachment Agreements
- Workplace Charging Districts

Permitting Processes for PEV Infrastructure
To gauge the current state of the inspections and permitting processes for charging stations in the Triangle, a survey of local municipalities and counties was conducted. Twenty-two municipalities and counties were contacted, and 11 were successfully interviewed, including: Cary, Fuquay-Varina, Wake County, Knightdale, Sanford/Lee County, Chatham County, Durham City/County, Clayton, Orange County, Chapel Hill and Carrboro.

The survey was developed using guidance from local Triangle stakeholders and also reviewing other permitting surveys such as one conducted in the Bay Area of California by Friends of Earth in 2010\(^\text{40}\).

\(^{40}\) A Survey of Bay Area Permitting Procedures for Electric Vehicle Charging Infrastructure, Friends of Earth
http://api.ning.com/files/qwVL7mNryMTIbVn1120qJTq2GeAJRgrahBw4N4HZcwA3qmAUlYhHpRo*TKuXrZJLgVcgIJ-R-8MjKmjrp10Vg0DDgjkXGBBF/EVSEPermittingSurvey_BayArea.pdf
Triangle Permitting Survey Questions

As to each permitting office:

“We are interested in learning the distinctive permitting procedures for installation of EV chargers as they apply to a) residences, b) commercial buildings (both new and existing), and c) municipal buildings.

- What is the process for obtaining a permit(s)?
- Which agencies are involved in the permitting process? Will a zoning permit be required? Are there overlay and historic districts which may apply to charging station permitting?
- Approximately how long does it take to secure the permit(s)?
- What are the costs involved in the permit process?
- What do you think has worked well in your city/county’s permitting process? What do you think has not worked well?
- What would you like to see in terms of a streamlined permitting process? Any recommendations?
- Can EV charging stations be identified via the permit such that a community would know how many are located within their jurisdiction? (Does this differ with residential vs. commercial permits?)”

Key Findings: Summarized Responses from Permitting Survey

Table 8 includes all of the responses by the municipalities surveyed.

Table 8. Summarized Responses from Permitting Survey, 2012

<table>
<thead>
<tr>
<th></th>
<th>Current process for obtaining permits:</th>
<th>Agencies involved in the permitting process:</th>
<th>Timeframe to secure permits (in business days):</th>
<th>Costs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cary</td>
<td>Commercial: completed application and four sets of plans Residential: online application and permitting</td>
<td>Commercial: Inspections, Planning and Zoning Residential: Inspections</td>
<td>Commercial: 3 to 5 Residential: 1 to 2</td>
<td>$60 electrical permit $60 mechanical permit</td>
</tr>
<tr>
<td>Fuquay-Varina</td>
<td>Standard electrical trade permitting process</td>
<td>Commercial: Inspections, Planning and Zoning Residential: Inspections</td>
<td>2 to 5</td>
<td>Electrical trade permitting fee of $60</td>
</tr>
<tr>
<td>Location</td>
<td>Permitting and Inspections</td>
<td>Time</td>
<td>Fees</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
<td>-------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Knightdale</td>
<td>Standard Building Permit process including three separate plans. There is currently limited placement for commercial stations. Planning                                                            1 to 5</td>
<td>Fees vary based on contracted cost of improvements being made</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clayton</td>
<td>No process currently in place</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Chapel Hill</td>
<td>Standard electrical permitting process</td>
<td>Permitting only unless it's located in a location with specific criteria such as a parking deck or historic district. If so, Planning department would also be involved</td>
<td>Standard time unknown</td>
<td>$35 per in-town trip $55 per out-of-town trip</td>
</tr>
<tr>
<td>Carrboro</td>
<td>Standard electrical permitting process</td>
<td>Zoning</td>
<td>1 to 3 (but usually same day)</td>
<td>Minimum $55 fee for electrical permit, or $110 fee for electrical and building permit If a pedestal system, there is a total $165 fee</td>
</tr>
<tr>
<td>Wake County</td>
<td>Commercial: Standard mechanical permit application with a list of contractors and their licensing information. Residential: Standard mechanical permit for residential buildings Permitting and Inspections</td>
<td>Generally permits are issued on the same day (for online or in person requests)</td>
<td>Fees vary but can be found online</td>
<td></td>
</tr>
<tr>
<td>Sanford/ Lee County</td>
<td>Standard electrical permit and possible plan review</td>
<td>Commercial: Inspections, Planning and Zoning Residential: Inspections</td>
<td>Same day</td>
<td>Fees vary, local jurisdictions permit application should be referred to</td>
</tr>
<tr>
<td>Chatham County</td>
<td>Standard electrical permit</td>
<td>Inspections</td>
<td>Same day</td>
<td>Commercial: if the total installation cost is over $2500 there is a flat fee of $195 no matter the number of trips Residential: $50 per trip (usually only requires one trip)</td>
</tr>
</tbody>
</table>
In summary:

Residential:
- Permits can be obtained in-person or online (in most places)
- Time: varies from same day to 10 business days
- Fees: often standard
- Majority of region uses existing process set up for electrical or manufacturing permits
  - Usually just involves the permitting/inspections department
  - Often a one trip inspection if it’s a simple install

Commercial/Municipal:
- Permits can be obtained in person or online (in most places)
- Time: varies from same day to 10 business days
- Fees: vary depending on how complex the installation is
- In many cases the fees can be found online
  - Often involves permitting/inspections, zoning, and planning departments
  - Generally requires at least two versions of plans

**Community Breakout Session at September 2012 NC PEV Taskforce Meeting**

As part of the NC PEV Taskforce meeting in Charlotte on September 19, the leads of the Triangle PEV Readiness Plan held a breakout session with Taskforce participants to discuss a few key topics/issues being considered for the Triangle PEV Readiness Planning Process. The participants were asked to provide feedback by answering questions in regards to permitting.

**Question Posted to NC PEV Taskforce Breakout Session Participants:**
*Permitting: Many local governments are not tracking permitting of charging stations. We would like to discuss ways to encourage tracking of electric vehicle charging station permitting and also future considerations for installations that may not require a contractor.*
Table 9 shows a summary of the responses, which ranged from adding a check box onto permitting applications to educating permitting officials to even involving local community colleges to help track permits. Key takeaways: the updated process would need to be simple to implement and not add additional time into the permitting process.

<table>
<thead>
<tr>
<th>Table 9. Paraphrased Responses, NC PEV Taskforce September 2012 Meeting, Community Break Out Session: Permitting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add a check box or field to identify charging stations onto permit application</td>
</tr>
<tr>
<td>Some counties are permitting charging stations but are not tracking (need to explain the importance of tracking permits and reporting to key stakeholders such as the electric utility)</td>
</tr>
<tr>
<td>This should be simple enough to make staff aware of the need to ask questions. Add a special check box on the building permit form; may be even highlighted in different color</td>
</tr>
<tr>
<td>Create ongoing Triangle charging station implementation group to continually revise/update charging station location forecasts</td>
</tr>
<tr>
<td>Local universities and community colleges could work with local governments to track permitting of charging stations. Students could verify whether permits are just standard or for charging stations.</td>
</tr>
</tbody>
</table>

**Electrical Code (Building Code)**

The Triangle Steering Committee deferred work concerning electrical and building codes to the Policy, Codes and Standards Working Group of the NC PEV Taskforce. For more information, reference the NC PEV Roadmap.

**ADA: Building Code**

The Working Group for the NC PEV Taskforce explored ADA requirements; however, the Triangle Working Group discussed considerations at the local level, such as:

- Installing a 48-inch accessible route from the electric vehicle charging space to an accessible route; and
- Ensuring that a path of travel is not blocked by a charging cord when in use.
Local Case Studies for ADA

Both the City of Raleigh and Durham City/County have been leaders in the research and exploration of ADA for charging stations. Charging station installations by Durham City/County have received state-wide recognition for their attention to ADA. Figure 16 provides an example of an installation at one of the Durham County Libraries.

![Figure 16. Durham Library Accessible Charging Space. The County altered the curb line so the charging station could be placed at the same level as the asphalt ensuring compliance with reach range requirements. Additionally, the bollards have been placed wide enough to allow for access by a wheelchair.](image)

Plans

There are benefits of including PEV readiness planning more than one local policy document. Examples include comprehensive plans and strategic plans. In certain cases such as zoning, state law requires that zoning amendments are justified by showing how they are consistent with the adopted comprehensive land use plans. Examples of local plans discussed among stakeholders included:

- Comprehensive Land Use Plans: It is recommended to include language in the Comprehensive Land Use Plan to encourage PEVs and associated infrastructure such as charging stations. Encouraging these technologies can help to achieve many goals that a comprehensive plan may
already have, such as greenhouse gas reduction and air quality goals. Additionally, this will provide the justification needed for local ordinance modifications.\footnote{Consistency statement with Comprehensive Plan for Zoning Amendments are required per NC General Statutes 160A Article 19 and 153A Article 18}

Local example: City of Raleigh, in Chapter Three of their Comprehensive Plan, has included policy language to encourage the adoption of PEVs and PEV infrastructure.

- Strategic Plans: Local government plans provide specific goals and details on how to achieve implementation.

  Local Example: Durham City-County Electric Vehicle and Charging Station Plan. The joint Sustainability Office for the City and County worked with department heads and local leaders to develop a strategic plan, which provided specific guidance for the installation and maintenance of the city/county owned fleet vehicles and charging station installations (plan included in Appendix 9).

- Small Area Plans: Will provide greater details on the character of a certain area within the city or county limits. It is recommended that PEV considerations are worked into these plans and items such as charging station installations should be considered.

**Zoning Ordinances**

Zoning Ordinance and Unified Development Ordinances were discussed at the NC PEV Taskforce Policy, Codes and Standards Working Group. Research for the zoning ordinance section was pulled from a variety of locations including:

- A Toolkit for Community Plug-In Electric Vehicle Readiness, California Plug-In Electric Vehicle Collaborative (www.pevcollaborative.org)
- Zoning Amendment for Electric Vehicle Charging Stations, Methuen Massachusetts
- APA Zoning Practice for EV Infrastructure
Stakeholders in the Triangle discussed considerations and interpretations at the local level. Those in the planning profession indicated it was important to include PEV specific considerations into a zoning ordinance for “consistency” of interpretations. For example, one planning official may require that a charging station be screened from view because it can be classified as “mechanical equipment,” where another planning official may use an opposite interpretation. Discussions also included:

- **Definitions:** Include PEVs in the definitions to help with consistent enforcement. The Steering Committee agreed it was best to include the electric vehicle in the definitions and to consider allowing Level 1 and Level 2 as accessory uses and to have Level 3 include battery exchange stations and a commercial use.

- **Table of Permitted Uses:** The Steering Committee discussed including charging stations in the Table of Permitted Uses to avoid improper classification from code officials who may not be familiar with charging stations.

- **Streets, Sidewalks and Public Places:** This section included considerations for on-street parking. Steering Committee members indicated that many of their streets with on-street parking are maintained by either the municipal government of the state DOT.

- **Off-Street Parking:** The design criteria for off-street parking considers where a charging station should be placed in consideration with other site elements.

- **Lighting:** Development ordinances generally require that all uses within a site are properly lit. This should be considered for charging stations. Users should have proper lighting for safety and for operation of a charging station.

- **Architectural Requirements:** Generally, architectural requirements cover building materials, color requirements and screening. The Triangle Steering Committee indicated that charging stations may be considered an “electrical or mechanical requirement.” If so, requirements may call for the charging station to be screened or hidden. This is an unintended consequence because the charging stations need to be highly visible to the public, especially drivers of electric vehicles.

- **Signage:** Ensure the proper wayfinding and informational signage is permitted for charging stations.
**Historic Districts**

An informal poll of Steering Committee members revealed that most municipalities had historic districts and commissions in their jurisdiction. The Triangle Steering Committee discussed ways to incorporate electric vehicles into local historic districts with insight from the North Carolina Historic Preservation Office. Discussion items included:

- **Permitting Charging Stations**: Should be similar to cases such as installing a satellite dish, which requires a certificate of appropriateness. One of the biggest barriers to PEV adoption within a local historic district may be the local commissions’ unfamiliarity with charging stations and, in turn, disapprove the request.  
- Producing educational materials to inform local historic commissions on charging stations as well as best practices for installations.

A representative from the North Carolina Historic Preservation Office indicated that their office would be willing to work with the NC PEV Taskforce to develop further guidance for local historic district officials.

**Parking Enforcement**

Parking enforcement was reviewed at the statewide level as well as with the Triangle Steering Committee; however, the Triangle group deferred this research to the statewide Working Group because this topic is not unique in the Triangle.

**Local example:** The City of Raleigh’s City Council passed the first parking enforcement ordinance in the state in 2012. This was reviewed by the NC PEV Taskforce Policy, Codes and Standards Working Group and is included in the NC PEV Roadmap. The ordinance indicates that a PEV must be plugged in and charging at a PEV parking spaces or the owner will be fined.

**Signage**

There are a variety of sign options including wayfinding, highway and identification signs for marking electric vehicle charging stations. This topic was deferred to the NC PEV Taskforce Policy, Codes and Standards Working Group.
**Encroachment Agreements**

Many of the representatives of the Steering Committee indicated they had a mixture of state- and locally-maintained roads in their jurisdictions. The discussion of encroachment agreements was deferred to the NC PEV Taskforce and is included in the NC PEV Roadmap.

**Workplace Charging Districts**

For the Triangle PEV Readiness Plan, the Steering Committee was unable to explore this topic in much detail but recommends further research. Through local initiatives such as the Blue Skies Project, many local employers in the Triangle have installed charging stations for their employees to use.

**Triangle Steering Committee**

The Triangle Steering Committee reviewed and addressed each of the policies listed in Table 10 and completed a worksheet. The responses were tabulated for the Triangle Readiness Plan. Table 10 provides the strategies identified using worksheet responses from stakeholder meetings, which can then be employed for policies, codes and standards considerations.

<table>
<thead>
<tr>
<th>Table 10. Strategies Identified Using Worksheet Responses:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>List the top three policies that should be addressed in your jurisdiction.</strong></td>
</tr>
<tr>
<td><strong>Number of Responses</strong></td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
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<tr>
<td>1</td>
</tr>
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<td>1</td>
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<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>
List the best strategies to implement these changes (who to talk to, what time of year, etc.).

<table>
<thead>
<tr>
<th>Number of Responses</th>
<th>Strategy Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>State and local historic preservation officials</td>
</tr>
<tr>
<td>6</td>
<td>City/county planning departments</td>
</tr>
<tr>
<td>5</td>
<td>NC Department of Insurance (ADA issues)</td>
</tr>
<tr>
<td>2</td>
<td>Attend Statewide Planning Conference</td>
</tr>
<tr>
<td>1</td>
<td>Reach out to Key Contacts</td>
</tr>
<tr>
<td>1</td>
<td>Create a working group to develop a strategic plan</td>
</tr>
<tr>
<td>1</td>
<td>Recommend changes in ordinance for approval by the planning board of commissions</td>
</tr>
<tr>
<td>1</td>
<td>Zoning boards</td>
</tr>
<tr>
<td>1</td>
<td>Residents of historic districts</td>
</tr>
<tr>
<td>1</td>
<td>City and/or county sustainability offices</td>
</tr>
<tr>
<td>1</td>
<td>NC Accessibility codes</td>
</tr>
<tr>
<td>1</td>
<td>Increase the availability of info to homeowners for potential applications</td>
</tr>
</tbody>
</table>

List the best ways to assist new PEV owners to navigate through local policies.

<table>
<thead>
<tr>
<th>Number of Responses</th>
<th>Strategy Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Website/online resources (one central location)</td>
</tr>
<tr>
<td>6</td>
<td>Create a brochure/flowchart</td>
</tr>
<tr>
<td>4</td>
<td>Produce a guide, similar to Town of Cary’s and City of Raleigh’s – make available online</td>
</tr>
<tr>
<td>2</td>
<td>Include residential permit as part of electrical permit</td>
</tr>
<tr>
<td>1</td>
<td>Commercial permits processed through standard site plan review process</td>
</tr>
<tr>
<td>1</td>
<td>Cost could be a stumbling block</td>
</tr>
<tr>
<td>1</td>
<td>Local Governments</td>
</tr>
<tr>
<td>1</td>
<td>Have historic district commissions create ordinances/rules</td>
</tr>
<tr>
<td>1</td>
<td>Have one person/entity that PEV owners work with for residential installations</td>
</tr>
<tr>
<td>1</td>
<td>Email/list serves</td>
</tr>
<tr>
<td>1</td>
<td>Social media- twitter, blogs</td>
</tr>
<tr>
<td>1</td>
<td>Events</td>
</tr>
<tr>
<td>1</td>
<td>Partnerships with Car Dealerships</td>
</tr>
</tbody>
</table>
5.5 Conclusions
Completing the Triangle PEV Readiness Plan allowed for several key points to be identified regarding Policies, Codes and Standards:

- Discussion amongst local stakeholders provided information regarding priorities for implementation;
- The research and discussion led to the identification of additional topic areas that should be explored further; and
- The stakeholder meeting provided an opportunity for local governments to share their experiences and policies with other local governments. This in turn allowed for the local governments to verify their research.

Table 11 provides recommendations from the Triangle Steering Committee’s Policies, Codes and Standards Work Area.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Time Frame*</th>
<th>Priority Level**</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Update Local Historic District Regulations</td>
<td>Short-Term</td>
<td>High</td>
</tr>
<tr>
<td>3.2 Support state and national efforts to develop ADA guidance</td>
<td>Short-Term</td>
<td>High</td>
</tr>
<tr>
<td>3.3 Update local Zoning Ordinances</td>
<td>Short-Term</td>
<td>High</td>
</tr>
<tr>
<td>3.4 Work with Local Governments to educate and encourage updating local codes by presenting at industry events, workshops and conferences</td>
<td>Short-Term</td>
<td>High</td>
</tr>
<tr>
<td>3.5 Update local planning documents</td>
<td>Mid-Term</td>
<td>Medium</td>
</tr>
<tr>
<td>3.6 Develop informational documents outlining permitting processes for charging stations</td>
<td>Short-Term</td>
<td>High</td>
</tr>
<tr>
<td>3.7 Utilize various outlets to ensure dissemination of local policies and processes (local newsletters, websites and social media, etc)</td>
<td>Mid-Term</td>
<td>High</td>
</tr>
<tr>
<td>3.8 Relay on ongoing regional efforts to facilitate updates for local governments</td>
<td>Short-Term</td>
<td>High</td>
</tr>
<tr>
<td>3.9 Ensure the citizen decision making boards (councils, planning boards, historic commissions, etc.) are educated on PEV topics</td>
<td>On-going</td>
<td>Medium</td>
</tr>
<tr>
<td>3.10 Coordinate with NC PEV Taskforce on policy recommendations to ensure uniform recommendations</td>
<td>On-going</td>
<td>High</td>
</tr>
</tbody>
</table>

*Term Lengths for Recommendations

<table>
<thead>
<tr>
<th>Term Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-Term</td>
<td>1 to 2 years</td>
</tr>
<tr>
<td>Mid-term</td>
<td>3 to 5 years</td>
</tr>
<tr>
<td>Long-term</td>
<td>6 to 10 years</td>
</tr>
<tr>
<td>------------</td>
<td>---------------</td>
</tr>
<tr>
<td>On-going</td>
<td>No set start or end time</td>
</tr>
</tbody>
</table>

**Priority Levels for Recommendations**

<table>
<thead>
<tr>
<th>Level</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>
6 EDUCATION AND OUTREACH

6.1 Introduction to Education and Outreach
The Education and Outreach Work Area explored the development of resources of PEV knowledge, dissemination of that knowledge, training and marketing. The education and outreach component of the plan was especially important because reaching target audiences in the community was found to be more effective at the community level as opposed to at the individual municipalities or statewide. The Education and Outreach Work Area leveraged the work completed by the NC PEV Taskforce Education and Outreach Working Group to disseminate information to the community as a whole. Outreach efforts were tailored to each audience based on their specific needs and goals, covering four areas that follow the guidance of the U.S. DOE’s Electric Vehicle Readiness Planning:

- Education of prospective PEV owners;
- Outreach to interested groups;
- Training of the PEV workforce (technicians, inspectors, charging station installers, etc.); and
- Marketing of PEVs to skeptics and the undecided.42

6.2 Existing Education and Outreach Initiatives in the Triangle
Table 12 provides an overview of the existing community education and outreach activities.

<table>
<thead>
<tr>
<th>Table 12. Existing Initiatives: Education and Outreach</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Raleigh:</td>
</tr>
<tr>
<td>➢ Online and New Media: The City of Raleigh has worked to teach the community about PEVs through several forms of media; includes Twitter, YouTube videos and an interactive sustainability map featuring charging station locations and their webpage.</td>
</tr>
<tr>
<td>➢ Collateral: Two specific pieces of education and outreach collateral were created: an FAQs sheet and a Fact Sheet.</td>
</tr>
<tr>
<td>City/County of Durham:</td>
</tr>
<tr>
<td>➢ Workshops and Trainings: Durham City/County creates and runs several workshops and training programs to help with education and outreach efforts; includes employee trainings, workshops on how to drive a Nissan LEAF, and workshops on where electric vehicle charging infrastructure is located.</td>
</tr>
<tr>
<td>➢ Online and New Media: To reach out to a large portion of the population, Durham City/County used online media resources including YouTube videos, their webpage and an electric vehicle charging infrastructure map. The charging stations have QR codes located on them which direct smart phone users to the City/County website about their electric vehicle</td>
</tr>
</tbody>
</table>

42 Community Planning Guide for Plug in Electric Vehicles, Advanced Energy
programs.

- **Collateral:** Durham City-County created a few pieces of education and outreach related collateral to help them with their PEV related efforts; includes the Durham City-County Electric Vehicle and Charging Station Plan, a FAQs document and a Fact Sheet.

| Sustainable Transportation Education Program (STEP) | A collaborative effort between the North Carolina State University College of Engineering and the NC Solar Center, this program aims to educate middle and high school students on electric transportation while introducing them to the possibility of a career in the field. Teachers specifically trained by STEP work with participating students to teach them about all areas of the program curriculum, including electric vehicles, plug-in hybrid electric vehicles, Smart Grid, alternatives fuels and careers in science, engineering and technology.  

- STEP also includes a competition every May for the middle and high school students during which student teams compete to see who can build the best electric vehicle and solar powered charging station. |

| North Carolina Museum of Natural Sciences | Raleigh’s North Carolin Museum of Natural Sciences hosts an electric vehicle exhibit in a special exhibit gallery, which is devoted to projects having to do with breakthroughs in engineering, health and modeling. Student made cars from the STEP Program as well as the frame of Chevrolet Volt can be found here. The Volt includes many diagrams and descriptions explaining its inner workings. |

| Advanced Energy | **Trainings, Workshops, Public Outreach Events:**
  - Community Planning Forums
  - PEV 101
  - First Responder Training
  - Fleet Workshops
  - Technical Trainings

- **Community Events:**
  - Earth Day
  - Work with Local Museums
  - PEV Awareness Day and Week
  - Ride and Drive Events
  - Workplace Events

- **Online and New Media**
  - Twitter
  - Blog |
6.3 NC PEV Taskforce: Education and Outreach Working Group

The NC PEV Taskforce’s Education and Outreach Working Group focused on state level considerations for education and outreach initiatives for plug-in electric vehicles.

**Goals**
- Identify barriers and perceptions related to PEVs
- Identify target audiences for education and outreach
- Develop key messages to disseminated to each target audience
- Develop resources to aid in providing education and outreach
- Identify opportunities to create or support training related to PEVs
- Develop a plan for marketing PEVs in North Carolina

**Focus Areas**

The Education and Outreach Working Group focuses on:
- Education, in general, as established by U.S. DOE guidance;
- Outreach, in general, as established by U.S. DOE guidance;
- Training opportunities related to PEVs and as established by DOE guidance; and
- Marketing as established by U.S. DOE guidance.

6.4 Triangle Community Plan: Education and Outreach Work Area

**Content Experts**

Several content experts were invited to speak at the Triangle Steering Committee meeting including representatives from:
- STEP Program at NC State University
- Wilson Community College
6.5 Education and Outreach Focus Area

Steering Committee members involved in education and outreach followed the guidance of the U.S. DOE's recommended topic areas for PEV readiness planning and also worked through identifying needs and prioritizing actions from the Community Planning Matrix. The Education and Outreach community leads began by assessing preparedness for private residential permitting and inspections in the regional activities. Under the Education and Outreach Working Areas, the group started to examine issues such as:

- Identifying stakeholders, goals, opportunities and barriers;
- Identifying target audiences and defining key messaging for each grouping;
- Exploring ways to disseminate information (such as partnerships with educational institutions, media resources, etc.);
- Identifying resources needed for education providers; and
- Examining how PEVs should be branded in their community;

Triangle Steering Committee Discussion

Stakeholders involved in the Triangle region had in-depth discussions about necessary Education and Outreach efforts related to PEVs. The discussions centered on the following:

- Key partners in the Triangle needed to advance education and outreach initiatives;
- Opportunities to support existing local education and outreach efforts; and
- The most important outreach and education efforts.

The stakeholders presented the most valuable partners to be:

- K-12 Schools/STEM Programs (Science, Technology, Engineering and Mathematics)
- Community colleges, universities and technical schools
- Media outlets
- Local utility providers (e.g., Progress Energy Carolinas, Duke Energy Carolinas)
- Youth organizations (e.g., Girl/Boy Scouts)
- Cities/towns/counties/municipalities

Opportunities to support existing local education and outreach efforts identified included:

- Use of local media
- Outreach at schools
- Attend relevant conferences
- Have PEV owners present and talk about their various experiences
The top three most important education and outreach activities needed in the Triangle were determined to be:

- Outreach for high school students/educational campaigns
- Internet resources
- Events/promotional materials in high traffic areas

**Topics Covered by the Triangle**

**Education**

For the purpose of PEV readiness planning, the term “education,” is defined as resource development. When considering the development of relevant resources it is important that audiences are defined and clearly examined to ensure the right messages are delivered to the right people at the right time. This was done at the state level through the NC PEV Taskforce’s Education and Outreach Working Group, and should be done at the regional level as well. Ideas for materials to be developed include:

- Brochures
- Handouts
- Informational sheets
- Website content
- Teaching programs
- Standard presentations on PEVs
- Community College curriculum module

Some educational materials developed through the statewide Working Group and disseminated to the Triangle Readiness Planning stakeholders included a “Test Drive Kit” which can be used to help local organizations plan for a test drive event for PEVs.

**Outreach**

Defined as the dissemination of resources, it is also important to consider proper outreach techniques for the resources created to ensure message delivery and acceptance. This has been done on the state level but has not yet been accomplished at the regional level. As such, the Steering Committee’s recommendations include the dissemination of educational resources.

**Review of Statewide NC PEV Taskforce Education and Outreach Working Group**

To help the Triangle community understand their own needs concerning education and outreach surrounding PEVs, a presentation on the focus of the statewide NC PEV Taskforce Education and Outreach Working Group was delivered to stakeholders at the September 19, 2012 NC PEV Taskforce meeting.
Training
Even though the presence of PEVs on our roadways is still fairly new, training resources and opportunities are continually being developed to suit the needs of PEV drivers. An example of such information can be found in the National Fire Protection Association (NFPA) manuals on first responder training. These resources have been used by instructors for trainings in the state of North Carolina and would certainly be relevant in the Triangle. Although there are many opportunities associated with training, there are also barriers that must be considered, such as increasing class attendance, keeping up with changing technology and increasing communication between various stakeholders. Examples of audiences for training include:

- First Responders (fire fighters)
- Towing Truck and Vehicle Mechanics
- Public Safety Officers
- Inspectors
- Installers
- Permitting Officials

Marketing
Marketing is the action which is used to help sell a business or service. It is important that a marketing strategy specific to PEVs in the Triangle region be developed since one does not currently exist. There are various opportunities surrounding the marketing of PEVs within North Carolina’s Triangle region. Ideas of how to best take advantage of the power marketing could have in the field of PEVs includes:

- Hiring a marketing firm to help develop strategies
- Creating a marketing plan
- Creating a web presence to help promote the region as PEV ready
- Utilizing a wide-range of media outlets for messaging delivery, including billboards and traditional media (i.e., television and radio)

Worksheet Responses
Table 13 provides a compilation of the all responses from the Triangle Steering Committee who completed a worksheet on the topic of Education and Outreach. Table 13a provides a listing of opportunities supporting existing local education and outreach efforts. Table 13b provides responses to what is missing from existing education and outreach activities in the Triangle. Table 13c provides respondents’ opinions on the most important education and outreach activities need in their area. The worksheet responses were used in the prioritization of recommendations for the Triangle PEV Plan.
Table 13. Key Partners in the Triangle Needed to Advance Education and Outreach Initiatives

<table>
<thead>
<tr>
<th>Number of Responses</th>
<th>Strategy Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>K-12 Schools/STEM Programs</td>
</tr>
<tr>
<td>9</td>
<td>Community Colleges, Universities, Tech Schools</td>
</tr>
<tr>
<td>5</td>
<td>Media Outlets</td>
</tr>
<tr>
<td>4</td>
<td>Progress/Duke Energy Carolinas and Utilities</td>
</tr>
<tr>
<td>4</td>
<td>Youth Organizations (Girl Scouts/Boy Scouts/etc.)</td>
</tr>
<tr>
<td>4</td>
<td>Cities/Towns/Counties/Municipalities</td>
</tr>
<tr>
<td>3</td>
<td>High School Vocational Programs</td>
</tr>
<tr>
<td>2</td>
<td>Triangle J Council of Governments</td>
</tr>
<tr>
<td>2</td>
<td>Car Dealers</td>
</tr>
<tr>
<td>2</td>
<td>NC Solar Center</td>
</tr>
<tr>
<td>2</td>
<td>Advanced Energy</td>
</tr>
<tr>
<td>2</td>
<td>Teacher/Curriculum</td>
</tr>
<tr>
<td>2</td>
<td>Central Business Districts</td>
</tr>
<tr>
<td>2</td>
<td>Social Media (blogs/twitter/etc.)</td>
</tr>
<tr>
<td>2</td>
<td>Museums</td>
</tr>
<tr>
<td>1</td>
<td>High School Career/Guidance Counselors</td>
</tr>
<tr>
<td>1</td>
<td>Community Events</td>
</tr>
<tr>
<td>1</td>
<td>Sustainability Related Businesses</td>
</tr>
<tr>
<td>1</td>
<td>Energy and Science Fairs</td>
</tr>
<tr>
<td>1</td>
<td>State Fairs</td>
</tr>
<tr>
<td>1</td>
<td>Internet Resources</td>
</tr>
<tr>
<td>1</td>
<td>PBS</td>
</tr>
<tr>
<td>1</td>
<td>Civic Organizations</td>
</tr>
<tr>
<td>1</td>
<td>Grassroots Efforts</td>
</tr>
<tr>
<td>1</td>
<td>Clean Cities</td>
</tr>
<tr>
<td>1</td>
<td>ATEC</td>
</tr>
<tr>
<td>1</td>
<td>UNC School of Governments (They reach out to jurisdictions throughout the state)</td>
</tr>
<tr>
<td>1</td>
<td>Churches/NC Interfaith Power and Light Organization</td>
</tr>
<tr>
<td>Number of Responses</td>
<td>Strategy Identified</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>4</td>
<td>Local Media</td>
</tr>
<tr>
<td>3</td>
<td>Outreach at Schools</td>
</tr>
<tr>
<td>3</td>
<td>Attend Relevant Conferences- Education/Curriculum/Planning/Etc.</td>
</tr>
<tr>
<td>3</td>
<td>Have PEV Owners Talk about Various Experiences</td>
</tr>
<tr>
<td>1</td>
<td>Create Traveling Table Top Informational Displays for Events</td>
</tr>
<tr>
<td>1</td>
<td>Contests</td>
</tr>
<tr>
<td>1</td>
<td>PEV Races</td>
</tr>
<tr>
<td>1</td>
<td>Certificate Programs</td>
</tr>
<tr>
<td>1</td>
<td>PEV Motorcycle included in Bike Fest</td>
</tr>
<tr>
<td>1</td>
<td>PEV Parades</td>
</tr>
<tr>
<td>1</td>
<td>PEV Display at Mall/Public Events/Car Shows/Etc.</td>
</tr>
<tr>
<td>1</td>
<td>PEV Awareness Week</td>
</tr>
<tr>
<td>1</td>
<td>EcoCar Programs</td>
</tr>
<tr>
<td>1</td>
<td>Earth Day Events</td>
</tr>
<tr>
<td>1</td>
<td>AFV Odyssey Day- Oct 18 on NAFTC Program</td>
</tr>
<tr>
<td>1</td>
<td>Collaboration with Planners</td>
</tr>
<tr>
<td>1</td>
<td>Speakers Bureau with “Created and Canned Presentations” for Events</td>
</tr>
<tr>
<td>1</td>
<td>Grants</td>
</tr>
<tr>
<td>1</td>
<td>Private Initiatives</td>
</tr>
<tr>
<td>1</td>
<td>Local Government Subsidies</td>
</tr>
<tr>
<td>1</td>
<td>State Fairs</td>
</tr>
<tr>
<td>1</td>
<td>Churches</td>
</tr>
<tr>
<td>1</td>
<td>Building Inspector Associations</td>
</tr>
</tbody>
</table>

**Table 13b. Existing Education and Outreach Activities in the Triangle: What is Missing?**

<table>
<thead>
<tr>
<th>Number of Responses</th>
<th>Strategy Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Grants for Teaching Energy Efficiency/Sustainability Related Programs</td>
</tr>
<tr>
<td>2</td>
<td>Outreach at Schools</td>
</tr>
<tr>
<td>1</td>
<td>Information for Dealerships to have on hand for customers interested in buying PEVs</td>
</tr>
<tr>
<td>Number of Responses</td>
<td>Strategy Identified</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Outreach for High School Students/Educational Campaigns</td>
</tr>
<tr>
<td>4</td>
<td>Internet Resources</td>
</tr>
<tr>
<td>4</td>
<td>Events/Promotional Materials in High Traffic Area- Sporting Etc.</td>
</tr>
</tbody>
</table>

### 6.6 Education and Outreach Events Completed as Part of the Triangle PEV Readiness Plan

As part of the NC PEV Readiness Initiative, several education and outreach events were held in the Triangle region. Many of these events were held as part of Advanced Energy’s program and were aligned to meet the criteria and deliverables of the M2S project.

**First Responder Trainings**

Part of a series being offered through North Carolina’s Community Colleges, as a joint effort by Duke Energy Carolinas and Advanced Energy, first responders received training for emergencies involving PEVs at Durham County Community College’s Orange County Campus in July 2012. Attendees learned about electric drive technology in order to gain a better understanding of how electric drive vehicles differ from conventional vehicles in relation to fire control and extrication strategies.

An important factor in first responder training is learning the unique aspects of emergency response to PEVs. A local Chevrolet Volt owner hosted a training earlier in 2012 at the Town of Chapel Hill N.C. Fire Department. This local stakeholder based the training on the basic Volt emergency response guide provided by General Motors.

![First Responder Training in Durham, NC](image-url)
**Technical Forums**
A technical training was conducted in October to local inspectors and installers in the Triangle. Advanced Energy partnered with the City of Raleigh to present on applicable electrical code and best practices for siting and installing charging stations.

**Ride and Drive Events**
Several Ride and Drive events have been held throughout the Triangle to involve giving the public, or a specific company’s workforce, the opportunity to test drive and learn about a specific PEV.

Through the NC PEV Taskforce Education and Outreach Working Group, a *Test Drive Kit* was prepared for the four participating communities in the PEV readiness planning process. The test drive kit created for the Triangle will be distributed to local stakeholders who are interested in hosting a ride and drive event.

**Triangle Plug-In Day 2012**
Triangle Plug-In Day 2012 was organized in conjunction with Plug-In America’s National Plug-In Day, which is meant to draw global attention to all the benefits of driving a PEV. The Triangle event, hosted by the Triangle EV Fan Club, was held in Durham, N.C. and featured a vehicle display, as well as networking opportunities for PEV owners and enthusiasts.

**Triangle Plug-In Electric Vehicle Awareness Week**
The Triangle Region hosted its first Plug-In Electric Vehicle Awareness Week in October 2012 (10/1-6). This initiative was led by Advanced Energy with heavy involvement and sponsorships from local stakeholders including local electric utility provider Progress Energy Carolinas, local governments, businesses and PEV owners. The week-long events included:
Triangle PEV Awareness Week Kickoff Event at Qualcomm

This event kicked-off the Triangle’s PEV Awareness Week with an official proclamation of the event by local officials from local municipalities at Qualcomm in Raleigh. The local officials arrived at Qualcomm in PEVs from their respective fleets. The day’s events included a lunch and learn as well as an opportunity for attendees to participate in a ride and drive.

Welcome to McDonald’s…Would You Like a Free Charge with that?
North Carolina’s Green McDonald’s, located in Cary, hosted a family fun night with a focus on PEVs. The Green McDonald’s offers free Level 2 charging and is looking to expand its charging options in the near future. This event included a display of PEVs, face painting, children’s activities and a McDonald’s prize wheel.

“Revenge of the Electric Car” Movie Screening
This event was held in conjunction with Raleigh’s First Friday Art Walk and gave attendees the opportunity to view the documentary Revenge of the Electric Car in partnership with Marbles Museum in downtown Raleigh. Marbles Museum also kicked off its National Energy Month with a focus on electric vehicles. Other features of the event included a vehicle display, ride and drive opportunities, a children’s activity based around electric vehicles, a special display by the NCSU STEP program and a panel discussion.

Electric Vehicle Rally
The final event of the Triangle’s PEV Awareness week was the Electric Vehicle Rally which featured a PEV display for owners of electric-converted electric vehicles, plug-in hybrid electric vehicles, or all-electric vehicles. The event featured opportunities for PEV drivers to meet other PEV owners, live music and other activities.
6.7 Recommendations
Table 14 provides a list of Recommendations for Education and Outreach.

<table>
<thead>
<tr>
<th>Table 14. Recommendations for Education and Outreach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>4.1 Work with local schools to incorporate PEV considerations into their curriculum through initiatives such as the STEP Program</td>
</tr>
<tr>
<td>4.2 Work with local community colleges, universities, and other workforce training centers</td>
</tr>
<tr>
<td>4.3 Work with media outlets to disseminate key information</td>
</tr>
<tr>
<td>4.4 Display information at relevant events and conferences, particularly those targeted at populations who may be interested in buying PEVs (PEV Awareness Week, Earth Day, AFV Odyssey Day, etc)</td>
</tr>
<tr>
<td>4.5 Develop informational handouts to provide customers at car dealerships</td>
</tr>
</tbody>
</table>

*Term Lengths for Recommendations |

| Short-Term | 1 to 2 years |
| Mid-term | 3 to 5 years |
| Long-term | 6-10 years |
| On-going | No set start or end time |

**Priority Levels for Recommendations |

| Low |
| Medium |
| High |
7 INCENTIVES

7.1 Introduction to Incentives for PEVs

*Incentives*
Economic, air quality and security concerns at the national level certainly have impacts at the local level. The Triangle is not isolated from national concerns as the transportation system reflects the national model for moving people, goods and services. Uncoupling our local economy from petroleum is as important as moving our national economy away from oil. National leadership is supporting a move to domestically sourced alternative fuels, as are Triangle Community leaders.

Given the importance of adopting PEVs in the Triangle, utilizing incentives is an important way to support the level of early adoption necessary to make PEVs a common consumer choice. The Incentives Work Area covered efforts to define and evaluate various benefits that could be provided to encourage community members to become PEV owners and drivers. Stakeholders assessed existing incentives and economic development opportunities and worked to develop a plan to communicate the available or anticipated benefits of these incentives for PEV owners and industry.

*Why are Incentives Needed?*
At what point do electricity, battery and electric motor costs equal the ICE and fuel prices? Reducing battery costs and increasing battery energy density are two areas prime for research and development. Development of these technologies increases the potential of reducing costs to the point where PEVs will be less expensive than ICE-powered transportation. Until that time, however, incentives are needed to encourage adoption by more users.

7.2 Existing Incentives in the Triangle

*Local Incentives for PEVs*
The Research Triangle is leading North Carolina in PEV adoption and part of this early adoption can be attributed to the local incentives and programs in the region. Table 15 provides some examples of local incentives:

<table>
<thead>
<tr>
<th>Table 15. Local Incentive Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Charging</td>
</tr>
<tr>
<td>Preferred Parking</td>
</tr>
</tbody>
</table>
### Employer Incentives
- Some of the larger employers in the Triangle, such as Burt’s Bees, BioGen Idec, and Qualcomm are offering rebates to employees who purchase vehicle PEV.

### Expedited Permitting
- The City of Raleigh received national recognition for its expedited permitting processes for home charging installations. In response to the adoption of PEVs, Raleigh residents can receive their permits within a day.

### Reduced Interest Rates
- The N.C.-based State Employees Credit Union is encouraging reduced low emissions vehicles purchases by offering a reduced interest rate loan for these vehicles.

### Programs:
- Advanced Energy, through a grant from the N.C. State Energy Office, offered a $7,500 rebate for the purchase or lease of 40 PEVs in the Triangle for a Vehicle Usage Study project. The 40 vehicle incentives have been filled and the study is currently underway.
- Progress Energy Carolinas and Duke Energy Carolinas offered a residential charging station rebate program for a study of charging behavior. These project limits have been filled and the study is underway.

#### 7.3 NC PEV Taskforce: Incentives and Economic Development Working Group
The Incentives and Economic Development Work Group included representatives from industry, utilities, city and state government, non-profits and interested private citizens. One NC elected official, State Representative Joe Tolson, participated in meetings and expressed support for the Working Group efforts. This Working Group met seven times between January and September 2012 with individual meeting participation ranging from 15 to 26 attendees, and was co-lead by the NC Solar Center/North Carolina State University (NCSU) and the N.C. Department of Commerce with meetings held at the NC Solar Center offices at NCSU.

**Goals**
The Incentives and Economic Development Working Group goal was to assess best practices in the realm of PEV related incentives and develop recommendations to position North Carolina as advantageously as possible for widespread PEV adoption. An overarching goal is to encourage business development to grow North Carolina’s green economy with PEV related industries.
**Tasks**

- Survey NC fleet related personnel about potential incentives
- Develop list of PEV industry contacts in North Carolina
- Analyze incentives for PEV adoption in other states
- Draft Potential policy language to support PEV expansion
- Facilitate a prioritized portfolio of incentives
- Create maps of PEV Industry in North Carolina
- Provide guest presentations relevant to PEV industry expansion

### 7.4 Triangle: Incentives Work Area

**Content Experts (Work Area Leads)**

Advanced Energy and TJCogo reached out to several “content experts” to in the Triangle area to attend the meeting which focused on Incentives. Those content experts who attended included:

- North Carolina State Employees Credit Union
- North Carolina Solar Center/NCSU
- Local Employers
- Local Vehicle Dealerships

**Goals**

The goals of the Triangle Planning effort related to incentives included:

- Identification of local incentives;
- Discussion of effective potential incentives (monetary and non-monetary); and
- Submission of recommendations to the statewide Incentives Working Group.

### 7.5 Incentives

**Triangle Steering Committee**

The Triangle Steering Committee discussed incentives for the Triangle region with representatives from the NC Solar Center leading the statewide Incentives Working Group. The Steering Committee then explored some potential monetary and non-monetary incentives which could be considered in the Triangle, then wrote down their responses using worksheets. Top results are listed at the end of this section. Some of the topics of discussion among the Triangle Steering Committee included:

- Who can offer local incentives;
- Monetary versus non-monetary incentives; and
- Avoiding resentment from ICE drivers.
**Who Can Offer Local Incentives?**

- Employers
- Lenders
- Utilities
- Local Governments
- Local Vehicle Dealers
- Local Businesses/Retail/Parking/Entertainment Venues
- Others

**Monetary vs. Non-monetary Incentives**

Monetary incentive examples include:
- Vehicle tax credits (federal)
- Rebates or tax credits (state)
- Rebates or tax credits for charging infrastructure
- Waived license fees (may cause resentment with ICE drivers)
- State sales tax
- Emissions testing fees
- Free or reduced tolls
- Low interest rate loans
- Free public charging

For the purpose of the Triangle PEV Plan, the Steering Committee focused on local monetary incentives and deferred the state and national incentive discussion to the NC PEV Taskforce’s Incentives and Economic Development Working Group. Recommendations from the state working group were documented by the NC Solar Center in the *Plug-in Electric Vehicle (PEV) Incentives Analysis and Options for North Carolina* paper which is included in the NC PEV Roadmap. Several locally-based banks had indicated they would provide low interest rate loans for electric vehicle infrastructure and PEVs. Additionally, the State Employees Credit Union indicated they have a member program that finds the most competitive pricing for the purchase of a PEV.

Another financial benefit that appears to be gaining ground is discounted insurance rates. Because of the simplicity of PEVs, and low claims-generation from PEV owners, Hartford Insurance announced a five percent discount to PEV owners nationwide. The typical annual insurance premium paid by North Carolina residents in 2009 was $1500. A five percent saving will yield an additional $75 savings.
Public Charging Station Incentives
A most important PEV adoption incentive pointed to by researchers and manufacturers is the placement of public charging stations. The Triangle has been quite proficient at this, with many publically available charging stations available in and around the region.

Range anxiety – the fear of driving an electric car and becoming stranded without sufficient locations available for recharging – is noted as the potential buyer’s first hurdle to overcome. Publically available charging stations are very effective for providing “fuel security.” Preliminary data from Advanced Energy’s Vehicle Usage study shows that PEV owners increase their vehicle miles traveled as they become more familiar with the vehicle’s range.

Examples of non-monetary incentives include:
- HOV lane access (already approved- but there are currently no HOV lanes in Triangle)
- Work place charging
- Preferred dedicated parking
- Expedited permitting
- Updated building codes to install basic circuits required to streamline charging station deployment.

The Steering Committee focused on local non-monetary incentives and deferred the state and national incentive discussion to the NC PEV Taskforce’s Incentives and Economic Development Working Group.

The Steering Committee indicated that local car dealers could help to incentivize PEV adoption by providing specific local information such as charging station locations and local programs. Additional discussion items included coordinating signage, as uniform signage will provide PEV owners with easily recognizable notices for PEV charging stations. To address potential buyers’ as well as owners’ anxiety over where the next refueling opportunity exists, the Triangle Taskforce should support prominent placement of signage directing motorist to recharging stations throughout the Triangle. Charging station signage should include notice along our interstates (as do gasoline stations), and wayfinding signage off the interstate. Special attention should be placed on signage for intercity, urban and suburban locations as charging station sites are not as prominent and easy to locate as gasoline stations. Adopting a local flavor for signage is recommended.

Other options discussed included:
- “Friends of PEVs” Program: Recognize local businesses that provide PEV charging to patrons. A similar model is used by the local biofuel organizations that recognize local restaurants who sell their used grease for biofuel usage.
- Free “Valet” Parking: A local Lexus dealership provides free valet services for Lexus drivers at area shopping centers. This is a local incentive which could be added for PEVs.
- **Free Parking for Large Events** such as local sporting events and the N.C. State Fair. A suggestion would be to have the car companies sponsor the free parking.
- **Reserved Parking**: Several PEV drivers indicated that they didn’t necessarily need or want premier parking, but the enforcement of “PEV only” parking for charging locations was very important to their needs. Potential PEV drivers will also need the security of knowing that charging station spaces are reserved only for PEVs.

**Avoiding Resentment Among ICE Drivers**
The Steering Committee considered incentive options such as waiving or reducing automotive license fees, gasoline sales taxes and other taxes. The consensus was that this could create resentment among ICE drivers. Additionally, these fees are used for various components such as road maintenance, so those incentives are not sustainable options.

Table 16 provides information on key partners needed to develop and implement local PEV incentives. Table 16a provides possible approaches to establishing effective incentives and Table 16b provides the best approaches to communicating the availability of incentives.

### Table 16. Key Partners Needed to Develop and Implement Local PEV Incentives

<table>
<thead>
<tr>
<th>Number of Responses</th>
<th>Strategy Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>State and Local Governments</td>
</tr>
<tr>
<td>5</td>
<td>Retailers (shopping centers/malls)</td>
</tr>
<tr>
<td>4</td>
<td>Chambers of Commerce</td>
</tr>
<tr>
<td>4</td>
<td>Dealers</td>
</tr>
<tr>
<td>3</td>
<td>Banks/Lending Institutions</td>
</tr>
<tr>
<td>3</td>
<td>Large Cultural Event Centers</td>
</tr>
<tr>
<td>2</td>
<td>Elected Officials</td>
</tr>
<tr>
<td>2</td>
<td>Home-owners Associations</td>
</tr>
<tr>
<td>2</td>
<td>Restaurants</td>
</tr>
<tr>
<td>1</td>
<td>Business Development Professionals</td>
</tr>
<tr>
<td>1</td>
<td>Green Business Community</td>
</tr>
<tr>
<td>1</td>
<td>LEED and Green Building Development</td>
</tr>
<tr>
<td>1</td>
<td>Private Business</td>
</tr>
<tr>
<td>1</td>
<td>Environmental/Air Quality Organizations</td>
</tr>
<tr>
<td>1</td>
<td>Employers</td>
</tr>
<tr>
<td>1</td>
<td>Auto Manufacturers</td>
</tr>
<tr>
<td>1</td>
<td>Churches</td>
</tr>
</tbody>
</table>
Table 16a. Possible Approaches to Establishing Effective Incentives

<table>
<thead>
<tr>
<th>Number of Responses</th>
<th>Strategy Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Announce/broadcast/advertise information about what is available</td>
</tr>
<tr>
<td>1</td>
<td>Setting time limited goals</td>
</tr>
<tr>
<td>1</td>
<td>Presenting at Town/City Council Meetings</td>
</tr>
<tr>
<td>1</td>
<td>Inform Car Dealers</td>
</tr>
<tr>
<td>1</td>
<td>Don’t cause resentment among ICE drivers</td>
</tr>
<tr>
<td>1</td>
<td>Make advertisements simple</td>
</tr>
<tr>
<td>1</td>
<td>Business Challenges</td>
</tr>
<tr>
<td>1</td>
<td>Advertise that they’re “green”</td>
</tr>
<tr>
<td>1</td>
<td>Give incentives to PEV drivers at local businesses (store, restaurants, etc.)</td>
</tr>
<tr>
<td>1</td>
<td>Use shopping center and business owner association</td>
</tr>
</tbody>
</table>

Table 16b. Best Ways to Communicate Effective Incentives

<table>
<thead>
<tr>
<th>Number of Responses</th>
<th>Strategy Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Local media</td>
</tr>
<tr>
<td>4</td>
<td>Dealerships</td>
</tr>
<tr>
<td>4</td>
<td>Social Media</td>
</tr>
<tr>
<td>2</td>
<td>Chambers of Commerce</td>
</tr>
<tr>
<td>2</td>
<td>Announce at Special/Press Events</td>
</tr>
<tr>
<td>2</td>
<td>Public Service Ads</td>
</tr>
<tr>
<td>2</td>
<td>State and Local Government Websites</td>
</tr>
<tr>
<td>1</td>
<td>Celebrity Endorsements</td>
</tr>
<tr>
<td>1</td>
<td>Word of Mouth</td>
</tr>
<tr>
<td>1</td>
<td>Websites that List Incentives of PEVs state-by-state</td>
</tr>
<tr>
<td></td>
<td>Business Advertising</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Free Publicity</td>
</tr>
<tr>
<td>1</td>
<td>Advertising on Social Media Sites</td>
</tr>
<tr>
<td>1</td>
<td>Electric Bills</td>
</tr>
<tr>
<td>1</td>
<td>Some Kind of Advertisement at Facilities with Charging Stations</td>
</tr>
</tbody>
</table>

**Local Economic Development Opportunities**

Locally adopted incentives can tie into economic development in the Triangle. For example, incentives offered by local employers are making a statement about the type of workforce they are trying to attract and will continue to encourage workers locate in the Triangle. In fact, incentives and economic development have such a strong tie that the NC PEV Taskforce Working Groups for Incentives and Economic Development were tied together as a joint Working Group.

**7.6 Conclusions**

The Research and Steering Committee discussions revealed many of the most impactful incentive option would come from the Statewide Working Group for Incentives and Economic Development, however, the group identified several local incentive options which may help to boost PEV adoption in the Triangle.

To reference the recommendations for state and federal level incentives, please visit the NC PEV Roadmap which contains the incentives research and recommendations from the NC PEV Taskforce, Incentives and Economic Development Working Group.
7.7 Recommendations

Table 17 provides a list of Recommendations for Incentives.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Time Frame*</th>
<th>Priority Level**</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Encourage local partners to develop monetary and non-monetary incentives (Chambers of Commerce, retail businesses, etc)</td>
<td>Short-Term</td>
<td>High</td>
</tr>
<tr>
<td>5.2 Work through dealerships and other local partners to communicate available incentives using local media and social media</td>
<td>Short-Term</td>
<td>High</td>
</tr>
<tr>
<td>5.3 Support recommendations of statewide readiness plan</td>
<td>Short-Term</td>
<td>High</td>
</tr>
</tbody>
</table>

**Term Lengths for Recommendations**

<table>
<thead>
<tr>
<th>Description</th>
<th>Term Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-Term</td>
<td>1 to 2 years</td>
</tr>
<tr>
<td>Mid-Term</td>
<td>3 to 5 years</td>
</tr>
<tr>
<td>Long-Term</td>
<td>6 to 10 years</td>
</tr>
<tr>
<td>On-going</td>
<td>No set start or end time</td>
</tr>
</tbody>
</table>

**Priority Levels for Recommendations**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>
8 ELECTRIC UTILITIES

8.1 Overview of North Carolina

North Carolina’s electric utilities include the electric power holding companies such as Duke Energy Carolinas, Progress Energy Carolinas and Dominion, as well as electric cooperatives and municipally owned utilities. Each of the utilities is engaging in various PEV readiness activities to help better prepare their operations and the electric rate payers for the adoption of PEVs.

Types of Utilities

The following list outlines the types of electric utilities in North Carolina. A description of each utility can be referenced in Section 8.2.

<table>
<thead>
<tr>
<th>Investor Owned Utility (IOU): “a utility company owned and operated by private investors as opposed to ownership by a governmental agency or member-customers” [for-profit] 43</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are two (2) investor-owned utilities (IOUs) in North Carolina:</td>
</tr>
<tr>
<td>• Duke Energy, which includes Duke Energy Carolinas and Progress Energy Carolinas</td>
</tr>
<tr>
<td>• Dominion NC Power</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cooperative: “a non-profit utility owned by its members” 44</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Carolina has 26 Electric Membership Corporations (EMCs)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Muni: “a municipal power agency; while some munis [municipalities] generate their own power, most purchase it wholesale from a larger utility.” 45</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Carolina has 74 Municipal and University-owned Electric Distribution Systems</td>
</tr>
</tbody>
</table>

North Carolina generates its electricity from a mix of energy sources primarily including coal and nuclear with smaller amounts of hydroelectric, natural gas and other sources such as solar, wind and biomass. The U.S. Energy Information Administration indicates in the State Electricity Profile for North Carolina, released

43 Public Utilities Reports Inc. Guide, 2004
44 Public Utilities Reports Inc. Guide, 2004
45 Public Utilities Reports Inc. Guide, 2004
in January 2012, that North Carolina has decreased its use of coal as an energy source from 58.7% in 2000 to 53.8% in 2010. Since the data is already two years old, it does not fully reflect the recent coal plant retirements in the state by the major utilities nor the rapidly increasing renewable energy segment. Several more coal plants are expected to be retired in the coming years to be replaced by natural gas combined cycle plants, shifting the fuel mix even further to cleaner sources.

![Figure 1 NC Electric Industry Primary Energy Source as of 2010:](http://www.eia.gov/electricity/state/northcarolina/)

The Union of Concerned Scientist, in a report released in 2012, indicates that the benefits of electric vehicles are linked to the electricity grid and concludes that as the national sales of electric vehicles increase, this should also be accompanied by a shift to cleaner sources of energy in order to balance the impact of emissions.

North Carolina benefits from both policy and market-driven initiatives that aim to continue the shift to cleaner electricity generation. In 2002, the NC Clean Smokestacks Act was enacted with the support of Progress Energy and Duke Energy and has contributed to a significant reduction of emissions related to coal generation. In 2007, North Carolina became the first state in the Southeast to adopt a Renewable

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Energy and Energy Efficiency Portfolio Standard (REPS), which requires that electric utilities obtain a portion of their energy through renewable energy resources or energy efficiency measures.\textsuperscript{48}

In a market driven initiative, electric utility customers have the ability to help mitigate greenhouse gas emissions by purchasing renewable energy via NC GreenPower, an independent nonprofit organization established by the NC Utilities Commission. NC GreenPower supports electrical generation from renewable energy sources such as solar, wind, and organic matter.\textsuperscript{49} For more information on PEV adopters offsetting the energy usage by contributing to NC GreenPower, visit Chapter 4 Vehicles of this plan.

The North Carolina Utilities Commission, in 1980, founded Advanced Energy, an independent non-profit organization whose mission is to “create economic, environmental and societal benefits through innovative and market-based approaches to energy issues”\textsuperscript{50}. Advanced Energy’s Transportation Division works closely with North Carolina electric utilities on various electric transportation initiatives to help communities understand, plan for and implement electric transportation.

8.2 Description of North Carolina’s Electric Utilities

The North Carolina Electric utilities and associations have all participated in collaborative PEV readiness initiatives such as the NC PEV Taskforce and the U.S. Department of Energy’s PEV Planning grant in NC, “Plugging-in from M2S”. Each utility and utility association has submitted a description of their operations for this plan.

\textit{Duke Energy}  
\textit{(Information provided by Duke Energy)}

Duke Energy is the largest electric power holding company in the United States with more than $100 billion in total assets. Its regulated utility operations serve approximately 7.1 million electric customers located in six states in the Southeast.

\textsuperscript{48} http://www.ncuc.commerce.state.nc.us/reps/reps.htm
\textsuperscript{49} NC GreenPower Website, http://www.ncgreenpower.org
\textsuperscript{50} Advanced Energy, www.advancedenergy.org (Dec 2012)
and Midwest. Its commercial power and international business segments own and operate diverse power generation assets in North America and Latin America, including a growing portfolio of renewable energy assets in the United States. Headquartered in Charlotte, N.C., Duke Energy is a Fortune 250 company traded on the New York Stock Exchange under the symbol DUK. More information about the company is available at: www.duke-energy.com.

_Duke Energy Carolinas_

Duke Energy Carolinas owns nuclear, coal-fired, natural gas and hydroelectric generation. That diverse fuel mix provides approximately 19,500 megawatts of owned electric capacity to approximately 2.4 million customers in a 24,000-square-mile service area of North Carolina and South Carolina.

_Progress Energy Carolinas_

Progress Energy Carolinas, a subsidiary of Duke Energy (NYSE: DUK), provides electricity and related services to nearly 1.5 million customers in North Carolina and South Carolina. The company is headquartered in Raleigh, N.C., and serves a territory encompassing more than 34,000 square miles including the cities of Raleigh, Wilmington and Asheville in North Carolina and Florence and Sumter in South Carolina. More information is available at www.progress-energy.com.

_ElectriCities (Information provided by ElectriCities)_

ElectriCities provides customer service and safety training, emergency and technical assistance, communications, government affairs and legal services to 70 municipal electric systems in the state of North Carolina. Through consolidation of these services, members save their customers the expense of administering these functions locally.

ElectriCities also provides management services to the state’s two municipal Power Agencies: North Carolina Municipal Power Agency Number 1 (NCMPA1) and North Carolina Eastern Municipal Power Agency (NCEMPA). Most member cities have been in the electric business for 100 years or more.
North Carolina’s Electric Cooperatives
(Information provided by NC Electric Cooperatives)

North Carolina’s electric cooperatives serve more than 2.5 million people across North Carolina in 93 of the state’s 100 counties. The 26 electric cooperatives are private, independent and not-for-profit entities committed to providing a high standard of service to residential, commercial, industrial and agricultural customers with at-cost electric service. Each of North Carolina’s electric cooperatives is governed by a board of directors elected from its membership. Members are also owners. North Carolina’s electric cooperatives emphasize the importance of community involvement, integrity, accountability and innovation.
8.2 Utility PEV Readiness Matrix
Utilities in North Carolina are involved in various activities to prepare their services and customers for PEV adoption. For more information, please reference the NC PEV Roadmap, which includes a matrix capturing the various readiness efforts of the utilities.

8.3 Public Utilities PEV Readiness Programs and Activities
In addition to the preparations listed in the Utility PEV Readiness Matrix in the NC PEV Roadmap, North Carolina electric utilities are each involved in a variety of studies, programs and other initiatives designed to help prepare both the utilities and the residents in N.C. for PEVs. This section contains the readiness activities undertaken by all utility partners including the North Carolina Electric Cooperatives and ElectriCities.

*Duke Energy Carolinas*
*(Information provided by Duke Energy Carolinas)*
Duke Energy Carolinas is currently participating in pilots to collect data that will enable us to learn about grid impacts, better understand customer charging behavior, and potentially develop PEV-related products that will appeal to PEV owning customers. Two of these pilot programs are based in North Carolina.

**GM Chevrolet Volt EV Field Test**

The purpose of the General Motors (GM) Volt Deployment Project is to evaluate the technical performance, system impacts, and user preferences associated with PEV charging during normal usage of extended range electric vehicles (EREV). Technical attributes to be tested include impacts on distribution-level power delivery equipment, power quality impacts, and interoperability with customer-sited energy management systems. To achieve these objectives, Duke Energy purchased 16 Chevrolet Volts. Ten of these Volts were issued to Duke Energy employees with diverse commuter profiles and in some cases previously installed home energy management equipment and the other six vehicles were distributed as part of fleet pool vehicles. In addition, charging stations and necessary monitoring equipment were installed as needed to support EREV usage and collect data in accordance with the test plan. The results of the project will be primarily technical aspects of EREV usage. These results will be made available to other business units to help project the impacts of future electric vehicle adoption.

In addition to the objectives of this project, tests will be conducted to meet the requirements of U.S. DOE Recovery Act Statement of Work (DE-FOA-0000028) which establishes information sharing requirements and some operational requirements related to EREV usage.

**Charge Carolinas Project**

This is a PEV infrastructure pilot designed for Duke Energy to learn about residential customer charging behavior and test residential offers. This project involves 150 Duke Energy residential customers and 150 Duke Energy owned intelligent charging stations in North and South Carolina. A total of 121 customer participants are located throughout Duke Energy’s North Carolina service territory as follows:

<table>
<thead>
<tr>
<th>Region</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Asheville Community region</td>
<td>5</td>
</tr>
<tr>
<td>Greater Charlotte region</td>
<td>51</td>
</tr>
<tr>
<td>Piedmont Triad region</td>
<td>18</td>
</tr>
<tr>
<td>Research Triangle region</td>
<td>41</td>
</tr>
<tr>
<td>Other NC locations</td>
<td>6</td>
</tr>
</tbody>
</table>
In addition to these pilots, Duke Energy has collaborated with Advanced Energy since 2010 to assist with PEV community readiness efforts and partially fund the development and delivery of PEV related training courses, throughout the State.

**Envision Energy Project**
Another significant effort in North Carolina involving PEVs is Envision Energy Project located in the McAlpine Creek neighborhood in Charlotte, NC. McAlpine Creek is a Duke Energy test site for new technology. Residents and businesses in the area are testing a variety of components for Duke Energy, including solar panels, digital smart meters, battery storage, PEVs and home energy management systems. Putting the technology to use within the neighborhood allows Duke Energy to assess how various technologies may work on a much broader scale in the future. It allows us to understand how these technologies interact with each other, how they will integrate with the power grid, and what the customer experience will be like. The McAlpine substation serves almost 17,000 residential and commercial customers.

**Fleet Vehicles**
Duke Energy is also greening its vehicle fleet. We are testing and using PEVs in our fleet, and plan to buy more. In 2009, we made a commitment at the Clinton Global Initiative that by 2020, that all new vehicle purchases will be PEVs. This represents an investment of hundreds of millions of dollars and has the potential to significantly reduce fleet costs and greenhouse emissions over the next 10 years.

**The Envision Center**
In partnership with Advanced Energy, Duke Energy opened the Envision Center on the Centennial Campus of North Carolina State University, Raleigh, NC in 2009. The Envision Center is an interactive demonstration facility where visitors can discover how new energy technologies are transforming today’s power delivery system into tomorrow’s smart grid. It features modernized power equipment, a “smart” home complete with solar panels, a plug-in hybrid electric vehicle, an advanced meter display and a power delivery center with real-time monitoring capabilities. The Center promotes energy efficiency and innovation, and gives visitors an inside look at how smart grid technologies can help customers conserve energy, save money and improve the environment. Since its opening, more than 2,500 visitors have toured the center.

**Progress Energy Carolinas** *(Information provided by Progress Energy Carolinas)*
The information contained in this document pertains solely to legacy Progress Energy and its operating utility Progress Energy Carolinas in the state of North Carolina. Legacy Duke Energy and the Duke Energy Carolinas operating utility information is not represented in this section.
Progress Energy Carolinas is actively engaged in a range of activities related to the research and demonstration of PEVs and related charging infrastructure. The information gathered from this work will enable us to learn about grid impacts, better understand customer charging behavior and needs, and potentially develop PEV-related products that will appeal to PEV customers.

**GM Chevrolet Volt demonstration**
Progress Energy Carolinas is a utility partner in a grant awarded to General Motors under the American Recovery and Reinvestment Act. The automaker is utilizing the funding to help develop, demonstrate and deploy its Chevrolet Volt extended-range electric vehicle. Progress Energy is participating by demonstrating 12 early production Chevrolet Volts, five of which are deployed in the North Carolina territory. This expands our existing partnership and our knowledge of the technology. The vehicles join a national GM demonstration fleet of Volts with enhanced data logging capability to better understand vehicle performance and charging behavior. In addition, Progress Energy Carolinas will be completing a technology evaluation of demand response via OnStar, as well as facilitating additional research on DC fast charging and large-scale PEV charge management.

**Plugged-In Carolinas Project**
This is a PEV charging infrastructure research project designed for Progress Energy Carolinas to learn about residential and public access electric vehicle charging infrastructure and charging behavior. This project is targeting the deployment of approximately 150 residential and 50 commercial, publically accessible smart charging stations with Progress Energy Carolinas customers in North and South Carolina. Data collected from the stations will help us to evaluate charging needs outside the home, impact on the grid and the costs and issues associated with installing public-access charging stations. These insights will help us as we continue to prepare for the large-scale adoption of PEVs.

**Plug-In Vehicle Community Readiness Planning**
Progress Energy Carolinas has collaborated with Advanced Energy since 2009 to assist with PEV community readiness efforts and to partially fund the development and delivery of PEV-related training courses throughout the state.

**Plug-In Vehicle Fleet**
Progress Energy, through its Carolinas and Florida operating utilities, has deployed one of the largest plug-in vehicle fleets in the country. Specific to North Carolina, the company operates seven Chevrolet Volts, one Nissan LEAF, one prototype Ford Escape plug-in hybrid, several Toyota Plug-in Prius vehicles, and has demonstrated the Southeast’s first plug-in hybrid bucket truck. The company also has working relationships with General Motors, Nissan, Ford and others to better understand vehicle technology and facilitate the integration of PEVs into the nation’s electric grid.
**Advanced Transportation Energy Center**

Progress Energy Carolinas and NCSU announced in April 2008 the creation of the Advanced Transportation Energy Center. This innovative research center will focus on developing a lighter, cheaper and more-efficient battery and advanced charging systems for PEVs.

**PLUG-IN 2011 Conference**

Progress Energy Carolinas hosted and co-organized a national conference on PEVs in Raleigh, N.C., in July 2011 – the first time this major industry conference was held outside California. The conference was an outstanding success, including achieving a new record for public night attendance.

**Education and Outreach**

Progress Energy Carolinas is a sponsor and board member of STEP at the North Carolina Solar Center. This program engages middle and high school students in learning about the transition toward electric transportation.

**North Carolina’s Electric Cooperatives**

*(Information provided by NC Electric Cooperatives)*

**Our Support of PEV Development:**

The cooperatives within North Carolina, as well as the North Carolina Statewide Association, have actively participated in the promotion of the PEV market. Individually, many cooperatives have purchased electric vehicles and “wrapped” these cars in PEV promotional attire and featured them at their Annual Member meetings. Collectively, we financially support the Raleigh-based organization Advanced Energy. Dedicated research dollars are provided to assist Advanced Energy’s PEV market research based initiatives, as well as develop collateral materials for our communities, coops, and their members. NCAEC also has membership with EDTA. Educational PEV support articles and editorials have been featured in our award winning publication “Carolina Country.” In addition, we have provided timely national and North Carolina specific consumer market research on PEVs to this market readiness effort. And lastly, we even have a dedicated solar power charging station for our fleet PEV.

**Policies/Rates/Infrastructure Support:**

Not for profit electric cooperatives, by their very nature, are organizations run by their owners, the members. As the PEV market matures in each individual cooperative’s territory, the cooperatives are nimble to support the needs of the membership accordingly. No one size fits all policy will work in this diverse environment, ranging from deeply rural, to metropolitan bedroom community. As wholesale power purchasers, coops will work closely with their supplier and markets to manage and leverage distribution and energy costs as PEV demand grows.
Electricities

(Information provided by ElectriCities)

- 2007 – joined Plug-In Partners, a national grassroots initiative to demonstrate to automakers that a market for flexible-fuel Plug-in Hybrid Electric Vehicles (PHEV) exist today.
- 2008 – With help from an American Public Power Association grant, purchased a Toyota Prius and had it converted to a plug-in hybrid. The objective of the grant was to promote plug-in hybrids among the membership and to measure the miles per gallon performance
  - In a one year project period covering 2008-2009, the NC Public Power plug in hybrid car made 46 visits to cities and ElectriCities sponsored events. Below are some specific bullet points of the cars reach:
    - 46 total visits to member cities or to ElectriCities sponsored events
    - 38 unique city visits
    - 4 cities used the car twice
    - 4 ElectriCities events where the car was displayed
    - 513,521 people attended events where the car was on display
    - There were 9 events covered by local media.

The car averaged the following range of gas mileage in charge depleting/charge sustaining mode:

<table>
<thead>
<tr>
<th>Fuel Economy Range</th>
<th>Percent of total miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-60 mpg</td>
<td>42%</td>
</tr>
<tr>
<td>60-80</td>
<td>44%</td>
</tr>
<tr>
<td>80-100</td>
<td>10%</td>
</tr>
<tr>
<td>100-120</td>
<td>4%</td>
</tr>
</tbody>
</table>

- 2010-present – serve as an advisor/matchmaker to member cities on issues such as charging stations and electric vehicle availability
- 2012 – organized a technical session on electric vehicles at the ElectriCities Annual Meeting including a ride and drive for members to test drive one of three electric vehicles: a Nissan Leaf, a Chevrolet Volt, and a Mitsubishi iMiev.

8.4 Conclusions

The NC electric utilities have undertaken many initiatives to better understand and prepare for the adoption of electric vehicles. Part of the task is not only understanding the impact of electric vehicle adoption to the grid but helping the electric rate payers learn about best practices for vehicle usage.

A highlighted in this chapter, the electric utilities in the state are highly engaged in PEV preparedness. Some notable trends include active engagement with collaborative efforts and rate payers, research-based studies, and contributions and recognition on a national scale.
9 IMPLEMENTATION

9.1 Plan Implementation and Monitoring
The recommendations in the previous sections will be carried out through both direct and indirect routes. The local TCCC will collaborate with the statewide NC PEV Taskforce to directly implement applicable recommendations as a part of their larger mission to reduce petroleum usage in the region.

The second more indirect route is one that will be carried out by any local governments that replicate this plan for their own jurisdictions. We have formatted the report to facilitate this replication by highlighting the questions we asked, the sources we used, and the public engagement process we followed. We have also worked with the Board of Directors of the TJCOG to get their feedback throughout the planning process and will be asking them to pass a resolution of support for the plan. The template for this resolution can be found in Appendix 7. This Board consists of elected officials representing cities and counties across this region and their support of this plan should encourage the TJCOG member governments to use this plan as a model for creating their own.

9.2 Amending & Updating the Plan
The NC PEV Taskforce, Advanced Energy and the TCCC will continue to get periodic data updates on the number of PEVs in the Triangle from the NCDMV and EPRI, and will collaborate to amend the plan with this new data. We plan to review the progress that has been made in this region by our combined stakeholders on the recommended actions on a three year basis, with the first review to be held in 2015. At that time, these organizations will also amend or modify the plan’s recommendations as appropriate in light of new data and changes in the regional context as well as to align with other related regional planning initiatives.

Through its participation in this planning process the TCCC will be better prepared to target effective outreach to key audiences within the PEV community in the Triangle. The TCCC will further align its workplan to contribute to the PEV outreach efforts and will track the ongoing efforts of Coalition member organizations. The TCCC will continue to produce PEV case studies, success stories, as part of their normal coalition activities as well as to communicate with community-level stakeholders through stakeholder meetings and outreach events as they occur.
9.3 Continued Support and Funding

Partners in the planning process will continue to engage with the NCSEO and NCDENR to stay appraised of new grant or other governmental funding opportunities to continue plan implementation. The industry partners that we have engaged in this process may also be interested in supporting implementation actions that match their interests in the PEV market in the Triangle. These businesses and other private and public organizations will be able to hear about new Federal grant opportunities and informational resources through joining the TCCC.

Once funding is secured, it will be important to ensure that budgetary decision makers and staff involved with purchasing are made aware of the expenses involved with PEV readiness in order to reduce obstacles in the approval of expenditures. The utilities will also be a possible source of support for the implementation of this plan as they have a large stake in the Triangle’s PEV Readiness. The three large universities in the Research Triangle (UNC Chapel Hill, NC State University, and Duke) may also be able to provide continued technical support in the form of graduate student internships and research projects. While the coordination and advising of these PEV research projects will take some resources, the creativity, energy and resources of these students may help drive implementation efforts.

Table 19 provides a comprehensive list of Recommendations for the Triangle Readiness Plan.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Time Frame*</th>
<th>Priority Level**</th>
<th>Funding Needed? (if yes, list type of funding needed)</th>
<th>Primary Implementing Organization Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Establish key partnerships with fleet managers, local governments, and dealerships.</td>
<td>Ongoing</td>
<td>High</td>
<td>Staff time</td>
<td>Local Government, Statewide or regional non-profit</td>
</tr>
<tr>
<td>1.2 Correct misinformation that leads to perceived barriers to PEV adoption.</td>
<td>Long-Term</td>
<td>High</td>
<td>Staff time</td>
<td>Statewide or regional non-profit</td>
</tr>
<tr>
<td>1.3 Increase visibility and knowledge of the benefits of PEVs broadly through news media and in a more targeted way through social media, and owner testimonials.</td>
<td>Mid-Term</td>
<td>Medium</td>
<td>Staff time and paid media placements</td>
<td>Statewide or regional non-profit</td>
</tr>
<tr>
<td>1.4 Communicate the benefits and total cost of ownership of PEVs to public and private fleet managers.</td>
<td>Mid-Term</td>
<td>High</td>
<td>Staff time and for fleet contact lists</td>
<td>Local Government, Statewide or regional non-profit</td>
</tr>
<tr>
<td>1.5 Provide authoritative third party information about PEVs</td>
<td>Short-Term</td>
<td>High</td>
<td>Staff time</td>
<td>Statewide or regional non-profit</td>
</tr>
<tr>
<td>Section</td>
<td>Action Description</td>
<td>Timeframe</td>
<td>Staff Time</td>
<td>负责方</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------</td>
<td>-----------</td>
<td>-----------</td>
<td>------</td>
</tr>
<tr>
<td>2.1</td>
<td>Create an ongoing Triangle EVSE coordinating council that can continually revise/update EVSE locations and forecasts</td>
<td>Short-Term</td>
<td>High</td>
<td>Staff time</td>
</tr>
<tr>
<td>2.2</td>
<td>Prioritize key locations, including workplace and retail locations, and concentrate public installations on very visible bridging locations</td>
<td>Mid-Term</td>
<td>High</td>
<td>Staff time</td>
</tr>
<tr>
<td>2.3</td>
<td>Coordinate with the Triangle Clean Cities Coalition to help municipalities and private organizations deploy charging infrastructure</td>
<td>Mid-Term</td>
<td>Medium</td>
<td>State-level taskforce, State or regional non-profit</td>
</tr>
<tr>
<td>2.4</td>
<td>Work with local higher education and government partners to develop protocols to track which 240v electrical outlet installations are tied to EVSE.</td>
<td>Mid-Term</td>
<td>Low</td>
<td>Staff time</td>
</tr>
<tr>
<td>2.5</td>
<td>Establish an ongoing relationship with NC DMV to correlate PEV ownership with home installations.</td>
<td>Mid-Term</td>
<td>Medium</td>
<td>Staff time</td>
</tr>
<tr>
<td>2.6</td>
<td>Work with the Triangle Transportation Demand Management program (TJC0G) to survey major employers locally and ask if they have now or plan to have charging access in the future.</td>
<td>Short-Term</td>
<td>Low</td>
<td>Staff time and for survey costs</td>
</tr>
<tr>
<td>2.7</td>
<td>Identify channels and methods to communicate charging station considerations to large, multi-family operators (HOA groups, building managers, etc.).</td>
<td>Short-term</td>
<td>High</td>
<td>State-level taskforce, State or regional non-profit</td>
</tr>
<tr>
<td>2.8</td>
<td>Conduct local surveys of plans to install charging stations utilizing templates and information developed by Advanced Energy</td>
<td>Mid-Term</td>
<td>Low</td>
<td>Statewide or regional non-profit, local government</td>
</tr>
<tr>
<td>2.9</td>
<td>Develop or identify business models for localities to recoup charging station costs (i.e., the cost of providing electricity)</td>
<td>Mid-Term</td>
<td>High</td>
<td>Utilities, State-level taskforce, State or regional non-profit</td>
</tr>
<tr>
<td>2.10</td>
<td>Update projections of EVSE and PEV adoption scenarios as they are available from EPRI and other sources</td>
<td>Short-Term</td>
<td>High</td>
<td>Staff time</td>
</tr>
<tr>
<td>3.1</td>
<td>Update Local Historic District Regulations</td>
<td>Short-Term</td>
<td>High</td>
<td>Local government</td>
</tr>
<tr>
<td>3.2</td>
<td>Support state and national efforts to develop ADA guidance</td>
<td>Short-Term</td>
<td>High</td>
<td>State-level taskforce, State or regional non-profit</td>
</tr>
<tr>
<td>3.3</td>
<td>Update local Zoning Ordinances</td>
<td>Short-Term</td>
<td>High</td>
<td>Local government</td>
</tr>
<tr>
<td>3.4</td>
<td>Work with Local Governments to educate and encourage updating local codes by presenting at industry events, workshops and conferences</td>
<td>Short-Term</td>
<td>High</td>
<td>Staff Time</td>
</tr>
<tr>
<td>3.5</td>
<td>Update local planning documents</td>
<td>Short-Term</td>
<td>High</td>
<td>Local Government</td>
</tr>
<tr>
<td>3.6</td>
<td>Develop informational documents outlining permitting processes for charging stations</td>
<td>Short-Term</td>
<td>High</td>
<td>Staff Time</td>
</tr>
<tr>
<td>3.7</td>
<td>Utilize various outlets to ensure dissemination of local policies and processes (local newsletters, websites and social media, etc)</td>
<td>Mid-Term</td>
<td>High</td>
<td>Staff-time</td>
</tr>
<tr>
<td>3.8</td>
<td>Relay ongoing regional efforts to facilitate updates for local governments</td>
<td>Short-Term</td>
<td>High</td>
<td>State-level taskforce, State or regional non-profit</td>
</tr>
<tr>
<td>3.9</td>
<td>Ensure the citizen decision making boards (councils, planning boards, historic</td>
<td>On-going</td>
<td>Medium</td>
<td>Staff Time</td>
</tr>
<tr>
<td></td>
<td>commissions, etc.) are educated on PEV topics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>3.10</td>
<td>Coordinate with NC PEV Taskforce on policy recommendations to ensure uniform recommendations</td>
<td>On-going</td>
<td>High</td>
<td>State or regional non-profit</td>
</tr>
<tr>
<td>4.1</td>
<td>Work with local schools to incorporate PEV considerations into their curriculum through initiatives such as the STEP Program</td>
<td>On-going</td>
<td>High</td>
<td>Staff Time</td>
</tr>
<tr>
<td>4.2</td>
<td>Work with local community colleges, universities, and other workforce training centers</td>
<td>Long-Term</td>
<td>High</td>
<td>Staff Time</td>
</tr>
<tr>
<td>4.3</td>
<td>Work with media outlets to disseminate key information</td>
<td>On-going</td>
<td>High</td>
<td>Staff Time</td>
</tr>
<tr>
<td>4.4</td>
<td>Display information at relevant events and conferences, particularly those targeted at populations who may be interested in buying PEVs (PEV Awareness Week, Earth Day, AFV Odyssey Day, etc)</td>
<td>On-going</td>
<td>High</td>
<td>Staff Time</td>
</tr>
<tr>
<td>4.5</td>
<td>Develop informational handouts to provide customers at car dealerships</td>
<td>Short-Term</td>
<td>Medium</td>
<td>Staff Time</td>
</tr>
<tr>
<td>5.1</td>
<td>Encourage local partners to develop monetary and non-monetary incentives (Chambers of Commerce, retail businesses, etc)</td>
<td>Short-Term</td>
<td>High</td>
<td>Staff Time</td>
</tr>
<tr>
<td>5.2</td>
<td>Work through dealerships and other local partners to communicate available incentives using local media and social media</td>
<td>Short-Term</td>
<td>High</td>
<td>Staff Time</td>
</tr>
<tr>
<td>5.3</td>
<td>Support recommendations of statewide readiness plan</td>
<td>Short-Term</td>
<td>High</td>
<td>Staff Time</td>
</tr>
</tbody>
</table>
**Term Lengths for Recommendations**

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-Term</td>
<td>1 to 2 years</td>
</tr>
<tr>
<td>Mid-Term</td>
<td>3 to 5 years</td>
</tr>
<tr>
<td>Long-Term</td>
<td>6 to 10 years</td>
</tr>
<tr>
<td>On-going</td>
<td>No set start or end time</td>
</tr>
</tbody>
</table>

**Priority Levels for Recommendations**

<table>
<thead>
<tr>
<th>Priority Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>
APPENDIX

Appendix 1: PEV Planning Boundary Survey
Appendix 2: Stakeholder Participation Survey
Appendix 3: Steering Committee Worksheets
Appendix 4: PEV Planning Flyer
Appendix 5: Comprehensive PEV Initiative Document
Appendix 6: Steering Committee Recruitment Flyer
Appendix 7: Sample Resolution
Appendix 8: Durham City-County Electric Vehicle and Charging Station Plan
APPENDIX 1

PLANNING BOUNDARY SURVEY:
ADMINISTERED TO METROPOLITAN PLANNING ORGANIZATIONS
Defining Your Region – A Guide to Establishing the Project Area and Focus Area Boundaries for the Mountains to Sea Project

This PEV Planning Boundary Survey is designed to be your guide in a phone interview or in-person meeting with a staff representative from the MPOs in your region. The steps listed below outline the process we are recommending for PIs to follow when defining the boundary for their area (Task 1.1 from Scope of Work). There are two reasons that we recommend following this process. First, we believe that defining the boundary of the project area and focus area based on pre-established criteria such as data used by the MPOs (traffic pattern data, work place densities, and other considerations) will assist with the justification of the boundary delineations. Secondly, this will allow for the early involvement of area MPOs as stakeholders.

Recommended steps for defining the project boundary in your area:

1. The PEV Planning Boundary Survey will be supplied to PIs to ask their local MPO representatives (See next page).
2. PIs will designate two levels of the project area: 1. Overall project boundaries (may follow regional council’s boundaries), 2. Focus area (defined using responses from survey given to MPO representatives)
3. PIs set up conference call or meeting with MPO staff representatives to ask questions to help determine the boundaries using PEV Planning Boundary Survey as a guide).
4. PIs assess answers collected from MPOs
   a. Use employment centers (or other applicable center) as the center of a 20 and 30 mile radius map to help inform the selection (suggest using Google tool http://maps.forum.nu/gm_driving_radius.html, or GIS to set radius). It is suggested to develop both a 20 mile and 30 mile boundary from established centers (20 miles being the core focus area and 30 miles being the outer range for the focus area). Identify any key areas or municipalities that don’t fall within the 20 and 30 buffers.
   b. Document and provide commentary on selection process.
5. PIs submit survey answers and commentary to Basecamp for all PIs to review. PIs can contact Advanced Energy before posting for support with the analysis.
6. Advanced Energy facilitates conference call/webinar for group discussion of assessment. It is recommended to take good notes of conversation for future documentation such as reports and the community readiness plan.
7. PIs create list of municipalities to be included in the focus area, and create refined focus area map. Both documents to be marked as drafts and posted to Basecamp.
8. PIs return draft maps to MPO representatives for feedback. The intent of this step is to allow for the MPOs to see the draft map and comment on any changes they would recommend.
9. PIs finalize map of project area and focus area boundaries and post to Basecamp (marked as final).
10. PI presents findings to TAC/TCC (Transportation Advisory Committee, and Technical Coordinating Committee) (political decision-makers) to recruit stakeholders (optional, only if time and resources permit).

PEV Planning Boundary Survey for Metropolitan Planning Organization Representatives

North Carolina was awarded a planning grant from the US Department of Energy to create a policy and deployment plan for plug-in electric vehicles statewide. As a necessary first step in the planning process, the state must first be split into the primary communities/regions where electric vehicles are most likely to be adopted. Areas that are predicted to have the greatest number of electric vehicles are employment centers with high concentrations of commuters that travel a maximum of 20 to 30 miles to work (one way). In order to make the best use of federal funds, this initial electric vehicle planning effort will focus on these 20 to 30 mile commute-sheds for the MPO regions associated with the state’s largest municipalities. To define these commute-sheds we would like to ask you several questions:

1. Within the defined political boundary of your MPO, what are the areas (greater than one TAZ, or other applicable boundary, such as zip code) with the greatest concentration of employment?
2. Would this area change if you were to include your entire modeling area? If so, where is that area?
3. Disregarding political boundaries, what employment centers would you recommend we use to focus our planning efforts?
4. If you were to draw 20 and 30 mile buffers (network distance) from these employment centers, would the area covered be roughly representative of most of the commuters in your region?
5. If you had to support an assertion that these centers are a focal point for commuters, what data would you use?
6. Is there anything else that you feel we need to consider in defining the geographic focus areas for our electric vehicle policy and infrastructure planning? Examples of this could include:
   a. early adopter communities located outside the 20 and 30 mile buffers from employment areas,
   b. daily travel patterns that may not include high workplace density locations,
   c. popular local and tourist destinations (accessed daily)

We’d like to invite you or someone else from your MPO to join our planning effort. We are in the process of putting together a regional working group that will guide the creation of this community’s/region’s electric vehicle plan. If you would like to participate in this effort, please let us know and we will notify you of our upcoming meetings.
APPENDIX 2

STAKEHOLDER SURVEY
Triangle Plug-in Electric Vehicle Planning

Welcome to the Triangle Plug-in Electric Vehicle Planning survey!

Through the N.C. PEV Readiness Initiative, Plugging in from Mountains to Sea, Triangle stakeholders are working together to develop the area's first community-wide PEV Readiness Plan. For a successful plan, it is critical that feedback be obtained from key stakeholders in the Triangle.

The Readiness Plan is led by Advanced Energy and Triangle J Council of Governments who have developed a three-tier stakeholder involvement process in which to engage stakeholders from the entire Triangle community. This engagement process consists of:
* Establishing a Steering Committee;
* Bringing in content experts when discussing specific topics; and
* Preparing a survey and hosting a PEV Awareness Week for all Triangle stakeholders.

All feedback obtained through this survey will be compiled and used to help shape the Triangle PEV Readiness Plan.

Start Survey!
2. Please rank in order of importance what you consider being the most vital issues related to charging infrastructure in order for the adoption of PEVs to be successful in the Triangle area.

Addressing issues related to charging station permitting and inspection requirements

Raising awareness of installing residential charging stations

Increasing the number of public charging stations (there are currently close to 50 publicly available charging stations in the Triangle)

Ensuring that state and local policies and codes support PEV adoption

Drag items here to rank them

3. Please rank in order of importance what you consider being the most vital issues related to vehicles in order for the adoption of PEVs to be successful in the Triangle area.

Increasing consumer awareness of suitable uses and potential benefits of PEVs

Increasing the awareness of public and private fleets of suitable uses and potential benefits of PEVs

Providing economic incentives for PEV infrastructure purchasing

Providing economic incentives for PEV purchasing

Drag items here to rank them
I would like to participate in activities related to topic areas of interest only as selected in previous question.
I will participate periodically as needed.
I would like to only receive email updates.
I am not interested in participating at this time.
Other, please specify

8. Please select your business/industry type:
   - Government
   - Instructional (university/college)
   - Business/nonprofit
   - Other, please specify

9. Please provide your contact information (optional)
   - Name
   - Company
   - Address 1
   - Address 2
   - City
   - State
   - Zip
   - Email Address

Submit
APPENDIX 3

STAKEHOLDER WORKSHEETS
Education and Outreach Worksheet for the Triangle PEV Readiness Plan:
Thank you for serving as a stakeholder in the development of the Triangle's first Plug in Electric Vehicle Readiness Plan. Your participation and feedback will provide valuable information for this plan. This worksheet lays out the scope for the “Education and Outreach” work area.

State Level: Scope of Work from NC PEV Taskforce Education and Outreach Working Group
- **Objective:**
  In relation to PEVs, Education and Outreach has been widely accepted as both a barrier and an opportunity. The objective of the Education and Outreach Working Group is to help formulate strategies to increase general PEV awareness among stakeholders such as the green workforce, the public, the government and key organizations.

- **Deliverables:**
  1. **Barriers and Perceptions** - Identify barriers and perceptions related to PEVs
  2. **Target Audiences** - Identify target audiences for education and outreach
  3. **Key Messages** - Determine key messages for each target audience
  4. **Resources** - Develop resources for education and outreach
     a. Fact sheet
     b. Test Drive Kit
     c. YouTube videos
     d. PEV 101 Power Point Presentation
  5. **Communicate Incentives** - Create a plan to communicate monetary and non-monetary incentives for PEVs to target audiences
  6. **Training** - Identify opportunities for training related to PEVs.
     Create a plan to support existing training programs for PEVs across the State
     a. Technical training for charging station installations and inspections
     b. First Responder Training
     c. Community Planning workshops
  7. **Marketing** - Develop a plan for marketing PEVs to target audiences

Local Level: Scope of Work for Triangle Community PEV Readiness Plan
- **Objective:**
  To work within the community to address education, outreach, training, and marketing of electric vehicle related topics.

- **Deliverables:**
  o To document existing education and outreach activities in the Triangle and to identify recommendations for additional activities and partners.
To make recommendations to the state-wide NC PEV Taskforce Education and Outreach Working Group if necessary.

**Triangle Education and Outreach** *(existing initiatives in the Triangle)*

**Advanced Energy**

**Workshops and Trainings**
- Technical Trainings
- Community Planning Forums
- PEV 101
- First Responder Training
- Fleet Workshops (will be offering)

**Community Events**
- Earth Day
- Marbles
- PEV Awareness Day and Week

**Online and New Media**
- Twitter
- Community Planning Guide
- PEV 101
- First Responder Training
- Fleet Workshops (will be offering)

**Collateral**
- Charging Station Handbook
- FAQs
- Blog
- Online website EVSE tool

**Other**
- Ride-n-Drive Events
- Workplace events

**City of Raleigh**

**Online and New Media**
- Twitter
- YouTube Videos
- Charging station location map
- Web page

**Collateral**
- FAQs
- Fact Sheet

**Durham (County and City)**

**Workshops and Trainings**
- Employee training
  - Driving the LEAF
  - Locations with charging stations

**Online and New Media**
- YouTube
- Charging station location map
- Web page

**Collateral**
- Durham EV and Charging Station Plan
- FAQs
- Fact Sheet

**Marketing**
- QR (quick response) Codes on Charging stations
Please consider the questions below:

1. List key partners in the Triangle needed to advance education and outreach initiatives.

2. What are opportunities to support existing local education and outreach efforts?

3. Based on the list provided of existing education and outreach activities in the Triangle, what is missing?

4. In your opinion, what are the top three most important education and outreach activities needed in your area?
Policies, Codes and Standards Worksheet for the Triangle PEV Readiness Plan:
Thank you for serving as a stakeholder in the development of the Triangle’s first Plug in Electric Vehicle Readiness Plan. Your participation and feedback will provide valuable information for this plan. This worksheet lays out the scope for the “Policies, Codes and Standards” work area.

**State Level: Scope of Work from NC PEV Taskforce Infrastructure Working Group**

- **Objective:**
  The level and effectiveness of the policies, codes and standards in North Carolina concerning PEVs can greatly affect the state’s capacity to support the vehicles on its roadways as well as its appeal to related opportunities. The Policy, Codes and Standards Working Group will help identify existing policies that can easily be adopted to help promote PEVs.

- **Deliverables:**
  1. **Americans with Disabilities Act (ADA)** - Recommend standards based on national trends, local case-studies and NC Dept. of Insurance guidance.
  2. **Signage** - Develop guidebook for signage based on federal recommendations and other emerging standards.
  3. **Building Codes**
     a. Review current codes for applicable regulations
     b. Approach NC Building Code Council for guidance
  4. **Permitting**
     a. Recommend expedited permitting system for EVSE, Establish “flag” of EVSE / PEV related permits in order to track installations
  5. **Zoning Codes**
     a. Approach local planning professionals to establish zoning standards and recommendations for PEVs and charging infrastructure
     b. Address encroachment agreement and right-of-way issues
  6. **Technical Training** (coordinate w/ Education & Outreach Working Group)
     a. Electrical Inspectors, Contractor Certification, and Inspection Groups
  7. **Case Studies** - Collect case studies of local ordinances that facilitate the installation of publicly available charging infrastructure and support public access.
  8. **Legislative Considerations**
  9. **Model Plans** - Identify and collect local plans and policies; i.e., Durham City-County Electric Vehicle and Charging Station Plan

**Local Level: Scope of Work for Triangle Community PEV Readiness Plan**

- **Objective:**
To address local policy codes and standards that may need to be reviewed or modified to prepare the Triangle for electric vehicle readiness.

- **Deliverables:**
  
  - Provide research and recommendations on local policy modifications.
  
  - Provide recommendations to statewide Policy Codes and Standards Working Group for any statewide policies that may need to be reviewed.

**Please consider the questions below:**

1. Based on today’s discussion, are there one or more policies that should be addressed in your jurisdictions? List your top three.

2. List the best strategies to implement these changes. Who to talk to? What time of year? Who are the decision making bodies that approve the local policies, codes and standards?

3. What are the best ways to assist new PEV owners to navigate through the local policies?
Infrastructure Worksheet for the Triangle PEV Readiness Plan:
Thank you for serving as a stakeholder in the development of the Triangle's first Plug in Electric Vehicle Readiness Plan. Your participation and feedback will provide valuable information for this plan. This worksheet lays out the scope for the “Infrastructure” work area. We will discuss and fill out the questions on the back page during our meeting today.

**State Level: Scope of Work from NC PEV Taskforce Infrastructure Working Group**
- **Objective:**
  Create a plan for effectively deploying residential, workplace, private, and publicly available charging infrastructure (EVSE) throughout the State of North Carolina.
- **Questions to be explored:**
  - How many consumers will have access to private residential charging and/or workplace charging infrastructure?
  - How will/should EVs interact with the electric grid in NC and will they be smart grid compatible?
- **Deliverables:**
  - An estimate of the number and type of EVSE that will be available in the near future, based on the number of EVs expected in the statewide market.

**Local Level: Scope of Work for Triangle Community PEV Readiness Plan**
- **Objective:**
  Create a plan for effectively deploying residential, workplace, private, and publicly available charging infrastructure throughout the Triangle region.
- **Questions to be explored:**
  - Approximately how many of each type of housing are represented in the Triangle, especially among those most likely to purchase an EV?
  - What is the status of workplace charging?
  - How can information on EVSE availability, multi-family EVSE installation, and smart grid compatibility be shared most effectively in the Triangle?
- **Deliverables:**
  - Estimate and map the number and types of residences in the Triangle region - single family or multi-unit dwellings, with or without garage, etc.
  - Survey the major employers and fleet managers to determine if they have now or plan to have charging access in the future and what support they may need.
  - Identify channels and educational opportunities to pass on information developed at the state level.
Please consider the questions below:

1. Who are key partners needed to develop and implement local EV infrastructure?

2. What are some approaches to establish effective EV charging infrastructure?

3. What are the best ways to communicate best practices about EV infrastructure (EVSE availability, multi-family EVSE installation, and smart grid compatibility, etc.)?
Economic Development Worksheet for the Triangle PEV Readiness Plan:
Thank you for serving as a stakeholder in the development of the Triangle's first Plug in Electric Vehicle Readiness Plan. Your participation and feedback will provide valuable information for this plan. This worksheet lays out the scope for the “Economic Development” work area.

State Level: Scope of Work from NC PEV Taskforce Economic Development Working Group
- **Objective**: Develop recommendations, best practices, and forecasts that make North Carolina as advantageous as possible for widespread Plug-In Electric Vehicle (PEV) adoption and business development to grow North Carolina's green economy with PEV related industries.
- **Questions to be explored**:
  - How many businesses in NC are directly connected to EVs or charging infrastructure and what is their combined impact on the state’s economy (# of jobs, size of market, etc.)?
  - How can we make North Carolina become as advantageous as possible for PEV focused economic development?
  - How can the environmental benefits of PEVs be used in a way that supports economic development?
- **Deliverables**:
  - NC PEV Industry contact list.
  - Survey on electric vehicle incentives.
  - Series of meetings on industry needs.
  - Cost benefit analysis on cost savings derived from foregoing underground fuel storage and associated maintenance, permitting, and clean-up costs

Local Level: Scope of Work for Triangle Community PEV Readiness Plan
- **Objective**: Develop recommendations and best practices for economic development activities intended to accelerate the adoption of Plug-In Electric Vehicles (PEV) and encourage business development to grow the Triangle’s green economy with PEV related industries.
- **Questions to be explored**:
  - The Triangle has an existing cluster of PEV industries. How can we encourage growth and new development of these industries?
  - How can we take advantage of existing workforce training opportunities to incorporate PEV considerations?
- **Deliverables**:
  - Provide recommendations to taskforce Working Group
  - Identify local PEV industries and explore options for collaborations/partnerships
Please consider the questions below:

1. Who are key partners needed to further develop the local PEV economy on the supply side?

2. What are some approaches to further develop the local PEV economy on the supply side?

3. What are the best ways to communicate the importance of the local PEV economy and ways to support it?
Incentives Worksheet for the Triangle PEV Readiness Plan:
Thank you for serving as a stakeholder in the development of the Triangle's first Plug in Electric Vehicle Readiness Plan. Your participation and feedback will provide valuable information for this plan. This worksheet lays out the scope for the "Incentives" work area. We will discuss and fill out the questions on the back page during our meeting today.

State Level: Scope of Work from NC PEV Taskforce Incentives Working Group
- **Objective**: Develop recommendations, best practices, and forecasts that make North Carolina as advantageous as possible for widespread Plug-In Electric Vehicle (PEV) adoption and business development to grow North Carolina’s green economy with PEV related industries.
- **Questions to be explored**:
  - How can the awareness of both financial and non-financial incentives related to PEV adoption, including the true cost of ownership, be increased?
  - What disincentives for PEV adoption exist, and what strategies can contest them?
  - What kind of incentives, both financial and non-financial, should be created?
- **Deliverables**:
  - Survey of NC stakeholders about potential incentives
  - Analysis of incentives of PEV adoption in other states
  - Facilitate prioritized portfolio of incentives

Local Level: Scope of Work for Triangle Community PEV Readiness Plan
- **Objective**: Develop recommendations and best practices for incentives intended to accelerate the adoption of Plug-In Electric Vehicles (PEV) and encourage business development to grow the Triangle’s green economy with PEV related industries.
- **Questions to be explored**:
  - How can the awareness of both financial and non-financial incentives related to PEV adoption be increased?
  - What disincentives for PEV adoption exist, and what strategies can contest them?
  - What kind of incentives, both financial and non-financial, should be created?
  - Who are the key stakeholders in the Triangle who should be involved/NOTIFIED?
  - What are the key barriers to establishing local incentives and how can they be addressed?
- **Deliverables**:
  - Document existing local incentives
  - Provide recommendations on local incentives based on stakeholder feedback
Please consider the questions below:

1. Who are key partners needed to develop and implement local PEV incentives?

2. What are some approaches to establish effective incentives?

3. What are the best ways to communicate effective incentives?

Information about the Triangle Community PEV Readiness Plan

Electric Power Research Institute estimates the Triangle will have more than 18,000 cumulative PEV sales by 2020. In order to accelerate the adoption of these new vehicles, area stakeholders are making a true commitment to the widespread acceptance of electrified transportation. Advanced Energy and the Triangle J Council of Governments are currently developing the first Community-wide PEV Readiness Plan, as part of the Mountains to Sea PEV Readiness Initiative funded by the U.S. Department of Energy through the Centralina Council of Governments. This plan focuses on:

- Economic development, including incentives for the expansion of the PEV industry in the area;
- Vehicle and Infrastructure planning;
- Education, Outreach, Marketing and Training;
- Environmental benefits, consisting of reduced dependence on fossil fuels and improved local air quality; and
- Updating local policy to encourage and not constrain
Vehicles Worksheet for the Triangle PEV Readiness Plan

Thank you for serving as a stakeholder in the development of the Triangle’s first Plug in Electric Vehicle Readiness Plan. Your participation and feedback will provide valuable information for this plan. This worksheet lays out the scope for the “Vehicles” work area. We will discuss and fill out the questions on the back page at our meeting on May 8th. Please look over the materials prior to the meeting to prepare.

State Level: Scope of Work from NC PEV Taskforce Vehicles Working Group
- **Objective**: Develop recommendations, best practices, and forecasts that encourage and further prepare North Carolina for widespread Plug-In Electric Vehicle (PEV) adoption.
  - **Questions to be explored**:
    - How can we work with the NC DMV to better track the number of registered plug-in electric vehicles in the state?
    - What do the Original Equipment Manufacturers have planned for deployment in NC, and how can we work with them to show our readiness?
    - What are the relevant existing practices and models (nationally and within the state)?
  - **Deliverables**:
    - Established connection with NC DMV data sources for regular updates on PEV numbers.
    - An estimate and justification of the number of privately owned personal PEVs, and the number of private or public fleet PEVs. (Requirement from DOE)

Local Level:
- **Objective**: Develop recommendations, best practices, and forecasts that encourage and further prepare The Triangle Community for widespread Plug-In Electric Vehicle (PEV) adoption.
  - **Questions to be explored**:
    - Beyond residential consumers, what information do dealerships, and public and private fleets need to make the case for PEVs?
      - What are the best ways to communicate this information?
  - **Deliverables**:
    - PEV Rally – Regional level celebration of PEVs with some opportunity to collect data from current PEV users.
    - Analysis of PEV usage patterns
    - Outreach materials for dealerships and fleets.
Pulling from the discussions at the May 8th Triangle Steering Committee Meeting, please consider the questions below:

1. Who are key partners needed to expand the use of PEVs in the Triangle?
2. What are some approaches to increasing the use of PEVs in the Triangle?
3. What are the best ways to communicate the benefits of PEVs?

Information about the Triangle Community PEV Readiness Plan
Electric Power Research Institute estimates the Triangle will have more than 18,000 cumulative PEV sales by 2020. In order to accelerate the adoption of these new vehicles, area stakeholders are making a true commitment to the widespread acceptance of electrified transportation. Advanced Energy and the Triangle J Council of Governments are currently developing the first Community-wide PEV Readiness Plan, as part of the Mountains to Sea PEV Readiness Initiative funded by the U.S. Department of Energy through the Centralina Council of Governments. This plan focuses on:

- Economic development, including incentives for the expansion of the PEV industry in the area;
- Vehicle and Infrastructure planning;
- Education, Outreach, Marketing and Training;
- Environmental benefits, consisting of reduced dependence on fossil fuels and improved local air quality; and
- Updating local policy to encourage and not constrain adoption of PEVs.
APPENDIX 4

PEV PLANNING FLYER
PEV READINESS PLANNING FLOW CHART

Define PEV Readiness Planning Area
(Working with local MPOs using Vehicular Trip Destination Data-use MPO PEV Planning Boundary Survey)

Identify Stakeholders

Establish Steering Committee

Utilize Community Planning Matrix (CPM) to research, gather feedback and identify barriers while addressing six topic areas of electric vehicle preparedness

All Stakeholders
  Content Experts
  Steering Committee

Topic Areas for Electric Vehicle Readiness from CPM:
- Incentives
- Economic Dev
- Vehicles
- Education and Outreach
- Infrastructure
- Policy, Codes and Standards

Gather Research and Collect Feedback from Stakeholders

Document Research and Feedback in CPM

Create Plan for PEV Readiness
Based on research and findings from the Steering Committee and CPM

Implement Plan
- Plan Awareness
- Adoption of Plan among local officials
- Monitor implementation

Utilize Various Methods to Gather Feedback:
- Surveys
- PEV rallies
- Online blogs and websites
- Trainings
- Invite Content Experts to Participate in Topic-Specific Meetings

Advanced ENERGY
Appendix 5

Triangle PEV Initiative Document
Plug-In Electric Vehicle Initiatives

Triangle, N.C.

Plug-In Electric Vehicles: A Call to Action
In 2011, the Nissan Leaf and Chevrolet Volt became the first production plug-in electric vehicles (PEVs) available to consumers in the United States. PEVs give drivers the choice of fueling their cars with electricity instead of gasoline, offering the potential for significant fuel cost savings, reduced emissions, higher performance, and a more secure energy supply.

Driving Factors
Global market estimates from independent research organizations, such as J.D. Power & Associates and Pike Research, appear to support the U.S. Department of Energy’s analysis that the nation is on track to meet or exceed President Obama’s 2015 target for PEV Adoption. How do these market estimates apply locally, now that PEVs are available for purchase at dealerships across the state?

According to current projections from the Electric Power Research Institute (EPRI), the Triangle is expected to have almost 1000 PEVs in service by the end of 2012 and over 18,000 such vehicles on its roads by 2015, making it a necessity for local municipalities within the Triangle to be prepared for this new technology.

EPRI’s market projections appear to be higher than what would be expected by simply scaling the national goal to the local population, due to several key factors. First, data from the NC Department of Motor Vehicles indicates a high density of local hybrid vehicle ownership, a leading indicator for consumer interest in PEVs which is reflected in manufacturer market surveys. The Triangle’s PEV market also benefits from having: 1. A well-educated citizenry, supported by multiple community colleges, colleges and universities; 2. Local electric utilities and electric cooperatives which are highly engaged with the PEV industry; and 3. Proactive municipal local governments that are supported by multiple local technical advisors.

Triangle Community PEV Readiness Plan Mission:
To provide a resource for the Triangle region, in coordination with state-level planning efforts, to address the barriers to the adoption of plug-in electric vehicle infrastructure as part of a broader sustainable transportation strategy by leveraging the collaboration of local public and private organizations.

For all these reasons, interest in PEVs is growing steadily in the United States and around the world. Every major vehicle manufacturer has announced their plans to add a PEV to their product line, and several new start-up companies have entered the auto industry with the express purpose of producing PEVs.

The United States government believes that the manufacture and support of PEVs represent key components of future American economic growth, international competitiveness, national security, and environmental health. As a result, the United States has invested billions of dollars of federal funding in battery development, vehicle manufacturing, infrastructure planning and infrastructure deployment. Recently, significant federal tax credits have encouraged the purchase of PEVs, and in his 2010 State of the Union address President Obama challenged American industry and citizens to put one million plug-in vehicles into service on American roads by 2015.

Acknowledgment: “This document is supported through the NC PEV Readiness Initiative: Plugging in from Mountains to Sea (M2S) planning project with funding provided by the U.S. Department of Energy’s Clean Cities Program through Centralina Council of Governments. Project collaborators include: Advanced Energy, Land-of-Sky Regional Council, NC Solar Center/NC State University, Piedmont Triad Regional Council, & Triangle J Council of Governments.”
Triangle PEV Readiness Plan: Goals and Objectives

Community Goals and Objectives were developed through discussions with the community stakeholders who are guiding the PEV Readiness Plan.

**Goal #1**
Streamline Permitting and Installation Process.
Identify and recommend modifications to permitting and inspections of plug-in vehicle charging stations. This could include modifications to local codes, standards, ordinances, permitting applications and processes.

**Goal #2**
Increase Environmental Benefits
Accelerate the use of plug-in electric vehicles to help meet standards for improved air quality and reduce the community’s reliance on petroleum.

**Goal #3**
Exchange Information for Economic Development
Work with existing community programs to promote an open exchange of information with providers of charging stations and vehicles, and promote training opportunities for the PEV workforce.
1. Contact and involve PEV and EVSE manufacturers in the planning process.
2. Support new and existing PEV workforce training opportunities at employment centers and community colleges.

**Goal #4**
Identify and Resolve Unintended Consequences
Identify and address the unintended consequences of promoting and incentivizing PEVs at the expense of other traditional and alternative transportation options.

**Goal #5**
Address Emerging Charging Concerns
Create a process to determine optimal charging station locations considering built environment impacts on charging behavior, and installations at multi-family dwelling units.

**Goal #6**
Collaborate to sustain momentum
Explore ways to sustain the momentum created by this planning collaboration beyond the current grant by engaging the regional political leaders to work towards plan endorsement and adoption.
**Triangle Community PEV Initiative Highlights**

- **2008** Triangle Region’s first public PEV charging station is unveiled in Cary.
- **2009** RMI’s Project Get Ready is launched to help prepare the nation for PEVs and Raleigh joins the effort as one of the first three cities.
- **2010-2011** The Carolina Blue Skies & Green Jobs Program and other Recovery Act funding allows for installation of over 130 charging stations and the purchase of more than 40 EVs in NC.
- **2011** NC utilities begin a commercial and residential EV program.
- **2011** Statewide Mountains to Sea PEV Planning effort begins.
- **2011** Raleigh hosts the national Plug-in Conference. This is the first time it has been held on the East Coast.
- **2011** Raleigh becomes the first city in the state to officially adopt a local PEV Plan.
- **2012** Durham becomes the first city in the state to officially adopt a local PEV Plan.
- **1990s** The City of Raleigh leased its first electric Ford Ranger.

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**Getting Into Gear and Moving Forward**

The Triangle PEV Planning Workgroup was convened on March 1st, 2012 and currently meets monthly to discuss obstacles to PEV adoption and propose solutions. Over the course of this process they will address each of the following topics regarding PEV implementation:

- Standards
- Stations
- Vehicles
- Policies
- Incentives
- Outreach

In the interim, planning staff at Advanced Energy and the Triangle Clean Cities Coalition will use Workgroup input to draft corresponding sections of the Triangle PEV Readiness Plan for their approval with the aim of finishing the plan by the end of August 2012.

The plan will then be incorporated into the statewide PEV Readiness Plan, and will be submitted to the US Department of Energy to serve as one of five model plans for the nation.

The statewide PEV Taskforce overseeing this planning process will also use these plans to continue to promote PEV infrastructure adoption and will work to establish a sustained market for PEVs in North Carolina.
Learn More About North Carolina’s PEV Initiatives

Those behind the Triangle Community’s PEV Readiness Initiative have been working hard to produce a publicly releasable community PEV readiness plan with the support of the M2S grant and the collaboration of our key partners (see list on right).

PEV planning efforts are also ongoing throughout the State. Through the leadership of the NC PEV Taskforce, and the sustaining funding of the Mountains to Sea grant, 3 additional regional communities throughout the state are creating PEV readiness plans and are collaborating to state a single statewide readiness plan (roadmap).

For additional information and resources visit:
www.NCPEVTaskforce.org
http://www.trianglecleancities.org/

The Mountains to Sea NC PEV Readiness Initiative

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What is a Plug-in Electric Vehicle?

A PEV is a highway-capable vehicle that uses an electric motor for propulsion. The electric motor is powered by a large battery, which can be recharged by plugging the vehicle into an external source of electricity. PEVs can be all-electric, relying solely on the energy stored in the battery, or they can use a hybrid design with an on-board internal combustion engine to support propulsion and/or recharge the battery.

The Chevrolet Volt is an example of a plug-in hybrid design, and the Nissan Leaf is an example of a plug-in all-electric design. PEV owners are expected to primarily charge their vehicles at their home (or place of business for fleet vehicles), and may also rely on charging at public locations where available.

Key Partners

Advanced Energy
CAMPO
CBRE
Cisco
City-County of Durham
City of Raleigh
DCHC MPO
Duke Energy
NC Solar Center
NC State University
Progress Energy
TARPO
Town of Chapel Hill
Triangle J Council of Governments
UNC Chapel Hill
Wake County
APPENDIX 6

STEERING COMMITTEE RECRUITMENT FLYER
Communities across the state of North Carolina are getting ready to embrace the "vehicles of tomorrow" today! Global car manufacturers have deemed The Triangle as a “hot spot” – an area most likely to embrace plug-in electric vehicles (PEVs). With growing interest and acceptance comes the need for communities not only to understand PEVs but also plan for and support the charging infrastructure needed for the expected influx of PEVs in our state.

**LOCAL AND STATE PEV INITIATIVES**

**The Triangle Community PEV Readiness Plan**

Electric Power Research Institute estimates the Triangle will have more than 40,000 cumulative PEVs on the road by 2020. In order to accelerate the adoption of these new vehicles, area stakeholders are making a true commitment to the wide-spread acceptance of electrified transportation.

Advanced Energy and the Triangle J Council of Governments are currently developing the first Community-wide PEV Readiness Plan, as part of the Mountains to Sea PEV Readiness Initiative funded by the U.S. Department of Energy through the Centralina Council of Governments. This plan focuses on:

1. Economic development, including incentives for the expansion of the PEV industry in the area;
2. Vehicle and Infrastructure planning;
3. Education, Outreach, Marketing and Training;
4. Environmental benefits, consisting of reduced dependence on fossil fuels and improved local air quality; and
5. Updating local policy to encourage and not constrain adoption of PEVs.

**Mountains to Sea Initiative**

The Mountains to Sea (M2S) PEV Readiness for North Carolina initiative is one of 16 electric vehicle community readiness projects awarded by the U.S. Department of Energy (DOE) in an effort to increase awareness and actual consumer usage, as well as to help communities develop the infrastructure needed to support the expected influx of PEVs.

M2S includes multiple initiatives consisting of the development of a state-wide PEV readiness plan and four local PEV readiness plans for Asheville, Charlotte, the Triad and the Triangle. These readiness plans will serve as a guide to strengthen existing local and state initiatives to help North Carolina communities address their specific needs, including:

- Updating permitting processes;
- Revising codes;
- Training appropriate personnel;
- Assessing infrastructure needs;
- Promoting public awareness; and
- Evaluating and developing incentives.

**NC PEV Taskforce**

The NC PEV Taskforce is focused on establishing North Carolina as the leader in electrified transportation and promoting PEV readiness throughout the state. A collaborative group of key stakeholders from private industry, academia, non-profit and local and state government, this Taskforce is working to ensure the rapid and seamless integration of PEVs into local communities and the marketplace.

The primary goals of the Taskforce are to increase the adoption of PEVs and support economic development opportunities through the exchange of innovative ideas and experience.
NC PEV Taskforce: Goals
Infused with funding from the M2S grant, the NC PEV Taskforce is currently working on developing the state-wide PEV readiness plan (roadmap).
Taskforce Goals include:

- Establish North Carolina as the leader in electrified transportation
- Promote PEV readiness throughout the state of North Carolina
- Create a PEV roadmap (funded through the U.S. DOE Mountains to Sea Grant);
- Develop a network of PEV charging stations across the state; and
- Align North Carolina’s electrified transportation goals with those on a national level.

Engaging the Triangle in PEV Readiness Planning
Through the NC PEV Readiness Initiative, Plugging in from Mountains to Sea, Triangle stakeholders are working together, to develop a Community PEV Readiness Plan. Below is an outline of the process: Advanced Energy, in collaboration with the Triangle J Council of Governments, has developed a three tier stakeholder involvement process in which to engage stakeholders from the entire Triangle community. This engagement process consists of:

- Establishing a steering committee;
- Bringing in content experts when discussing specific topics; and
- Preparing a survey and hosting a PEV Rally for all Triangle Stakeholders.

The following items are specific topic areas the Steering Committee will cover in preparation for the Triangle’s first PEV Readiness Plan.

**Vehicles**
The Vehicles work area addresses goals related to increasing the number of PEVs in operation such as cost-benefit comparison of PEV use versus the use of conventional ICE or hybrid vehicles, and developing a plan for fleet adoption.

**Infrastructure**
Consideration for deploying residential, workplace, private, and publicly available charging infrastructure in the community.

**Education and Outreach**
Identify existing or needed resources for electric vehicle knowledge, and develop a plan for disseminating that knowledge to appropriate partners and the public through outreach, training, and marketing.

**Incentives**
Define and evaluate various benefits that could be provided to encourage community members to become PEV owners or drivers.

**Policy, Codes and Standards**
1. To identify or eliminate processes or requirements that may unintentionally inhibit the adoption of PEVs or the installation of PEV charging infrastructure.
2. To define or create policies, codes or ordinances that foster adoption of PEVs and installation of PEV charging infrastructure.

**Economic Development**
Search for and create/document opportunities for economic development with industries such as component manufacturers, infrastructure, manufacturers or installation of PEV related services.

This document is supported through the NC PEV Readiness Initiative: Plugging in from Mountains to Sea (M2S) planning project with funding provided by the U.S. Department of Energy’s Clean Cities Program through Centralina Council of Governments. Project collaborators include: Advanced Energy, Land-of-Sky Regional Council, NC Solar Center/NC State University, Piedmont Triad Regional Council, & Triangle J Council of Governments.
APPENDIX 7

SAMPLE RESOLUTION
A RESOLUTION TO PROMOTE PLUG-IN ELECTRIC VEHICLE PLANNING IN REGION <insert letter designation of region>

Whereas North Carolina has the opportunity to harness consumer spending on electric vehicles and charging infrastructure to bolster local manufacturing and technology firms, support economic development and job creation and help address air-quality related health concerns; and

Whereas consumers are demanding electric vehicles, vehicle manufacturers are responding positively to this increased consumer demand and the increasing adoption of electric vehicles has not been halted by a weak economy; and

Whereas as of the summer of 2012, North Carolinians were already operating over 700 electric vehicles of personal, governmental and commercial applications; and this number is projected to grow to more than 90,000 in 2020.

Whereas local governments in Region <insert letter designation of region> can support the adoption of electric vehicles through their ability to exercise control over budgets that allocate funds for local PEV readiness planning and incentives; set policies to track the installation of charging infrastructure through their permitting office to enable better utility planning; and make commitments to purchase cost-saving PEVs when replacing appropriate vehicles in their fleets; and

Whereas the <insert name of plan> supports the creation of further PEV Readiness Plans by local governments by providing the current state and local information and a comprehensive and replicable format; and

Whereas the North Carolina Plug-In Electric Vehicle Taskforce is working in support of electric vehicle adoption across the state as an engine for clean-air economic growth; and
Whereas local governments in Region <insert letter designation of region> promote economic development and job creation and are responsible for protecting and enhancing the health, welfare and safety of their residents in prudent and cost-effective ways; and

Whereas the people of Region <insert letter designation of region> will benefit significantly through the success of the <insert name of plan> and the electric vehicle through a stronger economy and cleaner air.

Now, therefore be it resolved, that the <insert name of regional organization and name of governing body> pledges to promote the replication and adoption of the <insert name of plan> to its member governments, employees and residents as appropriate to help build the local electric vehicle economy.

Adopted and approved this <insert date> the day of <Month> <year>.

ATTEST: 

<insert name>, Chairman

<insert name>, Executive Director
Appendix 8

Durham City-County Electric Vehicle and Charging Station Plan
Durham City-County
Electric Vehicle and Charging Station Plan

Goal: Encourage the use of plug-in electric vehicles in Durham as a substitute for petroleum powered vehicles to help achieve community-wide air quality and greenhouse gas emissions reduction goals.

Background
Plug-in electric vehicles (PEVs) are now commercially available. Car companies that are manufacturing PEVs have identified the Triangle as one of the areas that they will initially target with the vehicles. As manufacturers ramp up production, more PEVs will hit the streets in North Carolina in the coming years. It is important that adequate charging infrastructure be in place to provide confidence in the public’s mind that PEVs are viable options as well as to enable PEV owners the ability to travel throughout the area with as little inconvenience as possible.

Widespread use of PEVs can help Durham meet local air quality and greenhouse gas emissions reduction goals. PEVs do not emit exhaust and, therefore, do not contribute to local emissions of air pollutants such as nitrogen oxide, carbon monoxide, and particulate matter. Pollutant emissions and greenhouse gas emissions from the electricity generation and transmission needed to charge the vehicles will vary depending on the time of day the vehicle is charged and the source of the electricity. PEVs charged at night and other off-peak times will contribute no additional emissions because power plants generate excess energy at those times to maintain a base level of generation. As smart grid technology becomes more prevalent, PEVs could act as storage for this excess electricity and discharge it back to the grid during peak periods to off-set peak loads, which would further reduce pollution and greenhouse gas emissions.

Most private PEVs will be charged at home overnight when electricity can be less expensive and it is convenient to plug the vehicles in for a long period of time. However, the early PEVs have a shorter range than conventional vehicles, and if one runs out of battery charge on the road, there is no easy way to recharge the vehicle. There can be anxiety on the part of the PEV owner if they perceive that they will not be able to charge while away from home. This “range-anxiety” can be a barrier to greater acceptance of these vehicles by the public or could discourage a PEV driver from visiting Durham locations. Having a network of publically accessible charging stations can alleviate that anxiety.

The City is installing two EVCSs in the City Hall Annex parking garage for fleet vehicles and has installed two at Golden Belt for fleet vehicles and public use. The County has installed four public stations at the Justice Center Parking Deck, and two each at Main Library, Human Services, South Library, and North Library.

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1 In 2007, the City of Durham and Durham County adopted a the “Greenhouse Gas and Criteria Air Pollutant Emissions Inventory and Local Action Plan for Emissions Reduction”, which sets the goal of reducing greenhouse gas emissions by government by 50% and the community by 30% from 2005 levels by 2030.
Charging Technology and Cost

The main determining factors of how long it will take to fully charge a vehicle is the design of the vehicle and the type of charging station. As vehicle design evolves, they will be able to go further on a shorter charge.

There are currently three types of PEV charging stations available for consideration. Level I uses a standard 120V AC (voltage of alternating current) outlet and can provide enough charge for approximately 40 miles of driving range with 8-10 hours of charging. This is likely to be suitable for overnight charging and may be suitable for workplace charging. Level II chargers are similar in power to 240V AC clothes dryer outlets and can provide enough charge for approximately 80 miles of driving range in 6-8 hours. These are appropriate for home or public charging stations.

DC (direct current) fast charge stations are much higher power connection that can charge a typical battery to 80% capacity in only 20-30 minutes. These draw a lot of electricity when in use and also can decrease battery life. They are most appropriate when options for when a slower charge are not feasible, such as long distance trips or emergency situations.

Due to cost and time constraints, most public charging stations will likely be Level II, 240-V AC stations. These stations can provide enough charge to satisfy most citizens’ daily commute in 3-4 hours and cost about $3,000-$5,000 each (depending on chosen features and additional material costs). Labor costs are variable depending on site-specific requirements. Factors that affect labor costs include: distance to connect to electric infrastructure, ability of current electric utility to provide additional power at that location, physical obstructions between the charging station location and electricity infrastructure, installation method (e.g. on a pedestal, pole, or wall) and the level of physical protection (e.g. bollards) required.

At an electricity cost of $0.10/kWh, charging a Nissan Leaf or Chevy Volt for four hours at Level II would provide approximately 40 miles of driving range for under $1.50. Future vehicles, such as the Ford Focus EV expected to go on sale in 2012, will likely recharge their batteries at twice that rate, providing approximately 80 miles of range for under $3.00 in the same four hours. Several charging stations with a modest electric vehicle fleet would incur energy costs of

<table>
<thead>
<tr>
<th>Charger Type</th>
<th>Power requirements: Voltage (Amperage)</th>
<th>Power Supply</th>
<th>Charge Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I</td>
<td>120V AC (15A)</td>
<td>Standard three-pronged outlet</td>
<td>16-20 hours (~80 miles)</td>
</tr>
<tr>
<td>Level II</td>
<td>240V AC (Up to 80A, typically 30A)</td>
<td>Dedicated hardware with standard vehicle connection</td>
<td>6-8 hours (~80 miles)</td>
</tr>
<tr>
<td>DC Fast Charge</td>
<td>480V DC (80-100A)</td>
<td>Dedicated hardware with non-standard vehicle connection</td>
<td>20-30 min (~80% of battery capacity)</td>
</tr>
</tbody>
</table>
just a few hundred dollars annually. The North Carolina Utilities Commission restricts the sale of electricity, therefore we could not charge users for the electricity that they use on City or County-owned charging stations. It would be possible to generate revenue by charging for parking spaces, using metered parking, permit fees, etc., but in the short term the cost of recovering those funds would exceed revenue. However, it is important to plan for these options in the future when stations might be used more extensively.

**Electric Vehicle Charging Station and Plug-In Electric Vehicle Plan**

**Objective 1 – City and County Operations:** Provide electric vehicles and electric vehicle charging stations (EVCS) for City and County operations.

**Initiative 1.1 Assign Responsibility to Departments**

A. The City Manager will designate a City department as the lead agency responsible for implementing Electric Vehicle Charging Stations (EVCS) policies and practices related to City operations. Foreseeable departmental roles:

1. Transportation – manage 3rd party contract for collection of fees once the City begins to charge for use of EVCSs (likely at least 5 years out)
2. Sustainability – Oversight of policy development and annual review, strategic planning, outreach and education, maintain list of current and future stations, coordinate with other entities in Durham that own or plan to install EVCSs
3. General Services – maintain City-owned EVCSs, plan for future charging stations by installing conduit and properly sized electrical panels during new construction/major renovation
4. Public Works – evaluate capital improvement projects for roads and/or sidewalks to determine if conduit can be placed within the limits of the project, after a funding source has been identified for the additional design and construction costs that will be associated with this work
5. Inspections – provide information to property owners on EVCS installation requirements, inspect EVCSs as appropriate, provide information on EVCS inspections to the City-County Sustainability Manager, permitting
6. Fleet Management – Purchase and maintain electric vehicles in the City Fleet, maintain EVCSs
7. Planning – Review site plans (where required), permitting
8. Fire Department – Remain trained and up to date on first responder protocols for PEVs and EVCSs.

B. The County Manager will designate a County department as the lead agency responsible for implementing EVCS policies and practices related to County operations. Foreseeable departmental roles:

1. General Services – maintain County-owned EVCSs, oversee electric vehicle purchase and maintenance
2. Engineering – plan for future charging stations by installing conduit and properly sized electrical panels during construction/major renovations
3. Sustainability – Oversight of policy development and annual review, strategic planning, outreach and education, maintain list of current and future stations, coordinate with other entities in Durham that own or plan to install EVCSs
4. Inspections – provide information to property owners on EVCS installation requirements, inspect EVCSs as appropriate, provide information on EVCS inspections to the City-County Sustainability Manager, permitting
5. Planning – Review site plans (where required), permitting

C. Given the rapidly changing nature of electric vehicles supply and demand, the City-County Sustainability Manager should review the Electric Vehicle Charging Stations and Plug-In Electric Vehicle Plan (“Plan”) annually and update as needed. This update shall include an analysis of the staff and other resources needed to continue the work as defined in the Plan.

Initiative 1.2 Install EVCS Facilities. The City and County will install Level II EVCSs for fleet use, as funding becomes available and vehicles are purchased.

Initiative 1.3 Purchase Electric Vehicles.

A. The City Fleet Manager will purchase plug-in electric vehicles and assign them to departments for regular use, where appropriate.
B. The County Fleet Management/Inventory Coordinator shall evaluate vehicle requests to see if they could be fulfilled by purchasing and electric vehicle and will work with the affected department to purchase electric vehicles, as appropriate.

Initiative 1.4 Adopt Policies. The City Manager and County Manager will revise existing relevant policies or adopt new policies for use of PEVs and EVCSs by employees, as vehicles are purchased and EVCSs are installed.

Objective 2 – Standards and Barriers: Establish standards for and remove regulatory barriers to public and private EVCS facilities in Durham.

Initiative 2.1 Site Selection and Design Criteria. Establish a set of criteria to guide the location of future publicly funded EVCSs, including public safety, convenience, proximity to utility service, siting standards, signage and visibility, handicapped access, public interest, etc.

A. Safety: Chargers should be sited away from traffic and other hazards. Adequate lighting should be provided for security. By siting the stations in well lit areas this will provide safety and cut down on the potential for vandalism.
B. **Convenience:** Chargers should be located conveniently near the main building or facility, whenever possible. The PEV owner should have easy clear path to the EVCS. Check with the City of Durham Public Works Department, City of Durham Transportation Department and/or the NC Department of Transportation for placement on public right of ways.

C. **Proximity to Utility Equipment:** Site charging stations near the facility’s electrical panel, or near the electric utility’s feeder lines or transformers, whenever possible, to reduce installation costs. In general, the closer the EVCS is to the power source the less expensive and time-consuming the installation process will be.

D. **Proximity to Communication Infrastructure:** Data collection is pertinent to the EVCS program. Data is collected for reporting purposes, management of the system, monitoring usage and location coordination. Data can be collected wirelessly via Wi-Fi but the preferred method is directly tied into an intranet connection. The conduit needed for the power source will be larger than the conduit for the communication service.

E. **Cable Management:** To avoid injury from tripping over cables, cords and cables should not cross sidewalks or pedestrian traffic patterns, and should be installed with the PEV user's convenience in mind. Cable retractors should be considered for permanently wired cables. This will also help to prevent the cable from potential damage.

F. **Potential Hazards:** Ensure that PEV charging spaces are not located near potential hazards.
   i. EVCS should not be installed near explosive material; flammable vapors, liquids and gases; combustible dust or fibers; and materials which ignite spontaneously on contact with air.
   ii. EVCS installation will comply with all current, or amended, National Electrical Codes (NEC). If charge stands are installed in an enclosed area, check ventilation requirements.
   iii. EVCSs shall not be located in special flood plain hazard areas or areas prone to flooding in a rain event.

G. **Protection:** Curbs, wheel stops, bollards and setbacks should be provided so that PEVs or other vehicles cannot inadvertently drive into the EVCS. When installing curbs, wheel stops, bollards and setbacks, consider ease of access to the charger, mobility of users and foot traffic in the area.

H. **Visibility:** EVCSs should be made as visible as possible so they are easy to find. This can be achieved through signage, additional lighting, location, poles, etc. Signs may be needed to designate parking spaces for PEV-use only. These signs should be positioned 7 feet above grade.
I. **Disabled Access:** At least one EVCS at each location should be sited where it can be accessed from a space sized to accommodate a handicapped accessible van, until clear guidance is issued from the NC Department of Insurance (NCDOI). This space does not have to be restricted to handicapped accessible vehicles, but it should be at least 16 feet wide (can be 11 foot stall with 5 foot access aisle or 8 foot stall with 8 foot aisle) with appropriate access to the EVCS.

**Initiative 2.2 ADA Requirements.** Currently NCDOI does not have a set of guidelines or requirements for ADA compliance when installing EVCSs. The City-County Inspections Department should prepare draft set of standard for handicapped access to EVCSs to propose to the NCDOI & NC Building Codes Council.

**Initiative 2.3 Inspections Expertise.** The City-County Inspections Department will ensure that at least one if its electrical inspectors is knowledgeable in building code issues related to EVCS, so that potential developers can get correct and timely information.

**Initiative 2.4 Site Plan Requirements.** The City-County Planning and Inspections departments will draft a set of standards to determine when a site plan approval is required for new EVCSs installations. Plan requirements may include bollards, compact sites, ADA requirements, etc.

**Objective 3 – Infrastructure:** Provide EVCS infrastructure for citizens of Durham City and County.

**Initiative 3.1 Publicly Accessible Charging Facilities.** The City and County will provide publicly accessible Level II EVCS facilities at strategic locations around Durham.

**Initiative 3.2 Future EVCS Facilities Planning.** The City and County will identify locations for future EVCS facilities around Durham County, focusing on locations where people tend to spend at least an hour and that draw visitors from at least 25 miles away.
   A. Prepare and maintain a list of priority locations for future publicly funded installations of EVCSs.
   B. Apply for grant and other funding to pay for EVCS purchase and installation.
   C. Encourage commercial property owners to install publically accessible EVCSs on their property.

**Initiative 3.3 Infrastructure for Future Facilities.**
   A. The City and County will incorporate EVCSs or conduit for EVCSs in construction of new public facilities and parking facilities, including public streets, when budgets permit and when locations meet Site Selection Criteria.
   B. The City and County will install conduit for future EVCS sites when performing regular maintenance/construction of roads, sidewalks, parking lots, etc. when budgets permit and when locations meet Site Selection Criteria. This includes conduit for electrical and data collection infrastructure.
Objective 4 – Public Information: Provide public education and information about electric vehicles, EVCSs, and standards.

Initiative 4.1 EVCS Facilities Map.
A. The City-County Sustainability Manager will prepare and maintain an on-line map that shows present and proposed publicly accessible EVCSs in Durham and surrounding areas, using information from local, state, and federal sources.
B. The City-County Sustainability Manager will report new EVCSs to the Triangle Clean Cities Coalition for inclusion in regional and national databases and maps of EVCSs.
C. The City-County Sustainability Manager will provide information on City and County owned, publically-accessible EVCSs to area dealerships that sell PEVs.

Initiative 4.3 Publicizing Electric Vehicle Use. The City and County Public Affairs Offices will, as appropriate, publicize the City and County’s use of PEVs and availability of EVCSs through press releases, press events, and DTV8 programming.

Initiative 4.4 Signage. When financially viable, the City and County will include signage or other marketing/awareness material at the site of new EVCSs. This material should include information on the benefits of charging PEVs during off-peak hours, whenever possible.

Initiative 4.5 Electric Vehicle Graphics. When financially viable, the City and County will include art, graphics, and/or text on fleet PEVs that educate the public on the benefits of using all-electric vehicles. This could include vehicle wraps, magnets, logos, etc.

Policy Recommendations

Policy Objective 1 – City and County Operations.

Measures: At least once a year, track and review actual use and operating costs of fleet PEVs and analyze cost/benefit of the program.

After 1 year of owning and operating PEVs and EVCSs, the City and County will evaluate vehicle use and charging station use and analyze cost of operation. Based on this analysis, the City and County will establish goals for converting a certain portion of the vehicle fleet to PEVs and installing a certain number of EVCSs within a certain number of years. This goal will be reevaluated annually.

Policy 1.1 Fleet Electric Vehicles.
a. The City and County will revise existing fleet replacement policies to include purchases of PEVs as opportunities arise and as budgets permit if cost/benefit analysis shows they are competitive with conventional vehicles.
b. The City Fleet Manager and County Fleet Management/Inventory Coordinator will be responsible for performing a usage feasibility study before gasoline powered vehicles are replaced with PEVs. Feasibility study may include mileage/usage study, evaluation of proximity to charging infrastructure, type of function performed by the vehicle, etc.

c. The City Fleet Manager will review annually the maintenance needs of the City PEV fleet and determine the cost effectiveness of performing maintenance in-house versus contracted out.

Policy 1.2 Fleet Electric Vehicle Charging Stations. The City and County will install EVCSs reserved for City and County fleets at locations deemed necessary as PEVs join the fleet.

Policy 1.3 Electric Vehicle Charging. Unless otherwise necessary, City and County staff will charge PEVs in off-peak hours as defined by Duke Energy.

Policy 1.4 Cost of Electricity. The City and County departments responsible for paying site utility bills will be responsible for paying for the cost of electricity used by EVCSs at that site.

Policy 1.5 Expertise. At least 1 electrician for the City and County will be knowledgeable about the installation and maintenance of EVCSs.

Policy Objective 2 – Standards and Barriers.

Measures:

a. Within 90 days, the City-County Inspections Department will train at least 1 electrical inspector in applicable building codes for EVCSs.

b. Within 90 days, the City-County Inspections Department will prepare a draft set of standards to the NCDOI regarding ADA compliance for EVCS installations.

Policy Objective 3 – Infrastructure.

Measures: At least annually, the City-County Sustainability Manager will analyze use data for public EVCS to determine if additional stations are needed and if it is financially viable to bill for use. After 1 year pilot of having public EVCSs, the City and County will establish goals for providing a certain number of publically-available EVCSs within 5 years throughout Durham.

Policy 3.1 Billing.

a. Until financially viable, the City and County will not bill for use of public EVCSs.

b. The City and County will evaluate EVCS use annually and determine when it is financially viable and in the best public interest to charge for use of public EVCSs.

Policy 3.2 Regulation. The City and County may regulate the use of City and County owned EVCS infrastructure by means of time limitations, ticketing, signage, etc.
**Policy 3.3 Incentives.** The City and County will consider incentives to encourage commercial property owners to install publically accessible EVCSs in areas that have been identified as priority locations.

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**Priority Locations for Future Installation of Publicly Accessible EVCSs**

This is a list of locations that the City and County has identified as potential good candidates for future publically-owned and commercially-owned EVCSs.

**Priority of Potential Public Station Locations**

1. Durham Performing Arts Center
2. Museum of Life & Science
3. Heavily used Parks and Rec site?
4. Downtown City Parking Garages
5. Durham Regional Hospital
6. Future parking decks
7. Eno River State Park

**Priority of Potential Commercial Station Locations**

1. NCCU
2. Durham Tech
3. Southpoint Mall
4. Northgate Mall
5. 9th Street
6. Around future light rail stations and in transit oriented development zones
7. Brightleaf Square
8. Future parking decks
9. Apartment complexes
List of City and County Facilities

1. Durham County Justice Center Parking Deck (County)  
   S. Roxboro St. and S. Dillard St.  
   Two level II stations on each of parking level 1 and 3

2. Durham County Human Services Complex (County)  
   400 E. Main St.  
   Two level II stations in public parking lot

3. Durham County Main Library (County)  
   300 N. Roxboro St.  
   Two level II stations in public parking lot

4. South Regional Library (County)  
   4505 S. Alston Ave.  
   Two level II stations in public parking lot

5. North Regional Library (County)  
   221 Milton Rd.  
   Two level II stations in public parking lot

6. Goldenbelt (City)  
   800 E. Main St.  
   Two level II stations in parking lot

7. City Hall Annex parking deck (City)  
   101 City Hall Plaza  
   Two level II stations for fleet use only

A map of these locations and other commercially-owned public stations can be found at www.GreenerDurham.net. (http://g.co/maps/23npr)
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