Electric Vehicles in America:
The question is no longer "whether" they will come, but "how fast" and "where first"
America is on the verge of a tipping point in its transportation paradigm. Electric vehicles are evolving from an uncertain experiment to an increasingly relevant modality for the future.

The debate around plug–in electric vehicles (PEVs1) has long revolved around technology, costs, charging stations, and consumer acceptance. For many years, PEVs seemed to be a distant scenario, but recently, rapid advancements in technology (especially batteries) have been achieved thanks to massive investment by industry and governments. Now, PEVs have become a reality and attention is shifting from technology viability and pilots to resolving infrastructure, incentives, education, and overall readiness issues.

Roland Berger Strategy Consultants and Rocky Mountain Institute’s Project Get Ready have endeavored to identify which cities in America are currently readiest for PEVs, which are making progress to develop the necessary eco–systems in the near future, and which need to accelerate to accommodate the imminent launch of electric vehicles. Based on a combination of research and city stakeholder interviews conducted from January through August 2010, we have assessed America’s top 50 metro areas in terms of their readiness. We considered key framework elements (barriers, enablers, accelerators), evaluating factors from regulatory requirements, incentives, public charging, permitting and planning to power reliability, payback, education, consumer behavior, and the weather.

As the situation related to PEVs is extremely dynamic, and since our analysis is based on a mix of objective and subjective criteria, we understand that our findings should be considered indicative. Nonetheless, we hope our work will inform readers about critical topics, including where cities should focus their readiness efforts, the best practices from leading cities, and where e–mobility will likely thrive over the next few years. A summary of our findings is included in this document.

1) Including Electric Vehicles (EVs) and Plug–in Hybrid Electric Vehicles (PHEVs)
SUMMARY

Some cities in America have been preparing for many years, but PEVs will affect the entire country relatively quickly. The first wave of electric vehicles is upon us (starting by the end of 2010) and will hit specific, well-known areas where, for a number of reasons, readiness and appetite is highest (e.g., LA, San Francisco). The path of the subsequent nationwide rollout of PEVs will be driven by the “chicken–and–egg” dilemma of city readiness and charging infrastructure. The good news is that, in recent months, the road map to e–mobility has become clearer and shorter (thanks to pioneer cities), so it is not too late for cities to prepare to join the next, higher volume waves of PEVs—by taking lessons from the leaders, other cities can rapidly “get ready.”

“Getting ready” is not just about building charging stations—electric vehicles need an entire ecosystem to succeed and fully deliver potential economic and environmental benefits. Cities are essential to this development, through facilitation, planning, and coordination of stakeholders from local governments to automakers. For PEVs to become fully viable, cities need to foster infrastructure, a supportive regulatory and operating environment, and ultimately, consumer readiness. While some US cities have adopted supportive policies, no city can truly be considered “ready”—only when PEVs really hit the roads over the next year or so will the actual needs and critical issues become apparent. In the meantime, and given their crucial role, cities should focus on: developing robust plans, engaging and partnering with stakeholders, facilitating permits, offering a mix of non–financial incentives, and educating consumers.

Cities that prepare and “get ready,” while facing considerable challenges and uncertainty, stand to attract federal funds, build a “green” reputation, and participate in the early waves of PEVs, since automakers will concentrate scarce EV allocations on them. Even cities that are not leaders or pioneers can benefit from proper planning, by avoiding missed opportunities, permit and registration confusion and delays, or disappointed drivers. Otherwise, they risk facing disaffected citizens or decreased ability to cut GHG (greenhouse gas) emissions, amidst a haphazard e–mobility rollout.

TAKEAWAYS

PEVs will only succeed through the combined efforts of many different stakeholders. Without the contribution and participation of all, PEVs will fall short in achieving their full potential.

CITIES
> Focus to improve PEV readiness should be on issues like education, permitting, and coordination
  - Infrastructure plans should be pragmatic and rely on partnerships
  - Ease of permitting and awareness can strongly help build momentum
  - Stakeholder working groups can help identify and overcome barriers

STATES
> State leadership is needed in areas where a first or second wave city has not emerged and taken initiative
> Infrastructure can be delayed in rural areas
> State–wide readiness initiatives should be in place within two years (e.g., streamlined permitting)

FEDERAL GOVERNMENT
> First and second wave cities can pursue PEVs independently, though additional federal funds will accelerate efforts
> Other cities may need additional encouragement
> PEVs will most effectively reduce GHG emissions and fuel consumption in cities with clean power and longer commutes
> National guidelines or standards (e.g., permitting, signage) will benefit all cities

AUTOMAKERS
> After the first wave, PEV delivery will expand to cities with high momentum, before nationwide rollout
> Continued concentration on areas where the ecosystem is in place will help ensure success
> Clear communication of PEV limitations (e.g., range) will help temper expectations

CONSUMERS
> EVs are most advantageous in cities with “green” power, high gas prices, reasonable commutes, and attractive incentives or “perks”
> PEVs will be widely available within two years, but long waiting periods possible

UTILITIES
> Investments are needed to prepare for local adoption—e.g., test fleet, PEV–specific rates, upgrading transformers
> Key role to drive, shape and enable local e–mobility through education (e.g., website, training)
KEY REQUIREMENTS AND EVALUATION FRAMEWORK FOR PEV READINESS

- Regulatory environment: to plan for, facilitate, require or otherwise incent PEVs
  - CARB/GHG regulations
  - Purchase incentives
  - Operating “perks”
  - Infrastructure incentives
- Level of planning
- Infrastructure readiness: to enable PEV operation and impact
  - Charging stations
  - Smart grid (AMI) penetration
  - Electricity reliability and outages
  - Carbon intensity of electricity
- Consumer readiness: to generate and secure EV demand
  - Air quality and pollution levels
  - Hybrid penetration
- Operating environment: to ensure practical application of PEVs
  - Energy prices and payback period
  - Weather conditions
  - Garage availability
  - Commute mileage

Skeptics have long doubted the potential for electric vehicles in America, pointing to the many challenges and barriers. From stubbornly high battery prices to historically low fuel prices, and from concerns about local grid load to range anxiety, PEVs have many issues to address. However, the criticisms from the last generation of electric vehicles have influenced the emergence of the new generation, since the key stakeholders have learned from the past and are taking steps to facilitate PEVs. The US has changed dramatically in the past decade, and electric vehicles will certainly find America to be more willing, accepting, and accommodating than before. That being said, because the vehicles are not yet on the road, no US city can be considered fully ready for PEVs or be said to have overcome all the barriers. Readiness is about more than charging stations or cash incentives, and every city can improve preparations in some way or another. For instance, virtually any city could do more to foster consumer awareness and readiness.

Nonetheless, leaders have emerged, lengthening the list of first wave cities by combining smart policies, infrastructure initiatives, and a favorable operating environment. Key stakeholders in these cities have made PEVs a priority and invested in preparations to overcome the uncertainty and expense related to this nascent market. In the process, the leaders have developed lessons that can be leveraged by follower cities. Due to the work of pioneer cities, followers have a clearer and shorter path to readiness, especially in the areas of infrastructure planning, regulatory alignment, and consumer awareness. Based on the lessons learned, follower cities can develop good plans that enable maximum benefit while avoiding costly mistakes. Some followers have already made good progress and are moving to aggressively and rapidly close the gap, while other cities will wait before committing to e–mobility.

PEV READINESS:
EVALUATION CRITERIA

- Climate change
- Air quality
- Energy prices and payback period
- Weather conditions
- Garage availability
- Commute mileage

Note: Cities were divided into “leaders” and “followers” based on the readiness evaluation criteria. Followers were segmented depending on current level of planning (high/medium/low).

DEFINITIONS

- Leader: A city with a strong foundation for PEVs and likely participant in the first wave of e–mobility
- Aggressive follower: A city with a non–traditional foundation for PEVs but high momentum and planning to prepare and likely join the first wave
- Fast follower: A city with some basis for PEVs, but significant areas of improvement and likely participant in the second wave (with continued preparations)
- Follower: A city with limited current foundation for PEVs, low planning levels, and likely participant in later waves of e–mobility (absent additional preparations)

SELECTED SMALLER “HOT CITIES” WITH PEV INITIATIVES

- Honolulu, HI
- Eugene, OR
- Tucson, AZ
- Vacaville, CA

ACHIEVING EV READINESS IN PORTLAND

- Given its environmentally-sensitive citizens, aggressive GHG reduction goals, moderate weather, and relatively clean power sources, Portland has a strong basis for e–mobility
- Portland has built upon its advantageous starting position (as well as Oregon’s generous state incentives and aggressive smart grid plans from its utility) to become a leader in PEV readiness
- Portland’s leadership includes actions such as:
  - Collaboration with key stakeholders (from Portland General Electric to ECOtality)
  - Development of strategic plan to prepare for PEVs
  - Acceleration of charger permitting process
  - Designation of preferred parking for PEVs

Note: Cities were divided into “leaders” and “followers” based on the readiness evaluation criteria. Followers were segmented depending on current level of planning (high/medium/low).

1) Based on aforementioned framework, desk research and interviews
2) Contact the authors or visit www.rolandberger.com or www.projectgetready.org for more details on our methodology and findings.
Regulatory readiness is built upon planning, coordination, requirements and incentives to facilitate both supply and demand. In the PEV market’s infancy, policies such as state and federal incentives play a critical role to stimulate demand, which cities can complement. However, once the market matures and becomes self-sustaining, such incentives will lose their role. In the meantime, adopting an optimal mix of PEV–friendly regulatory policies is the most important way a city can improve PEV–readiness.

Purchase incentives and CARB (California Air Resources Board) requirements are proving to be the most critical regulatory policies, since OEMs prioritize markets and phase EV launches in part based on these regulatory signals. States eager to promote “green” vehicles have adopted these rules, so metros in states with CARB rules and high purchase incentives, typically on the West and East coasts (see Figure 1), will see the first wave of PEVs. Of course, within 12 to 18 months of initial launch, automakers will offer PEVs across the country (due largely to dealer franchise laws). However, geographic PEV allocation and availability will still be driven by area readiness, especially local policies and incentives.

Like states, cities can create a favorable regulatory environment with a mix of “carrots” and “sticks” (i.e., incentives and requirements) for PEVs and charging infrastructure.

**INCENTIVES**
Cities differentiate by offering small scale infrastructure funding programs or low cost “perks”, such as preferred parking. High cost incentives, such as infrastructure grants or purchase incentives beyond the federal tax credit, are typically set at the state level, if available.

**REQUIREMENTS**
To a limited degree, cities enact requirements to spur PEV adoption. For example, several cities now require dedicated charge spots in new buildings. More serious are the California Air Resources Board (CARB) emissions rules, which require specific levels of PEVs in participating states.

**F I G U R E 1:**
Available purchase incentive & PEV premium and CARB requirements in US

<table>
<thead>
<tr>
<th>Incentive Type</th>
<th>Top 50 Metro Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Break on vehicle testing/registration requirements</td>
<td>16</td>
</tr>
<tr>
<td>Preferred parking</td>
<td>16</td>
</tr>
<tr>
<td>Special access to HOV/carpool lanes</td>
<td>44</td>
</tr>
<tr>
<td>Infrastructure grant/credit</td>
<td>60</td>
</tr>
</tbody>
</table>

Source: Pew, AFDC

**EXAMPLES OF BEST IN CLASS PRACTICES**

**PERMIT TURNAROUND TIME**
Portland, Raleigh, San Francisco (instant)

**PURCHASE INCENTIVE**
Denver (USD 6,000, from state)

**RAPID REGULATORY POLICY ALIGNMENT**
Houston (~12 months)

**REGIONAL REGULATORY ALIGNMENT**
Los Angeles (Southern California Regional PEV Plan)

**EV FLEET TARGETS**
San Francisco (25% of municipal fleet to be ZEV by 2018)

**EV CITY TARGETS**
Portland (10% of vehicle miles (i.e., parc) by 2020)

**PUBLIC CHARGING INFRASTRUCTURE PLAN AND FUNDING**
San Francisco (>2,000 public charging stations in near term)

**CITIES WITH SOME DEGREE OF FREE OR DISCOUNTED POWER**
Baltimore, Raleigh, Houston, Orlando, Los Angeles
Without adequate infrastructure readiness, PEVs will continue to face “range anxiety” and limits to their GHG reduction potential. However, in conjunction with utilities and other stakeholders, cities are beginning to take a pragmatic approach to infrastructure with strategic planning and prudent investments.

The debate around infrastructure has matured greatly in the past year and a pragmatic understanding is emerging. Previously, stakeholders had focused mostly on public charging stations. However, having unused or misallocated EVSEs (electric vehicle supply equipment) is just as much a problem as having too few stations. Now, the consensus is that PEVs will charge mostly at home or work, so ubiquitous public charging is no longer viewed as critical.

As a result, infrastructure readiness now has two dimensions—PEV charge point installation and clean, reliable electricity generation. Adequate public charging must be available to overcome “range anxiety,” while charging points must also be “smart” enough to accommodate the grid load through advanced metering. Electricity should be generated from clean sources, to achieve full GHG reduction potential, and should also be reliable without periodic disruptions that could strand PEV owners. Government, utilities, automakers, and EVSE providers all play a role to develop this critical infrastructure.

**CHARGING INFRASTRUCTURE**

We expect even one public charging station per 100 PEVs should be sufficient to overcome “range anxiety” during the initial ramp up of e-mobility, as most charging should take place at home. Encouraging, rather than a massive rollout of public charging, which would cost billions of dollars and encourage undesirable day-time charging, cities are setting more reasonable goals. Furthermore, cities are partnering with infrastructure providers and leveraging federal grants to minimize local costs.

On the other hand, the availability of smart meters to manage grid load remains an open issue outside the control of most cities. Rather, smart grid is a key priority for utilities, so they will take the lead. Indeed, several utilities have already announced aggressive smart grid plans. While smart grids still sit in infancy, we expect major utilities to install a high level of smart metering within the medium term independent of any e-mobility initiative, given numerous non-PEV related benefits. That being said, full deployment of smart grid will take years, and a faster adoption of PEVs could cause disruptions in the meantime.

**POWER INFRASTRUCTURE**

There is little cities can do to immediately address issues of electricity reliability or emissions—only the current status is the result of previous utility investments (or a lack thereof) and the weather is policy-agnostic in any case. However, cities should encourage renewable energy over the long run, as “green” power enhances the GHG benefit of PEVs.

**FIGURE 2: CARBON INTENSITY OF POWER IN TOP 50 METROS [lbs CO2/MWh]**

| City         | New York | Los Angeles | Chicago | Philadelphia | Houston | Miami | Atlanta | Washington | Boston | Detroit | Phoenix | San Francisco | Riverside | Seattle | Minneapolis | Portland | Sacramento | Detroit | Jacksonville | Orlando | Memphis | Indianapolis | Louisville | Oklahoma City | Hartford | New Orleans | Birmingham | Salt Lake City | Raleigh | Buffalo |
|--------------|----------|-------------|---------|--------------|---------|------|---------|------------|--------|---------|---------|--------------|-----------|---------|-------------|-----------|------------|---------|-------------|--------|---------|-------------|------------|-------------|----------|------------|------------|-----------|--------|
| Carbon Int.  | 1,195    | 1,056       | 1,094   | 667          | 963     | 999  | 742     | 895        | 1,242  | 1,042   | 215     | 1,697        | 1,659     | 1,911   | 1,816       | 1,949     | 1,476      | 1,828   | 1,291       | 1,760   | 1,348   | 1,630       | 2,030      | 2,311      | 1,981   | 1,311       | 1,793     | 2,096     | 2,076   | 1,696     | 1,322     | 1,791     | 1,724     | 2,040     | 1,780     | 684       |
CONSUMER READINESS

While PEVs will be offered from coast to coast within a couple of years, the consumers who will buy them are not equally distributed, regardless of local infrastructure or incentives. In the end, the private market will rule and supply of PEVs will follow consumer demand, so cities and other stakeholders should educate and prepare consumers to accelerate PEVs’ transition from niche toy of the elite to a mass market shift in America’s transportation paradigm.

Government and industry can directly drive PEV adoption only so far—in the end, consumer demand will determine where electric vehicle adoption accelerates and where it stalls. Consumer demand is driven by a number of factors (see sidebar), and though PEVs may be available nationwide within a few years, we expect to see higher concentrations continue in areas where consumers have high environmental sensitivity, higher disposable income, etc. Hybrid penetration (see Figure 3) is an excellent indicator of likely PEV demand patterns, as many of the same considerations are involved—e.g., price premium, fuel economy, image, impact on local pollution, etc. As such, we can expect PEVs to be especially popular in selected coastal cities and metropolitan areas.

Even so, consumer demand for PEVs remains uncertain and other stakeholders can still take steps to indirectly increase consumer readiness and demand. For example, in addition to offering incentives and “perks” to improve the cost position of PEVs relative to traditional vehicles, cities should take steps to educate consumers about these incentives, illustrate the potential positive impact of PEVs on the local environment and air quality, and provoke realistic expectations about PEV capabilities, ranges, limitations, and other challenges.

Utilities can also play an important role in education, given their direct role with consumers. Several leading cities and utilities have developed campaigns or websites to educate residents about PEVs. As for automakers, they can continue to invest in improving PEVs cost-to-performance ratio while also preparing dealers to best win over potential PEV consumers.

Source: Census

FIGURE 3:
HYBRID SHARE OF VEHICLE PARC (2009)\(^1\)

<table>
<thead>
<tr>
<th>City</th>
<th>Hybrid Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>0.7%</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>0.6%</td>
</tr>
<tr>
<td>Chicago</td>
<td>0.5%</td>
</tr>
<tr>
<td>Dallas</td>
<td>0.6%</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>0.5%</td>
</tr>
<tr>
<td>Houston</td>
<td>0.4%</td>
</tr>
<tr>
<td>Miami</td>
<td>0.3%</td>
</tr>
<tr>
<td>Atlanta</td>
<td>0.2%</td>
</tr>
<tr>
<td>Washington</td>
<td>1.4%</td>
</tr>
<tr>
<td>Boston</td>
<td>0.9%</td>
</tr>
<tr>
<td>Detroit</td>
<td>0.9%</td>
</tr>
<tr>
<td>Phoenix</td>
<td>2.3%</td>
</tr>
<tr>
<td>San Francisco</td>
<td>1.4%</td>
</tr>
<tr>
<td>Riverside</td>
<td>0.6%</td>
</tr>
<tr>
<td>Seattle</td>
<td>1.2%</td>
</tr>
<tr>
<td>Minneapolis</td>
<td>0.6%</td>
</tr>
<tr>
<td>St. Louis</td>
<td>0.9%</td>
</tr>
<tr>
<td>Tampa</td>
<td>0.6%</td>
</tr>
<tr>
<td>Baltimore</td>
<td>0.8%</td>
</tr>
<tr>
<td>Denver</td>
<td>0.9%</td>
</tr>
<tr>
<td>Pittsburgh</td>
<td>1.2%</td>
</tr>
<tr>
<td>Portland</td>
<td>0.4%</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>0.4%</td>
</tr>
<tr>
<td>Sacramento</td>
<td>1.0%</td>
</tr>
<tr>
<td>Cleveland</td>
<td>0.4%</td>
</tr>
<tr>
<td>Orlando</td>
<td>0.6%</td>
</tr>
<tr>
<td>San Antonio</td>
<td>0.6%</td>
</tr>
<tr>
<td>Kansas City</td>
<td>1.0%</td>
</tr>
<tr>
<td>Las Vegas</td>
<td>0.7%</td>
</tr>
<tr>
<td>San Jose</td>
<td>0.4%</td>
</tr>
<tr>
<td>Columbus</td>
<td>0.4%</td>
</tr>
<tr>
<td>Indianapolis</td>
<td>0.4%</td>
</tr>
<tr>
<td>Charlotte</td>
<td>0.5%</td>
</tr>
<tr>
<td>Norfolk</td>
<td>0.6%</td>
</tr>
<tr>
<td>Austin</td>
<td>0.5%</td>
</tr>
<tr>
<td>Providence</td>
<td>0.6%</td>
</tr>
<tr>
<td>Nashville</td>
<td>0.4%</td>
</tr>
<tr>
<td>Milwaukee</td>
<td>0.5%</td>
</tr>
<tr>
<td>Jacksonville</td>
<td>0.4%</td>
</tr>
<tr>
<td>Memphis</td>
<td>0.3%</td>
</tr>
<tr>
<td>Louisville</td>
<td>0.3%</td>
</tr>
<tr>
<td>Richmond</td>
<td>0.5%</td>
</tr>
<tr>
<td>Oklahoma City</td>
<td>0.3%</td>
</tr>
<tr>
<td>Hartford</td>
<td>0.7%</td>
</tr>
<tr>
<td>New Orleans</td>
<td>0.3%</td>
</tr>
<tr>
<td>Birmingham</td>
<td>0.3%</td>
</tr>
<tr>
<td>Salt Lake City</td>
<td>0.0%</td>
</tr>
<tr>
<td>Raleigh</td>
<td>0.3%</td>
</tr>
<tr>
<td>Buffalo</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

\(^1\) Based on DMA (designated market area)

Source: Polk

TOP CITIES IN CONSUMER READINESS

- Los Angeles
- San Francisco
- San Jose
- Seattle
- Washington

SELECTED FACTORS BEHIND CONSUMER DEMAND

- Environmental sensitivity
- Status and image considerations
- Wealth, premium, and TCO savings (total cost of ownership, or investment vs. reduced operating costs over vehicle lifetime)
- Awareness of benefits
- Other transit options

WEALTHIEST CITIES (2008 MEDIAN HOUSEHOLD INCOME)

- San Jose [USD 87k]
- Washington [USD 85k]
- Denver [USD 79k]
- San Francisco [USD 76k]
- Boston [USD 70k]
OPERATING ENVIRONMENT

The operating environment is largely immune to typical short term readiness efforts, but still must be considered in initial EV rollout efforts. As EV and charging technologies improve, the cost of EVs falls, and incentives expire, some elements of the operating environment will become less critical and others will increase in importance.

Regulatory, infrastructure, and consumer readiness are all critical pillars of a successful PEV ecosystem. However, additional factors relating to how the PEVs will actually operate also impact the rollout. Such operating environment elements include commute patterns, the weather, gasoline and electricity prices, and garage availability.

The initial PEVs will be handicapped by limited ranges and sensitivity to temperature extremes. As such, in the first wave, PEVs are most practical in cities with moderate climates and reasonable driving distances (see Figure 4). We expect such operating conditions to diminish in importance in the future, as OEMs and suppliers are investing heavily to improve PEV battery performance.

Another important consideration in the operating environment is energy costs—both gasoline and electricity prices affect PEV payback. All else equal, electric vehicles make more sense in cities with higher gas prices and lower electricity prices. However, at this point, without subsidies, PEVs do not pay back in a meaningful time frame in any city. As PEV costs fall and subsidies expire, energy prices will play a greater role.

Over the long run, governments could certainly improve the PEV operating environment beyond simple reliance on cost and technology improvements. However, enacting policies to greatly increase the price of gasoline, reduce the price of electricity, discourage urban sprawl, or cap carbon emissions are not practical as preconditions to the impending electric vehicle era. Such policies are currently difficult to “sell” politically, though in the long run, macroeconomic conditions and external pressures may force governments to act anyways.
Outlook: Growing Momentum

The first wave of electric vehicles is upon us, and it will hit leading cities that have made extensive preparations. However, fast followers are moving aggressively to build momentum and prepare for the next wave and should achieve readiness within the next 2–3 years.

The current status of cities is only one aspect of PEV readiness as evaluated. Even more encouraging is what is happening now to prepare for the future. To assess the likely future momentum of cities, we also conducted interviews [see Figure 5]. The lead-time to EV readiness is shrinking, so current followers can quickly build momentum and lead in the future.

**Figure 5:** 'As-is' readiness vs. future momentum of Top 50 metros

Cities are building momentum for PEVs in a number of ways. In particular, cities with the highest momentum have developed electric vehicle strategies, allocated funding for incentives, streamlined the permitting process, and led developed educational campaigns. As illustrated in the next two pages, these leaders are not particularly challenging for a city to apply, and momentum can be generated quickly—e.g., Houston has re-positioned itself from a third wave city into a first wave city within twelve months.

Regardless of waves, all cities will have access to PEVs within 1–2 years, given the nationwide rollout planned by OEMs. However, electric vehicle allocation and availability will likely skew toward first and second wave cities for the foreseeable future.
**KEY ENABLER: PERMITTING**

Cities must streamline permitting of Level 2 home charging stations to enable a functional PEV market in the future.

One of the most important levers that impacts a city’s readiness for PEVs and likely momentum is the home-charger permitting process. The Electric Power Research Institute (EPRI) estimates that 80% of electric vehicles will charge at home, so the ease with which PEV purchasers can secure permits for charge station installation may have a real impact on the degree to which this technology is embraced. Depending on a variety of regional and regulatory factors, the current process for permitting charging equipment could vary from quick and cheap to time-consuming and expensive. To meet future demand, permitting and building codes must be updated to account for electric vehicle supply equipment. The permitting process should also be accelerated to at most 1–2 days, as not to encumber or discourage PEV purchases.

While the federal government is working on permit guidelines, it’s up to the local governments to decide on their own codes and processes. By establishing a process that streamlines the inspection of the EVSE site and shortens the approval time for permits, municipalities can establish a more advantageous environment for the electric vehicle. Consumers will demand a shorter lag-time between vehicle purchase and use, but this needs to be tempered by the assurance of a safe installation that will not impede the reliability of the electrical system.

Cities are developing and implementing a number of innovative solutions to address the permitting issue. For example, some cities have an inspection certification process that only requires a fraction of stations to be inspected, if the installer is continually found to use good practices. Other cities offer conditional approval that will be confirmed within a certain time period (e.g., 30 days), allowing for use of the station prior to inspection. Another effective method (adopted by cities like Portland) is to designate charging stations with a “minor label” (comparable to a washing machine and dryer), circumventing the need for a lengthy inspection and permitting process.

The permitting process is a prime concern for automakers, and municipal authorities are becoming aware of the possible problems. If local authorities and regulators can learn from the Mini E pilot and resolve this issue, the PEV market can enjoy a functional and successful launch.

**KEY ENABLER: EDUCATION AND AWARENESS**

The public today remains largely under-informed about the electric vehicle. Likewise, many key stakeholders—including municipalities and utilities—lack a comprehensive understanding of how the technology will affect consumers and users.

As the first wave of vehicles rolls out, each stakeholder should be prepared to respond to a host of questions, many of which may not apply directly to their area of expertise: if cities, utilities, automakers, and other stakeholders can prepare effectively to proactively address consumer concerns through education, this could greatly assuage some of the largest barriers to widespread vehicle electrification.

Utilities are in a particularly advantageous position with educating the public. It is in their best interest to educate the their customers on the advantages and proper use of electric vehicles (e.g., when to charge, whether electrical upgrades are needed). Education and outreach may be enacted through television commercials, websites, or inserts in bill envelopes.

Municipalities can also play an important role in easing range anxiety by educating the public on available public charging sites. Along with automakers and dealers, cities can keep consumers informed on permitting requirements and available “perks” or tax credits, both federal and local.

Encouragingly, of America’s 50 largest cities, almost 40% have, or will soon launch, education and outreach programs. These vary from consumer focused programs to broad websites to programs that concentrate on educating and training electricians, inspectors and professionals.

Most education and outreach programs have concentrated on two tasks: informing the consumer and providing technical training. Consumer focused programs tend to use websites, public demonstrations, school lessons, and smart grid education. The workforce training education focuses on training modules for inspectors, university curriculum, and permitting guidebooks.

By investing in educational programs to promote consumer awareness and readiness, cities and other stakeholders can help accelerate the adoption and success of electric vehicles.

**SUCCESSFUL CITY EDUCATION PROGRAMS**

**INDIANAPOLIS** — The city is using US$ 6 m dollars toward education and curriculum in a technical community college. In addition, Indianapolis is applying US$ 5 m in funding toward smart grid programs, aimed training a future workforce.

**RALEIGH** — The city targets both residences and professionals. Raleigh has launched training programs for 300–400 electrical contractors and has developed a guidebook for EVSE training purposes. In addition, Raleigh has launched web pages and routine newspaper articles, in the effort to keep the public informed about electric vehicles.

**UTILITY INVOLVEMENT IN E—MOBILITY PLANNING**

**NORTHEAST UTILITIES** — This consortium of utilities in New England has paid for commercials aimed at informing the public about public charging stations.

**SOUTHERN CALIFORNIA EDISON** — SCE leads in customer interaction, having developed a plug-in rate assistant tool to help drivers understand which rates work best for them and conducted online surveys to proactively identify potential hot areas for upgrades before problems arise.

**PORTLAND GENERAL ELECTRIC** — PGE leads the nation in developing attractive, standardized EV signage and is working closely with Portland on e-mobility.

**DUKE AND PROGRESS ENERGY** — Both view PEVs as a first step to introduce consumers to smart grid, so they participate in local awareness programs, lead the nation in developing charger installation certification programs, and have developed an EVSE RFI template.

**SAN DIEGO GAS AND ELECTRIC** — SDGE is developing guidelines regarding how to charge EVs in multi-unit dwellings.
While we fully expect electric vehicles to secure a strong foothold in the American psyche and significant market share over the next decade, we acknowledge that our view, that “The Future Drives Electric”, is but one potential scenario.

A number of variables and uncertainties will affect the outcome, including:

**BATTERY TECHNOLOGY**
- Given the high level of investment in Lithium batteries and other advanced energy storage, we expect cost per kWh to decline even as performance improves; should technological progress falter and battery costs remain high, PEV penetration could stall.

**CONSUMER ACCEPTANCE**
- Despite the marketing and awareness efforts from automakers, utilities, and governments, PEVs still must prove themselves to consumers; for instance, one media report about an “electric vehicle battery explosion”, even if false, could set back progress by several years; also, while American consumers might quickly adopt certain technologies (e.g., smart phones), they have been notoriously resistant to paying a premium for alternative, fuel efficient technologies like diesels or hybrids, even in an era of high fuel prices.

**FUEL PRICES**
- Given our low fuel taxes, volatility continues at the fuel pump; fuel prices should increase interest in PEVs; however, oil experts differ on peak oil, if it will happen, when it will happen, or if it has already happened, so the impact on PEVs is similarly uncertain.

**REGULATIONS**
- The federal and California regulatory environment (CAFE/EPA and CARB) is somewhat clear until 2016, encouraging the introduction of PEVs; if the government continues to press and incent automakers towards fuel economy and lower GHG emissions beyond 2016, then we can expect industry investments to continue.
ACKNOWLEDGEMENTS

This publication has been made possible with the efforts of many contributors. Specifically, we would like to acknowledge Stephanie Tortomasi and Tina Jantzi as well as Fenglei Ma, Hiroko Kawai, and Ben Holland. We would also like to thank the many city officials, stakeholders, and partners we interviewed whose insights have been invaluable.

AUTHORS

ANTONIO BENECCHI
Partner
Roland Berger Strategy Consultants
Antonio.Benecci@us.rolandberger.com

MATT MATTILA
Consultant
Rocky Mountain Institute
mmattila@rmi.org

SHAMSUDDIN NAUMAN SYED
Consultant
Roland Berger Strategy Consultants
Shamsuddin.Syed@us.rolandberger.com