

PEV READINESS STUDY

In collaboration with Rocky Mountain Institute and Project Get Ready

Electric Vehicles in America:

The question is no longer "whether" they will come,
but "how fast" and "where first"

STUDY BACKGROUND AND OBJECTIVES

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)

CONTENTS

SUMMARY	04
PEV READINESS	06
OUTLOOK	16
KEY ENABLERS	18
OPEN ISSUES	20
ABOUT US	21
AUTHORS	22

SUMMARY

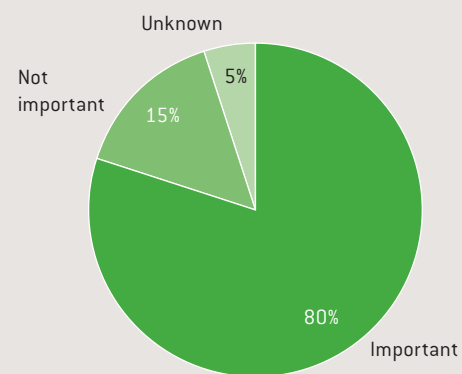
FAST FACTS ABOUT US PEVS

- > First mass market PEVs on roads in Q4 2010
- > President Obama hopes the US will have 1 m plug-in electric vehicles (PEVs) by 2015
- > Congress could grant hundreds of millions of dollars to 5–8 early deployment regions
- > Cities are competing to be US "EV capital"
- > Roland Berger projects >10% of new US vehicles could be electric by 2020

KEY DRIVERS

- > High levels of auto industry investment
- > Government subsidies and investments
- > National fuel economy standards
- > State ZEV and GHG requirements
- > Deployment of smart metering infrastructure
- > Heightened consumer awareness
- > Volatile fuel prices

IMPORTANCE OF BEING A LEADER IN PEVS AMONG TOP 50 METROS [%]



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 utilities 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 permitting, 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 misdirected investments, 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 or task forces can help identify and overcome barriers
- > First wave cities, from Portland to San Francisco to Houston, are developing best practices that other cities can learn from



AUTOMAKERS

- > After the first wave, PEV delivery will expand to cities with high momentum, before national 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



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)



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



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



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)

PEV READINESS: EVALUATION CRITERIA

KEY REQUIREMENTS AND EVALUATION FRAMEWORK FOR PEV READINESS¹⁾

- > **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.

1) Contact the authors or visit www.rolandberger.com or www.projectgetready.org for more details on our methodology and findings

READINESS OF TOP 50 METROS¹⁾

LEADER		
> Austin	> Phoenix	> San Diego
> Denver	> Portland	> San Francisco
> Los Angeles	> Raleigh	> San Jose
> New York	> Riverside	> Seattle
> Orlando	> Sacramento	

AGGRESSIVE FOLLOWER		
> Detroit	> Houston	> Indianapolis

FAST FOLLOWER		
> Atlanta	> Kansas City	> San Antonio
> Baltimore	> Las Vegas	> St. Louis
> Chicago	> Minneapolis	> Tampa
> Dallas	> Providence	

FOLLOWER		
> Birmingham	> Jacksonville	> Norfolk
> Boston	> Louisville	> Pittsburgh
> Buffalo	> Memphis	> Philadelphia
> Charlotte	> Miami	> Richmond
> Cincinnati	> Milwaukee	> Salt Lake City
> Cleveland	> Nashville	> Washington
> Columbus	> New Orleans	
> Hartford	> Oklahoma City	

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

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

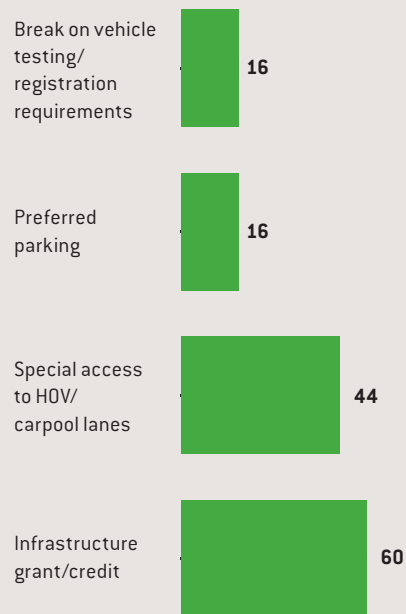
- > Given its environmentally-sensitive citizens, aggressive GHG reduction goals, moderate weather, and relatively clean power sources, Portland has a strong basis for e-mobility
- > Portland has built upon its advantageous starting position (as well as Oregon's generous state incentives and aggressive 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

REGULATORY ENVIRONMENT

TOP CITIES IN REGULATORY READINESS

- > Los Angeles
- > San Francisco
- > San Diego
- > San Jose
- > Seattle

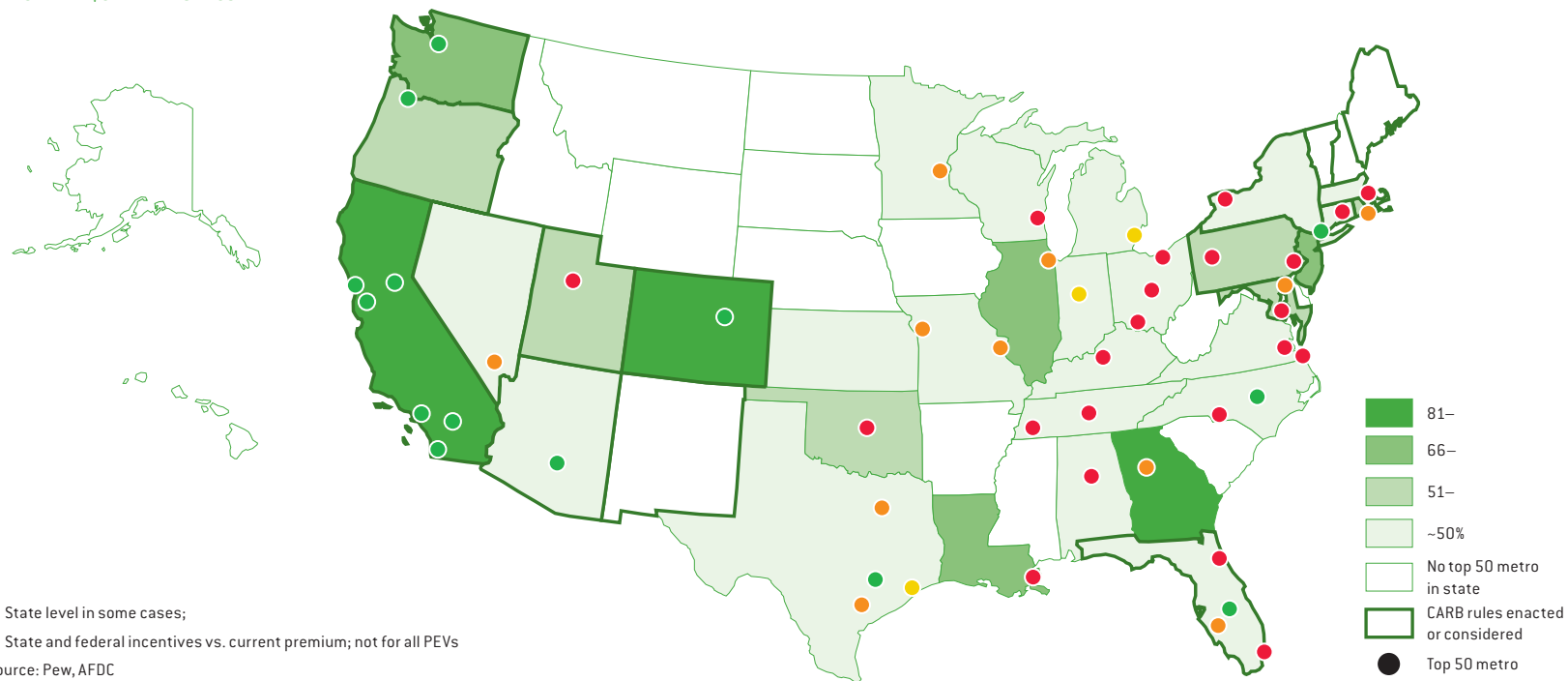
PENETRATION¹⁾ OF SELECTED INCENTIVES IN TOP 50 METROS [%]



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.

FIGURE 1:
AVAILABLE PURCHASE INCENTIVE % OF EV PREMIUM²⁾
AND CARB REQUIREMENTS IN US



1) State level in some cases;
2) State and federal incentives vs. current premium; not for all PEVs
Source: Pew, AFDC

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.

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

INFRASTRUCTURE READINESS

TOP CITIES IN INFRASTRUCTURE READINESS

- > Portland
- > Los Angeles
- > Riverside
- > Sacramento
- > San Jose

CITIES WITH MOST CHARGING STATIONS

- > Los Angeles
- > Portland
- > Riverside
- > Sacramento
- > San Francisco

COULOMB AND ECOTALITY PARTNER CITIES FOR CHARGING INFRASTRUCTURE (TOP 50 METROS)

- > Austin
- > Dallas
- > Detroit
- > Houston
- > Los Angeles
- > Nashville
- > New York
- > Orlando
- > Phoenix
- > Portland
- > Sacramento
- > San Diego
- > San Francisco
- > San Jose
- > Seattle
- > Washington

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

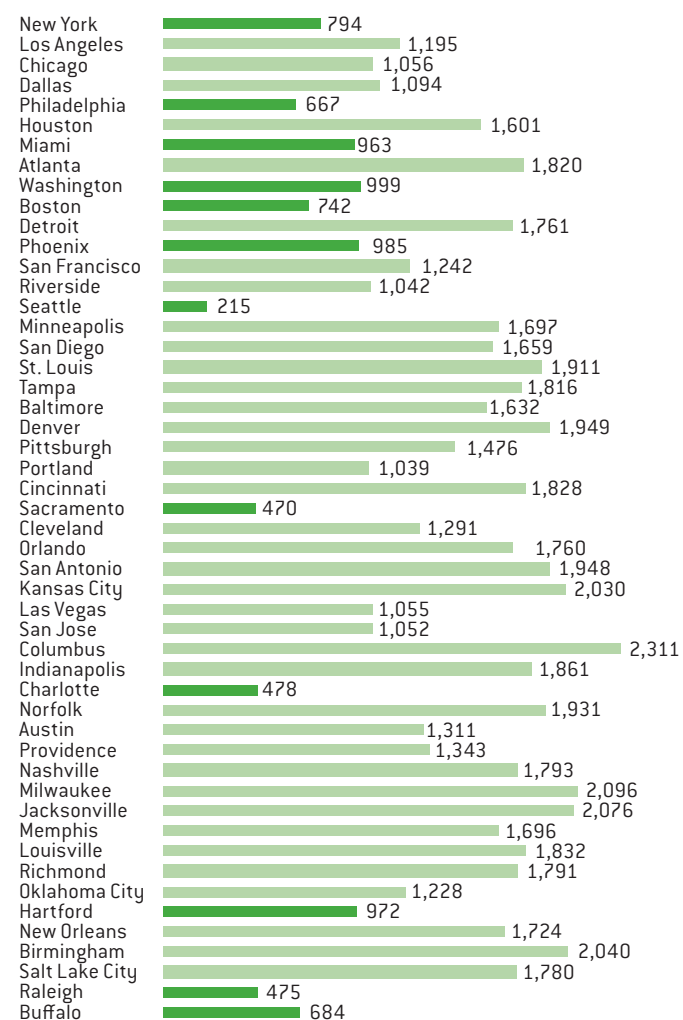
We expect even one public charging station per 100 PEVs should be sufficient to overcome "range anxiety" during the initial ramp up of e-mobility, as most charging should take place at home. Encouragingly, rather than a massive rollout of public charging, which would cost billions of dollars and encourage 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 grid is still in its infancy, we expect most 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—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]



Source: CARMA

PEV CHARGING BUSINESS MODELS

- > Several paradigms and networks are emerging
- > City, utility, EVSE provider, or investor ownership of stations are possible
- > Electricity re-sale, permitting, right-of-way, and dynamic pricing can all impact final business model, depending on jurisdiction

DEVELOPING CHARGING INFRASTRUCTURE IN DETROIT

- > Currently, Detroit is lagging in many areas critical to PEV infrastructure
- > Detroit has frequent power outages, relatively carbon intense fuel, minimal AMI penetration, and few charging stations
- > However, in the past year, Detroit has generated significant momentum on the way to preparing a PEV infrastructure
- > NextEnergy, an area nonprofit, has taken the lead in planning for PEVs, along with a consortium of organizations, including state and city officials
- > General Motors has promised Detroit first generation PEVs, so robust workplace charging station targets have been set—4,000 by the end of 2011
- > Furthermore, DTE, the local utility, has committed to smart grids, partnered with automakers and EVSE providers to offer 2,500 free charging stations, and become one of the first utilities to set time-of-use rates for electric vehicles
- > Given the leadership of key stakeholders, Detroit should be able to overcome a weak starting position and build sufficient infrastructure to accommodate the first wave of PEVs

CONSUMER READINESS

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 87 k]
- > Washington [USD 85 k]
- > Denver [USD 79 k]
- > San Francisco [USD 76 k]
- > Boston [USD 70 k]

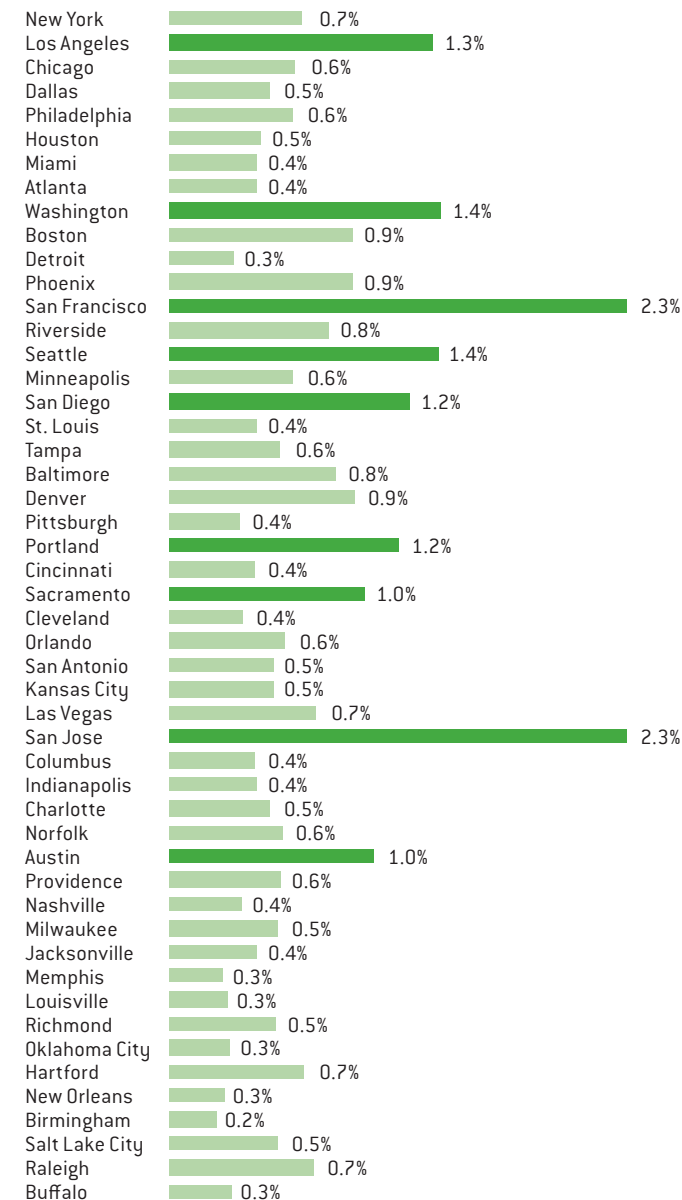
While PEVs will be offered from coast to coast within a couple of years, the consumers who will buy them are not equally distributed, regardless of local infrastructure or incentives. In the end, the private market will rule and supply of PEVs will follow consumer demand, so cities and other stakeholders 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 provide 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.

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



1) Based on DMA (designated market area)
Source: Polk

CITIES WITH HIGHEST AVERAGE NUMBER OF UNHEALTHY AIR QUALITY DAYS

- > Houston
- > Los Angeles
- > Pittsburgh
- > Riverside
- > Sacramento

CITIES WITH HIGHEST AWARENESS OF PEVS

- > Los Angeles
- > Oklahoma City
- > Orlando
- > Portland
- > Seattle

OPERATING ENVIRONMENT

CITIES WITH MOST FAVORABLE OPERATING ENVIRONMENT

- > Los Angeles
- > Riverside
- > San Diego
- > San Francisco
- > San Jose

WHY GARAGES MATTER

- > Garage availability is critical for the first wave of PEVs, as a garage easily enables home charging—public charging is only needed to overcome "range anxiety" for PEV drivers with garages
- > "Garage orphans", or PEVs that park on the street, will require adequate public charging simply to operate

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 PEVs falls, and incentives expire, some elements of the operating environment will become less critical and others will increase in importance.

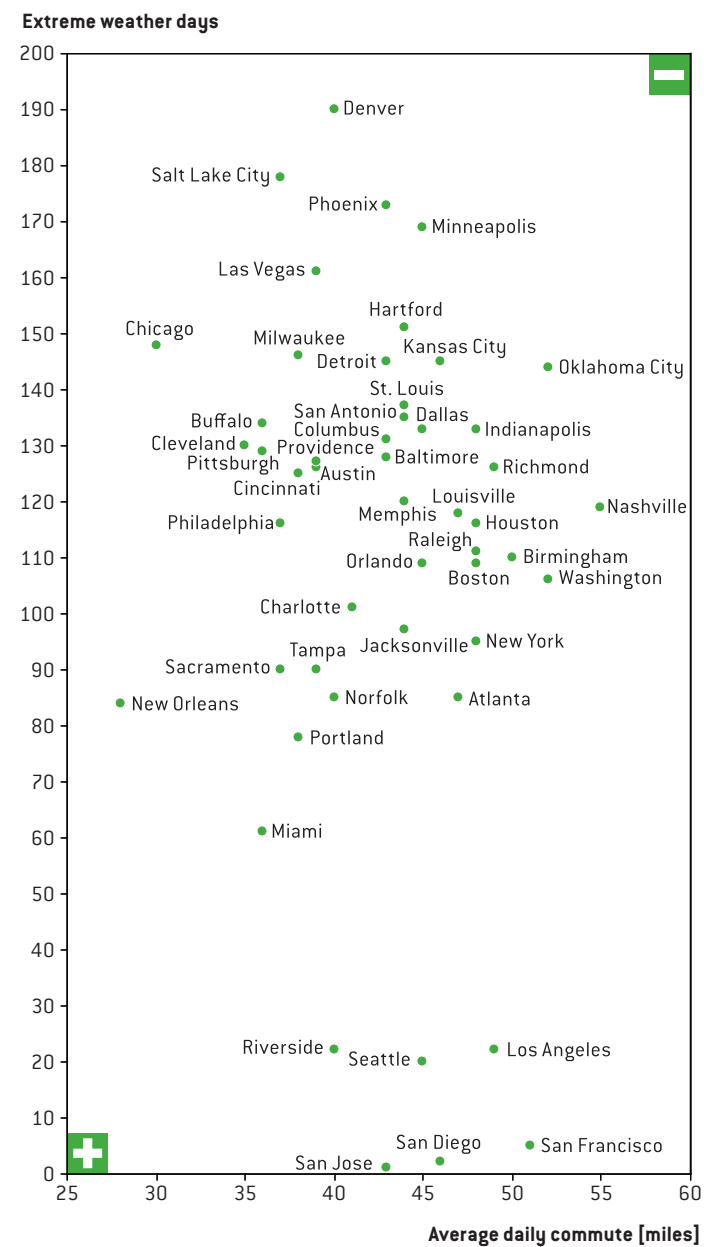
Regulatory, infrastructure, and consumer readiness are all critical pillars of a successful PEV ecosystem. However, additional factors relating to how the PEVs will actually operate also impact the rollout. Such operating environment elements include commute patterns, the weather, gasoline and electricity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

FIGURE 4: WEATHER VS. COMMUTE—TOP 50 METROS



CITIES WITH MOST FAVORABLE ENERGY COSTS (MIX OF HIGH GASOLINE, LOW ELECTRICITY PRICES)

- > Chicago
- > Louisville
- > Pittsburgh
- > Salt Lake City
- > Seattle

CITIES WITH MOST EXTREME WEATHER DAYS (>90 DEGREES OR <32 DEGREES FAHRENHEIT)

- > Denver
- > Las Vegas
- > Minneapolis
- > Phoenix
- > Salt Lake City

OUTLOOK: GROWING MOMENTUM

CITIES WITH MOST MOMENTUM FOR E-MOBILITY

- > Indianapolis
- > Raleigh
- > San Francisco
- > Portland
- > Phoenix

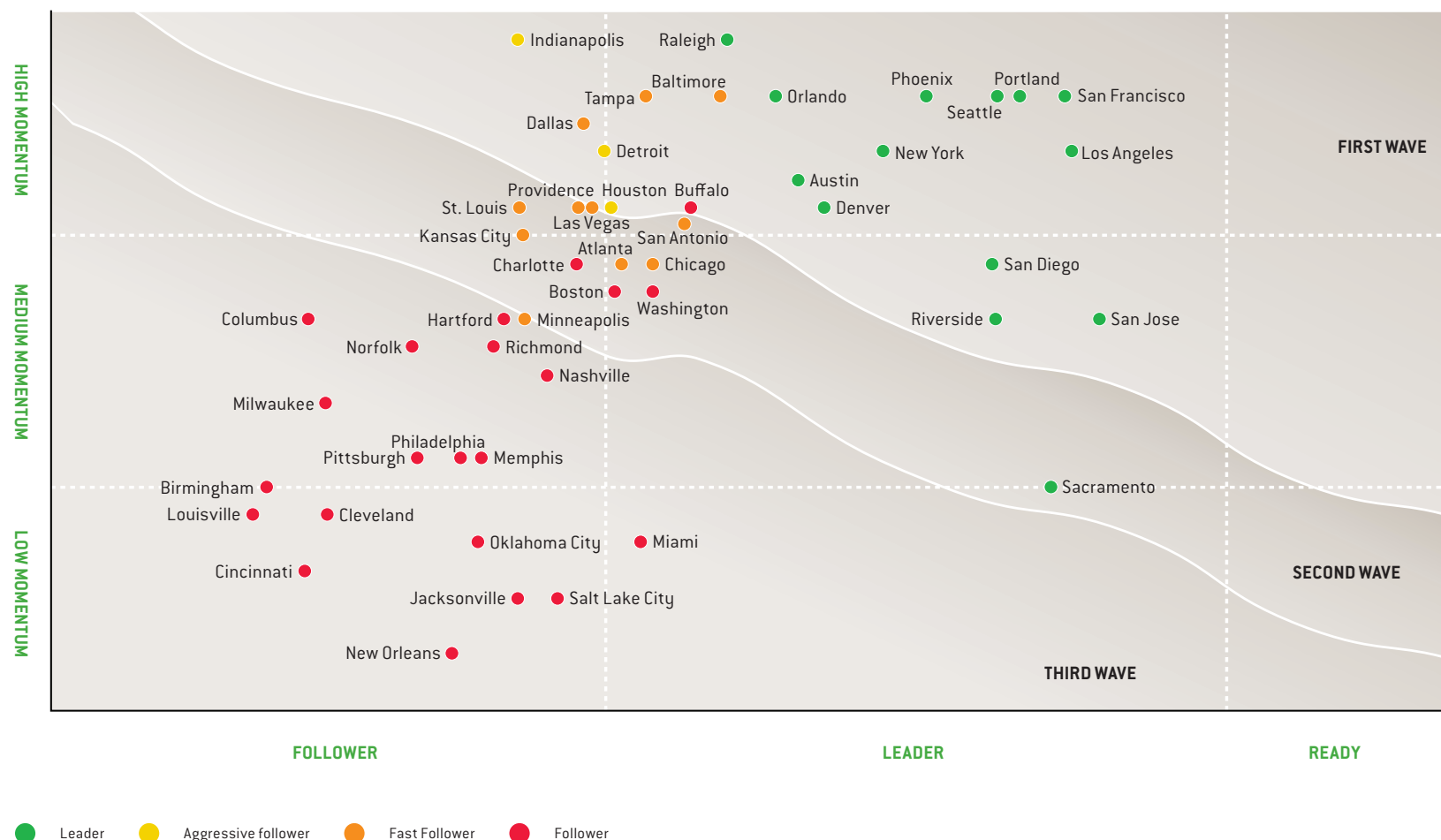
BUILDING EV MOMENTUM IN HOUSTON

- > Houston has many characteristics atypical of an ideal e-mobility environment
 - Relatively low fuel prices
 - Sprawling commute network
 - Center of oil and gas industry
 - Preference for large, fuel inefficient vehicle types (e.g., pickups)
- > Despite these barriers, Houston has made significant and rapid progress
 - After developing a GHG plan focused on city operations, Houston joined Project Get Ready in 2009 to focus on PEVs
 - Since then, it has enacted progressive policies and developed a hospitable environment for e-mobility—e.g., rapid permitting, partnerships
 - Now, Houston will be one of the few non-CARB cities to receive mass market PEVs in the first wave
- > Some of Houston's key initiatives include:
 - Acceleration of basic home charging permitting process to 48 hours
 - Designation of electric vehicle "champion" and Selection of stakeholder council
 - Conversion of 10 Toyota PHEVs as pilot
 - Recruitment of private entities and fleets to buy 200 PEVs and City commitment to buy 100 PEVs in 2010
 - Collaboration with ECOTality and federally funded "EV Project" to accelerate infrastructure
 - Cooperation with Nissan and Houston Advanced Research Center to develop strategic road map

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 we 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/or developed educational campaigns. As illustrated in the next two pages, these levers 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.

GAUGING CITY MOMENTUM

To determine city momentum, we evaluated four elements: **ATTITUDE**, **PLANNING**, **INFRASTRUCTURE**, and **EDUCATION**

ATTITUDE

- > Cities with high Attitude scores are optimistic, active and seek a leadership role in electric vehicle readiness
- > **65%** of cities we interviewed have a positive view of PEVs and their preparation efforts, while **18%** are pessimistic
- > Examples of high scoring cities include: San Jose, St. Louis, and Tucson

PLANNING

- > High planning scores indicate structured, long term electric vehicle plans
- > Only **11%** of cities have a high level of planning, while **40%** have very limited planning activities
- > Examples of high scoring cities include: Austin, Los Angeles and Portland

INFRASTRUCTURE

- > Infrastructure scores are based on funding for charging stations, incentives and a streamlined permitting process
- > Only **11%** of cities have a comprehensive approach to infrastructure, while **42%** have not started to think of the critical issues
- > Examples of high scoring cities include: Indianapolis, Phoenix, and San Francisco

EDUCATION

- > Education scores are based on existing education and outreach efforts
- > **25%** of cities have a high level of awareness building, while **38%** have only minimal education efforts
- > Examples of high scoring cities include: Orlando, Raleigh, and Seattle

KEY ENABLER: PERMITTING

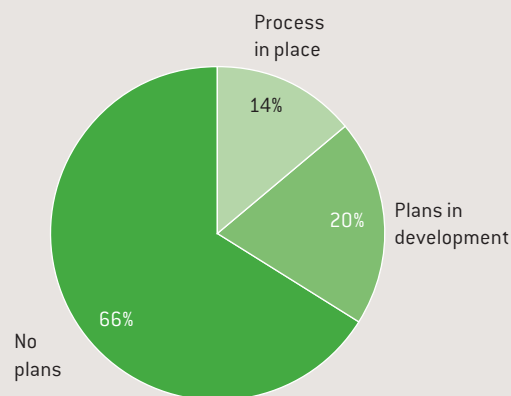
EXAMPLE: MINI-E PERMITTING CHALLENGES

In April 2009, BMW launched a test of 450 units of MINI-E. Many vehicles arrived late and without the adequate equipment. Lessees of the vehicles were provided Level 2, 220 Volt charging stations from Clean Fuel Connections, paid for by the automaker. But the charge cord lacked UL safety approval, so few inspectors would approve permits for the installation of the equipment. Furthermore, few homes chosen for the test possessed adequate wiring for the necessary voltage.

Rather than being able to drive a vehicle off the lot, these electric vehicles were idle in a garage as a snarl of red tape was unraveled.

Thanks to lessons learned from these PEV pioneers, many cities have committed to 24 hour permitting and the private sector has developed packages that take care of the whole purchase, installation, and permitting for the consumer.

PERMITTING ADOPTION BY TOP 50 METROS



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, so 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 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 applying USD 6 m dollars toward education and curriculum in a technical community college. In addition, Indianapolis is applying USD 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 are have developed an EVSE RFI template.

SAN DIEGO GAS AND ELECTRIC—SDGE is developing guidelines regarding how to charge EVs in multi-unit dwellings.

OPEN ISSUES

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 are highly correlated with interest in fuel economy, so higher 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

ROLAND BERGER STRATEGY CONSULTANTS

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ROCKY MOUNTAIN INSTITUTE

Founded in 1982, Rocky Mountain Institute® (RMI®) is a non-profit organization whose mission is to drive the efficient and restorative use of resources. RMI is an international leader in identifying and catalyzing breakthroughs in energy efficiency and renewable energy. Our work is geared toward our vision of a world thriving, verdant, and secure, for all, for ever. RMI's strategy is to transform the ways that we design and operate our transportation and electrical system, built environment and the industries that support our modern society. For more information, visit www.rmi.org.

PROJECT GET READY

Project Get Ready, is an initiative led by Rocky Mountain Institute (RMI) which aims to help communities throughout North America prepare for and welcome electric vehicles. The initiative and website (www.projectgetready.com) focus on actions that communities must take to be truly ready for the plug-in transition, and serve as a hub for collaboration between city officials, investors, technology providers, and consumers to share lessons learned and best practices. For more information, visit www.projectgetready.com.

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