

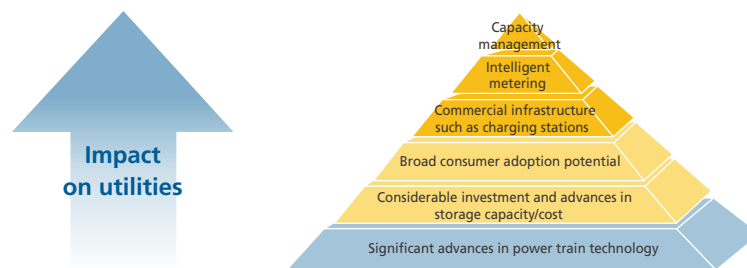
# What's Your Strategy for the Electric Vehicle Market?

By Mark Hirschey

In just a few short years since their debut in 1999, hybrid gas-electric vehicles are selling at over 300,000 vehicles per year in the United States, a trend that seems likely to accelerate. The medium-term end-game will probably be plug-in hybrid electric vehicles (PHEVs), with a high likelihood of fully electric vehicles being mass-marketed in the longer term. Some \$2.7 billion in direct U.S. government stimulus earmarks, supporting federal electric vehicle fleets, advanced battery system development, and end-user market development programs, will undoubtedly encourage the participants to speed up this market transition.

Many utility and non-utility executives, encouraged by increased government interest and public awareness, have begun developing some key market enablers, as shown in Exhibit 1. To achieve a state where individual transportation is powered more and more by electricity, these key building blocks are critical, and many of them fall squarely in the domain of electric utilities.

Exhibit 1 **Critical enablers for electric vehicles**



Some utility executives have begun to address critical questions, including:

- What can we learn from other utilities and non-utilities operating in this space?
- What risks require proactive strategies?
- Which opportunities should be aggressively pursued?
- Where do we need to shape the market and how do we prioritize?

## Current activity and investment

Proponents of environmentally friendly vehicles are investing in some combination of PHEVs, fuel cell vehicles, and biomass fuels as a means of reducing dependence on fossil fuels or meeting the increasing calls for greener emissions. Activities range from participation in technical research, primarily related to battery storage, such as the Department of Energy FreedomCAR and Fuel Partnership, to development of smart meter technologies, which have applications outside of electric vehicles. Some utilities have moved forward with grid impact and management studies, and Duke and Xcel have already begun testing grid management systems.

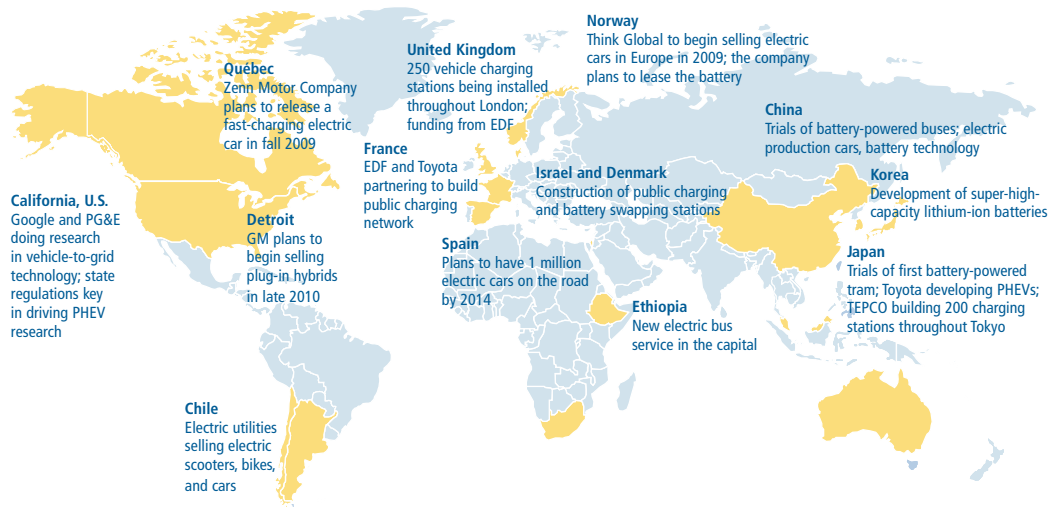
Utilities have also launched programs to determine the impact of electric fleets on their infrastructure, as well as whether the technology is market-ready. Several utilities are already preparing go-to-market strategies, mainly in markets where electric vehicles are likely to find early consumer acceptance.

### Exhibit 2 Examples of electric vehicle market participation

Technical research	Grid management	Live testing	Go-to-market
<ul style="list-style-type: none"> <li>• Pre-competition infrastructure research                             <ul style="list-style-type: none"> <li>– DTE, Southern California Edison</li> </ul> </li> <li>• Smart metering research                             <ul style="list-style-type: none"> <li>– BC Hydro, PG&amp;E, SCE, SCL</li> </ul> </li> <li>• Advanced battery storage research                             <ul style="list-style-type: none"> <li>– AEP, Xcel</li> </ul> </li> <li>• Environmental impact assessment                             <ul style="list-style-type: none"> <li>– DTE</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Evaluation of grid integration</li> <li>• Partnership with smart grid technology partners                             <ul style="list-style-type: none"> <li>– Duke and Xcel with GridPoint</li> </ul> </li> <li>• Vehicle-to-grid research and proof of concept                             <ul style="list-style-type: none"> <li>– PG&amp;E</li> <li>– Manitoba Hydro</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Owned PHEV fleet testing                             <ul style="list-style-type: none"> <li>– Many</li> </ul> </li> <li>• Third-party fleet testing and support                             <ul style="list-style-type: none"> <li>– Duke Energy and Coke</li> <li>– Con Edison and the <i>New York Times</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Live vehicle charging station                             <ul style="list-style-type: none"> <li>– Portland General Electric, PG&amp;E, Xcel</li> <li>– TEPCO (Japan), EDF (France) testing rapid charging stations</li> </ul> </li> <li>• Rebate stimulus to drive uptake                             <ul style="list-style-type: none"> <li>– Austin Energy</li> </ul> </li> </ul>

Source: Company websites, press releases, annual reports, news articles, Oliver Wyman analysis

### Exhibit 3 Electric vehicle market highlights worldwide

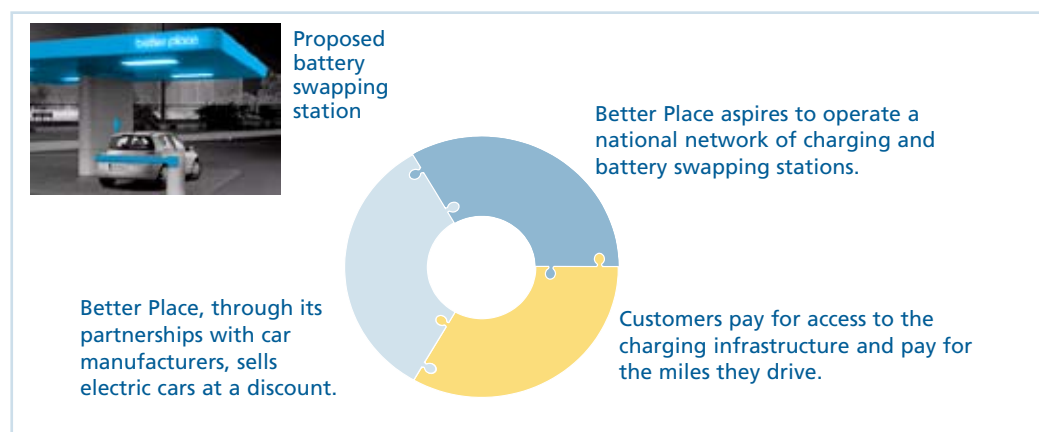


Source: Company websites, press releases, annual reports, news articles, Oliver Wyman analysis

Outside of direct power distribution technologies, utilities may also need to consider how best to engage with non-utility participants. Whether examining R&D efforts with battery operators, incentive schemes with local municipalities, technology partnerships, or battery storage joint ventures, utilities need to have a clear understanding of the risks and opportunities that each player brings to the table. Several utilities have begun forming alliances with private infrastructure providers such as Coulomb Technologies, which have the potential to change the way customers think of buying electricity. Other developments such as solar charging garages may create some disintermediation between the utility and the end users of energy.

Non-utility participants are also emerging that could possibly impact utility business models. One example is Better Place, shown in Exhibit 4. This start-up has landed a major joint development deal in the U.S. with aggressive plans to expand the electric vehicle marketplace one service area at a time. Another start-up, Envision Solar, plans on building wind- and solar-powered garages capable of charging vehicles primarily through renewable energy. Market developers like these can either become partners or disruptors of a utility's business model.

Exhibit 4 **Better Place's business design**



Current status	Potential obstacles
<ul style="list-style-type: none"> <li>• November 2008, launched in the U.S. with a joint initiative to build charging infrastructure throughout the Bay Area</li> <li>• Over \$200 million in venture capital backing; significant media coverage</li> <li>• By the end of 2011, expects to have electric cars in mass production, 100 swap stations, and 500,000 charging stations</li> <li>• Formal partnerships with Israel and Denmark</li> </ul>	<ul style="list-style-type: none"> <li>• Evolution of battery technology may preclude the need for a dense network of charging stations or battery swap stations</li> <li>• Other business designs may emerge in other countries (e.g., battery leasing, private charging stations) before Better Place spreads beyond Israel and Denmark</li> </ul>

Source: Better Place website, press releases, news articles

## The risks of inaction

Estimates of PHEV and battery-electric vehicles (BEVs) that will be on the road over the next decade range from 1 to 5 million new vehicles per year. Whatever the eventual level of adoption, utilities need to be actively planning for the potential widespread adoption of electric vehicles, in order to both mitigate the considerable risks and to capitalize on the potential opportunities.

On the risk side of the equation, start with the possibility of generation capacity shortfall. Peak demand with electric vehicle charging, identified as a significant issue in the 2008 Oak Ridge Study<sup>1</sup>, is anticipated to create an average 2% generation capacity shortfall. At the individual utility level, the customers buying and using electric vehicles are likely to be geographically concentrated (based on demographics), raising the importance of detailed system planning and management. If a utility does nothing else, it will need to understand and manage the flow of electricity along entirely new customer behavior patterns. Retaining control over the customer relationship may become difficult, as some of the new entrants are looking to disintermediate the current utility-customer relationship.

This and other risks summarized in Exhibit 5 should be analyzed at length to ensure that utilities are prepared for potential changes to the customer marketplace and resulting operational requirements, which will ultimately shape the economic impact of electric vehicles. Many forward-thinking utilities have already started to address these questions and align research and resources toward appropriate responses.

### Exhibit 5 Example risks of inaction

Risks	Strategic questions
Peak supply short-falls	<ul style="list-style-type: none"> <li>• What will be the impact to peak demand?</li> <li>• How will geographically localized demand evolve?</li> <li>• Can this be mitigated without additional generation capacity? (i.e., differential pricing for peak charging)</li> <li>• What is the right technology to help manage customers and their energy usage?</li> </ul>
Customer disintermediation	<ul style="list-style-type: none"> <li>• How will third-party energy service providers, (e.g., solar garages, Better Place) impact the utility-customer relationship?</li> <li>• What services do utilities need to perform to maintain this connection, if any?</li> <li>• What is the risk of losing some supplier power within the existing customer relationship?</li> </ul>
Failure of electric vehicles market evolution	<ul style="list-style-type: none"> <li>• How important is it for my market area to be at the leading edge?</li> <li>• What are the risks attributed to late innovation and service delivery (e.g., increased disaggregation)?</li> <li>• What is the timing and cost of key enablers to ensure that my utility captures the upside?</li> </ul>
Loss of revenue generating business opportunities	<ul style="list-style-type: none"> <li>• How will competition for services look if my utility moves late?</li> <li>• With whom should I partner to ensure control and presence?</li> </ul>
Erosion of environmentally friendly image efforts	<ul style="list-style-type: none"> <li>• Will inaction damage corporate and environmental sustainability efforts?</li> <li>• How much do my customers care about this issue?</li> </ul>

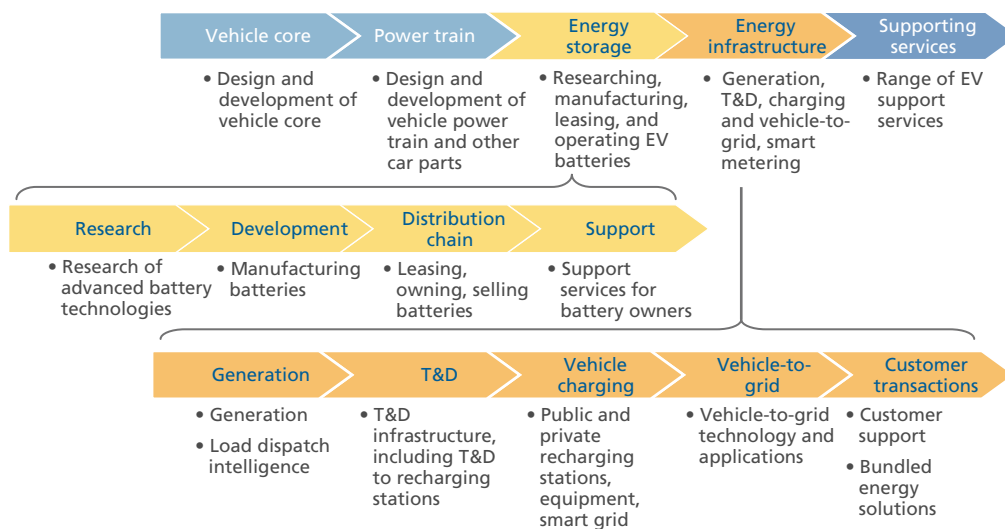
Source: Oliver Wyman

Success in addressing these risks will depend on careful prioritization and planning. Because of long lead times or the outsized risk of being caught unprepared, assessment of some risks should start immediately. For example, issues around peak demand load planning and generation capacity as well as infrastructure requirements have substantial implications for capital commitment and organizational structure.

### Opportunities across the value chain

With the expected launch of plug-in electric vehicles in 2010, utilities should start to develop focused strategies in areas where they are best-positioned to serve the electric vehicle value chain. At the moment, a variety of business design ideas are competing to shape the new marketplace. Many will prove to be uneconomical, operationally impractical, or uninteresting to customers. While the shape of this industry is still emerging, energy storage and the infrastructure to deliver customer-centric energy appear to be most relevant to a typical utility's existing assets and skill base (Exhibit 6). These areas also have the highest potential implications to cost of service and ability to manage future energy use.

Exhibit 6 Potential electric vehicle value chain opportunities for utilities



Each link along the electric vehicle value chain raises its own questions. In the energy storage portion, there are opportunities for unique businesses designs. For instance, should a utility own the batteries and lease them to consumers? This would help defray vehicle costs to consumers, since batteries are so expensive, while providing the utility control over the energy flow to and from batteries. Should a utility engage in direct R&D efforts with companies such as Johnson Controls or A123 Systems, or become a battery lessor to service providers such as Better Place?

On the infrastructure side, support service business designs could include rebate management, electric charging system service and support, as well as fleet vehicle service. These have the potential to act as sources of strategic control as well as market accelerators.

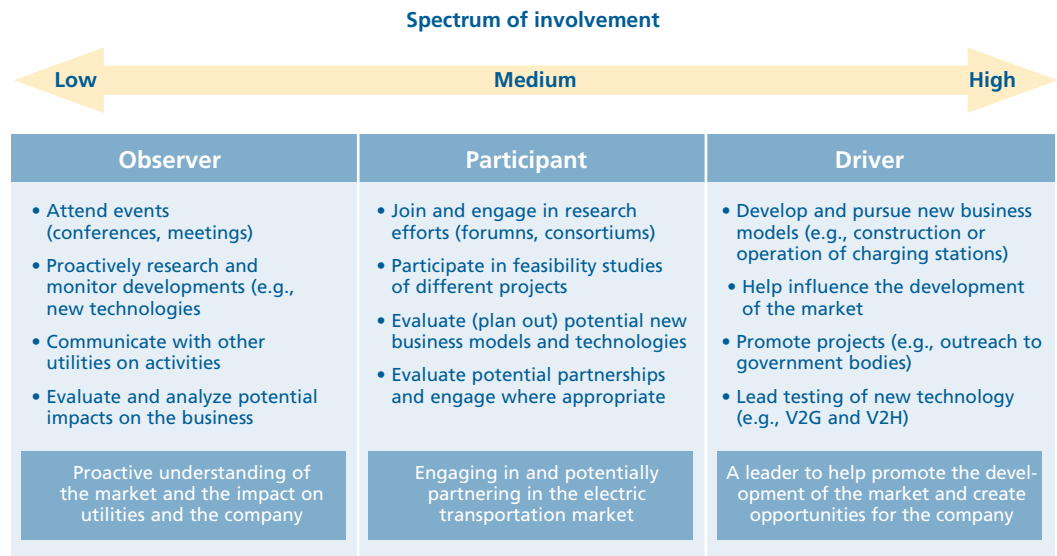
In our work with utility clients, we have found that the business design process has helped executives explore risks and opportunities of emerging markets, as managers often lack the specific resources needed to understand the impact of different market scenarios.

This analysis should examine factors such as the potential for mass energy storage, potential changes to emission standards, market timing, market scalability, requirements of a smart grid, the impact on spinning reserve capacity, rate case impacts, and localized pools of early adopters.

### Next steps for utility executives

The level and nature of utility engagement must strike a balance, one that guards against over-investment in promising but unproven technologies and infrastructure, yet also actively determines where there is the greatest potential upside (or risk) and designs a business to seize that opportunity (or mitigate the risk). Utilities are approaching this market with varying degrees of activity, as shown in Exhibit 7.

Exhibit 7 **Spectrum of utility engagement in electric vehicle market development**

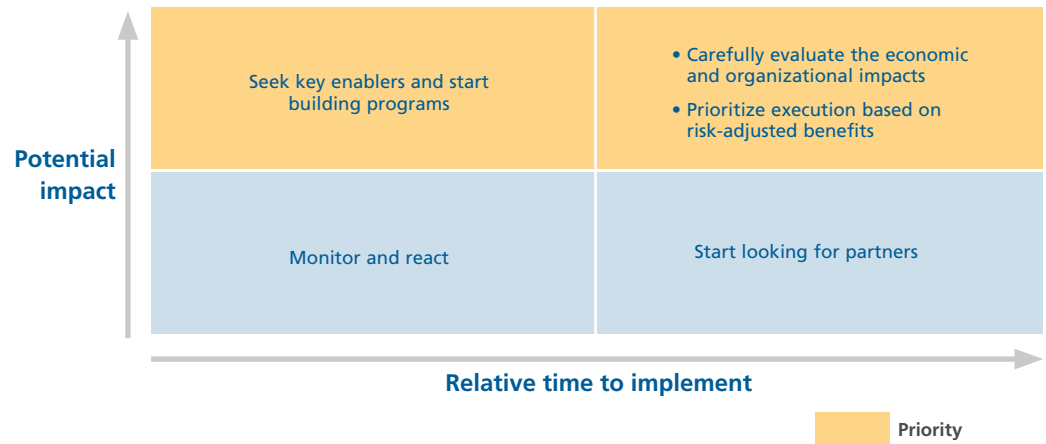


Source: Oliver Wyman

While the electric vehicle market's eventual form will not be known for the better part of the next decade, some utilities are already engaging a specific area of the value chain, setting priorities for near-term, medium-term, and long-term initiatives. They have begun to model different market and business impact scenarios, with the goal of identifying the biggest upsides and pitfalls.

Each opportunity and risk can be arrayed on a matrix of potential impact to the utility vs. relative time to implement, shown simplistically in Exhibit 8. This matrix will help utilities introduce relevant initiatives into their planning processes.

#### Exhibit 8 Prioritization categories for early investment



Source: Oliver Wyman

Executives should keep several principles in mind during this period of market evolution:

1. Develop a clear understanding of the various market scenarios and their effect on your operations.
2. Start actively shaping the market where there is a disproportionate strategic, operational, or economic benefit to doing so.
3. Begin to prioritize your activities and understand the true reaction time for preparing for different scenarios.
4. Maintain a level of flexibility to allow for strategy shifts as the environment evolves.

First movers that place smart bets on the right combination of technology, infrastructure, customer development, and products and services could create high barriers to competitor entry reinforced by ownership of strategic assets. Companies that wait too long, by contrast, may never be able to recover and participate in this emerging market. ❖

<sup>1</sup> Oak Ridge Laboratory, "Potential Impacts of Plug-in Hybrid Electric Vehicles on Regional Power Generation," 2008

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