

Testimony of Mr. Richard Lowenthal
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Good morning Chairman Dorgan, Senator Bennett, and members of the Committee. Thank you for the opportunity to speak with you regarding a tremendous opportunity for our country: the transition to electric-drive transportation. I'm the founder and CEO of Coulomb Technologies, a company that is deploying charging stations and business software systems for electric vehicle charging, a necessary ingredient for the successful adoption of electric vehicles.

Recently, Coulomb Technologies was selected by the Department of Energy to participate in the Electrification of Transportation program that was recommended for funding by this committee. This public/private partnership entitled "Charge America" will deploy charging infrastructure in up to twelve American cities. We will begin to deploy technology almost immediately, creating American jobs in engineering, manufacturing, and installation.

An electric drive future is one that leverages the diversity, flexibility, and stability of the electric power sector to sustainably power our transportation sector. Today, our cars and trucks rely on a single energy source—petroleum—for more than 95 percent of their delivered energy. This heavy reliance has generated profound economic, national security, and environmental risks for the United States. In contrast, vehicles that draw power from the grid—grid-enabled vehicles (GEVs)—derive their energy from the full range of fuel sources that produce electricity in the United States today. These fuel sources are stable, domestic, and diverse.

Grid-enabled electric drive systems can be either pure electric vehicles (EVs) or plug-in hybrid electric vehicles (PHEVs). Both EVs and PHEVs store energy from the grid in on-board batteries. Energy from the battery powers a highly efficient electric motor that propels the vehicle. EVs substitute an electric drivetrain for all conventional drivetrain components. PHEVs retain the use of a down-sized internal combustion engine that supplements a smaller battery.

Both EVs and PHEVs provide consumers and the broader economy with two distinct advantages compared to conventional vehicles. First, electric miles are cheaper than gasoline miles. Operating a vehicle on electricity in the United States is considerably less expensive than operating a vehicle on gasoline. In large part, this is due to the high efficiency of electric motors, which can turn 90 percent of the energy content of electricity into mechanical energy. In contrast, today's best internal combustion (IC) engines have efficiency ratings of just 25 to 27 percent. With gasoline at \$3.00 per gallon, the operating cost of a highly efficient IC engine vehicle (30 miles per gallon) is 10 cents per mile. For current pure electric vehicles, assuming an

average electricity price of 10 cents per kilowatt hour, operating costs are only 2.5 cents per mile.

Second, electric miles are cleaner than gasoline miles. Vehicle miles fueled by electricity emit less CO₂ than those fueled by gasoline—even with today’s mix of generating resources. As renewable power increases its share of the electricity portfolio, and to the extent that new nuclear power comes on line, the emissions profile of the U.S. power sector will continue to improve over time; this improvement will directly enhance the emissions benefits of grid-enabled vehicles.

By adopting these technologies at scale, the United States would dramatically reduce its dependence on petroleum, achieve significant reductions in energy-related greenhouse gas emissions, and catalyze the next generation of industry and manufacturing jobs that could be the backbone of our country’s economic competitiveness in the decades to come. Ultimately, moving to an electric-drive transportation sector would also substantially increase disposable income for American households, because overall spending on energy would decrease.

This transition is not only technologically possible, it is fundamentally necessary if we are to improve our economic and national security while preserving our natural environment. However, the wide-scale transformation of our petroleum-based transport system to one powered by electricity is far from certain today. There are a number of challenges facing electrification that, if not addressed in the near-term, could postpone or prevent progress toward a more secure, efficient transportation sector.

I want to be clear in stressing that these challenges are not technological problems with batteries, vehicles, or charging infrastructure. While ongoing research and development will be critical, battery technology has advanced to the point at which grid-enabled vehicles will provide consumers with the performance, safety, and durability that they require. To be sure, cost continues to be a factor. However, it is important to note that based on existing federal tax credits, and at today’s gasoline prices, a plug-in hybrid electric vehicle will already provide consumers with a net economic benefit over the life of the vehicle.

Electric vehicles will begin to appear on American roads and highways within a year. But for electric drive technology to be truly transformative, the market will need assistance in overcoming a number of challenges. Beyond financial issues, there is a set of regulatory issues that will need to be addressed at the federal level.

Some Definitions

Electric Vehicle charging stations, known formally as electric vehicle supply equipment (EVSE), are available in three “Levels”. ***Level I EVSEs are based on 110-volt household electricity.*** Level I charging is slow. A 30 kWh battery in a pure EV could take as long as 23 hours to fully charge. Smaller PHEV batteries will take less time, with the Chevrolet Volt specified to take approximately ten hours to completely charge at Level I.

These Level 1 charge times will likely convince most EV owners to opt for higher voltage and faster Level II charging. ***Level II charging is specified at 220 volts,*** similar to an electric clothes dryer. With a Level II charger, vehicles will take about 4 hours to charge.

Level III, or DC chargers, can charge vehicles in under an hour. DC fast-charge equipment will be significantly more expensive than Level I or II chargers and is expected to be available only at commercial charging establishments.

Setting aside technical specifications, charging infrastructure can generally be divided into two categories: shared and private. ***Private charging infrastructure*** would include a charging station installed in a private home for dedicated use by a single customer. ***Shared charging infrastructure*** would include units installed in condominiums, apartments, retail centers, public parking facilities, the workplace, or along major transportation arteries.

For drivers with access to a dedicated outlet, the most convenient time to charge their GEV will be overnight at home. Most passenger vehicles sit parked during the hours between roughly 8:00 pm and 6:00 am, which could provide ample opportunity to supply consumers with the charge levels required for typical daily usage of GEVs. Moreover, by concentrating charging during off-peak hours, the electric power sector could today charge more than 100 million GEVs (if the vehicles were entirely PHEVs, the number could be as high as 160 million) without the need to install significant additional generating capacity. While Level I charging will be an option for some PHEV owners, most consumers will prefer Level II charging in their homes.

As important as access to home charging will be for achieving high rates of electric vehicle deployment, shared charging is arguably even more important during the early stages of EV adoption. Drivers are accustomed to being able to fill up using the ubiquitous gasoline infrastructure developed over the last 100 years. Insufficient public charging opportunities will generate hesitancy and could hinder the adoption of electric vehicles. Studies show that 80 percent of EV owners will want to charge more than once a day.

Range anxiety on the part of consumers remains a substantial challenge for EV adoption. People are afraid that their vehicle will be incapable of travelling the long distances required, or that

they will be unable to get the necessary recharge along the way. Despite the fact that data on consumer habits shows that drivers rarely travel long distances, when asked their opinions, they express unease over range. Early research supports the conclusion that reliable access to public charging infrastructure diminishes this anxiety.

The first mass-produced fully-electric vehicles (BEVs) to reach U.S. markets will have an all-electric driving range of approximately 100 miles. With these vehicles, when the battery is depleted, it must be recharged before the vehicle can be driven again. Consumers are unlikely to purchase a vehicle unless they have confidence that it can be conveniently refueled.

Regardless of which technology—PHEV or EV—captures the dominant share of the market at any time, consumers will demand access to public charging infrastructure. Whether one is concerned about operating efficiency or basic necessity, grid-enabled vehicles will need to charge their batteries conveniently. If the market fails to meet this standard upfront, high operating costs and consumer anxiety about range will simply prevent grid-enabled vehicles from reaching mass market penetration. In this sense, we are faced with a classic problem of coordination. Consumers will not adopt electric drive technology at scale if they are not confident in their ability to refuel. At the same time, there is little incentive for the private sector to install public charging infrastructure if that equipment is expected to sit idle.

Policy Recommendations

Permitting electrical work is a local issue—typically the responsibility of city or county governments—and rules vary widely between jurisdictions. The process of requiring an electrician to obtain a permit and schedule an inspection can stretch an otherwise short and simple electrical upgrade into a burdensome, several week-long process, a concern that was confirmed by several participants in a recent pilot project conducted by BMW in Los Angeles, New York, and New Jersey. Market participants have suggested allowing third parties to inspect newly installed equipment and even to allow installers to self-certify the installation.

Policy 1: We need streamlined permitting processes nationwide for installation of EVSE.

Today, there are roughly 54 million private garages for 247 million light-duty vehicles (cars and SUVs). For consumers who park in parking lots or curbside at night, overnight charging requires shared stations.

By treating electricity as a transportation fuel, regulators can foster competition in the nascent EV infrastructure marketplace and help to facilitate rapid deployment of public charging infrastructure. The California Public Utilities Commission recently indicated that it is not

inclined to regulate electricity sales for EVs. Nonetheless, the decision is not yet finalized and represents the opinion of only a single PUC.

One critical issue is that electricity for GEVs is not yet viewed as a transportation fuel. For public charging infrastructure, this precedent could present particularly burdensome regulatory issues. In many cases, current regulations require a seller of electricity to be treated as a regulated utility. In other words, if an apartment building, shopping center, or fast food restaurant has charging stations, it could be subject to the full range of regulatory compliance mechanisms that affect utilities. This level of regulation would likely prevent even minimal deployment of shared charging infrastructure in the public, in private garages, in condominiums, apartments, and the workplace.

Rather than depending on all of the nation's public utility commissions to come to the conclusion that we need a competitive commercial market for vehicle charging, we need a national policy of allowing free-market vehicle charging, potentially through Federal Energy Regulatory Commission policy and authority.

Policy 2: FERC should ensure that Electric Vehicle Charging is a competitive market with market-based pricing for charging vehicles.

The US has over 3,000 electric utilities. Drivers will charge in several different utilities' service areas. Because no third-party provider is likely to be ubiquitous, some type of "roaming" capability will likely be necessary. On longer trips, this is sure to be the case.

It is important that the responsibility not be placed on drivers to establish billing relationships with all utilities within whose service area they may charge.

Policy 3: Payment systems that allow for consumer roaming should be encouraged.

Today, the electric power sector has substantial untapped generating capacity off peak, which can already allow millions of EV batteries to charge without adding power generation or transmission capacity. However, consumers will likely require incentives to charge off-peak and disincentives to charge during peak demand, high-cost hours. Utilities and equipment providers should include smart-grid integration technology for demand response and time-of-use charging plans.

Policy 4: Smart grid integration, demand response, and time of use pricing should be required.

Coulomb has developed electric vehicle charging stations and business software systems that ensure EV charging is a sustainable, scalable business. Our stations include a business software suite that includes a billing system that provides money to pay for all recurring costs, and asset management tools to allow infrastructure to be well-managed. We have the capability to build charging infrastructure that will enable rapid growth of the electric vehicle market, and we have been shipping these products since 2008.

Policy 5: Charging infrastructure selection must consider life cycle costs.

EV charging stations are designed and manufactured in the United States and distribution is available nationwide. Our products are “shovel-ready” and require the skills of local electricians and contractors to install, providing jobs nationwide. Each station we install employs three people for a day.

Our company has faced a classic chicken and egg problem. Consumers will not adopt electric drive technology if they are not confident in their ability to refuel. At the same time, there is little incentive for companies to install charging infrastructure before the cars arrive.

The federal government can play an important role as it considers stimulus spending and other financial incentives to assist the nascent market for electric vehicle charging infrastructure. Public sector investment in shared charging infrastructure during the early phases of EV deployment can help overcome consumer range anxiety and enable those who don't have home charging stations to buy these cars.

Policy 6: Public investment in EV infrastructure creates jobs and addresses the chicken-and-egg problem.

Currently, there is a 50 percent tax credit available for infrastructure installations, which expires at the end of this year.

Congress should extend the tax credit for alternative fueling facilities and make it useful by making it convertible to a rebate or to a payroll tax credit.

There are far too many restrictions in the current tax credit. For example, it cannot be used for station owners who pay the alternative minimum tax or for companies with tax loss carry forward.

Policy 7: Extend and improve the infrastructure tax credit that is about to expire.

In order to benefit from Level II charging in their homes, a large percentage of EV consumers will require the installation of a dedicated 220 volt circuit in their garages or car ports. These installation costs can be dramatically reduced if garages are pre-wired for electric vehicle charging.

While building codes are generally a local/municipal issues, I cannot stress their importance enough. All new garages and parking lots should be required to include wiring for future electric vehicles. This will significantly lower the cost of adding EVSE later.

Policy 8: The federal government should use its clout to ensure that building codes nationally require all new parking places include wiring for future EVs.

Finally, like Mr. Smith, who spoke on your first panel, I am a member of the Electrification Coalition, a group of CEOs from companies that represent the entire value chain of electrification. The Coalition and its members are committed to promoting policies and actions that facilitate the deployment of electric vehicles on a mass scale in order to combat the economic, environmental, and national security dangers caused by our nation's dependence on petroleum.

As a final policy recommendation, I would like to stress the importance of the concept of targeted investment in a limited number of electrification ecosystems. Such a program will accomplish a number of important objectives: it will prove that electric vehicles work as a concept; it will help drive economies of scale for a number of businesses; and it will facilitate critical research on technology and driver behavior. Most critically, it will create the local networks in which electric vehicles can thrive.

This technology is here today. We have the capability right now to deploy an electrified transportation sector that will dramatically improve our nation's trade balance, national security, and environment, and reduce consumers cost of transportation. What is required is coordination and support to push past initial regulatory and financial hurdles. This is the right thing to do for our nation, and I urge you to move forward.

Thank you for your time and your attention.