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## **The Economics of EVs and the Roles of Government**

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### **Abstract**

By 2050 there will be two billion cars on the world's roads. How many of those will be electric vehicles? To gain a significant share of that market, EVs must be affordable to the average citizen. Implementation begins in developed nations and, as mass production lowers the unit cost, vehicles can be exported to other countries. Government has several important roles. It starts with government-financed research and development of the technologies necessary to turn the electric vehicle concept into reality. Government has also assisted EVs indirectly through GHG emission goals and continually increasing miles per gallon requirements for vehicles. The cost of batteries elevated the EV purchase price, which has been partially offset in many areas through government-funded credits or rebates at the time of purchase, plus additional perks for EV users. These include free battery charging facilities, free access to carpool or toll lanes, free downtown parking, etc. Range anxiety has been a marketing barrier until recently. The cost of batteries is plummeting and the range has more than tripled, with even greater improvements on the way. Another opportunity for EVs lies in the source of power. The internal combustion engine requires oil in some form for power, but EVs don't. Clean energy is rapidly becoming cost competitive. In some areas, wind power is now cheaper than coal and the cost of large scale solar power has been plummeting. The main issue with renewable energy sources is around-the-clock availability. This problem is being effectively addressed through molten salt storage, such as the facility currently in operation near Seville, Spain. This technology is currently being replicated on a larger scale in the United States. EV market share of two billion cars in 2050 will depend on continuing governmental support through research and policies, decreasing the cost and increasing the range of EV batteries, and expanding the world's production of low cost clean energy.

*Regulation, Market, California, EDTA, Electric Drive*

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## 1. Introduction

The number of cars on the world's roads will double by 2050 to two billion [1], plus a nearly equal number of trucks, buses, and motorcycles [2]. Thanks to technological improvements, government support, and increasing involvement from the private sector, the time has arrived for electric vehicles (EVs) of all types to obtain a substantial share of that huge market. The size of that share will depend on a variety of factors including, perhaps most importantly, the cooperative relationship between the public and private sectors, working together to achieve not just an expanded market share for EVs but accomplishment of societal goals regarding climate change, clean energy, greenhouse gas (GHG) emissions, and ending dependence on fossil fuels. Technological improvements, government leadership, marketing and mass production, and affordability for the average consumer are the keys to success.

## 2. Technological Advances

The economics of electric vehicles have been a major barrier to their widespread acceptance by the average consumer. As recently as 2008, an EV battery (the major cost component for EVs) cost \$12,000 and was limited to a 40-mile range between charges. [3] Now, the Nissan Leaf and several other models have a range of 75 to 80

miles with battery costs projected to drop to \$3,600 by 2015 and \$1,500 by 2020 [4]. In 2001, the replacement battery pack for the Toyota Prius Hybrid was \$10,000 -- now, it is \$2,300 (after a credit for turning in the old battery pack to be recycled). [5] General Motors has announced development of an EV with a 200 mile range, [6] thanks primarily to tripling the density of its lithium-ion cells, and Tesla models have a range up to 265 miles [7] depending on the cost that consumers are willing to pay for the vehicle's battery. Fast charging has also become a recent phenomenon, reducing the time required to charge a battery from hours to minutes.

## 3. Government's Role

Government has performed the essential role in funding technological research and development while establishing goals, standards, and requirements for greenhouse gas emissions and clean energy to reduce reliance on fossil fuels and address climate change. Several European nations have led the way while the United States has only recently become substantially involved. The federal government has lacked a consistent national policy, leaving it to the states and the Obama Administration to address the societal and economical advantages of becoming a leader in the arena. Twenty-seven states have adopted Renewable Portfolio Standards (RPS) while ten more have set voluntary goals. [8]

The U.S. federal \$7,500 tax credit for electric vehicle purchases has been in effect for several years, with some states adding additional incentives (\$2,500 in California) for consumers. [9] President Obama established a 54.5 miles per gallon standard by 2025 with the goal of 80% of U.S. energy to be generated from renewable sources by 2035. [10] In late June, he reiterated his goal of reducing GHG emissions by 17% of 2005 levels by 2020. [11]

California set a standard years ago of reducing GHG emissions to 80% below 1990 levels by 2050. [12] More recent goals include 1.5 million zero emission vehicles (ZEVs) on California's roads by 2025 [13] and, perhaps more significantly, requiring that 15% of vehicles sold in California must be ZEVs or PHEVs by 2025. [14] This has resulted in a price war by manufacturers who must achieve that goal, with low EV prices a necessary element. Governments are also providing subsidies for installing charging facilities at home or in the work place, free parking, free access to carpool/toll/bus lanes, and free battery charging stations, among the many perks available to EV consumers.

Several European nations have been leading the way since the early 1990s. Additional perks in several of those countries include tax and vehicle registration exemptions, reducing the corporation tax by reducing the taxable value of company EV cars or fleets, grants (rather than tax credits) to dealers to provide discounts to buyers at the time

of purchase, and financial incentives for trading in current vehicles when purchasing an EV.

## 4. The Role of Clean Energy

The internal combustion engine requires oil as its source of power, which is a serious drawback for nations now seeking to seriously address the impacts of climate change accompanied by a desire to achieve energy independence. This obviously opens the door to EVs as a significant player in achieving these goals but that path must become cost competitive. The latest available comprehensive data from 2011 shows that wind is cheaper than coal and only slightly more than natural gas in some areas [15] while the cost of solar power is dropping dramatically. [16]

Achieving goals on reducing GHG emissions and expanding the role of renewables relies on around-the-clock availability of clean energy. Storage of energy when the wind isn't blowing and the sun isn't shining has been a barrier to increasing the role of renewables while reducing the reliance on fossil fuels.

Working together, the public and private sectors have developed a dramatic solution. A Gemasolar facility near Seville, Spain powers a town of 25,000 homes 24 hours a day by storing the heat from the sun in tanks of molten salt, drawing on that stored energy to power the town during the night as well as when the sun is shining. [17] A much larger facility by Solar Reserve is under

construction in Nevada with several more to follow. [18] Various salts are being tested to determine the most effective, efficient, and economical storage material.

## 5. Education and Marketing

A recent *Los Angeles Times* front page article titled "Price War on Electric Vehicles" began with the question: "What would it take to get you into an electric car today?" In the first paragraph, it concluded that: "For the first time, electric vehicles are penciling out cheaper than their gas-powered counterparts." [19]

This was not a trade journal or paid advertisement -- it was a page one news story in a major metropolitan newspaper which was quickly picked up by other papers.

That story was the result of years of research and technological development, government incentives, a dedicated private sector, and gradual progress toward the achievement of societal goals. The requirement in California that zero emission vehicles must account for 15% of all new vehicle sales by 2025 is a dramatic increase from the current level of less than 1% [20] causing manufacturers to start leasing EVs at less than \$200 per month, in some cases throwing in auto insurance and a 240-volt EV home charging station. [21] Nissan cut its base price on the Leaf by \$6,400 and has retooled a plant in Tennessee

capable of sending 150,000 vehicles per year off the assembly line. [22]

Television documentaries, such as *The Next Frontier* [23] and the upcoming *We've Got the Power*, [24] along with websites and other social media, portray EVs as attractive, smooth, quiet, peppy and affordable, operating at one-fourth the cost of a standard car without ever going to a gas station, but driving in the carpool or toll lane for free.

A new feature on the Department of Energy's website is eGallon. [25] This enables potential EV buyers to determine the actual cost of driving an EV versus a standard vehicle in any state, along with the U.S. overall average.

## 6. Conclusion

Sales of battery electric vehicles in the U.S. for the first several months of this year were four times last year (but still only 4% of total sales). [26] Economically and technologically, EVs have arrived -- not next year or next decade, but now!

It is up to governments and the private sector, working together energetically and intelligently, to dramatically increase the electric vehicle share of an expanding market while furthering the achievement of societal and environmental goals and objectives in the coming years.

## References

- [1] U.S. Energy Secretary Steven Chu's Remarks at Detroit Economic Club, <http://energy.gov/articles/secretary-chus-remarks-detroit-economic-club-prepared-delivery>, accessed on 2013-02-15.
- [2] Daniel Sperling; Deborah Gordon. *Two Billion Cars*, ISBN 978-01-19-973723-9, New York, Oxford University Press, 2009.
- [3] Secretary Chu's Remarks at Detroit Economic Club, <http://energy.gov/articles/secretary-chus-remarks-detroit-economic-club-prepared-delivery>, accessed on 2013-02-15.
- [4] Secretary Chu's Remarks at Detroit Economic Club, <http://energy.gov/articles/secretary-chus-remarks-detroit-economic-club-prepared-delivery>, accessed on 2013-02-15.
- [5] Clean Car Reports, [http://www.greencarreports.com/news/1084937\\_nissan-to-offer-leaf-battery-replacement-plan-100-a-month](http://www.greencarreports.com/news/1084937_nissan-to-offer-leaf-battery-replacement-plan-100-a-month), accessed on 2013-01-20.
- [6] Clean Car Reports, [http://www.greencarreports.com/news/1082761\\_gm-working-on-200-mile-electric-car-says-ceo-akerson](http://www.greencarreports.com/news/1082761_gm-working-on-200-mile-electric-car-says-ceo-akerson), accessed on 2013-03-07.
- [7] Tesla Model S. <http://www.teslamotors.com/models>, accessed on 2013-07-01.
- [8] Today in Energy. <http://www.eia.gov/todayinenergy/detail.cfm?id=4850>, accessed on 2012-03-03.
- [9] U.S. D.O.E. EERE Fuel Economy. <http://www.fueleconomy.gov/feg/taxevb.shtml>, accessed on 2013-02-01
- [10] Obama Administration Finalizes Historic 54.5 MPG Fuel Efficiency Standards. <http://www.whitehouse.gov/the-press-office/2012/08/28/obama-administration-finalizes-historic-545-mpg-fuel-efficiency-standard>, accessed on 2012-08-29.
- [11] <http://www.whitehouse.gov/the-press-office/2013/06/25/remarks-president-climate-change>, accessed on 2013-06-25.
- [12] State of California Executive Order. <http://www.dot.ca.gov/hq/energy/ExecOrderS-3-05.htm>, accessed on 2005-03-03.
- [13] Governor's Office of Planning and Research. [http://www.opr.ca.gov/s\\_zevactionplan.php](http://www.opr.ca.gov/s_zevactionplan.php), accessed on 2012-03-23.
- [14] California Air Resources Board's Clean Car Standards. <http://www.arb.ca.gov/cc/ccms/ccms.htm>, accessed on 2013-01-01
- [15], [16] Levelized Cost of New Generation Resources in the Annual Energy Outlook 2012. [http://www.eia.gov/forecasts/aeo/electricity\\_generation.cfm](http://www.eia.gov/forecasts/aeo/electricity_generation.cfm), accessed on 2013-03-18.
- [17] Gemasolar Characteristics. <http://www.torresolenergy.com/TORRESOL/gemasolar-plant/en>, accessed on 2012-08-15.
- [18] Solar Reserve. <http://www.solarreserve.com/>, accessed on 2012-09-01.
- [19], [20] Los Angeles Times. <http://articles.latimes.com/2013/jun/01/autos/la-fi-0601-hy-autos-electric-cars-20130531>, 2013-06-01.
- [21] TIME, Business and Money. <http://business.time.com/2013/06/18/all-of-a-sudden-there-arent-enough-electric-cars-to-keep-up-with-demand/>, accessed on 2013-06-18.
- [22] The Tennessean. <http://www.tennessean.com/article/20130428/BUSINESS03/304280052/New-Leaf-plugging-along-Nissan-s-Smyrna-plant>, accessed on 2013-04-29

[23] The Next Frontier Movie.  
<http://thenextfrontiermovie.com/>, accessed on 2011-06-01.

[24] We've Got the Power Movie.  
<https://www.facebook.com/wevegotthepowermovie>, accessed on 2013-03-21.

[25] U.S. DOE eGallon.  
<http://energy.gov/articles/egallon-how-much-cheaper-it-drive-electricity>, accessed on 2013-06-13.

[26] EDTA.  
<http://www.electricdrive.org/index.php?ht=d/sp/i/20952/pid/20952>, accessed on 2013-07-01.

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