ICEVs to EVs in Commercial and Governmental Fleets: A Business Case

Bay Area Climate Collaborative
August 23, 2010

Introduction

Electric Vehicles (EVs) are emerging in the automotive industry as a viable alternative over Internal Combustion Engine Vehicles (ICEVs). Some projections estimate that within the next ten years, the number of EVs on US roads will increase from today's 100,000 to over 2.5 million, 17% of which will likely be in California.[1] This growth projection is supported by billions in federal[2] and private investment. Based on current technology, EVs provide measurable direct financial benefits and very significant indirect benefits making them worthy of serious consideration, especially in pooled fleet applications. This paper summarizes the benefits based on the leading research.

Why Fleets?

Sedan and light duty fleets with a defined driving range of around 100 miles per day or less can expect measurable gains from transitioning to EVs. Owners in the fleet market will see meaningful financial benefits arising from lower fueling and maintenance costs. They will also garner significant reputational benefits from the broader economic, national security and environmental gains arising from visible steps to reduce dependence on petroleum. In addition, fleets can secure added benefits from a reduced reliance on public infrastructure (charging stations) and lower infrastructure costs arising from centralization.

Financial Benefits

Overall, all-electric EVs can be expected to achieve the following approximate benefits versus gas-powered ICEV: [3]

- $4,500 overall savings in 5 year period, based on conservative estimates
- 50% reduction in maintenance costs
- Annual fuel savings from $300 to $1,800, dependent on gas prices ($2-$4.5/gal)

Financial considerations for EV consumers include the costs of the initial vehicle, fueling, maintenance, battery replacement, and chargers and charger installation. Additionally, tax credits, rebates, and other incentives must be factored into the lifecycle cost of these vehicles. Analysis of these and other factors over the lifetime of the vehicles reveals a measurable savings at present. Furthermore, projections of increased demand of EVs and batteries, increasing gas prices, and better charging infrastructure and technologies allows fleet owners

[1] Stewart et al., 2010; http://baclimate.org/images/stories/actionareas/ev/stanford_advancingevmarket.pdf
[2] Department of Energy (2010) plans $5 billion for transportation electrification http://www.whitehouse.gov/files/documents/Battery-and-Electric-Vehicle-Report-FINAL.pdf
[3] Stewart et al., 2010. & Lidicker, Jeffrey, Timothy E. Lipman, Susan A. Shaheen. 2010. http://pubs.its.ucdavis.edu/publication_detail.php?id=1379

to expect significant saving in the near future.[4]

Initial vehicle costs of EVs are becoming comparable to those of ICEVs. The Nissan Leaf, for example, will cost $25,280 after federal tax breaks have been applied, with fleet bulk purchases likely to be even better.[5] This and other similar models will offer a good match for passenger-car fleets with centralized infrastructure and frequent short and medium range routes. California consumers, including government and non-profit agencies, have access to additional rebates towards the purchase of new electric vehicles.

Lifecycle savings on EVs are primarily attributable to the cost of fueling the vehicle. Assuming current gas prices, $3.00 per gallon, and most recent CAFE (Corporate Average Fuel Economy) standards, passenger cars and light trucks will cost between 11 and 13 cents per mile to operate, whereas a similar model EV typically cost 2.5 to 4 cents per mile.[6] Per mile fueling costs have been projected as low as 1.5 cents per mile for EV fleets with off-peak charging utilizing wholesale electrical rates and fuel cells.[7] Given current oil production and demand projections and the petroleum volatility of 2007, it is reasonable to expect that gas prices will rise, possibly soon and dramatically, driving up these cost savings. Annual savings for fleet owners can be upwards of $1,800 per vehicle at $4.54 per gallon[8] and more as prices climb.

EVs require substantially less maintenance than ICEVs, contributing to further savings and considerably extended vehicle life. Relative to ICEVs, EVs are mechanically simple; they have 70% fewer parts, including dramatically fewer moving parts. Annual maintenance costs for EVs are estimated to be around 50% that of ICEV maintenance costs, a savings upwards of $350 per vehicle per year. For fleets with onsite repairs, savings can also be assumed for training, diagnostics and tool costs. [9] Hybrids also experience lower maintenance costs but to a lesser degree.

Current federal and state incentives available to purchasers make EVs even more attractive. Incentives are significant and include, but are not limited to, tax credits, rebates, and grant opportunities. A tax credit of $2,500 to $7,500 per vehicle is available to non-government consumers. Businesses may also earn up to $50,000 for installing fleet charging stations.[10] Public and private fleets can earn up to $5,000 in state rebates for light duty vehicles and up to $20,000 in rebates for zero emission vehicles.[11] Additionally, grants and low interest loans

[4] Department of Energy (2010) projections of gas prices and battery costs over time http://www.whitehouse.gov/files/documents/Battery-and-Electric-Vehicle-Report-FINAL.pdf
[5] ARI, 2009. http://www.automotive-fleet.com/Statistics/StatsViewer.aspx?file=http%3a%2f%2fwww.automotive-fleet.com%2ffc_resources%2fstats%2fAFFB10-09-fleetstats.pdf
[6] Stewart et al., 2010.
[7] http://baclimate.org/images/stories/Events/2010/07-evworkshop/sonoma.pdf
[8] Becker et al., 2009. http://cet.berkeley.edu/dl/CET_Technical%20Brief_EconomicModel2030_f.pdf; ARI, 2009. http://www.automotivefleet.com/Statistics/StatsViewer.aspx?file=http%3a%2f%2fwww.automotive-fleet.com%2ffc_resources%2fstats%2fAFFB10-36-opcost.pdf
[9] Stewart et al., 2010.
[10] ARRA, 2010. http://www.recovery.gov/News/featured/Pages/TaxCredits.aspx
[11] CA EPA ARB, 2010. http://www.arb.ca.gov/msprog/zevprog/zevprog.htm

are available to parties interested in advancing their alternative-fueling infrastructure.[12]

With all factors considered, EVs offer an effective strategy for reducing an agency or company's bottom line costs. Reports indicate savings for EVs relative to ICEVs of more than $4,500 over an initial five-year period per vehicle. Even with battery replacement and 100,000-120,000 mile use of the vehicle, one can expect savings up to $7,200.. Again, these savings mount as gas prices rise, demand increases, and infrastructure improves. Emerging technological advances, such as battery life improvement and smart charging, will further boost these savings.[13]

Security, Economic and Environmental Benefits of EVs

EVs provide dramatic additional benefits:

- Reduced dangerous reliance on foreign oil, and associated security risks[14]
- Investment and job creation for the US
- Reduction of over 10,000 lbs of CO_2 emissions per vehicle per year[15]

Our nation relies very heavily on foreign oil, importing more than $312 million in oil per day, much of it from unstable and hostile regions of the world. This practice has concurrent military costs and loss of potential domestic investment.[16] As global demand increases and geologically easily extracted oil diminishes extreme price volatility and sharp price increases are likely. This is projected by some in the petroleum industry to arrive imminently.[17] EV use will play a critical role in reducing this foreign oil dependency, related fuel and military costs, and supply concern given the size of fleets in the automobile market.[18] And should the US light duty fleet be largely powered by electricity rather than by petroleum, up to 1.9 million related jobs could be created in the US by 2030.[19]

Finally, transportation accounts for a major source of greenhouse gases, approximately 38%, and other major pollutants in California.[20] EVs are a key solution as the net emissions, including centralized electric power generation, are lower, especially in California. The vehicles can play an instrumental part of the climate action plans being put into action by many local governments. Fleet companies are rapidly following suit. In the last two years, the percentage of companies tracking greenhouse gas emissions jumped from 28% to 49%.[21]

Reputation Enhancement

[12] Breen, D. 2010. http://baclimate.org/images/stories/Events/2010/07-evworkshop/baaqmd.pdf
[13] Becker et al., 2009. http://cet.berkeley.edu/dl/CET_Technical%20Brief_EconomicModel2030_f.pdf; Draper et al., 2008. http://cet.berkeley.edu/dl/EV3Econ_Final.pdf.
[14] CFR Task Force. 2006. www.cfr.org/content/publications/attachments/EnergyTFR.pdf
[15] Coda's Electric Vehicle Cost Calculator, 2010. http://www.codaautomotive.com/savings_calculator.html
[16] Draper et al, 2008. http://cet.berkeley.edu/dl/EV3Econ_Final.pdf. & CFR Task Force, 2006.
[17] Kuwait Oil Company, 2010 http://pubs.acs.org/doi/abs/10.1021/ef901240p and Zittel et al., 2010. http://www.energywatchgroup.org/fileadmin/global/pdf/EWG_Oilreport_10-2007.pdf
[18] US EIA 2010. http://tonto.eia.doe.gov/oog/info/gdu/gasdiesel.asp
[19] Electrification Coalition, 2010. http://www.electrificationcoalition.org/media/EC_ImpactReport.pdf
[20] CA EPA ARB. 2000-2008. http://www.arb.ca.gov/cc/inventory/data/graph/graph.htm Inventory http://www.arb.ca.gov/cc/inventory/data/graph/graph.htm
[21] PHH ARVAL, 2010. http://www.phharval.com/home/news-and-media/press-releases/784-phh-arval-announces-results-of-2010-green-survey-

EVs create unique leadership and reputational opportunities:

- Public support of ethical and responsible leadership
- "Green" branding opportunity supported by high community visibility
- Consumer respect: 70% of consumers are "paying attention to what companies are doing with regard to the environment"[22]

In spite of the recession and record low consumer confidence, surveys indicate a growing consumer interest in environmentally responsible products and business practices as well. Studies suggest high consumer demand for environmentally responsible business practices and that these practices dictate consumer choices. A major University of Sydney and University of Iowa study of businesses social and financial performance found that environmentally responsible business practices, in particular, pay off.[23]

Electric vehicles, as a result of their continuous significant public visibility on roadways, especially when visually distinguished, provide unusually high visibility opportunities. Because of growing consumer interest, financial pay-off, and public support for EV adoption, governments and businesses have a significant opportunity in demonstrable leadership and marketing.[24]

Common Questions

Will the EV range meet the needs of my fleet?

Most EVs are operable from 100 or more miles between charges, with some variance depending on temperatures and driving patterns.[25] Commercial and public agency fleet vehicles average 72 miles daily, making these EVs more than sufficient.[26] For fleet vehicles with greater needs, alternatives include Bay Area fast charging stations and available models with improved range.[27]

How will I charge my fleet vehicles?

Overnight charging is more than ample for the needs of the typical fleet vehicle. Chargers and/or battery-swap installations are required to "fuel" vehicles. Charger options include Level I (110 volts, 10 hour charge for typical all-electric) and Level II (240 volts, 2-4 hour charge for typical all-electric) charging infrastructure on site. A small percentage of fleets will need 24-hour vehicle access and may not have the opportunity to charge overnight. In these cases, DC quick charge (480 volts, 10-20 minute charge) stations will be increasingly available in the Bay Area's near future and rapid battery replacement options are under development. Again, businesses may earn up to $50,000 for charging infrastructure through

[22] Cone, 2009. http://www.coneinc.com/content2032
[23] Orlitzky et al., 2003.
[24] Stewart et al., 2010.
[25] US DOE, 2010. http://www.fueleconomy.gov/feg/evtech.shtml
[26] ARI, 2009. http://www.automotivefleet.com/Statistics/StatsViewer.aspx?file=http%3a%2f%2fwww.automotive-fleet.com%2ffc_resources%2fstats%2fAFFB10-36-opcost.pdf
[27] Solren Press Release, 2010. http://www.automotivefleet.com/Statistics/StatsViewer.aspx?file=http%3a%2f%2fwww.automotive-fleet.com%2ffc_resources%2fstats%2fAFFB10-36-opcost.pdf; Dinger et al., 2010

federal assistance.[28]

Do cost savings factor in battery life and costs?

While current batteries have a ten-year life and a significant replacement cost, patrons can still expect savings upwards of $5,600 over the lifetime of each EV. Of further interest to fleet owners is the projected 65% decrease in battery pack prices over the next ten years; prices are likely to drop to less than $6,000 over the next ten years.[29] Also, consumer concerns related to battery prices have prompted potential money saving solutions: smaller less expensive packs with a six to seven year lifespan, battery warranty programs (such as the 100,000 Chevy Volt and Nissan Leaf warranties), and battery leasing options. Finally, field experts anticipate innovative battery uses, such as vehicle-to-grid and after market battery storage options, further diminish battery costs in the future. [30]

Does EV Depreciation affect the cost savings?

With depreciation figured into the equation, 100,000 mile-mark savings of EV versus ICEVs are expected to be between $5,600 and $7,203. Market improvement and increased demand is projected for the near future and will likely improve these savings.[31] Moreover, advances in technology may offer after-market uses for EV batteries further lessening depreciation rates. Finally, gas price volatility and increases will likely result in gas powered vehicles experiencing further significant depreciation.

Will the grid meet the demand of increasing numbers of EVs?

Overall power demand from EVs is expected to be modest. 1 million EVs added to California roads would increase the annual electricity demand by about 1.8%, which is the average annual increase without EVs considered.[32] 50% national market penetration of PHEVs would represent only ~6% of the total national electricity demand.[33] of use rates and charge time management aims to ensure the majority of EVs will charge at night, during off-peak hours to avert the need for increased generation during peak demand. A more significant issue surrounds neighborhood level infrastructure. Multiple EVs in the same neighborhood can strain neighborhood transformers. It is important to notify the relevant utility of plans to deploy multiple vehicles. Fleet managers should work closely with utilities to ensure utility infrastructure needs are addressed. Many utility companies such as PG&E in the SF Bay Area are actively working to ensure readiness. [34]

---

[28] ARRA, 2010. http://www.recovery.gov/News/featured/Pages/TaxCredits.aspx

[29] Dinger et al., 2010. http://www.bcg.com/documents/file36615.pdf, & PRTM, 2010 http://www.ifri.org/downloads/comptes_rendu/fichiers/34/derriennick29april.pdf

[30] Jia, 2009. http://www.nytimes.com/cwire/2009/07/22/22climatewire-vehicle-to-grid-technology-gains-some-tracti-50378.html

[31] Becker et al., 2009. http://cet.berkeley.edu/dl/CET_Technical%20Brief_EconomicModel2030_f.pdf; Draper et al., 2008. http://cet.berkeley.edu/dl/EV3Econ_Final.pdf.

[32] McCarthy, R. 2009. http://pubs.its.ucdavis.edu/publication_detail.php?id=1361

[33] Yonza, R., 2010. http://phev.ucdavis.edu/plug-in-2010-conference-expo/break-out-and-plenary-sessions/presentations/4/R.%20Yonza.pdf; Maitra, A., 2010. http://phev.ucdavis.edu/plug-in-2010-conference-expo/break-out-and-plenary-sessions/presentations/3/A.%20Maitra.pdf; & Lemoine et al., 2006. http://vtcite.info/%7Etransctr/pdf/pdf/Lemoine%20Article.pdf

[34] ECCCM, 2010.

Conclusion

In sum, the direct and indirect benefits of companies and agencies bringing EVs into their fleets are substantial. Fleet EV owners will see meaningful savings over the lifetime of their vehicles, particularly as gas prices rise. Additionally, EV owners will see enhanced community exposure and reputation as they lead the way to reduce the economic, social and environmental consequences of petroleum.

About the Bay Area Climate Collaborative

The Bay Area Climate Collaborative is a public-private initiative launched by the mayors of San Francisco, San Jose and Oakland to create common direction and accelerate the clean energy economy in the Bay Area. The Climate Collaborative is helping make the clean energy economy real so the Bay Area can serve as a model for the country. The electric vehicle work of the initiative is chaired by Bob Hayden, Clean Transportation Advisor for the City of San Francisco, and John Boesel, CEO of CALSTART.

For further detail and contact information please visit www.baclimate.org. Better Place (www.betterplace.com) and Coulomb Technologies (www.coulombtech.com) are BACC partners.

Works Cited

ARI (Automotive Resources International). 2010. Fleet Statistics. Retrieved from http://www.ariresources.com/FleetStats/ July 2, 2010.

ARI (Automotive Resources International). 2009. *Statistics on Car Operating Costs: 2009 Commercial Fleet Car Operating Costs per Region*. http://www.automotivefleet.com/Statistics/StatsViewer.aspx?file=http%3a%2f%2fwww.automotive-fleet.com%2ffc_resources%2fstats%2fAFFB10-36-opcost.pdf July 7, 2010

ARRA (American Recovery and Reinvestment Act). 2010. *Energy Tax Credits Extended.* Retrieved from http://www.recovery.gov/News/featured/Pages/TaxCredits.aspx July 8, 2010

Becker, Thomas A., and Ikhlaq Sidhu. (2009). *Electric Vehicles in the United States: A New Model with Forecasts to 2030.* University of California at Berkeley: Center for Entrepreneurship & Technology (CET). http://cet.berkeley.edu/dl/CET_Technical%20Brief_EconomicModel2030_f.pdf

Breen, D. (2010). Bay Area Climate Collaborative II. 2010 (Bay Area Climate Collaborative): New Opportunities in Clean Transportation: Electric Vehicle Workshop for Leaders. *Grants for EVs.* Retrieved from http://baclimate.org/images/stories/Events/2010/07-evworkshop/baaqmd.pdf on July 30, 2010.

California Environmental Protection Agency Air Resources Board (CA EPA ARB). 2000-2008 Inventory. *2008 GHG Emissions by Sector*. Retrieved from http://www.arb.ca.gov/cc/inventory/data/graph/graph.htm July 13, 2010.

Cal-Cars Press Release. 2008. *SF Bay Area Aims to Become U.S. Electric Car Capital; Coulomb, Better Place News.* Retrieved from http://www.calcars.org/calcars-news/1030.html June 20, 2010.

CEC (California Energy Commission). 2010. *Energy Almanac; California Major Sources of Energy*. Retrieved from http://energyalmanac.ca.gov/overview/energy_sources.html July 7, 2010

Coda's Electric Vehicle Cost Calculator. 2010. Retrieved from http://www.codaautomotive.com/savings_calculator.html July 13, 2010.

Cone Press Release. 2009. Consumer Environmental Survey. *Consumer interest in environmental purchasing not eclipsed by poor economy.* Retrieved from http://www.coneinc.com/content2032 July 2, 2010.

Dinger, A., Martin, R., Mosquet, X., Rabl, M., Rizoulis, D., Russo, M., and Sticher, G. (2010). *Batteries for Electric Cars: Challenges, Opportunities, and the Outlook for 2020.* The Boston Consulting Group. http://www.bcg.com/documents/file36615.pdf

DOE (Department of Energy). 2010. The Recovery Act: Transforming America's Transport Sector Batteries and Electric Vehicles. Retrieved from http://www.whitehouse.gov/files/documents/Battery-and-Electric-Vehicle-Report-FINAL.pdf on July 28, 2010

Draper, Matt, and Ernesto Rodriguez et al. (2008). *Impact of Electric Vehicle Adoption in the United States*. University of California at Berkeley: Global Venture Lab, Center for Entrepreneurship & Technology. http://cet.berkeley.edu/dl/EV3Econ_Final.pdf.

Electrification Coalition. 2010. *Economic Impact of the Electrification Roadmap.* Retrieved from http://www.electrificationcoalition.org/media/EC_ImpactReport.pdf July 13, 2010.

ECCCM. (Energy and Climate Change Committee Meeting). 2010. Bay Area Council.
Head, D. (2010). Bay Area Climate Collaborative I. 2010 (Bay Area Climate Collaborative): New Opportunities in Clean Transportation: Electric Vehicle Workshop for Leaders. *County of Sonoma: electric Vehicle Program*. Retrieved from http://baclimate.org/images/stories/Events/2010/07-evworkshop/sonoma.pdf on July 30, 2010.
Howell, D. 2009. *"Energy Storage R&D Overview,"* Department of Energy Office of Vehicle Technologies, May 19, 2009.
Garthwaite, J., (2010). *Depreciation: Looming Roadblock for Electric Cars.* Retrieved http://earth2tech.com/2010/06/25/depreciation-looming-roadblock-for-electric-cars/ June 29, 2010.
Jia, A. (2009). *Vehicle to Grid Technology Gains Some Traction. The New York Times: Energy and Environment*. Retrieved from http://www.nytimes.com/cwire/2009/07/22/22climatewire-vehicle-to-grid-technology-gains-some-tracti-50378.html July 12, 2010.
Lemoine, D., Kammen, D, & Farrell A. 2006. **Effects of Plug-In Hybrid Electric Vehicles in California Energy Markets.** UC Berkeley. Retrieved from http://vtcite.info/%7Etransctr/pdf/pdf/Lemoine%20Article.pdf on August 2, 2010.
Lidicker, Lipman, and Shaheen. 2010. *Economic Assessment of Electric Drive Vehicle Operation in California and the Unietd States*. Transportation Research Record. Retrieved from http://76.12.4.249/artman2/uploads/1/TRB10-3667_Final_for_Pub.pdf June 20, 2010.
Maitra, A. 2010. *Plug-in Electric Vehicle Distribution System Impacts.* Electric Power Research Institute. Plug-in 2010 Conference. Retrieved from http://phev.ucdavis.edu/plug-in-2010-conference-expo/break-out-and-plenary-sessions/presentations/3/A.%20Maitra.pdf on August 4, 2010.
McCarthy, R. 2009. Assessing Vehicle Electricity Demand Impacts on California Electricity Supply. University of Caliornia at Davis. Research Report UCD-ITS-RR-09-44. Retrieved from http://pubs.its.ucdavis.edu/publication_detail.php?id=1361 on Aug 4, 2010.
Nashawi, I.S., Malallah, A., & Al-Bisharah, M. 2010. *Forecasting World Crude Oil Production Using Multi-cyclic Hubbert Model*. Energy Fuels, 2010, 24 (3), pp 1788–1800. American Chemical Society. Retrieved from http://pubs.acs.org/doi/abs/10.1021/ef901240p on July 20, 2010.
NRDC (Natural Resources Defense Council). 2010. *Safe, strong and secure: Reducing america's oil dependence: America's rising consumption of oil threatens the economy and national security.* Retrieved from http://www.nrdc.org/air/transportation/aoilpolicy2.asp June 30, 2010.
Orlitzky, M., Schmidt, F., & Rynes, S., 2003. *Corporate Social and Financial Performance: A Meta-analysis.* Organization Studies. 24(3). 403-441; Sage Publications. http://www.freewebs.com/marcorlitzky/Papers/Orlitzky2008OUPHbofCSRChapter%205.pdf
PRTM. 2010. *Paving the Way for Electric Vehicles: A Trajectory for a 50% Cost Reduction by 2020.* Presentation at Bruxelle's EV Plug and Play. Retrieved from http://www.ifri.org/downloads/comptes_rendu/fichiers/34/derriennick29april.pdf on July 28, 2010.

RITA (Research and Innovation Technology Administration: Bureau of Transportation Statistics). 2010. *Table 4.2; Number of aircraft, railcars, vehicles, and vessels from 1990-2007.* Retrieved from http://www.bts.gov/publications/pocket_guide_to_transportation/2010/html/table_04_02.html June 26, 2010.

Solar City Press Release. 2010. *SolarCity and Rabobank Announce Corridor of Solar Electric Vehicle Charging Station*s. Retrieved from http://www.solarcity.com/pressreleases/44/SolarCity-and-Rabobank-Announce-Corridor-of-Solar-Powered-Electric-Vehicle-Charging-Stations.aspx July 2, 2010.

Solren Press Release. 2010. *Solectria Renewables Appoints President to Spearhead Aggressive Growth Plans.* March Communications. Retrieved from http://www.automotivefleet.com/Statistics/StatsViewer.aspx?file=http%3a%2f%2fwww.automotive-fleet.com%2ffc_resources%2fstats%2fAFFB10-36-opcost.pdf June 30, 2010.

Stewart, A., Carlisle, A., Brendel, J. (2010). *Advancing the use of electric vehicles in silicon valley: Policy options for city governments. Stanford University.* Public policy practicum prepared for Joint Venture: Silicon Valley Network http://baclimate.org/images/stories/actionareas/ev/stanford_advancingevmarket.pdf

US EIA (United States Energy Information Administration). 2010. *Gasoline and diesel fuel update.* Retrieved from http://tonto.eia.doe.gov/oog/info/gdu/gasdiesel.asp June 25, 2010.

US EPA (United States Environmental Protection Agency). *Transportation and Climate.* Retrieved from http://www.epa.gov/otaq/climate/ July 12, 2010.

US DOE (United States Department of Energy). 2010. *Electric Vehicles*: Retrieved from http://www.fueleconomy.gov/feg/evtech.shtml July 7, 2010.

US DOT FHA (United States Department of Transportation: Federal Highway Administration). 2007. *Highway Statistics 2007: State Motor Vehicle Registrations.* Retrieved from http://www.fhwa.dot.gov/policyinformation/statistics/2007/mv1.cfm on July 20, 2010.

Yonza, R. 2010. Forecasting *Plug-in Electric Vehicle Grid Energy and Capacity.* CEATI International. Plug-in 2010 Conference. Retrieved from http://phev.ucdavis.edu/plug-in-2010-conference-expo/break-out-and-plenary-sessions/presentations/4/R.%20Yonza.pdf on Aug 4, 2010.

Zittel, W., Schindler, J., 2007. Crude oil: *The supply outlook. Energy Watch Group*. Retrieved from http://www.energywatchgroup.org/fileadmin/global/pdf/EWG_Oilreport_10-2007.pdf June 20, 2010.