



A Word from the Publisher

## Introduction to AFV Insider

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Welcome to the AFV Insider! This exciting new service aims to be just as dynamic, innovative and exciting as the developing market and industry it covers. All across the world, entrepreneurs, inventors, start-up and old-line automakers, trade unions, government regulators, legislators, venture capitalists and millions of consumers are creating the brave new world of alternative fuel vehicles. Whole new industries will be needed to manufacture and service a range of new AFVs. Consumers will face a greatly expanded set of alternatives that can be tailored to their individual life-style and budget. The promise of a technological, commercial and ecological revolution is in the air.

The AFV Insider offers three main features:

- The AFV Insider **blog** launched in July 2011 (<http://afvinsider.com/blog>). We post items of various lengths and invite comments on them. We also regularly add links to news items related to AFVs. Anyone may register at no cost to read and comment on the blog.

- The AFV Insider **Website**, the world's most ambitious on the subject, is reserved for AFV Insider premium subscribers. In it you will find: a wealth of information relating to the production, distribution, servicing and regulation of new fangled vehicles in the United States, China, Western Europe and elsewhere; data on taxis, municipal fleets, buses, trucks, and personal vehicles; profiles of the leading companies, especially in China, which are emerging as players in the production of vehicles and parts; a comprehensive glossary of terms relating to AFVs and their equivalent in Mandarin Chinese; a Calendar of Events; and more. We aim to make the Website as comprehensive and up to date as humanly possible.

- The AFV Insider, a **quarterly publication** for regular and premium subscribers. We intend to help all our readers play their part in the AFV revolution no matter their location or areas of interest. Our multilingual staff pays special attention to developments in China, sorting out

conflicting data and linguistic uncertainties to produce what we believe is a unique resource in any language. AFV Insider will not, however, ignore the rest of the world. The world vehicle industry has roots all around the globe, and we will do our best to gather and organize data from every major region.

This inaugural issue of the AFV Insider includes features not easily found elsewhere:

- A concise summary of recent market, policy and technology developments around the world relating to AFVs.
- Two special reports: one on China's strategy for building fleets of AFVs; the other on Better Place's program to establish battery swapping systems for electric vehicles in Israel, Denmark and the United States.
- In our Perspectives section, a summary of the views of Professor C. C. Chan, considered the father of China's AFV industry, and a critique of a recent study by Boston Consulting Group.
- Profiles of the Chevrolet Volt and the Nissan Leaf.

In coming issues, we plan to introduce new features, including interviews with and commentary from a wide range of experts and industry leaders. We welcome your letters and will gladly consider opinion pieces for publication.

In every aspect, the AFV Insider is your tool. With your help, we will continuously expand, refine and update it. Whenever you inform us of any information, documentation or analysis that is needed for a fuller understanding of the global AFV market, we will do our utmost to locate and post it.

So, throughout the period of your subscription, please check the Website and the blog regularly. We will not be waiting for the next quarterly publication to post important news, statistics, documents and analysis. You need all those things in real time, and we'll do our best to provide them.

Welcome aboard for an exciting ride!

# Quarterly Developments

## NORTH AMERICA

## I. Market

<b>Fisker Delays EV Production in US</b>	Fisker has delayed US production of its all-electric Nina sedan until 2013. The Nina is to be produced at its plant in Delaware, which Fisker estimates will create 2,500 jobs. Fisker's Finnish-produced luxury Karma EV, which has a sticker price of \$96,000, is currently available on the U.S. market, after a two-year delay and issues meeting expected efficiency standards. In contrast to the Karma, the Nina is designed to be an affordable family car. Fisker is backed by a \$500 million Department of Energy loan guarantee, which stipulated that Fisker would produce and sell a minimum of 11,000 cars by the end of September.
<b>Fisker Unveils Atlantic Luxury Hybrid Sedan</b>	Fisker unveiled its Atlantic luxury plug-in hybrid sedan at the 2012 New York Auto Show, which was hosted by the Greater New York Auto Dealers Association (GNYADA) and the International Motor Press Association (IMPA).
<b>Fisker Announces Partnership with Dilwari in Canada</b>	On February 2, Fisker announced a partnership with leading Canadian auto dealer Dilwari Group to sell the Karma in Toronto, Calgary, and Vancouver.
<b>Tesla Unveils 2014 Model X Crossover</b>	On February 9, Tesla unveiled its 2014 Model X Crossover 7-seat all-electric SUV during a press conference in Los Angeles. Tesla claims the traffic flow on its website increased by 2,800% after the announcement, with two-thirds of the visitors new to the website. The Model X features a dual motor all-wheel drive and 60 or 85 kWh battery. The vehicle takes 4.4 seconds to accelerate from 0 to 60 mph. It will be produced in Fremont, CA at the end of 2013 and delivered in early 2014. Target production is 10,000 to 15,000 units per year. Following the Model X unveiling, reservations for the 2012 Model S increased by 30%. However, Nissan's experience shows that only 40% of reservations may actually result in sales. The Model X is slated for production at the end of 2013 and will cost \$80,000 - 100,000. Tesla netted \$40 million in 500 advance sales of the Model X within 24 hours of the announcement.
<b>Toyota &amp; BMW Cooperate on Batteries</b>	In December, Toyota and Ford formed a partnership to develop next-generation batteries and explore other green automotive technologies. Additionally, BMW will provide diesel engines to Toyota. The two companies have cooperated before: Toyota supplied the diesel engine for BMW's Mini. BMW also has a partnership with Peugeot Citroën to develop hybrid technology.
<b>Toyota &amp; Ford Cooperate on Hybrids</b>	In August, Toyota and Ford signed a memorandum of understanding to jointly develop a gas-electric hybrid system for the light-truck and sport-utility vehicles market.
<b>Toyota Prius Outsell Volt</b>	Toyota's Prius V outsold GM's Volt in the U.S. in 2011. Although the Prius V was only introduced to the U.S. market in October, 8,399 units were sold, versus 7,671 Volts, which were introduced in December 2010. January 2012 sales of all Prius models totaled 11,555 vehicles, versus 603 Volts. The Prius V costs \$12,000 less than the Volt. Toyota introduced the Prius V hybrid compact MPV/station wagon to the Japanese market in May 2011. The vehicle runs on a 1.8 liter Atkinson cycle gasoline engine and a nickel-metal hydride battery pack with a 12-15 mile range. The U.S. price starts at \$26,400. The Volt runs on a 1.4 liter 4 cylinder engine and a lithium-ion battery pack with a 35-mile range.
<b>GM Partners with LG for Future of EVs</b>	General Motors (GM) has signed an agreement with LG Chem to jointly develop several components for its next generation of electric cars. LG Chem supplies GM with the lithium-ion batteries used in the Chevrolet Volt. The batteries are manufactured at LG Chem's plant in Holland, Michigan, which was half-funded by a \$151 million DOE stimulus grant.
<b>GM Announces First EV</b>	In October, GM announced plans to release in 2013 its first all-electric vehicle since the EV-1: the Chevrolet Spark minicar. The Spark's battery will be supplied by A123.

### **Chrysler Pulls Request for DOE Loan**

On February 16, 2012, Chrysler announced it would develop hybrid and electric vehicles without a DOE loan. Chrysler initially requested a more than \$7 billion loan from the DOE's ATVM program in 2008. It subsequently reduced the request to less than \$3.5 billion. Similarly, GM withdrew its application for a \$14.4 billion DOE loan in January 2011 after raising \$23.1 billion from an IPO in late 2010. The 2009 bankruptcies of GM and Chrysler were a major factor in the loan requests.

In June 2009 Chrysler reorganized, becoming Chrysler Group LLC in an alliance with Italian automaker Fiat, which now owns 58.5% of Chrysler. Last year Chrysler repaid its debt to the U.S. and Canadian governments and turned its first profit since declaring bankruptcy.

Other auto manufacturers that have applied and received a loan from the ATVM program include Fisker, Ford, Nissan, Tesla and the Vehicle Production Group.

### **Odyne Delivers 7 Trucks to Wisconsin Clean Energy Transportation Program**

On January 31, Wisconsin-based plug-in hybrid truck manufacturer Odyne delivered 7 trucks to the Wisconsin Clean Transportation Program (WCTP), which was jointly created by the Wisconsin State Energy Office and Wisconsin Clean Cities. Four trucks were delivered to Milwaukee County for use in maintaining traffic signals and street signals. These trucks were built on a Kenworth chassis. Marshfield Utilities and the Richland Center and Lake Mills units of Wisconsin Public Power each received a vehicle for grid maintenance and construction. A Navistar chassis was used for these trucks. All 7 trucks feature a fiberglass body. Odyne's plug-in hybrid system was designed for medium and heavy-duty truck applications. The company has developed 14kW and 28kW systems that can be used in bucket trucks, compressors, digger derricks, dump trucks, mobile cranes, mobile shredders, refrigeration trucks, refuse trucks, septic trucks, and tanker trucks.

The WCTP's goal is to reduce Wisconsin's oil dependence through collaboration among 31 public and private fleets in the state. Odyne's hybrid trucks are 50% more fuel efficient than conventional trucks.

### **Smith Electric and Wanxiang Group announce joint venture in China**

On February 17, Kansas City (Missouri) based Smith Electric announced that Chinese auto manufacturer Wanxiang Group was investing \$25 million in Smith Electric and up to \$75 million in a joint venture between Smith and Wanxiang to make electric school buses and commercial vehicles in China. Smith filed for an initial public offering (IPO) of \$125 million in November 2011, but has not gone public yet. The company is raising \$40 million from private investors. It has also secured \$32 million in grants from DOE stimulus funds to build electric trucks with on-board telemetry systems.

Smith has produced electric trucks for leading companies, such as Coca-Cola and FedEx. Frito-Lay uses 176 trucks made by Smith and plans to purchase 100 more. Its current battery suppliers are Valence and A123. It offers two electric trucks models: the Newton (GVW 16,500-26,400lb) and the Edison (GVW 7,700-120,300lb). The Newton was unveiled at the Indianapolis NTEA Work Truck Show. FedEx will be the first company to deploy this model in the U.S. this year. Smith sold 320 vehicles from January through September 2011. In its IPO filing documents, Smith stated it had a backlog of 120 vehicles and had pre-sold 540 vehicles that will be produced through July 2012, and 2,220 vehicles that are slated for production between 2012 and 2015. Smith currently serves the U.S., European and now Chinese markets.

Established in 1969 in China, Wanxiang Group is one of the largest non-government-owned companies in China, the country's largest automotive components manufacturer, and a conglomerate with more than \$12 billion in revenue. Its business operations include financial services, renewable energy, agricultural products, international trading, natural resources, real estate, private equity and venture capital investment, among other activities. Wanxiang Group is involved with 19 companies in 8 countries; its sales and marketing network covers over 50 countries. The Boston Consulting Group has listed Wanxiang Group as one of the 100 most challenging and successful companies in China.

### ***Xtreme Green Secures EV Sales Agreement with Mexico City***

On September 1st, Las Vegas-based EV manufacturer Xtreme Green Products signed a 16-month agreement with Mexico City company AB Safe SA De CV to distribute Xtreme Green's products in Mexico. It is Xtreme Green's first international distribution agreement. AB Safe will distribute Xtreme Green electric vehicles, scooters, motorcycles and utility trucks to individuals, companies and government agencies in 29 states and the Federal District in Mexico (all states except for Yucatán and Jalisco). Xtreme Green's all-electric vehicle models are: the 80-mile range Xtreme Green Sentinel three-wheeled police mobility vehicle (PMV) designed to replace bicycle and foot patrol; the 100-mile range X Rider Electric Police Motorcycle (EPM), which is currently selling for \$7,999; the 75-mile range Police Pro All Terrain Vehicles (ATV); the 75-mile range Xtreme Green Sentinel four-wheel PMV, with a price of \$12,900; the 75-mile range 2-person Transport Pro Utility Terrain Vehicle (UTV), priced at \$13,784; the 75-mile range 4-passenger Transport Pro Extended UTV; and the 75-mile range scooter (\$8,000). Xtreme Green uses lithium iron phosphate battery cells. Xtreme Green's vehicles are produced in Las Vegas. The agreement with AB Safe covers 16% of its projected 2012 production capacity, or 192 units. Total projected capacity is 1,200 units. AB Safe has a 30-plus year history of distributing security products to government entities and consumer and commercial markets in Mexico.

In September Xtreme Green also signed a distribution agreement with Puerto Rico-based distributor ISP for 120 units. It plans to expand to Europe, Australia, South America and the Middle East this year and next. The US is currently Xtreme's primary market. Its Green X Rider motorcycle qualifies for a federal \$2,500 EV tax credit.

### ***Studebaker plans a green comeback***

On February 11, 2012, Studebaker Motor Company announced it is in the planning stages of a comeback as a primarily green vehicle producer. Studebaker started producing electric vehicles in South Bend (Indiana) in 1902 and shortly thereafter adopted gasoline technology. The company ceased producing vehicles in 1966, but has retained a loyal following of Studebaker drivers. CEO R.W. Reed revived the corporation in 2009, when he opened an office in Colorado. In the first phase of Studebaker's comeback, Reed plans to introduce a range of conventional and electric scooters. Next, he plans to re-introduce the Lark as a compact four-door sedan powered by a diesel-hybrid or fully electric powertrain. The vehicles would be manufactured in Detroit or South Bend. The third step would be to launch full-scale production of the Lark with an annual sales target of 20,000 units.

### ***Bright files for bankruptcy***

On February 28, Indiana-based EV manufacturer Bright Automotive filed for bankruptcy, blaming its failure on the inability to secure a federal government grant. Bright had been waiting for the approval of a \$450 million ATVM loan for three years. Bright's IDEA vehicle had a 100 MPG range and 13kWh lithium-ion battery. GM had invested \$5 million in Bright.

### ***Ener1 files for bankruptcy***

Indianapolis-based lithium-battery and fuel cell producer Ener1 filed for bankruptcy on January 26 and received approval to borrow \$13.5 million for reorganization. Ener1 was a principal investor in Norwegian EV manufacturer Think, which had received a \$118.5 million grant from the DOE in 2009, and then filed for bankruptcy in June 2011. In 2009 Ener1 invested \$18 million for a 31% stake in Think. Think's bankruptcy generated a \$165 million loss for Ener1 in 2010. Ener1 served the transportation, utility, and industrial markets.

### ***LG Chem and Johnson Controls top Pike Research EV battery ranking***

In February Pike Research released a ranking of lithium-ion battery producers that placed LG Chem and Johnson Controls in the lead. LG Chem was ranked first for its diversified customer base of international and successful automotive OEMs. The company is expected to grab the largest market share for EV batteries in 2012. Johnson Controls was ranked second based on its battery sales to both hybrid and plug-in hybrid EV automakers across North America, Europe, and Asia Pacific. The report evaluates 10 electric and hybrid vehicle battery manufacturing leaders using the following 10 criteria: vision, go-to-market strategy, partners, product strategy, roadmap, geographic reach, market share, sales and marketing, product quality, reliability, product portfolio and staying power. The lithium-ion battery applications considered are PHEVs, BEVs, HEVs, and SSVs.

# Quarterly Developments

## NORTH AMERICA

## II. Policy

### **President Obama's 2013 budget shifts support from fossil fuels to alternatives**

On February 13, President Obama sent Congress a budget request for the October 2012-September 2013 period including measures to support renewable energy and energy efficiency. The budget proposal eliminates \$4 billion per year in fossil fuel subsidies. It also allocates the DOE a 3% budget increase from 2012 levels, totaling \$27.2 billion.

### **Administration proposes EV tax credit expansion**

On February 16, President Obama proposed to expand the tax credit for electric vehicle purchases from \$7,500 per vehicle to \$10,000 through 2016. The Administration has set a goal of having one million EVs on the road by 2015. Four vehicles currently qualify for the EV tax credit: Chevy Volt, Nissan Leaf, Tesla Roadster, and Tesla Model S. Under Obama's proposal, the tax credit would drop to \$7,500 in 2017, \$5,000 in 2018, and \$2,500 in 2019. President Obama has vowed to purchase a Volt after he leaves office.

### **DOE issues \$120M grant opportunity for batteries and energy storage**

On February 1, the DOE issued a \$120 million grant opportunity (DE-FOA-0000559) under the rubric Energy Innovation Hub – Batteries and Energy Storage. The goal is to address the limitations of current electric energy storage options: limited energy and power density, low charge and discharge rates, limited lifecycles, low abuse tolerance, high cost, and poor performance at high and low temperatures. The DOE already has three other Energy Innovation Hubs, for Fuels from Sunlight, Energy Efficient Building Systems Design, and Modeling and Simulation for Nuclear Reactors.

### **NHTSA to Propose Pedestrian-Friendly EV Measures**

Under a mandate from the Pedestrian Safety Enhancement Act of 2010, the National Highway Traffic Safety Administration (NHTSA) is developing a set of proposals to protect pedestrians and the visually impaired from the quietness of hybrid and electric vehicles.

### **Portland Passes Comprehensive EV Plan**

In May, the Portland (Oregon) City Council passed an electric vehicle plan to meet its Climate Action Plan goals, which were set in 2010. Key policies include fleet purchases by the city government (20% by 2030), streamlined permitting, designated parking, "clean taxi" airport rules, partnerships with car-sharing companies, green job creation, and a drive to educate residents about incentives for EV purchases.

### **Tennessee expands EV rebate program**

On February 10, the Tennessee Department of Economics and Community announced that Chevy Volt purchasers are now eligible for the state's \$2,500 EV rebate, in addition to a federal tax rebate of up to \$7,500. Only Nissan Leaf purchasers had previously qualified for the rebate. In order to receive the rebate, car purchasers are required to participate in the public-private EV Project, a national study on EV use and charging infrastructure deployment that will run through April 30, 2013. Data is gathered by California-based ECOtality, which received a \$99 million grant from the DOE. ECOtality will use the data gathered from The EV Project to suggest locations for the installation of commercial and residential charging stations in 18 major U.S. cities.

### **Pennsylvania Senate passes bill to make NEVs road-legal**

On January 24, the Pennsylvania State Senate passed a bill that would allow Neighborhood Electric Vehicles (NEVs) on roads with speed limits of 25 mph and in some cases 35 mph. Pennsylvania is one of the few states, along with Connecticut, Mississippi and Montana that do not yet have a statute allowing low-speed vehicles on public roads. The National Highway Safety Administration defines NEVs as any four-wheeled electric vehicle with a top speed of 20-25 mph. NEVs generally provide a 40-mile range and cost between \$7,000 and \$9,000. The U.S. is the second largest market for NEVs; 14,737 units were sold in 2011.

**Arizona mulls EV tax**

In February, Arizona's legislature considered a proposal – House Bill 2257 – to impose a tax of up to 1.43 cents per mile traveled on EV drivers based on Oregon's law. Oregon implemented a 0.6 cents/mile tax on EV owners last year under a pay-as-you-go system. In February 2011, Washington's state Senate passed a bill that would have charged EV owners a \$100 annual license fee, but the measure was rejected by the state House. Kansas and Utah are also considering an EV tax. EV drivers currently do not contribute to road and infrastructure maintenance, as they do not pay the federal 18.4 cents/gallon gasoline tax.

**California passes most stringent auto emissions regulation in the U.S.**

On January 27, 2012, the California Air Resources Board (CARB) unanimously approved a strengthened Advanced Clean Car (ACC) regulatory framework, including a Zero Emissions Vehicle (ZEV) regulation. Regular extended-range EVs such as the Volt are considered to be "transitional ZEVs" (TZEVS). CARB's target is for 15.4% of new cars sold in the state to be all-electric, plug-in electric or fuel-cell vehicles by 2025. This would translate into 1.4 million ZEVs and TZEVS, of which 500,000 would be BEVs and FCVs. The regulation also created a new vehicle category to describe battery-electric vehicles with small range extenders: BEVx. The ACC mandates that gasoline and diesel vehicles reduce smog-forming pollutants by 75% and greenhouse gases by 50% by 2025. The ACC comprises three regulatory boards: ZEV regulations setting plug-in hybrid, all-electric and fuel cell vehicle targets; LEV regulations for the reduction of soot, smog-forming, criteria and PM pollutants; and Clean Fuels Outlets (CFO) regulations setting thresholds for the required construction of alternative fuel vehicle fuel infrastructure (the lowest trigger is now 10,000 AFVs of any particular fuel type).

California is part of an agreement with Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming to commit to cutting CO2 emissions by 52 million tons by 2025.

**LA Air Force to Launch First All-Electric Fleet**

In September the Los Angeles Air Force Base, home to the Space and Missile Center in El Segundo, announced plans to become the first federal facility with an all-electric fleet by 2012. All the base's cars, trucks and forklifts will be included in the conversion.

**Canada Launches ecoENERGY**

In early August the Canadian Federal government launched an ecoENERGY Innovation Initiative to invest CA \$97 million in research, development and demonstration projects for clean energy technologies. Electric vehicles are one of its five project areas. The government is especially interested in research on lithium ion battery recycling.

**US-China JCCT ends with US Gains on EV Market Access**

The semiannual meeting of the US-China Joint Committee on Commerce and Trade ended November 21 with apparent gains for the American side with regard to China's new energy vehicle industry. The communiqué includes several potentially significant concessions by China: 1) it clarified that it "does not and will not maintain measures that mandate the transfer of technology" by foreign investors; 2) it further clarified that the "establishment of brands is a corporate decision" and that the Chinese government "does not and will not impose any requirements for foreign-invested companies to establish domestic brands in China"; 3) it pledged to accord foreign-invested companies equal treatment with regard to subsidies and other preferential policies for NEVs; and 4) it pledged that its NEV policies would be "implemented in a manner consistent with WTO rules."



# Quarterly Developments

## NORTH AMERICA

## III. Technology

### **MIT Researchers Create Breakthrough Battery**

MIT researchers have made a major breakthrough in battery architecture that physically separates the storage and discharge functions of the battery. Using a semi-solid flow cell, the battery's cathode and anodes are suspended in liquid electrolyte, which is then pumped through a filtering system. The researchers claim their design could halve battery costs. The design would also allow for vehicle batteries to be refilled with liquid much like conventional cars are refueled with petroleum. This research received funding from the Department of Defense's Defense Advanced Research Projects Agency and Advanced Research Projects Agency/Energy (ARPA-E).

### **UC-Riverside secures solar-EV grant**

UC Riverside's Center for Environmental Research and Technology has secured a \$2 million grant to study electric vehicle charging from solar power. The project is one of eight funded by the South Coast Air Quality Management District. The two-year funding, approved on Jan. 6th, will help the university develop electric storage alternatives, use solar power to recharge electric vehicles, and build an electric trolley.

The university will install up to two megawatts of solar arrays and 2-MWh lithium battery storage systems to charge vehicles at three locations on and near the UC Riverside campus. In partnership with the City of Riverside and Riverside Public Utilities, UC Riverside engineers will work to optimize EV charging electric vehicle with solar energy in a way that minimizes load on the grid and electricity demand from non-renewable resources. The Winston Chung Global Energy Center, a new venture funded by Chinese inventor, entrepreneur and Fellow of the College Winston Chung will donate 2 megawatts of rare earth lithium-ion batteries to the project. In addition, UC Riverside plans to convert its campus diesel trolley into an electric one.

The project will help the City of Riverside realize its Green Action Plan and become EV Ready. Riverside currently offers a \$2,000 rebate to residents who purchase a new qualified alternative fuel or hybrid vehicle from an authorized Riverside dealership.

### **Tester Volts Catch Fire**

NHTSA is currently investigating the Volt in cooperation with GM and LG Chem. A vehicle had burst into flames following a side-impact crash during NHTSA testing in May. In November, two Volt batteries caught fire and a third emitted smoke after further NHTSA testing at its center in Wisconsin. GM offered to provide Volt owners with loaner cars while the investigation proceeds. In December, GM further offered to buy back Volts from concerned owners.

### **Coda and Nissan invest in development of energy storage systems**

Automakers Coda and Nissan have both launched initiatives to invest in the development of energy storage systems. On January 20, Coda announced the launch of Coda Energy to develop energy storage systems using its EV's lithium-ion battery system, battery management, and active thermal systems. Meanwhile, Nissan has partnered with power and automation technology leader ABB to create energy storage systems and back-up power sources with used battery packs from Leaf vehicles. Pike Research has estimated that global investment in energy storage technology will reach \$122 billion by 2021.

### **New light-weighting coalition forms**

The Center of Automotive Research (CAR) announced the launch of the Coalition of Automotive Lightweighting Materials (CALM) research group in January. CALM's goal is to encourage the use of cost-effective mixed materials in vehicles to help reduce weight and achieve better fuel economy. CALM is supported by the Aluminum Transportation Group and American Chemistry Council, which includes 200 member companies.

# Quarterly Developments

## EUROPE

## I. Market

### **Volvo and Siemens form EV Partnership**

Volvo and Siemens have formed a partnership to develop electric vehicles and related equipment. Volvo has committed to supplying 200 test vehicles to Siemens by the end of 2012. The partnership will focus on electric-drive technology, power electronics and charging technology in addition to the integration of these technologies into Volvo's C 30 electric cars. Volvo is also planning to develop a V60 plug-in hybrid electric vehicle. Siemens is already working with BMW and Renault to develop electric-car charging equipment.

### **BMW Acquires Stake in SGL Carbon**

In November, BMW AG acquired a 15.2 percent stake in SGL Carbon SE, a producer of lightweight carbon fibers and composites. BMW is planning to incorporate carbon-fiber components in its i3 EV and i8 plug-in hybrid cars. SGL's largest shareholder, Susanne Klatten, is a member of the family that holds 47 percent of BMW's voting shares.

### **EON Installs First Fast-Charging Station**

On August 29 German electric utility EON announced it was beginning to install the first fast-charging stations for electric vehicles along public roadways in the country. The stations are direct current, 50-kilowatt models.

### **Smart Announces Fortwo Upgrade**

At the Frankfurt Motor Show, Smart announced it is preparing a 3rd generation upgrade and worldwide distribution for its flagship Fortwo electric car. The new Fortwo will be equipped with an improved 55-kilowatt electric motor and a 17.6 kilowatt-hour lithium-ion battery. The car has a range of 60 miles and a top speed of 75 mph. The Fortwo is to be rolled out in at least 30 markets. Pre-order reservations are expected to start by the end of the year.

### **Honda Unveils EV Concept at Geneva Auto Show**

Honda unveiled its EV concept car at the Geneva Auto Show as part of its "Road to Zero Emissions" display. Honda plans to introduce a plug-in electric version of its Fit car to the U.S. and Japanese markets in 2012. The car will feature Honda's new two-motor hybrid technology.

### **Tesla Roadster Wins E-Miglia Again**

On August 2nd, 32 electric vehicles participated in a nearly 500-mile race from Munich, Germany to St Moritz, Switzerland. The E-Miglia race, which started in 2010, currently spans four countries. The Tesla Roadster won for the second time, playing into Tesla Motor's bid to expand in the Swiss market.

### **PG unveils the Elektrus**

On January 17, German company PG and Düsseldorf-based automobile designer Michael Fröhlich unveiled the PG Elektrus in Berlin. A sporty, luxury two-seater EV based on the Lotus platform, the Elektrus can achieve a maximum speed of 180 mph, but PG has limited the top speed to 150 mph. The vehicle can accelerate from 0 to 60mph in 3 seconds. The 200kw lithium-ion battery pack has a range of 215 miles and can fully charge in eight hours using a standard 120-volt outlet. The vehicle is also equipped for level 2 and 3 charging. The battery can be partially charged from a solar powered panel mounted at the vehicle's rear. The battery's cells are sourced from China. The Elektrus uses glass-fiber reinforced plastics to achieve a weight of only 2,000 pounds, making it 800 pounds lighter than the Tesla Roadster. The vehicle comes with an automatic transmission and stick shift, as well as a sound system that can either reproduce a V8 engine or Formula 1 sound. PG plans to build 667 vehicles in Düsseldorf at a base price of 285,600€ (\$367,700) beginning in 2012. The Elektrus is PG's first vehicle, building on the company's experience producing electric bicycles.



**Accell Acquires Currie Tech**

On January 11 2012, European e-bike leader Accell Group (based in Heerenveen, Netherlands) acquired U.S. e-bike company Currie Technologies (Chatsworth, California). The aim is to leverage Accell Group's resources, experience, and significant portfolio of advanced proprietary technologies to help accelerate the growth of Currie Technologies in the U.S. Currie currently has one plant and 40 employees, while Accell has several production facilities in the Netherlands, Germany, France, Hungary and Finland. Accell also owns two brands in the U.S. and Canada: Redline and Toker. According to estimates from the Light Electrical Vehicle Association, the e-bike market in the U.S. is expected to show continuous growth in the short to medium-term from its current level estimated at 50,000 units.

**Prokhorov Closer to Developing Russia's Own Hybrid Vehicles**

On February 20, Yo-Auto co-owner and Russian billionaire Mikhail Prokhorov unveiled plans to build a second Yo-mobile plant in the Russian Far East. Construction of the first assembly plant for Yo-mobile cars began outside St. Petersburg in March. The plants will produce the Yo-mobile hybrid crossover that was first introduced in Moscow in December 2010.

The body of the vehicle will be made out of composite materials for light-weighting. It will be powered by gasoline, natural gas, and a pair of electric motors. A fully charged Yo-mobile will have a total combined range 680 miles (1,090km) and a top speed of 80 mph (130 km/h). The vehicle will be capable of accelerating from 0 to 100 kilometers/hour (62 mph) in 10 seconds. Estimated fuel consumption is 3.5 liters per 100 kilometers. Many Russian automotive specialists have criticized the vehicle's design, accusing the company of being overambitious in this project given that it has no experience designing or producing this type of vehicle. In addition, some of the high-tech components on which the vehicle's design is based do not yet exist even at the experimental stage. Finally, the vehicle's high center of gravity, archaic design, and use of capacitors as power storage devices are all likely to downgrade the vehicle's safety rating. Despite these concerns, Yo-Auto received around 55,000 bids within the first 24 hours of accepting electronic orders for the Yo-mobile.

Production of the hybrid is slated to begin in the second half of this year and the first vehicle is expected to roll off the production line in December 2012 at the St Petersburg plant. The sales target is 10,000 units during the first year of production. In December 2011, Prokhorov claimed the vehicle would cost less than \$10,000. However, the latest price estimates are between \$10,000 and \$15,000. The St Petersburg plant has a 45,000-vehicle capacity, while the second plant's capacity is double. Prokhorov cited proximity to China and Japan as a reason for building the second plant in the Far East.

Yo-Auto is a joint venture headed by truck maker Yarovit and Prokhorov's Onexim investment group. The company currently has 3 vehicles models: a crossover (the most popular model), a 5-door hatchback and a mini-truck. Car ownership in Russia is 240 vehicles per 1,000 adults, compared to 800 vehicles per 1,000 adults in the U.S. market. The Boston Consulting Group estimates that the Russian automobile market has the potential to grow into the world's sixth largest automotive market by 2020.

## II. Policy

**Paris Experiments with Pay-as-you-go EVs**

In October, the city of Paris launched a two-month pilot pay-as-you-go EV program - Autolib - modeled on the popular Vélib self-service bicycle program. Membership costs 10 euros and enables all-electric BlueCar rentals for 4-8 euros per hour. Bolloré Group manages the program. Bolloré has invested \$1 billion euros in the development of a new lithium-metal polymer battery. It partnered with Italian company Pininfarina, which is also partnered with Ferrari, to design the BlueCar. Autolib aims to roll out 3,000 BlueCars at 1,100 hire stations.

**Finnish Electrictraffic project begins**

The public-private partnership Electrictraffic.fi was launched in December 2011 to gather data from a test fleet of 500 EVs, study the integration of renewables into a smart grid, and develop intelligent traffic systems. The Finnish Funding Agency for Technology and Innovation (Tekes) is coordinating the project. Tekes has been administering a 100-million euro Electric Vehicle Systems Program since 2010.

**UKH2Mobility launched**

On January 18th, 2012, the British government launched the UKH2Mobility partnership with 13 private sector leaders to promote and prepare for hydrogen fuel-cell vehicles. The partnership revolves around a pledge to share research, resources, and personnel to promote fuel-cell technology ahead of a projected 2014 release of hydrogen vehicles in the region.

McKinsey will coordinate the UKH2Mobility program in line with three goals: 1) Provide a detailed analysis of the UK case for the introduction of hydrogen fuel cell electric vehicles as one of a number of solutions to de-carbonize road transportation and quantify the potential emissions benefits; 2) Identify the investment required to commercialize the technology, including refueling infrastructure; 3) Determine how to make the UK the leading global player in hydrogen fuel cell vehicle manufacturing and thereby create new economic opportunities in the UK through new jobs and stimulus at the local level. The program will evaluate the potential of hydrogen by the end of 2012. If the results are encouraging, the next step will be to develop an action plan to improve UK readiness for the commercial rollout of hydrogen fuel cell EVs. Over the past five years, the UK Department of Transportation, in partnership with the Department for Business, Innovation and Skills, has invested \$615 million in public demonstrations, fueling stations, and testing for low-emission vehicles.

**Renault's Kangoo Van ZE Eligible  
For New UK Plug-In Van Grant**

In January, Renault's Kangoo Van Z.E. range became eligible for the UK's new Plug-in Van grant, bringing the standard van's cost down to £13,592 (\$21,800), excluding the VAT. The Kangoo will also be exempt from London congestion charges, road taxes and fuel duties, and benefit from a first-year capital write-down allowance. The Kangoo comes in three variants: the standard Kangoo Van Z.E., the longer wheelbase Maxi and five-seat Maxi Crew Van. The very first Kangoo Z.E. came off the production line on 22 September 2010. Since then, 68 vehicles were produced in 2010, and 281 in 2011 at Renault's Maubeuge plant.

In February, Transport Secretary Justine Greening and Business Minister Mark Prisk announced that seven vans were eligible for the grant: Azure Dynamics Transit Connect Electric, Daimler Benz Vito E-Cell, Faam Ecomile, Faam Jolly 2000, Mia Electric Mia U, Renault Kangoo, and Smith Electric Smith Edison.

## III. Technology

**Competence E Breakthrough to  
Halve Battery Cost by 2018**

Competence E project researchers at the Karlsruhe Institute of Technology in Germany have announced the development of iron-carbon nano-materials that can double the energy capacity of a lithium-ion battery. The researchers estimate the innovation will halve the cost of batteries by 2018. Competence E is a 200 million euro project that involves 250 scientists.

**Gamesa acquires stake in N2S**

On January 18, Spanish-based wind turbine manufacturer Gamesa acquired a 20% stake in Spanish software start-up N2S. Gamesa has designed several EV charging station models that it will begin producing in 2012 at its electric components factory in Valencia, using the spare capacity from its turbine converter plant in Valencia to power the manufacturing process. N2S has developed a POWER2DRIVE software platform for electric vehicle charging and real-time energy management. On the other end, its POWER2ENERGY software allows users to monitor and control charging from a computer or mobile device. N2S CEO Jorge Calvert explained in a Bloomberg interview: "The N2S deal is part of a plan to broaden the product range in areas where Gamesa's technology allows it to compete. Gamesa has industrial capacity we can't ignore. The idea is to have synergies from the first minute." Gamesa will also be able to use the N2S software in its energy auditing business. Great demand for charging stations is anticipated in Europe. In France, EV charging stations will be mandatory outside new apartment buildings starting this year and are to be placed in all parking lots by 2015. Meanwhile, German electric utility EON has begun installing fast-charging EV stations along public roadways. Through its investment fund Gamesa Venture Capital, the company invested in two other companies in 2011. The fund plans to invest up to \$16 million through 2016 to acquire stakes in green technology start-ups and ventures.

# Quarterly Developments

## ASIA

## I. Market

### Japan

#### ***Nissan's ESFLOW EV Sports Car to Reach Market in 2013***

Following a successful reception at the Geneva Auto Show this year, Nissan has announced that it will begin production of its newly designed ESFLOW concept EV sports car, which it plans to bring to market in 2013 for \$32,500. The car is powered by dual electric motors in the rear wheels, has a laminated lithium-ion battery providing a range of 150 miles, and can accelerate from 0-100mph in less than five seconds.

#### ***Toyota to Build Hybrid in Iwate***

In July, Toyota Motor Corp. announced plans to produce a new compact hybrid vehicle for both the domestic market and exports – either the Yaris hybrid or Prius C compacts – in the northeastern Iwate Prefecture. The Prius C and Yaris hybrids are slated for release in 2012. The former will be introduced to the US and Japanese markets, and the latter to Europe. Toyota has officially released the Prius C's specifications, which include a 4.4 kwh lithium-ion battery and a 51 MPGe range in the city (48 MPGe on the highway). Toyota plans to introduce 11 new or upgraded hybrid models within the next two years.

#### ***Mitsubishi Scouts for New Batteries***

Mitsubishi Motors Corp. is looking to source more lithium-ion battery packs globally to guarantee supply. It plans to launch eight EVs globally by 2016 as part of its ambition to become a global EV leader. Mitsubishi currently uses Toshiba batteries for a short-range version of its commercial EV van. Most of its Lithium-ion batteries are sourced from Lithium Energy Japan, its joint venture with Japanese battery manufacturer GS Yuasa Corp.

#### ***Honda Launches Fit Shuttle Hybrid in Japan***

In June, Honda launched the Fit Shuttle Hybrid compact in its home market. An IMA electric motor and an efficient 1.3-liter i-VTEC engine are used to deliver power and provide 25 km/liter (compared to 18.6 km/liter for the regular Fit Shuttle). The battery for the hybrid system is located under the rear cargo to enable flexible seating configurations without sacrificing space. The price of the new hybrid starts at \$22,420. Honda is producing the vehicle at its Suzuka plant, which is located 250 miles to the west of Tokyo. Honda plans to export the hybrid to other markets, including the US, by mid-2012.

#### ***Japanese Optimistic in 2012 KPMG Automotive Survey***

KPMG's annual Global Automotive Executive Survey, released in January, showed that the Japanese have the most optimistic outlook on electric vehicles. While the vast majority of respondents considered electro-mobility to be a major automotive industry trend due to tightening fuel efficiency standards, two thirds of respondents did not believe electric vehicles would exceed 15% of global sales in the next 15 years. However, almost half of Japanese respondents predicted electric vehicles would account for 25% of domestic sales in 2026. Most respondents estimated that, among alternative fuel technologies, fuel-cell powered vehicles would be in largest demand 13 years from now, except for the Chinese respondents, who maintained pure battery-electric vehicles would be the top technology. The survey also showed that by 2025, hybrids, including plug-ins, are expected to largely outsell all-electrics. The report identified environmental challenges, urbanization and changing customer behavior as the major issues currently shaping the global automotive industry. The issues in the next 15 years are expected to be electro-mobility, innovative urban car design concepts, OEM captive financing and leasing and connected car concepts. The Global Automotive Executive Survey is an annual assessment of the automotive industry's current state and future development. The respondents are 200 senior executives from the world's leading automotive companies, including automakers, suppliers, dealers, and financial and mobility service providers. Among the respondents, 47.5 percent of the executives are based in Europe, the Middle East and Africa, 31 percent in the Asia-Pacific region and 21.5 percent in the Americas.

## South Korea

### **SK Invests in Lithium-ion Battery Plant**

SK Innovative Company has announced an investment of 25 billion won (approximately \$25 million) to build a lithium-ion battery factory in Korea that will come on line 2012. It is expected to annually supply batteries to about 25,000 EVs produced by auto companies such as BlueOn, Mercedes-Benz and Mitsubishi. SK currently has one rechargeable battery plant in Daejeon, located 164 km south of Seoul. The plant has an annual capacity of 80,000 units for hybrid vehicles. SK has been supplying Li-ion batteries for Mitsubishi's Fuso hybrids since October 2009, and to Hyundai and Kia since July 2011.

### **Kia unveils Korea's first mass-produced EV**

In December 2011, Kia introduced the Ray EV, South Korea's first mass-produced electric vehicle. Closely related to the one-liter gas-powered Kia Ray CUV, the Ray EV is also the first electric vehicle to be manufactured on the same production line as conventional vehicles. The Ray minicar has a 16.4 kilowatt-hour lithium-ion battery and can achieve a maximum speed of 80 miles per hour. The vehicle can accelerate to 100 miles in 15.9 seconds.

Kia aims to produce 2,500 Ray EVs for public fleets in 2012. The vehicle is scheduled for release to individual consumers in 2013. Korea currently has 500 charging stations, and the government plans to invest in increasing the number to 3,100 by 2013.

## India

### **Tata unveils Megapixel**

Tata introduced its new four-seat Megapixel extended-range electric vehicle at the Geneva Auto show. The Megapixel EV is a concept city car with four electric wheel motors. Its 13 kWh lithium-ion phosphate battery can reach 80% capacity in as little as 30 minutes under the fast-charge mode. A combustion engine generator can also charge the battery. The vehicle can reach a maximum speed of 110 km/h and has a maximum range of 87 km in battery-only mode. Tata plans to have the Megapixel on the market by 2015.

Tata is India's largest automobile company. It also has operations in the UK, South Korea, Thailand, Spain and South Africa. The Tata Megapixel was developed by Tata's design centers in India, the UK and Italy.

## II. Policy

## Japan

### **Tax break extension drives up hybrid sales in Japan**

According to sales data jointly released by the Japan Automobile Dealers Association and Japan Mini Vehicles Association, sales of hybrid vehicles in January and February exceeded 20% of total passenger vehicle sales for the first time. The best selling hybrid vehicles for both months were the Toyota Prius and Aqua and Honda Fit and Freed.

According to the data, 60% of sales of both the Honda Freed and Fit models are hybrid vehicles. January sales of the Toyota Prius increased 2.1 times over sales the same month last year, with a total of 29,108 cars sold. February sales totaled 35,875 vehicles, including 21,951 Aquas.

Since January sales have always been a low point in Japan, this year's uncommonly high sales might be attributed to the extension of a tax break introduced by the Japanese government in April 2009 to encourage the purchase of fuel-efficient vehicles. This tax break was set to expire in April 2012. In December 2011 the Japanese cabinet announced a decision to extend it until 2015. Under this "new next generation vehicles", fuel cell vehicles, plug-in hybrids, hybrid electric vehicles, clean diesel and natural gas vehicles are exempt from acquisition and tonnage taxes.

## South Korea

### **South Korea implements EV tax break**

On December 1, 2011, the South Korean government implemented a tax cut on electric vehicle purchases. EV buyers will receive a tax cut of up to \$3,590 through a combination of lower consumption and acquisition taxes.

The South Korean government has stated that AFV development is a priority and has supported the industry through a number of regulatory and tax provisions. In August 2008, the South Korean government announced a plan for green development. A tax cut on hybrid vehicle purchases was implemented in from 1 July 2009 to 30 December 2012, providing reductions on consumption and registration taxes. The tax cuts allow for savings of up to \$2,920 dollars on the purchase of a hybrid vehicle. In June 2009, the South Korean government announced a \$133 million investment in AFV R&D with the goal of raising average AFV energy efficiency by five percent. The EV tax breaks came into force in January 2012. For each EV purchased at the price of 50 million won, the following tax breaks are offered: a two million won rebate on individual consumption taxes (5% of the vehicle price), a 600 thousand won rebate on education taxes (30% of individual consumption tax), and a 1.4 million won rebate on acquisition taxes.

## India

### **India Releases EV Development Plan**

In December 2011, the Society of Indian Automobile Manufacturers (SIAM) and Indian Department of Heavy Industry jointly issued a report projecting that by 2020 India will have six to seven million electric vehicles on the road, including 4.8 million two-wheeled vehicles. The Indian government has allocated RS 7.4 billion for EV R&D in its 12th five-year plan (2012-2017) with the goal of reducing the nation's dependence on fossil fuels. The government will also appoint a cabinet panel to oversee the project. The government's previous Automotive Mission Plan, released in 2006, included policies supporting joint projects between academic institutions and the private sector in developing AFVs.

## Taiwan

### **EVs for rent in Taiwan**

As a part of the "Greater Taipei Low-Carbon Travel Plan" introduced by the Ministry of Economic Affairs, the first EV rental store opened at Banqiao Station, Taipei, on February 20. The store rents out EVs for 599 NT (approximately \$20) for two hours. By the end of this year, 100 charging stations are to be built and 100 EVs from local automakers Luxgen and Tobe will be available for rent. Taipei currently has 14 charging stations. Models will include the Luxgen7 MPEV+ and the Tobe M'Car/w' Car EV. The EV rental store in Taipei is the second step in the "Greater Taipei Low-Carbon Travel Plan" following the launch of EV fleets in Taichung. The next step is to invest one billion NT to bring 200 EVs to Tainan.

### **Taichung adopts first municipal fleet in Taiwan**

In February, Taichung became the first city in Taiwan to use EVs in public fleets, integrating 49 Nissan Leafs and 51 Luxgen EVs into local police and government staff fleets. Additionally, 64 AC Power Corp. charging stations were put into service. The Taichung municipal government also waived four taxes and fees for EV purchases. The Luxgen EVs are locally produced; 14 have been delivered and 36 more are to be delivered by October 2012.

# Quarterly Developments

## ASIA

## III. Technology

### Japan

#### **Nissan, Mitsubishi and Toyota Develop V2G Devices**

Nissan, Mitsubishi and Toyota are separately developing new devices for the Japanese market that enable V2G (vehicle-to-grid charging). The first systems are expected to be available to customers within a year. Nissan's "Power Control System" will be designed for use with the Leaf, Mitsubishi's system for its upcoming crossover plug-in hybrid, and Toyota's for its Estima hybrid van (used after the tsunami in March) and 2010 plug-in Prius. The V2G technology enables plug-in hybrids or purely electric vehicles to become generators that could power houses during a blackout, for example. After testing the Power Control System with the Leaf, Nissan found it would be able to power a typical Japanese residence for two days. Japan intensified R&D efforts on these new devices after the tsunami. While Japan will be the target, Nissan has also invested in the marketability and feasibility of introducing the device to the American market, and Mitsubishi plans to incorporate the V2G system into the crossover plug-in hybrid vehicle slated for introduction in the U.S. market in 2013.

#### **Nissan and 4R Energy Develop New Solar EV Charging System**

In July, Nissan started testing 4R Energy Corporation's newly developed charging system for EVs that combines a solar power generation system with a high-capacity lithium-ion battery. The new system will enable the full charging of EVs through a renewable energy source. The collection will include 4 level-2 chargers and 3 level-3 chargers. By using stationary storage batteries, electricity could be supplied to EVs regardless of the time of day or weather. Based in Yokohama City, 4R Energy conducts demonstration tests and commercialization studies for second-life use of vehicle lithium-ion batteries. 4R's stakeholders are Nissan (51%) and Sumitomo (49%).

#### **Toyota announces rare earths reduction breakthrough**

In January, Toyota announced a technological breakthrough that would allow it to reduce the amount of rare earths, such as neodymium and dysprosium, used in its EV product supply chain. Toyota currently has no plans to commercialize the technology and will continue to research rare earth reduction strategies. Rare earths have become a concern for environmental and trade reasons. Since China has implemented strict export quotas on rare earths, their prices have dramatically increased. The price of dysprosium rose from \$118.49/kg to \$2,300/kg in the third quarter of 2011. The export quotas for rare earths totaled 50,145 tons in 2009, and fell to 30,258 tons in 2010 and 30,184 tons in 2011. China dominates rare earth supply, accounting for 95% of global production.

### South Korea

#### **Consortium Develops New 'Secondary Battery' Materials**

In September, Ulsan National Institute of Science and Technology (UNIST) and LG Chemical Institute of Technology announced the development of new electrode materials that can completely charge or discharge a rechargeable battery in two minutes. This technology could dramatically shorten charging times for EV batteries and make possible the development of more powerful EVs. The South Korean government is currently providing tax breaks for hybrid vehicles purchased between July 2009 and the end of 2012. These include exemptions from consumption, registration, education and other taxes up to 3.3 million won (\$3,000). The Korean government has set a production target of the 1.2 million AFV units by 2015, and has allocated 3.1 trillion won (\$3 billion) for AFV development beginning in 2011.



# Quarterly Developments

## CHINA

## I. Market

### **BYD Sales Tally for Dual-mode F3DMs Reaches 732**

BYD has sold 732 F3DMs to individual customers from March 2010 – when it was made available to the general public for the first time – through the end of June, including 730 in Shenzhen and 2 in Shanghai. The F3DM is a dual mode plug-in hybrid sedan that was released for fleet purchases in December 2008 at a cost of 149,800 RMB (\$23,400). BYD claims that demand for the F3DM has reached up to 500 units/month. However, due to battery shortages, F3DM is only able to supply 100 units per month.

### **BYD Signs Electric Bus Contract with German City**

On June 15, Frankfurt awarded BYD a contract to supply three eBus-12 units and two DC charging stations to the city's electric mobility system in the first quarter of 2012. The contract also includes technical support. The eBus-12, BYD's longest-range bus, can travel 250km per charge. BYD concluded a similar deal in June with SMRT Corporation for public transportation in Singapore, and one with Taiwan in August.

### **BYD & Hertz Partner to Introduce E6**

BYD has partnered with Hertz to introduce its all-electric e6 crossover to Chinese consumers in September 2011, making Hertz the first global car rental company to offer EVs in the Chinese car-rental market. The e6 has a 240 km range and costs around 300,000 RMB (\$47,000). It is currently operating in the Shenzhen taxi fleet, where the original fleet of 50 e6s has already logged over 4 million km. Multinational corporations are the primary targets for Hertz's e6 leases, which are more expensive than regular vehicle leasing.

### **FAW Begins Production of Besturn EVs & PHEVs**

On August 22, FAW Group broke ground on production at its new Changchun plant, which will produce its new Besturn sedan in both EV and PHEV models. The EV has a range of 170 km, while the PHEV has a range of 70 km. The plant has a production capacity of 10,000 – all for Changchun's market. FAW will also produce the Besturn at its plant in Dalian, Shenyang Province. FAW plans to invest 9.8 billion RMB (\$1.5 billion) in AFV development, including 8 product platforms, 13 passenger vehicles and 3 commercial vehicles. FAW's timeline reflects the central government's *Twelfth Five-Year Plan*. Furthermore, Changchun plans to subsidize AFV purchases and has committed to purchasing 200 Besturns for its government fleet. The Besturn plant is FAW's second plant in Changchun.

### **FAW-Volkswagen to Begin Production of First Forward E88 in 2013**

FAW-Volkswagen has announced plans to begin production of its compact "First Forward" E88 EV at its plant in Foshan by the end of 2013. The final model of the vehicle is to be finalized shortly. The Ministry of Industry and Technology has already approved the vehicle's inclusion under its "new energy vehicle category," meaning that it will be eligible for central government subsidies.

### **Zhuzhou to Build Largest AFV Manufacturing Base in China**

Zhuzhou city in Hunan province aims to build China's largest AFV manufacturing base. According to its most recent auto industry plan, it aims to attract 3 AFV manufacturers with a total annual output of over 110,000 vehicles by 2015. Automakers Chery and Ford are mentioned in particular. Zhuzhou aims to build a 100 billion RMB (\$15.6 billion) AFV industry cluster within 3-5 years.

### **Hunan Guifeng Creates EV Manufacturing Base in Yueyang**

Hunan Guifeng EV Manufacturing Company, Ltd. has invested 150 million RMB (\$23.5 million) to build a manufacturing base in Yueyang in Hunan province that will be able to annually produce 30,000 EV street sweepers and tour buses. The plant began production in August 2011. Guifeng specializes in manufacturing special purpose EVs. Hunan's *Strategic New Industry Development Plan* aims for the production of 50,000 EVs and 10,000 electric buses by 2015.

### **Ruihua Builds New EV Manufacturing Plant in Liaozhong**

In July, Shanghai Ruihua Group inaugurated two new EV manufacturing plants in Liaoning province. Ruihua invested 3 billion RMB (\$470 million) in a plant in Liaozhong to produce a planned 10,000 EV buses and 10,000 electric engines and other core components annually. The plant will produce two EV models released on 2007: a tour bus with a range of 300 km, and a public transportation bus with a range of 250 km. Both models were released in 2007. The Liaozhong government has offered Ruihua support should any problem occur during the plant's construction. Liaozhong is located at the rim of Shenyang's economic zone, which released an AFV development plan in 2010. Shenyang's government aims to deploy 1,000 AFVs by the end of 2012, including 600 hybrid buses, 400 hybrid taxis and 100 all-electric vehicles for government fleets. Ruihua's second Liaoning plant is in Dalian and has an annual capacity of 3,000 EV buses and 10,000 core components. Ruihua has a third plant, in Chengdu, Sichuan, with the same capacities as the Dalian plant.

### **Renault & Dongfeng begin luxury EV joint venture**

On Feb 24, Renault CEO Carlos Ghosn announced that Renault had signed a letter of intent to create a joint venture with Dongfeng Automobile Co., Ltd., targeting the electric and luxury car market in China.

Ghosn cited new foreign investment policies, such as the Catalogue of Encouraged Foreign Investment Industries, as the reason for choosing an AFV project. He explained that relevant government bodies told him the joint venture would only be approved if it involved an innovative project. The joint venture aims to begin production as early as 2014.

### **Coda & Great Wall Motors Form EV Partnership**

In August 2011, California-based CODA Holdings partnered with China's Great Wall Motors to develop new EV models for global markets combining the former's technology and the latter's vehicle platforms. China's Great Wall Motors is based in Baoding, Hebei Province. It has already successfully developed 7 AFV models: GWKULLA, Smart EV, Haval M3 EV, DEER electric coach car, HEV Haval, Florid Intelligent Control, and COWRY Plug-in HEV. Great Wall Motors and Coda aim to produce an EV that will compete with Nissan's Leaf.

### **Chery Launches QQ3EV Model**

On June 7, Chery Auto Company opened a 4S AFV Auto Services store in Wenzhou, Zhejiang province. 4S (Sales, Spare parts, Service & Survey) car shops are authorized dealerships. Chery currently has over 50 AFV service shops in China, mostly in Shandong, Henan, Anhui, Fujian, and Zhejiang provinces. At the same time, Chery officially launched its all-electric QQ3EV hatchback on the market with a sales price of 50,000 RMB (\$7,800). Chery produces the QQ3EV at its New Energy Vehicles Technology Company plant in Wuhu's Hi-tech Industries Development Zone (Anhui province). The QQ3EV has a silicon battery with a driving range of 80-120 km and maximum speed of 70 km/hour. Chery claims that the vehicle's charging cost for 100km is 90% less than that of its ICE equivalent. Chery also produces the all-electric M1EV hatchback, using a lithium-ion battery with a range of 120 km and maximum speed of 120 km/hour. Additionally, Chery's portfolio includes two hybrid models: the A5ISG mid-sized sedan and the A3ISG compact sedan. Chery's 4S auto shops service all four of its AFV models.

### **Wuzhoulong Becomes the World's Biggest Supplier of Hybrid Buses**

In July, Wuzhoulong became the world's biggest supplier of hybrid buses, with over 2,000 hybrid buses running throughout China. Wuzhoulong manufactures its own control systems, charging stations, and batteries, which are sold to other automakers as well. It is based in Baolong Industrial City of Long Gang District in Shenzhen, Guangdong Province. In addition to its home city, Wuzhoulong has sold buses to Kunming, Yunnan Province, and Shenyang, Liaoning Province. The company has also exported a small amount of buses to Macao, Hong Kong, the Philippines and the U.S. Hybrid models include the FDG6111HEVG, of which Shenzhen leased a fleet of 1,350 for the Universiade, the FDG6921AGC3, and the FDG6120HEVG. Wuzhoulong also has 2 LNG bus models (FDG6921NG and FDG6111NG) and 1 CNG model (FDG6121GC3).

### **Foreign EV charging device companies intensify activities in China**

Encouraged by the Chinese government's determination to develop AFVs, and especially EVs, several foreign charging device companies have become increasingly active in the Chinese market. In December Siemens Ltd. China received an order to install 140 EV chargers in China. In December, Better Place signed an agreement with Southern Grid Corporation to jointly promote and develop EV infrastructure projects throughout Southern Grid's network. The company also signed an agreement with Chery to provide technical assistance on current transfers. Better Place, Emerson and Siemens are the most visible foreign companies in China's charging infrastructure industry.

China does not currently have a national assistance program in place for charging infrastructure development, but some local governments provide subsidies to companies developing AFV infrastructure. For example, Shanghai's municipal government proposed in August 2011 to provide 20% investment subsidies to companies building charging infrastructure. Hangzhou's municipal government also provides subsidies that cover 20% of investment costs (not including land costs).

### **Freudenberg Group to enter Chinese EV battery market**

On February 23, German industrial conglomerate Freudenberg group announced its decision to enter the Chinese EV battery market to provide battery technology and related services to Chinese EV manufacturers. The company cited Chinese government policies promoting the EV industry as the reason for entering the Chinese battery market. Freudenberg has developed a separator that increases the intrinsic safety of battery cells and thus helps to prevent possible explosions. The technology is sold under its "Viledon" brand. Freudenberg has also developed special sealing materials for various coolants that may be used in lithium-ion batteries. Finally, Freudenberg has developed elastic components to replace rigid screwed joints, making the connections safer and more reliable.

Freudenberg group is a family-owned group of global companies with 4,500 employees in 70 locations. Its 16 business groups operate in various markets and industry sectors, including: automotive, mechanical and plant engineering, textile and clothing, construction, mining and heavy industry, energy, chemical, oil and gas, and tailor-made, innovative technological products and services. Customer groupings also include companies in the medical technology, civil aviation, rail vehicles and semiconductor sectors. Freudenberg has held business ties with customers and partners in China for over 100 years. Fifteen Freudenberg companies are represented in China through production centers and sales and service offices.

### **CAAM releases 1st quarter AFV sales data**

According to recently released statistics from the China Association of Automotive Manufacturers (CAAM) 2,855 AFVs were manufactured in the first quarter of 2012, while sales reached 3,329 vehicles. Of the AFVs produced, 1,655 were EVs and 1,300 were hybrids. Of the AFVs sold, 1,830 were EVs and 1,499 were hybrids.

Chinese production in 2011 reached 8,368 AFVs, while sales totaled 8,159 vehicles. Sales were 38% higher compared to 2010, when 5,321 vehicles were sold. However, private AFV ownership barely surpassed 1,000 vehicles, according to data from July 2011.

Of the 8,159 AFVs sold in 2011, 5,579 were electric vehicles and 2,580 were hybrids. The latter were not included in the Chinese government's AFV subsidy program unless they were plug-in hybrids. Regular hybrids are only eligible for a subsidy of 3,000 RMB (\$470) while all-electric vehicles qualify for subsidies of up to 60,000 RMB (\$9,400).

Capacity and sales fell far below the government's target for 2011 as outlined in the Auto Industry Restructuring and Revitalization Plan, which was published in 2009. The Plan had targeted a capacity of 500,000 all-electric, plug-in hybrid and hybrid vehicles, and sales amounting to 5% of conventional passenger vehicle sales, or 736,000 vehicles.

**Hengtong and Microvast establish  
China's first all-electric bus joint  
venture**

On February 17, Chongqing Hengtong Bus Co, Ltd. and Microvast established a respectively 70-30 all-electric bus joint venture: Hengtong Electric Bus Power Systems, Inc. The JV is located in Chongqing and has a registered capital of RMB 100 million (\$16 million). Chongqing Public Transportation Group has already ordered 200 electric buses, which are expected to start operating by the end of June 2012. Microvast will supply the battery packs for 50 units of fast-charge electric buses and 150 units of fast-charge plug-in hybrid buses. In addition to producing all-electric buses for the Chinese market, the joint venture with Hengtong plans to export electric buses to US, where it will target the airport transit bus market.

The largest shareholder, Microvast, is a US based power solutions company located in Houston with a subsidiary in Zhejiang province. One of the company's major areas of business is fast-charge lithium-ion battery R&D and manufacturing. The company has developed a fast-charge battery that can fully charge in 10 minutes. Microvast's role in the joint venture is to provide the fast-charge battery technology. The majority of Microvast's partners are currently in China, where the company has been very active in recent years. The company has cooperated with several EV bus manufacturers such as Xiamen Golden Dragon, Xiamen Kinglong, Shanghai Sunlong, Anhui Ankai and Yangzhou Yaxing to provide 80 hybrid electric buses to Kunming Public Transportation Group (KPTG). Microvast has also partnered with the World Bank, specifically the IFC and Ashmore Investment Management Ltd. In July 2011, the company secured \$30 million in equity financing for an up to \$50 million project from its two partners. According to the company's founder and CEO Yang Wu, the funding will be used to "expand its business and continue new technology development."

Chongqing Hengtong Bus Co. is a large bus manufacturer with a registered capital of RMB 12 million yuan, a building area of about 180,000 square meters and a manufacturing area of about 80,000 square meters. The company was founded in 1939 and is one of the largest Chinese bus manufacturers, with an annual production capacity of 8,000 buses. The company has developed and produced three AFV bus models. One of them is an EV bus while the other two are hybrid buses. Hengtong's EV buses were introduced to Chongqing's public transportation system in early May 2011.

**Guangxi Jieshen New Energy Tech to  
build battery plant in Laibin**

On February 13th 2012, Laibin's municipal government (Guangxi province) and Guangxi Jieshen New Energy Technology Co., Ltd. signed an agreement to build a vanadium lithium iron phosphate battery production line with an annual capacity of 400 million Ah. The 4.3 billion yuan (\$680 million) plant will be built in Laibin Phoenix Industrial Park. The plant will produce batteries for EVs, electric bicycles, electric motorcycles and other industries.

The project will be completed in three stages. The first stage is slated for completion by December this year, when six production lines will be built with an annual production capacity of 80 million Ah each. At this first stage the project is expected to have an annual production value of 900 million yuan (\$143 million) when it comes on line. The production value is expected to increase to 4.5 billion yuan (\$710 million) after all three stages are completed.

Guangxi Jieshen New Energy Technology Co. was established in June 2011. Its primary business is EV battery R&D and manufacturing. The company claims to hold 8 AFV battery patents in China.

# Quarterly Developments

## CHINA

## II. Policy

### National Level

#### **Twelfth Five-Year Plan for EVs**

On July 13, 2011, the Chinese government released its *National “Twelfth Five-Year Plan” for Scientific and Technological Development* affirming China’s commitment to alternative energy, a smart grid, and the EV industry. The plan emphasizes the development of purely electric-driven technologies and anticipates 1 million registered EVs by 2015.

With regard to R&D the plan focuses on the development of core technology for components (battery, engine), technology integration in hybrid and electric vehicles, and platform technology (technology standardization and regulation, infrastructure, and evaluation tools). Policy goals mirror the *Ten Cities, One Thousand Vehicles Program*, with an emphasis on producing a couple of world class manufacturers with intellectual property rights over key technologies.

By 2015, the plan anticipates breakthroughs in 23 core technologies, an expansion of the *Ten Cities, One Thousand Vehicles Program* to over 30 cities, the commercialization of AFVs in over 5 cities, the registration of 1 million EVs and an output value of 100 billion RMB (\$15.6 billion) for AFV industries.

#### **Chinese Government Finalizes Definition of Alternative Fuel Vehicles**

In August, the Chinese government finalized the definition of alternative fuel vehicles in its AFV Industry Development Plan (2011-2010). The term now includes plug-in hybrid vehicles, electric vehicles and fuel cell vehicles, but excludes regular hybrids for the first time. Plug-in hybrids qualify for a subsidy of 3,000 RMB/KWh (\$470/KWh), up to a maximum subsidy of 50,000 RMB (\$7,800). All-electric vehicles qualify for a subsidy of 3,000 RMB/KWh (\$470/KWh) up to 60,000 RMB (\$9,400).

Regular hybrid vehicles fall into the category of energy-saving vehicles because their fuel savings do not cross the 20% threshold (i.e. their average fuel consumption is 6.3 liters of gasoline or less for 100 km). Energy-saving vehicles qualify for a subsidy of 3,000 RMB (\$470) per unit.

#### **State Council promotes AFVs**

On January 18th 2012, the State Council issued its “industrial transformation and upgrade plan” for 2011-2015.

The plan reiterates government support for AFV R&D through innovation projects and a national scientific research program. It specifically supports continued R&D efforts in fuel cell and electric vehicle technologies.

Another goal is the acceleration of AFV infrastructure development, i.e. charging stations and battery swap stations.

The plan also strongly supports indigenous AFV manufacturers. One of the goals is to encourage the merger and acquisition of troubled manufacturers by well-performing ones, in order to create three to five large AFV manufacturers with core competence by the end of 2015. The target level of consolidation is for the top 10 auto manufacturers to control 90% of the AFV and fuel-efficient vehicle markets. A second target is to cumulatively produce and sell 500,000 AFVs by 2015.

The Chinese government also plans to increase emissions standards and reduce pollutant emissions to support the development of fuel-efficient vehicles. The plan aims to reduce the average fuel consumption of passenger vehicles to 5.9 liters (1.557 US gallons) per hundred kilometers (62 miles).

**MIIT's list of recommended vehicles for official use includes 5 AFVs**

On Feb 24, 2012, the Ministry of Industry and Information Technology (MIIT) released a draft list of 412 recommended vehicle brands and models for official use. After a comment period, the list was finalized on March 9.

All the listed vehicles (sedans, crossovers and off-road vehicles) are produced by indigenous automakers. Five AFV models are listed, including one plug-in hybrid vehicle and four all-electric vehicles: Tongyue's all-electric sedan (battery capacity: 15KWh; driving distance: 94 miles; maximum speed: 62 miles per hour) designed and manufactured by Anhui Jianghuai Automobile Co., Ltd; the F3DM plug-in hybrid sedan (battery capacity: 18KWh; driving distance: 63 miles; maximum speed: 94 miles per hour) designed and manufactured by BYD Automobile Co., Ltd; the MIEV all-electric car (battery capacity: 16KWh; driving distance: 56 miles; maximum speed: 56 miles per hour) designed and produced by Chery Automobile Co., Ltd; the LOVE all-electric car (battery capacity: 19KWh; driving distance: 66 miles; maximum speed: 75 miles per hour) designed and produced by Changan Automobile Co., Ltd; and the E300 all-electric car (battery capacity: 58KWh; driving distance: 125 miles; maximum speed: 75 miles per hour) designed and manufactured by Jiangnan Automobile Manufacturing Co., Ltd.

**MIIT issues national charging standards**

On December 22nd, 2011, China's Ministry of Industry and Information Technology (MIIT) released four national EV charging interface and communication protocol standards, which will come into effect on March 1st, 2012. The four standards include:

- 1) Connection set for charging - Conductive charging of electric vehicles - Part 1: General requirements
- 2) -Part 2: AC charging coupler
- 3) -Part 3: DC charging coupler
- 4) Communication protocols between off-board conductive chargers and battery management systems for electric vehicles

The current challenge is to unify the myriad standards that have been adopted by different cities and companies. The list of agencies involved in drafting the standards include the MIIT; National Energy Bureau; National Technical Committee of Auto Standardization; China Automotive Technology & Research Center; China Electricity Council; and China National Electric Apparatus Research Institute.

**MIIT releases "Buy China" rules for government vehicle purchases**

In November, the Ministry of Industry and Information Technology (MIIT) released a series of rules to set price and emission standards for the purchase of government vehicles. The purchase of alternative fuel vehicles is encouraged so long as the price does not exceed 180,000 RMB (around \$28,000) after subsidies. Conventional vehicles are subject to the same price limit and a 1.8-liter emissions limit. The rules apply to all levels of government under the rubric "official vehicles for general use". Vehicles for high-ranking officials (vice minister and above) are excluded.

In contrast, the previous rules did not include any provisions encouraging AFV purchases. Regarding conventional vehicles, they only applied to sedans and set limits of 250,000 RMB (\$39,000) and two-liter emissions. Limits were also set on vehicles for high-ranking officials: three liters and 350,000 RMB (\$54,500) for vice ministry level emissions, and 450,000 RMB for ministry level officials (\$70,000).

The Chinese government's Twelfth Five-Year Plan includes an "Energy-saving and alternative fuel vehicles for official use promotion project" to increase the number of energy-saving and alternative fuel vehicles to 50% of new vehicle purchases by public institutions, including government, hospitals, and schools.



**Taxes are cut for AFVs**

The Chinese government's new vehicle and ship tax, which came into effect on January 1st, eliminates taxes on fuel cell and all-electric vehicles while halving taxes on other AFVs. The Ministry of Commerce, the State Administration of Taxation and the Ministry of Industry and Information Technology jointly determined which vehicle models qualified for the tax cuts. Local governments are allowed to modify the tax rates set by the central government. The list of eligible vehicles currently has 49 models, including 42 all-electric and 7 fuel cell vehicles. Of the eligible vehicles 80% are designed and produced by domestic automakers. More than half of the models listed are still being developed and are not yet on the market.

**Foreign investment no longer encouraged in finished vehicles**

On January 16th 2012, the Ministry of Commerce released the Catalogue of Encouraged Foreign Investment Industries (2011 revised version). The new foreign investment catalogue removed finished vehicles, but added AFV components to the list of industries where foreign investments are encouraged. Key AFV components listed include: traction batteries, anode materials for batteries, cell separators, battery management systems, electric motor management systems, integrated electronic control panels for electric cars, electric car motors, automotive DC/DC converters, high power electronic components, and plug-in hybrid electromechanical coupling drive systems.

No official explanation was provided for the policy change. Analysts believe the Chinese government might be worried about over-capacity in finished vehicle manufacturing. The Catalogue also does not mention any specific incentive packages to foreign investment, leaving the details to local governments.

**State Grid Corporation Announces Charging Infrastructure Corridor**

In August 2011 the State Grid Corporation of China announced a *Plan on Interconnecting the EV Smart Charging Networks for Suzhou, Shanghai and Hangzhou* to facilitate travel in EVs between the cities. Specifically, 8 charging stations will be built in Zhejiang Province, along the Shanghai-Hangzhou, Changzhou-Taizhou, and Shanghai-Jiaxing highways. Another 6 stations will be built in the Shanghai service area along the Shanghai-Kunming highway, the Jiangsu service area along the Shanghai-Nanjing highway, and the Suzhou service area along the Changzhou-Taizhou highway. Suzhou, Shanghai and Hangzhou are major cities in the Ten Cities and Thousands Vehicles Program.

**Latest Statistics Reveal Over 10,000 Registered EVs in 25 Experimental Cities**

The Ministry of Industry and Information Technology has released statistics revealing that in July 2011 over 10,000 EVs were registered in 25 pilot cities, including over 1,000 units registered by individuals. Pilot EV fleets have logged over 330 million km so far. They also counted 100 charging stations encompassing 4,500 chargers in China. These results were in line with government goals.

## Local Level

**Cities set ambitious AFV goals for 2012**

In line with ambitious national guidelines, local Chinese governments have committed to adding 80,000 AFVs to their roads in 2012. Shenzhen, Hefei (Anhui province) and Hangzhou (Zhejiang province) have made the largest commitments. Shenzhen has announced a 4,500 AFV increase, including 2,000 government purchases. Shenzhen currently has 3,035 AFVs. In June, Hangzhou had announced a goal of adding 3,000 AFVs in 2012; in January, it more than sextupled its target to 20,000 AFVs. Yet the city only had 1,374 AFVs on the road at the end of 2011. Similarly, Hefei has a 20,000 AFV goal for 2012, but currently only has 781 AFVs. Wuhan (Hubei province) plans to double its number of AFVs (currently 800) in 2012, while Chongqing plans to triple its total.

The national government set a goal of 1 million AFVs by 2020 in its Twelfth Five-Year Plan.

### **Shenzhen Launches EV Ownership Program**

The Shenzhen Development and Reform Commission launched a new EV program in September to incentivize EV purchases by its residents. The program includes a maximum subsidy of 60,000 RMB (\$9,400) for all-electric vehicles, and 30,000 RMB (\$4,700) for plug-in hybrid vehicles. BYD's F3DM is this program's recommended model, although other models qualify for the subsidies. The Guangdong Price Bureau has set the electricity rate for EV charging at 1.0064RMB/kwh (\$0.1577) during peak hours and 0.2495RMB/kwh (\$0.0391) during off-peak hours. Shenzhen issued its first AFV plan in 2009.

### **BYD & Shenzhen Sign Largest EV Fleet Leasing Contract**

Shenzhen awarded BYD a contract to be the sole provider of electric vehicles at the 2011 International Universiade, an international multi-sport event organized for university athletes by the International University Sports Federation. The 26<sup>th</sup> Summer Universiade took place from August 12 to 23. Shenzhen made the EV fleet deal to comply with clean air requirements and the principle of "Government hosting with citizen involvement, an economic event with a marketing operation." The agreement is also a part of Shenzhen's 2009-2012 AFV deployment plan.

The leasing agreement includes 200 eBuses and 300 e6s. The BYD e6 is a 5-seat crossover with a 300km range. Its BYD-developed "Fe" lithium iron-phosphate battery has level-2 and level-3 charging capabilities. The e6 was released in May 2010 at a starting price of 200,000 RMB (\$35,000). The e12 is a 12-meter long electric bus with a 155-mile range that was released in December 2010. In addition to using BYD's iron-phosphate battery, the e12 draws energy from solar cells. The vehicles were integrated into Shenzhen's public transportation system after the games. Shenzhen Bus Group, Shenzhen Eastern Bus Group and Shenzhen Western Bus Company will service the vehicle. The BYD-Shenzhen deal is the world's largest electric vehicle leasing agreement to date. It builds on a previous BYD-Shenzhen deal whereby BYD delivered 40 e6 vehicles to Pengcheng Electric Taxi Company, making Shenzhen the first Chinese city to adopt electric taxis.

### **AFV Owners Could Bypass Beijing License Lottery**

In June, the central government announced that it will shortly implement its *Beijing Experimental Plan for Subsidizing Private-Owned AFVs* enabling individuals purchasing AFVs to obtain license plates without going through Beijing's lottery system. Any new energy vehicle qualifies, regardless of where it is produced. Beijing's City Government has been holding license lotteries since December 23, 2011 under its *Provisional Regulation on Controlling Passenger Car Quantities*. The lottery, which is unique to Beijing, is held every month on the 26<sup>th</sup>. It awards 17,600 licenses per month. The probability of winning decreased from 10.6:1 in January to 23:1 in March. The plan has led many AFV companies to open sales stores in Beijing. BYD Vice President Zhibing Xia has designated Beijing as the major target for BYD AFV sales this year, and Zotye plans to open its first AFV sales store at the end of 2011.

### **Chery Finalizes First Government Fleet Order of Chery QQ EVs**

In July, Wuhu-based (Anhui Province) Chery Auto Company delivered its first AFV government fleet order of 4 Chery QQ EVs to Jiangsu province. The EVs will be assigned to local health agencies. Chery QQ EVs have a much lower price and higher engine efficiency than comparable EV models from competitors, such as Zotye's Multipla, BYD's e6, and Changan's Benni Mini EV.

### **Hubei Xiangyang AFV high-tech industrial park is approved**

In February the Hubei Science and Technology Department approved an AFV high-tech industrial park in Xiangyang. The AFV high tech industrial park is a part of the Xiangyang hi-tech zone, which was established in 1992. The zone includes an Automobile Park and Entrepreneur Center.

The industrial park currently includes 12 AFV producers, including Dongfeng Motor Corporation, 50 core component producers and 200 companies in other high-tech industries. The industrial park will support the development of AFV vehicles and core components, such as batteries, motors, and electricity control systems. The industrial park will also encompass other sectors such as power supply, charging services and infrastructure development, and battery recycling.

**Hefei Grows EV Fleet & Services**

In June 2011, Hefei city in Anhui province committed to implementing a comprehensive plan to encourage the widespread adoption of alternative fuel vehicles. By the end of this year, it expects to add another 1,250 EVs to its fleet, build 2 EV charging stations and 4 battery replacement service stations, and open a 6S auto after-sale service store. In addition to the services that 4S stores provide, 6S stores provide customized design services and vehicle performance data collection. The city is still mulling a plan to subsidize AFV purchases. Hefei's plan refers to Anhui Jianghui Automobile's JAC Tongyue as a preferred vehicle. The sedan was released in 2010, has a range of 150 km, and costs 65,000 RMB (\$10,156) after subsidies. The full cost without subsidies is 150,000 RMB (\$23,400).

**Foshan Approves AFV Program**

In August 2011, the city of Foshan in Guangdong province approved its first AFV Development Plan that envisages the operation of 1,050 AFV buses by 2012, including 1,000 LNG buses and 50 hybrid or purely electric buses. Foshan also plans to introduce hybrid or electric taxis and to encourage the electrification of government fleets. The plan particularly emphasizes support for Beiqi Foton Nanhai Company, Foshan Feichi Automobile Transportation Group, Green Wheel Electric Vehicle Company, Advanced Electronics Energy Company, and FSPG Hi-Tech Company. Foshan is home to AFV manufacturers FAW and Beiqi Forton.

In the first stage of its AFV plan, Foshan aims to introduce 329 AFV buses in 2011 for use in public services, such as postal services. In the second stage, Foshan will introduce another 438 AFVs, including 388 LNG buses and 50 hybrid and all-electric buses. Foshan currently has 283 LNG buses in service.

Under the March 2010 *Plan for Electric Vehicle Development in Guangdong Province*, Guangdong plans to have 2-3 world-class EV manufacturers and a production capacity of 200,000 EVs by 2015.

**Jinhua Announces AFV Subsidy**

In August 2011, the city of Jinhua in Zhejiang province announced a decision to offer up to 80,000 RMB (\$12,500) in subsidies to local government agencies and residents for the purchase of an electric vehicle. The subsidies are part of a broader Zhejiang policy to promote AFVs. Jinhua is home to AFV manufacturers Kandi Vehicles, China Youngman Automobile Group, and Zotye Auto. Jinhua's plan promotes the purchase of vehicles from local brands: Kandi's KD5010XXY mini, which was released in 2010, has a range of 120 km, and costs 19,800 RMB (\$3,093); Yongman's eBUS; and Zoyte's JNJ700EVA1 and JNJ6400EVL2 SUV, which was released in 2010, has a range of 200 km, and costs 119,800 RMB (\$18,800).

**Chinese Government Invests in Linzhou AFV Program**

In August 2011, the Chinese central government invested 15 billion RMB (\$2.4 billion) in a national AFV program in the Red Flag Canal economic development zone (EDZ) in Linzhou, Henan province. The Red Flag Canal EDZ is one of 19 provincial EDZs in Henan province. It was created in 2006 and expanded into an industrial cluster that includes high-tech, auto, biology and equipment manufacturing. The project is to be carried out by the Chinese Committee for Energy Conservation, Energy-saving Technology Company, RCG Holdings, and automakers Zhongnenghua Group and Hongqiqu Company. After the project is implemented, the Red Flag EDZ is expected to produce 100,000 AFVs annually.

### **Changsa's EV bus order illustrates local AFV protectionism**

In December, Changsa (Hunan's capital) signed an agreement to purchase 100 all-electric K9 buses from BYD, which introduced the buses to the market in September 2010. The bus has a 32-passenger capacity and a low floor design that enable easy access. Its lithium-ion batteries have a 250 km range and can partially be charged from solar panels installed on the bus's roof. Although Changsa opened a tender process for the bus contract, local authorities explicitly stated that they would only consider BYD for the city's first order of 200 EV buses. Changsa currently only has two electric buses in service because the BYD plant in Changsa does not have sufficient capacity to produce 200 buses. Meanwhile, many EV manufacturers with the capacity to meet Changsa's demand have not been given the opportunity to do so. This situation illustrates the degree to which China's AFV market is fragmented. Experts believe that the regional barriers are a result of the national AFV program's structure wherein the 25 pilot cities have an incentive to subsidize locally based companies.

On February 29th, 2012, Changsha's municipal government released the "Guidance for Changsha Auto industry development in 2012". Changsha offers a maximum subsidy of 50,000 RMB for hybrids and 60,000 RMB for all-electric vehicles.

BYD acquired the Changsa bus producer Midea Sanxiang Bus Co., Ltd. in 2009 and has exclusively been producing buses at the plant. BYD owns nine plants in seven areas: Shenzhen, Xi'an, Beijing, Shanghai, Huizhou (Guangdong), Changsha, Shaoguan (Guangdong). All of BYD's government contracts are with cities and provinces where it has production plants. Most of its contracts are with Shenzhen's municipal government. 500 K9 buses have been operating in Shenzhen since August 2011. In November 2011, Xi'an (capital of Shaanxi province) also ordered 50 BYD K9 electric buses to add to its public transportation fleet. Internationally, Frankfurt's city government ordered three K9 buses in the first quarter of 2012. BYD produced 900 K9 buses in 2011 and plans to produce 3,000 buses in 2012.

## **III. Technology**

### **First All-in-one EV Charging & Battery Replacement Station Put Into Service in Qingdao**

On July 11, Shandong Electric Power Corporation and XJ Group Corporation (the leading power equipment manufacturing company in China) put China's first full-service EV charging and battery replacement station into service in Qingdao, Shandong province. It has the capacity to charge 120 electric buses or 360 passenger electric vehicles at the same time, and to replace batteries for 540 vehicles per day. It also has a comprehensive measurement system to determine electric power consumption and charging fees. The State Grid Corporation funded the project, which will mainly serve public transportation fleets. Qingdao is currently applying to be included in the *Ten Cities, One Thousand Vehicles Program*.

### **Aviation Changli Energy Technology launches zinc-air cell mobile charging station**

In February, Beijing Aviation Changli Energy Technology Co., Ltd. launched the world's first zinc-air fuel cell mobile charging station. The station weighs 35 tons and has an electric storage capacity of 1,000 kWh. The station's output voltage is between 300 to 440 volts and its output power is 35 kilowatts. One zinc-air battery mobile charging station can simultaneously charge eight electric minibuses or four electric buses or sanitation vehicles.

Aviation Changli Renewable Energy Technology is an alternative energy company that develops, manufactures and markets zinc-air fuel cell technology. The company was founded in 2010 and has a market capitalization of 500 million yuan. Its holding company is AVIC International Group. The holding company's original name was China Aero-Technology Import and Export Corporation, a leading Chinese military aircraft producer. In 2008, the company divested its military aircraft business and changed its name to AVIC International Group. The company now claims to be a major civilian aviation product hub. Its diverse business portfolio includes international aviation, trade and logistics, real estate and hotel management, energy investment and high-end consumer products. Other alternative energy companies held by AVIC include Huiteng Wind power equipment, China Aviation Industry Renewable Energy, Huide Wind Power Engineering, and Excellence Forging.

### **CSR, FAW & Changan Motors to Launch Joint R&D Program For EVs**

In July, China South Locomotive & Rolling Stock Corporation Limited (“CSR”) partnered with automakers FAW Group Corporation and Changan Motors to launch an R&D program for the creation of EV platforms. They aim to jointly build 2 platform models and 3 transitional platform (i.e. extended-range) models that will form their EV core technology. CSR and FAW had previously cooperated (in November 2010) on a program to develop core technology research on electric bus engines.

FAW is headquartered in Changchun, Jilin Province, while Changan Motors is based in Chongqing. Both released electric vehicles with 150 km ranges in 2010. FAW released its E-Bora sedan at a price of 107,800-146,500 RMB (\$17,000-23,000). Changan released the Benni Mini EV compact, which has a range of 150 km and costs 100,000-150,000 RMB (\$16,000-23,500). Hunan-based CSR is the world’s largest electric locomotive manufacturer.

The three companies are members of the “State-owned Enterprise EV Industry Alliance”, which is headed by the State-owned Assets Supervision and Administration Commission of the State Council (SASAC). The Alliance was founded in Beijing on August 18, 2010 with an initial investment of 1.3 billion RMB (\$200 million). Its short-term goal is to promote the standardization of electric car technologies. Its mid to long-term goals are to master core EV technologies and to build internationally competitive Chinese EV brands. The alliance’s members include automakers FAW, Changan and Dongfeng, and 13 state-owned enterprises in related sectors: Dongfang Electric Corporation, China South Locomotive and Rolling Stock Corporation, China National Offshore Oil Corporation, China Aerospace Science and Industry Corporation, Aviation Industry Corporation, State Grid Corporation of China, China Petrochemical Corporation, China Southern Power Grid Company, China Aviation Technology Import-Export Corporation, China Poly Group, China South Industries Group Corporation, China Potevio, and General Research Institute for Nonferrous Metals.

### **New AFV alliances founded**

Tongji University took the lead in founding the Chinese Fuel Cell Vehicle Technology Innovation Strategic Alliance and the Advanced Ground Transportation Alliance in Shanghai on January 16, 2012. Tongji is a prestigious Shanghai-based university with a renown engineering department and leading AFV research and development center. The fuel cell Alliance has 19 members, including four universities (Tongji, Tsinghua, Wuhan, and Chongqing), three research institutes, and 12 automobile/auto parts companies (notably FAW group, SAIC Group, Chery, and Changan). The ground transportation alliance has 13 members, including six universities, three research institutes, and four state-owned enterprises. The alliance’s members aim to work together as well as independently to overcome the key bottlenecks in the deployment of fuel cell technology and to accelerate technology innovation in advanced ground transportation.

The fuel cell alliance’s members are Tongji University, Tsinghua University, Wuhan University of Technology, Chongqing University, Dalian Institute of Chemical Physics (Chinese Academy of Sciences), Shanghai Clean Energy Research and Industry Promotion Center, China Automotive Technology & Research Center, FAW Group Corporation, SAIC Motor Corporation Limited, Dongfeng Electric Vehicle Co., Ltd, Shanghai Fuel Cell Vehicle Power Co., Ltd, Sunrise Power Co., Ltd, Chongqing Changan new energy vehicle Co., Ltd, Chery New Energy Vehicle Co., Ltd, Shanghai Shen-Li High Tech Co., Ltd, Foresight Energy Co., Ltd, Beijing SinoHytec Co., Ltd, Guangshun New Energy Technology Co., Ltd.

The ground transportation alliance’s members are Beijing University of Technology, Southeast University, Harbin Institute of Technology, Huazhong University of Science and Technology, Tsinghua University, Tongji University, Shanghai Academy of Science & Technology, Chinese Academy of Science Shanghai Branch, Research Institute of Highway Ministry of Transport, SAIC Motor Corporation Limited, China Electronics Technology Group Corporation, FAW Group Corporation, and China Communication Construction Company Ltd.

### **Hangzhou Puts EV Taxi Fleet Back Into Service After Accident**

Hangzhou's taxi fleet of Zotye Multipla (Langyue) EVs was put back in service on June 14 after a two-month suspension. The fleet was idled in April after one of the vehicles burst into flames. According to a panel of 11 experts appointed by the Zhejiang government the accident was caused by the improper installation of a battery pack. Battery leakage and insulation damage ensued, resulting in a short circuit. The panel also surmised that the improper installation may have been compounded by the use of "cheap and inferior equipment" to install batteries. Zotye accepted the investigation results and committed to re-evaluating the risks associated with its technological innovations in EV platform and engine design. However, Zotye declined responsibility for battery design and pack failures.

The Multipla vehicles were reintroduced into Hangzhou's taxi fleet with three adjustments: a GPRS was added to monitor vehicle performance; the manual shift was switched to automatic shift to increase driver control; and an iron fender was added between the back seats and battery tank to improve safety by creating a buffer between passengers and the battery should an accident occur. Hangzhou New Energy Taxi Company will service the EV fleet. Hangzhou has announced plans for 200 additional electric taxis by the end of this year.

The Multipla compact has a range of 200 km and costs 250,000 RMB (\$39,000) at full price and 148,000 RMB (\$23,000) after subsidies. Zotye also produces two EV SUV models with 200 km ranges. The 2008 model was released in April 2009 at a starting price of 119,800 RMB (\$19,000) while the 5008 model was released in July 2010 for 210,000 RMB (\$33,000). The 5008 model's principal innovations over the 2008 model are a BMS battery management system that monitors battery performance, and a fast charging option.

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### **Shandong Electric Power Company launches charging research center**

On February 1st 2012 Shandong Electric Power Corporation (a State Grid Corporation subsidiary) launched the Shandong EV Energy Supply Research Center. The center will test and evaluate new technological developments in EV charging. It will primarily focus on D/C and A/C charging, EV charging station monitoring systems, and designing various electricity supply modes for EVs.

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### **CATARC crash tests first EV**

In January the China Automotive Technology & Research Center (CATARC) conducted its first crash test on an electric vehicle: Changan Automotive Group's E30 all-electric sedan. The E30's exterior is based on the design of an EV produced by Chinese automaker Haifei automotive Co., Ltd. (CODA's predecessor in China), which merged with Changan in 2009. The E30 has a 61-horsepower motor produced by Broad-Ocean EV Co., Ltd. and lithium-ion batteries produced by Beijing Pride Power Co., Ltd. The vehicle has a range of 207 km (128 miles).

The EV passed the test and received a five-star safety rating. The testing consists of a full-width frontal crash test, a frontal offset crash test, and a side impact crash test. CATARC's testing is closely aligned with global standards. However, EV technological constraints for domestic EV producers are taken into account in the formulation of EV-specific standards in order to avoid hindering the development of the domestic EV industry. An example is testing the battery system's ability to automatically cut off battery power during a crash.

Beyond traditional auto safety concerns, the most important safety element in EV tests is gauging battery damage following a crash. "The high power batteries can ignite; high voltage electricity currents inside the car can harm the human body," said Zhou Rong, an engineer at the research center. In addition, EVs are heavier than conventional vehicles and can therefore cause more harm to passengers.

Changan produces two other EV models: the Benni Love and Benni Mini.

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**UL and CATARC form partnership**

On February 14, the leading global independent scientific certifier Underwriters Laboratories (UL) signed a partnership agreement with the Chinese Automotive Technology and Research Institute (CATARC) to jointly promote the AFV industry in China by advancing Chinese automakers' knowledge of safety issues. CATARC is a state-owned research institute that operates under the State-owned Assets Supervision and Administration Commission of the State Council.

The partnership is expected to draw Chinese AFV makers' attention to safety issues and to integrate Chinese AFV safety standards with global standards.

The agreement involves cooperation on the testing of AFV systems, products, components, and calibration; the development of safety standards; and a personnel training program. For example, UL will train CATARC personnel on developing safety standards in compliance with UL standards, with the goal of certifying CATARC. As an accredited UL subcontracting laboratory, CATARC will be able to conduct safety tests for Chinese EV battery producers and help them acquire UL certification. In addition, the two sides will provide training programs for Chinese battery testing engineers.

As a third party testing and certification institute with more than a century of experience, UL is a forerunner in the development of AFV safety standards. For example, the lithium-ion battery standards it released in 2009 became the US national safety standard (UL2850) in November 2011. UL provides product safety testing and certification services across many industries such as building materials, chemicals, energy, food safety, health sciences, lighting, and drinking water.

## Quarterly Developments

### REST OF WORLD

#### Australia

**Blade Partners with DLG to  
Produce First Aussie EV**

In September, energy systems company IRES Asia Pacific Pty Ltd. and Blade, a wholly Australian-owned EV start-up, formed a joint venture with Chinese-based lithium battery manufacturer DLG Battery Limited to create Australia's first domestically-produced electric vehicle and renewable energy service and distribution network. According to Blade founder and CEO Ross Blade, "The Blade DLG joint venture will bring 100 new high-tech jobs to Castlemaine in Central Victoria". IRES Managing Director Steve Carter added that the IRES service and distribution network would support Blade-DLG EVs while creating 250 new jobs throughout Australia. Production of an initial 800 units is slated to begin in 2012.

Blade has been developing electric vehicles and batteries since 2006. The company produced and exported its first electric vehicles in 2008. Its latest model, the Electron Mark VI hatchback, was released in June. It has an 18 KWh battery that provides a range of 100 km. The vehicle costs AUS \$47,000 (US \$45,500).

DLG began producing battery cells for the EV market in 2007.

IRES Pacific (International Renewable Energy Systems) was founded in 2009 in Melbourne as an offshoot of IRES Germany. It will provide servicing and network support to the joint venture.

**Australia Studies Natural Gas Potential**

On December 13, the Australian government released a Strategic Framework for Alternative Transport Fuels by 2030 as an input to its Energy White Paper. The framework's goal is to create a lower carbon economy by 2030 and enhance Australia's energy security through the development of alternative fuels in the transportation sector. The Framework suggests that CNG and LNG use in vehicles "may increase in the medium term with investment in distribution infrastructure and improvements in fuel tank technologies."

Infrastructure proposals include BOC's East Coast corridor and Kleenheat's trials in the Northern Territory and Western Australia. In October 2010, Australian gas service provider Kleenheat Gas partnered with US-based GreenMan Technologies and its subsidiary American Power Group Inc. (APG) to carry out a 90-day trial for a demonstration conversion of two 500+ horsepower heavy-duty trucks to APG's patented dual-fuel system using diesel fuel and liquefied natural gas. The trial was successful in achieving lower fuel operating costs.

Technological improvements cited in the framework include the recently released improved LPG Ford Falcon and GM Holden's dual-fuel Colorado vehicles, which emit up to 16% less CO<sub>2</sub> than equivalent ICE vehicles. The Australian Energy Market Commission is reviewing energy market barriers to natural gas vehicle deployment. Australia's final Energy White Paper is scheduled for release later this year.

**Holden launches new LPG range**

In February, Holden unveiled a range of LPG Commodores. One innovation is the removal of the Commodore's fuel tank from the boot and placement under the vehicle's floor, freeing up luggage space. Although the LPG versions of the Commodores will cost AUS\$2,500 more than their petroleum equivalents, the price differential will mostly be offset by the Australian federal government's AUS\$2,000 rebate to private buyers. An additional AUS\$1,000 rebate may be available for vehicles registered in Western Australia. Furthermore, LPG is sourced and refined in Australia and typically costs at least 30% less than gasoline. An LPG engine costs AUS\$11 less to refuel than a gas engine car for every 200km traveled.

Headquartered in Port Melbourne, GM Holden is represented by over 250 dealerships throughout Australia. Holden has an engine manufacturing plant at its headquarters and manufacturing operations in Adelaide. It became a subsidiary of GM in 1998. Holden produces 42 models based on four vehicle platforms: the Commodore range of sedans, Sportwagon, Ute, and Caprice long-wheel base luxury vehicles. Holden mainly exports to the Asian Pacific and European markets. The Commodore has had a 15-year run as Australia's favorite car since 1985, but was dethroned by the Mazda 3 in 2011. Holden launched its first LPG vehicle - the dual fuel Colorado pickups - in 2010. Australia's LPG Vehicle Scheme provides grants for the LPG conversion of a registered motor vehicle or the purchase of a new LPG vehicle, subject to eligibility criteria. The Scheme is capped at 25,000 eligible claims per year for the duration of the scheme (until 30 June 2014). The grant amount for LPG conversions completed between 1 July 2011 and 30 June 2012 is AUS\$1,250, and AUS\$1,000 for conversions completed between 1 July 2012 and 30 June 2014. Grants for the purchase of new LPG vehicles are AUS\$2,000. From July 2010 to February 2012, the government paid out 298,297 grants for LPG conversions and 2,650 grants for new LPG vehicles.

LPG currently accounts for around 6% of the Australia's transportation fuels. LPG infrastructure includes 3,700 refueling stations across Australia.

**Brazil****Hiriko to be tested in Brazil**

Following a trial run in Brussels this January, the Hiriko EV will be tested in the Brazilian city of Florianopolis this December. The trial will also incorporate a study of Florianopolis' transportation needs.

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## Colombia

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### **Bogota launches EV taxi fleet pilot project**

On January 24, the City of Bogota in Colombia launched an innovative New Public-Private Partnership Project to spur the use of EVs in the capital city's taxi fleet. The first 50 taxis, from BYD and Mitsubishi, are expected to be operational shortly. Taxi companies are responsible for purchasing and servicing the EVs, while the Bogota government will provide policy support, such as zero import duties and the removal of circulation restrictions and permitting requirements for EVs. The project results from Bogota's active participation in the C40-CCI EV Network of 17 global cities that have committed to implementing climate-related sustainability actions.

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## India

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### **Volvo Begins CNG City Bus Trial in New Delhi**

In June, Volvo Buses India Ltd. commenced a trial of the CNG version of its Volvo 8400 City Bus along the Delhi Transport Corporation (DTC)'s Teevra Mudrika route. The bus has 6 roof-mounted cylinders that give the vehicle a range of over 300 kilometers. The buses will be tested for 4 to 6 months before they replace DTC's phased-out buses.

Delhi implemented a CNG conversion kit program in 2002 to cut air pollution emissions. The program spurred New Delhi to develop one of the world's largest fleets of CNG vehicles. Approximately 90,000 CNG buses, taxis, and three-wheelers now operate in Delhi.

Volvo Buses has an 80% Indian market share in luxury inter-city buses and a 50% share in diesel buses. Volvo's share translates into 4,000 buses operating in 12 cities across India.

Volvo is producing the 8400-model CNG buses at its state-of-the-art Volvo Buses India manufacturing plant in Hoskote, near Bangalore.

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### **Maruti Suzuki's 2011 Annual Report Pledges CNG Development**

According to India's National Roadmap for expanding the use of CNG vehicles, which was released by the Gas Authority of India in 2009, India will have 3,708,965 CNG vehicles on the road by 2014. To meet the increase in demand, major Indian gas distributor Indraprastha Gas Limited (IGL) has announced plans to build 32 more CNG stations by the end of 2012, bringing its total to 310 stations. Thereafter, IGL plans to add around 35 stations every year.

The Indian government has an 18.28% stake in MSIL.

In its 2011 annual report, released in August, Maruti Suzuki India Ltd (MSIL) reiterated its commitment to the continued development of alternative-fuel technologies, and especially natural gas vehicles under its new "Techno Logical" approach. MSIL already increased its R&D budget by 140% between 2010 and 2011. The company has a 44.9% market share of the Indian passenger car market. MSIL is also currently studying the feasibility of electric mobility in India.

Last year MSIL launched CNG versions of five of its models: the Alto hatchback, WagonR hatchback, Ecco small van, Estilo mini MPV and SX4 crossover. Other CNG vehicle models on the Indian market include Hindustan Motors' Ambassador Classic 1800 ISZ CNG sedan, Hyundai Motor's Santro Xing KX hatchback, Tata Motors' Indica 1405 cc hatchback, and Toyota Kirloskar Motor's Innova MPV.

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## Israel

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### **Better Place Makes First EV Delivery to Israeli Rental Company**

On January 22, U.S. battery-swap station start-up Better Place LLC in partnership with Renault SA, delivered its first 100 EVs to Israeli car rental firm Eldan Group. The goal is to provide tourists and potential customers an opportunity to experience driving EVs. Eldan plans to acquire several hundred Renault Fluence Z.E. electric cars from Better Place in the second half of 2012.

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## Iran

### **IKCO Announces Production of CNG Vehicles in Partnership with Renault**

Iranian automotive manufacturer IKCO announced plans in June to produce 40,000 Renault-based Logan cars, of which 15% will be fitted with CNG/gasoline bi-fuel engines. About 6,000 of these vehicles are destined for export. The vehicles will be produced in Tehran. IKCO also plans a 2012 release for a new version of its Samand NX7 sedan, with a turbo-charged bi-fuel EF7 engine. Renault and IKCO established a joint venture in 2003. Renault France owns a 51% stake, while the remainder 49% stake is shared by IKCO and auto-manufacturer Saipa Group.

Iran began selling Logan models in 2007 as Renault Tondar 90. In 2010 IKCO and Renault-Pars agreed to produce three new Renault-branded models in Iran, including a revamped Tondar 90, a pickup truck and a station wagon. The pickup truck is expected to hit the market by the end of this year.

Iran's alternative fuel vehicle market was jumpstarted by the government's implementation of a Gasoline Rationing Plan between 2007 and 2010 in an effort to reduce the country's fuel consumption. It aimed to convert most existing cars to run on natural gas within 5 years at a rate of 1.2 million annually. The plan also calls for most new cars to be able to run on natural gas, and for Iran's 10,000 refueling stations to be retrofitted for natural gas within 5 years. In 2010 the Iranian government announced that the plan had saved the country \$11 billion in fuel consumption.

## Mozambique

### **Mozambique Capital Receives Tata CNG Bus**

This past summer, Mozambique's capital city of Maputo received a shipment of 150 natural gas-powered buses from Tata Motors of India. Maputo's Public Transportation Company (TPM) has put the buses into operation and will service them. TPM sent a contingent of engineers and mechanics to India for training on the vehicles.

The natural gas bus order is part of a national plan to improve public transportation in the highly congested capital. Mozambique's Transport and Communications Fund (FTC) provided TPM with \$19.5 million in funding to cover the cost of the bus purchase and spare parts, two tow trucks and four other vehicles that will provide technical assistance. TPM operates two CNG refueling stations and plans to build two more.

Tata currently ships all of its vehicles to Mozambique, but it has announced plans to build a plant in Mozambique to produce its Nano model.

## New Zealand

### **Mitsubishi and SolarCity Unveil Solar Charging System for i-MiEV**

Mitsubishi New Zealand and New Zealand-based SolarCity have formed a partnership to create a charging system that would allow i-MiEV EV consumers to lock in energy costs for 25 years and entirely use rooftop solar panels to charge their vehicle. The system was released on August 31, 2011. It has a 1.5-kilowatt capacity and is expected to produce an average of 1,900 kwh annually, providing enough power for the i-MiEV to travel 1,250km/month. The system is also able to power homes.

The complete solar system for i-MiEV car owners starts from NZ \$9,999 (US \$7,625) and is designed for installation on a home or garage roof. SolarCity will service the system.

SolarCity is the only solar power company in New Zealand to provide the full spectrum of solar services ranging from design, product development and manufacturing, installation financing, and servicing.

According to the *New Zealand Energy Strategy to 2050*, New Zealand aims to be one of the first countries to widely deploy electric vehicles. The government is also developing policies to promote the production and purchase of vehicles that are capable of accepting blends with 10% biofuels. The strategy also includes LPG and hydrogen technologies.

## Nigeria

### **Nigeria Orders 126 T3 Electric Vehicles from T3 Motion**

On January 24, T3 Motion Inc. announced it had received an order from a newly appointed Nigerian distributor for 126 T3 Electric Stand-up Vehicles (ESVs) and 126 Motiontrak GPS tracking systems. The vehicles are to be used by the Nigerian government customs and security departments. T3 Motion CEO Ki Nam portrayed the order as a part of the company's global expansion strategy. This is the company's first order from Nigeria.

T3 Motion is an electric vehicle and public safety product company based in Orange County, California. Its major product is the T3 Series, which was launched in 2006. The T3 is an electric three-wheel stand-up vehicle designed for the public safety, private security and government markets. The vehicle has a 40-mile range, two field-swappable lithium-polymer power modules that can charge in three to four hours, a 5-20 mph range and a zero-degree turning radius. Its 9-inch raised platform offers above-crowd visibility. The Motiontrak is a camera and black box data recording system for vehicles that records driving data and accident data 15 seconds before and 10 seconds after an accident. Motiontrak records critical information relating to the speed, direction, GPS position, time, impact force and compact direction with video footage.

As of 2011, more than 3,000 T3 Series vehicles are deployed in over 30 countries, mostly in the Middle East, North America and Caribbean region. The company currently has a presence in North and South America, Asia, Europe and Africa.

No alternative fuel vehicle models are currently available in Nigeria, but Benin City has commissioned the country's first CNG plant from Nigerian Independent Petroleum Company (NIPCO) in an effort to encourage motorists to convert their vehicles to gas-powered engines.

## South Africa

### **Hyundai Introduces CNG Van in South Africa**

In September, Hyundai Automotive South Africa (HASA) introduced a CNG-converted H1 panel van in South Africa. Hyundai claims the converted vehicle can achieve fuel savings of up to 45%. Local fleet companies are currently testing the 3-seater cargo van. HASA also plans to test the viability of CNG buses and passenger vehicle conversions to CNG.

HASA currently imports all of its vehicles, including the H1, from the South Korean Hyundai Motor Company, but it has just started the construction of an assembly plant in Gauteng, South Africa. HASA is the third largest market player in the South African passenger car and light commercial vehicles market, behind Volkswagen and Toyota.

South Africa's Department of Science and Technology rolled out a Green Transport Program in 2009 to showcase green transportation technology at the 2010 Soccer World Cup. The South African National Energy Research Institute has announced plans to set up a Green Transport Research and Demo Center.

Additional original documents and translations available in **AFVInsider online** edition:

- Portland Electric Vehicle Plan
- US-China JCCT proceedings
- China's Twelfth Five-Year Plan
- China's Ten Cities, One Thousand Vehicles Program
- Provisional Regulation on Controlling Passenger Car Quantities
- Plan for Electric Vehicle Development in Guangdong Province
- India's National Roadmap
- New Zealand Energy Strategy to 2050

## GLOBAL FEATURE STUDY

### BETTER PLACE IN ISRAEL

#### **Facts on Israel**

##### **Population:**

- 7.5 million

##### **Total vehicles:**

- 2,458,716

##### **Vehicles Per 1000 People:**

- 457 (2009)

##### **Standard Vehicle Taxes:**

- 83% purchase tax (average)
- 7% custom duties (Japan/South Korea)
- 16% VAT

##### **Gas Prices:**

- 27.82 NIS per gallon (or \$7.50, including a per gallon tax of \$2.92), September 2011

Israel's first all-electric vehicles will hit the road in December 2011. However, it remains to be seen whether they will take off.

In many ways, Israel, a country of 7.5 million and the size of New Jersey, is an ideal candidate for electric vehicle use. Because of cold or overtly hostile relations with its neighbors, driving is confined to Israel's borders—250 miles is the maximum a driver can effectively travel.<sup>1</sup> About 90% of drivers travel under 70 km a day.<sup>2</sup> Much as in an island country, this confined driving space limits the costly EV-infrastructure needed to power Israeli EVs. Moreover, taxes on standard cars are high and fuel costs are on par with the high rates in Europe. Gas in Israel cost approximately 7.50 dollars per gallon.<sup>3</sup>

Moreover, with its domestic energy consumption continually rising, energy security is a major concern for Israel. The country currently relies on imported fossil fuels to meet most of its energy needs, including oil (230 thousand barrels per day), natural gas (60 billion cubic feet), and coal (14 million tons).<sup>4</sup> Recent disruptions in the natural gas Israel receives from Egypt—40% of its total supply—have further stoked Israel's energy security fears. Egypt's natural gas pipeline to Israel was sabotaged 4 times in the past 6 months.<sup>5</sup>

Likewise, Israel's diplomatic relations with its neighbors have worsened in recent months. In early September, Israel's embassy in Cairo was stormed by Egyptian protesters. And its once-close ties with Turkey have deteriorated, culminating with Turkey's downgrading of diplomatic relations with Israel. On September 2, 2011, Turkey announced its decision to expel Israel's ambassador. These events have only served to stoke Israel's security concerns.

These concerns have spurred Israeli efforts to promote greater energy independence. Israel plans to tap into recently discovered natural gas reserves off its coast. About 16 trillion cubic feet (Tcf) of natural gas was discovered at the offshore Leviathan Field

earlier this year and 8.4 Tcf was found at the Tamar Field in 2009, the largest natural gas discovery of that year.<sup>6</sup>

Israel is also increasingly investing in renewable energy sources, which currently constitute less than 1% of its energy supply mix. The Israeli government has mandated the goal of generating 5% of its power generation from renewable sources by 2014 and 10% by 2020.<sup>7</sup> To promote renewable energy use, Israel offers subsidies to generate greater supply as well as feed-in-tariffs to spur demand.<sup>8</sup>

These policies extend to Israel's motor vehicle sector, which comprises about 2.5 million vehicles. (See figures below and the website for more data on the Israeli auto sector). Of particular note, Israel has a relatively large proportion of vehicle fleets. Its company car fleet doubled between 1996 and 2006, with a 2006 figure of 229,913 company vehicles.<sup>9</sup> The government vehicle fleet amounts to about 50,000 vehicles.<sup>10</sup>

Israel instituted a "Green Taxation" reform in 2009 offering tax breaks to buyers of cleaner vehicles.<sup>11</sup> Under the reform, the tax rate on a vehicle purchase is determined by its emission levels. Vehicles are divided into 15 groups that form the basis for tax credits, ranging from NIS 15,000 (US\$3,900) for the cleanest vehicles to zero for the most polluting group. The tax benefit is granted after applying the standard vehicle purchase tax rate of 83%.<sup>12</sup> Electric and hybrid cars enjoy additional tax exemptions. Electric cars have a 10% purchase tax until 2014, when the rate will rise to 30%. In 2020 EVs are scheduled to be taxed like a standard vehicle. Hybrid cars will be taxed at 30% until 2012. The tax rate will then gradually increase until it reaches the same rate as all-gasoline or all-diesel vehicles.<sup>13</sup> According to 2010 numbers, Israel has around 10,000 hybrid and 8,000 natural-gas powered vehicles.<sup>14</sup>



Additionally, in February 2010, the government launched a multi-billion dollar program to promote the research, demonstration and deployment of new technologies in the alternative-fuel vehicle space. The program, which will run from 2011 and 2020, will have a budget of NIS 4 billion (\$1 billion) for its first five years, and at least NIS 10 billion (\$2.7 billion) for the next five years.<sup>15</sup>

Finally in March 2010, Israel's Department of Environment and Department of Transportation launched a "Cash for Clunkers" program offering NIS 3,000 (\$815) to anyone who turns in a vehicle over 20 years old. The Government has allocated NIS 100 million (\$27 million) to this program from 2010-2015.<sup>16</sup>

According to a recent Bank of Israel report, these reforms have already succeeded in reducing air pollution from vehicle emissions by encouraging the purchase of less-polluting vehicles.<sup>17</sup>

## Better Place

Better Place, the brainchild of Israeli technology executive Shai Agassi, is the company at the center of Israel's efforts to untether its cars from their ICE heritage. The Silicon Valley-based company, formed in 2008, is an electric vehicle service provider that has partnered with Renault to mass produce the first switchable battery EV: the Fluence Z.E. Under this 2009 partnership, Renault agreed to produce 100,000 EVs for sale in Israel and Denmark by 2016, with Better Place investing \$150 million to create an EV power infrastructure.

Better Place's business model has several unique aspects. First, it is developing and managing an integrated EV "smart grid" that includes charging spots as well as battery switch stations, in which depleted car batteries are automatically swapped with fully-charged ones in under five

minutes. As with conventional EVs, charging spots enable the car to be plugged in and recharged over a longer period of time (e.g., at home during the night). Battery switch stations provide a much faster "refill," thus eliminating the issue of EV range limitation and long charging times. The company plans to deploy 40 battery switch stations throughout Israel by the end of 2011.<sup>18</sup> It also recently signed 400 agreements with parking lot owners to deploy thousands of charging stations as well as cooperation agreements with 27 Israeli municipalities. Four hundred and sixty companies and organizations, comprising a combined fleet of 85,000 vehicles, have pledged to switch to EVs in by 2015.<sup>19</sup>

Another innovation of the Better Place model is that consumers will own the Fluence Z.E., but not its battery. Better Place will own the car's battery and lease its use to the driver through a choice of battery subscription services. Like cell phone owners subscribing to a plan with a certain number of minutes, car owners can buy subscriptions that vary according to the number of miles of they drive per year. Better Place's service package plans include an annual mileage plan, installation and maintenance of a home charging station, free access to Better Place's battery switch stations, battery availability, a computerized driver support system, navigation aids, and roadside service. The table below lists service package plan costs.<sup>20</sup>

<b>Better Place Service Package Plan</b>	<b>Cost (Per Month, Including VAT)</b>
Less than 20,000 km	NIS 1090 (\$321)
Less than 23,000 km	NIS 1300 (\$383)
Less than 26,000 km	NIS 1470 (\$433)
Less than 30,000 km	NIS 1599 (\$471)

The Fluence Z.E. has a range of approximately 100 miles per charge. This is largely sufficient for most daily commutes in Israel. The standard model

will cost NIS 122,900 (\$36,150). A luxury version, which includes leather seats and other amenities, will cost an additional 5,000 shekels (\$1,475). Better Place opened its vehicle showroom this past summer. In August 2011, Better Place signed a marketing agreement with Israeli leasing company, Albar. Under the agreement, Albar, will lease the Fluence Z.E. to Israeli business and individuals.<sup>21</sup> Better Place also plans on operating similar electric vehicle services in other countries. On June 28, 2011, the company opened its first switch station in Denmark, the next country to receive a Better Place-Renault network. In June 2011, Better Place and Renault announced a similar agreement to bring the Fluence to Australia. Specifically "Renault will import the first electric car equipped with a switchable battery, the Fluence Z.E. into Australia, and Better Place will provide the electric car charging network and services."<sup>22</sup> Better Place is establishing similar projects in Hawaii, San Francisco, Ontario as well as in Japan and other areas in Europe with Renault as well as other car manufacturers. Most recently, it signed a strategic agreement with China Southern Power Grid Co. to promote EVs with switchable batteries in China.<sup>23</sup>

## Bumpy Road Ahead?

Not all Israelis, however, are welcoming Better Place and Israel's EV plan with open arms. Some columnists and others have expressed their skepticism. Most critiques center on the limitations or high costs to consumers.

Many stakeholders, such as automobile importers, favor a system where EV drivers can charge their vehicles at home. However, according to an earlier Ministry of Infrastructure draft of charging station regulations, charging at home may be prohibited. Rather, EV owners would be required to charge at a limited amount of public charging stations or at privately-owned charging stations operated by Better Place.<sup>24</sup>

Under this “managed charging” system, critics lament that EV drivers will pay substantially higher electricity fees than they would on the normal grid system.<sup>25</sup> According to sources from the Israeli Electric Corporation, Better Place pushed for such a system so as to ensure it a market. Its fear is that Fluence Z.E. owners might mostly charge at home using a regular outlet, as recent feedback on Volt and Leaf usage in the U.S. has shown to be more a more popular charging method than anticipated. The Israeli utility, however, has decided to deny Better Place a monopoly and open the system to competing charging systems

These complaints about high prices extend to the pricing of Renault’s Fluence Z.E. car as well as Better Places’ subscription pricing. The Fluence Z.E.’s cost is slightly more than a regular Fluence, even though the purchase tax on the electric car is only 10 percent instead of the standard 83%. Essentially, critics argue, Better Place, and not consumers, will be the main beneficiary of the tax breaks (amounting to about NIS 70,000, or \$20,600, per car).

Likewise, as Haaretz writer Dan Rabinowitz notes, the cost of driving 16,700 kilometers per year—the average annual distance travelled—in a standard vehicle, comes out to NIS 1,000 (\$270) less for gas than the fixed cost of the Better Place package for 20,000km. Comparisons with hybrids are even more troubling: the gas the average hybrid car consumes over 16,700 kilometers costs from NIS 5,000 (\$1,475) to NIS 8,000 (\$2,350) less than Better Place’s minimum package.<sup>26</sup>

Sources suggest that Better Place is deliberately pricing the vehicles and plans at a higher rate because its battery swapping and charging infrastructure is not yet complete and ready to handle a large number of EVs. As a first step and testing ground, Better Place would like to focus on fleet purchases, which are easier

to manage and service. Fleet purchases and subscriptions are discounted and already economically more attractive when compared to a conventional vehicle fleet.

Despite these reservations, the Fluence Z.E. is sold out for this year and close to sold out for 2012. It remains to be seen, however, how durable Better Place’s business model will prove to be in Israel and beyond.

### Better Place Early Buyers

More than 460 Israeli companies with combined fleets of 85,000 vehicles have pledged to buy Better Places’ EVs. Some of the early buyers include prominent Israeli companies such as:

Direct Insurance  
Glasshouse Technologies  
Israel Corporation  
Jafora  
Matrix IT  
Netafim, Keter Plastics  
Nike Israel  
Orange Communications  
Orbotech, Manpower Israel  
Partner Communications  
Pelephone Communications  
Rafael Advanced Defense Systems  
SQLink  
Tabori  
Teva Pharmaceuticals Industries<sup>27</sup>

Additional charts available in  
**AFVInsider online** edition:

- Table of Israeli roads by type
- Chart of vehicles by type
- Table of vehicles by company
- Table of vehicles by country

### Notes & Sources:

<sup>1</sup> [http://www.wired.com/cars/futuretransport/magazine/16-09/ff\\_agassi?currentPage=all](http://www.wired.com/cars/futuretransport/magazine/16-09/ff_agassi?currentPage=all)

<sup>2</sup> <http://www.renault.com/en/groupe/developpement-durable/environnement/pages/focus-better-place.aspx>

<sup>3</sup> <http://www.globes.co.il/serveen/globes/docview.asp?did=1000643878&fid=1725>; <http://www.globes.co.il/serveen/globes/docview.asp?did=1000670180>

<sup>4</sup> <http://www.cia.gov/countries/country-data.cfm?fips=IS>

<sup>5</sup> <http://www.globes.co.il/serveen/globes/docview.asp?did=1000660246>, <http://www.energynow.com/video/2011/05/16/israel-factor-energy-security>

<sup>6</sup> Brower, Derek. Israel Drills for Energy Security. *Petroleum Economist*. July 1, 2001; [http://www.forbes.com/2011/01/13/israel-energy-leviathan-field-opinions-contributors-wurmser-baron\\_print.html](http://www.forbes.com/2011/01/13/israel-energy-leviathan-field-opinions-contributors-wurmser-baron_print.html); [http://www.nobleenergyinc.com/filelib/FileCabinet/PDFs/Presentations/2011\\_05\\_Investor\\_Meetings.pdf](http://www.nobleenergyinc.com/filelib/FileCabinet/PDFs/Presentations/2011_05_Investor_Meetings.pdf)

<sup>7</sup> The projected mix of renewable energy in 2020 includes approximately 49% solar, 30% wind and 21% biofuels; [http://www.theisraelproject.org/atf/cf/%7B84dc5887-741e-4056-8d91-a389164bc94e%7D/ALTERNATIVE ENERGY PRESS KIT 20101111 FINAL WITH GRAPHICS APPROVED BY DZH.PDF](http://www.theisraelproject.org/atf/cf/%7B84dc5887-741e-4056-8d91-a389164bc94e%7D/ALTERNATIVE%20ENERGY%20PRESS%20KIT%2020101111%20FINAL%20WITH%20GRAPHICS%20APPROVED%20BY%20DZH.PDF)

<sup>8</sup> “Taxes and Incentives for Renewable Energy” KPMG, 2010

<sup>9</sup> Cohen-Blankshtain, Gila. “Framing Transport—environmental policy: The case of company car taxation in Israel.” *Transportation Research Part D*. 13 (2008). Pp. 67-68.

<sup>10</sup> <http://www.autoblog.com/2011/05/26/jerusalem-think-tank-proposes-replacing-50-000-israeli-govt-car/>

<sup>11</sup> [http://www.ciu.com/index.asp?layout=ib3Article&article\\_id=607842445&pubtypeid=1112462496&country\\_id=1840000184&category\\_id=775133077&rf=0](http://www.ciu.com/index.asp?layout=ib3Article&article_id=607842445&pubtypeid=1112462496&country_id=1840000184&category_id=775133077&rf=0)

<sup>12</sup> <http://www.haaretz.com/print-edition/business/taxman-rolls-out-green-revolution-1.277603>

<sup>13</sup> [http://www.eiu.com/index.asp?layout=ib3Article&article\\_id=607842445&pubtypeid=1112462496&country\\_id=1840000184&category\\_id=775133077&rft=0](http://www.eiu.com/index.asp?layout=ib3Article&article_id=607842445&pubtypeid=1112462496&country_id=1840000184&category_id=775133077&rft=0)

<sup>15</sup> <http://www.globes.co.il/serveen/globes/docview.asp?did=1000621360&fid=1724>

<sup>16</sup> <http://www.haaretz.com/print-edition/business/cash-for-clunkers-the-israeli-version-1.260684>

<sup>17</sup> Bank of Israel, Annual Report, 2010.

<sup>18</sup> The first nine of the 40 battery switch stations that have already been deployed are in locations across Israel including: Hadera, Modi'in, Mahanaim, Mitzpeh Ramon, Be'er Sheva, Yavne, Beit Shean and Bilu Junction.

<sup>19</sup> <http://www.greenprophet.com/2011/03/better-place-unveils-its-mammoth-recharging-plan/>

<sup>20</sup> <http://www.globes.co.il/serveen/globes/docview.asp?did=1000645209>

<sup>21</sup> <http://www.globes.co.il/serveen/globes/docview.asp?did=1000671033&fid=1725>

<sup>22</sup> Better Place, Renault, WSJ, <http://www.youtube.com/watch?v=3NB0Rvgad0w>

<sup>23</sup> <http://www.technologyreview.com/energy/37982/page2/> ; <http://www.globes.co.il/serveen/globes/docview.asp?did=1000641185>

<sup>24</sup> Better Place currently has exclusive rights over the private charging stations in malls, gas stations, parking lots and office buildings. Private charging companies such as Better Place will have Private firms may also set up charging stations in public areas, though it's not clear how many companies will enter the market; <http://english.themarket.com/official-electric-car-policy-gives-better-place-the-edge-1.346368>

<sup>25</sup> <http://www.globes.co.il/serveen/globes/docview.asp?did=1000641185>

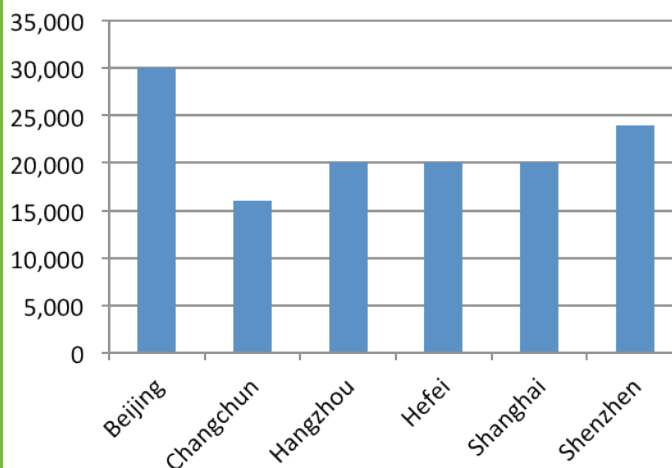
<sup>26</sup> <http://www.haaretz.com/print-edition/opinion/an-electric-car-named-cottage-cheese-1.371672>

<sup>27</sup> Jerusalem Post, Better Place & Autoblog.com; <http://green.autoblog.com/2009/02/26/better-place-announces-19-vision-partners-aka-early-buyers-i/> ; [http://api.ning.com/files/1e\\_s/FZXMCE3PELWH\\*sOXyW0GHfLzImEI1d72ip3Aaorpv3PP6VMJAGAw0CO6mhxqYV6Z3F90PNajMdEfcJGAqgkZdG1GYK5pAW7F/LocalfirmstohelpBetterPlaceJerusalemPost.pdf](http://api.ning.com/files/1e_s/FZXMCE3PELWH*sOXyW0GHfLzImEI1d72ip3Aaorpv3PP6VMJAGAw0CO6mhxqYV6Z3F90PNajMdEfcJGAqgkZdG1GYK5pAW7F/LocalfirmstohelpBetterPlaceJerusalemPost.pdf)

## CHINA FEATURE STUDY

### CHINESE GREEN FLEETS

Target Numbers of AFVs by 2012



## An Ambitious AFV Program

China has made an unmatched commitment to the development of alternative fuel - or as the Chinese say, “new energy” - vehicles. The Chinese central government has allocated 100 billion yuan (more than \$15 billion) to promoting the industrialization of green vehicles and securing a global leadership position for China in this area. Since January 2009, China has been implementing its *Ten Cities, Thousand Vehicles Program*, jointly launched by the Ministry of Science and Technology, Ministry of Industry and Information Technology, Ministry of Finance, and National Development and Reform Commission. The program aims to accelerate the development of new energy vehicles<sup>1</sup> with national subsidies. Citing a need to reduce fuel consumption and carbon emissions and to promote green vehicles in major cities, the program set a goal of deploying an average of 1,000 new energy vehicles annually for public services in every pilot city through 2012. The program was initially implemented in thirteen pilot cities chosen by the central government<sup>2</sup>. These included Beijing, Changchun, Hangzhou, Hefei, Shanghai and Shenzhen. It has since expanded to 25 cities on the mainland and is still growing.<sup>3</sup>

The central government provides a subsidy of up to 50,000 yuan to any consumer who buys a plug-in hybrid vehicle (PHEV) and 60,000 yuan for a purely battery-electric vehicle (BEV). In addition, the government provides a 3,000 yuan subsidy for fuel efficient cars weighing from 1,205 to 1,320 kilograms and consuming no more than 6.9 liters of fuel per 100 kilometers. More than 400 vehicle models qualify for one of these subsidies, which have been in place since June 2010<sup>4</sup>. On October 1st, China tightened the efficiency threshold from 6.9 to 6.3 liters per

100 kilometers. At the local level, several cities have offered additional subsidies for green vehicle purchases. For example, Beijing will provide a subsidy of 3,000 yuan for each kilowatt of electric battery capacity. This translates into a maximum 60,000 yuan subsidy for a BEV purchase. Shenzhen will provide a similar subsidy for BEV purchases. At the city level, Beijing and Shenzhen offer the most generous consumer subsidies in China. Meanwhile, Shandong province is providing an up to 400,000 yuan subsidy for city buses powered by batteries. Other pilot cities have yet to unveil their local subsidy programs.

According to the latest data from China’s Ministry of Industry and Information Technology, there are now over 10,000 new energy vehicles registered in the 25 pilot cities. These include electric, hybrid, and fuel cell vehicles. Since the subsidies were implemented in 2010, individual consumer purchases have risen to over 1,000 vehicles. The Ministry of Science and Technology’s research expects EV production capacity to reach 300,000 units by 2012.

China’s *12th Five-Year Plan* (2011-2015) sets a goal of reaching a production capacity of 1 million AFVs by 2015, with BEVs and PHEVs accounting for 50 percent of the total. The *11th Five-Year Plan* had mainly focused on the research and development of AFV technologies. In March 2011, the Chinese government unveiled a draft Energy-Saving and New Energy Vehicles Industry Development Plan for its automotive industry, aiming for a top global position and a sales volume of 5 million units by 2020. The government plans to invest heavily in core technologies, including motor, battery, and auto parts, to build a competitive AFV industry supply chain.

## Building the World's Largest Electric Fleet

China has been focusing on taxi and bus fleet electrification in major cities with the principal goal of stemming air pollution. Currently, China's all-electric cars are mainly used for taxi demonstration programs in pilot cities. Taxi fleets account for the bulk of BEV fleets.

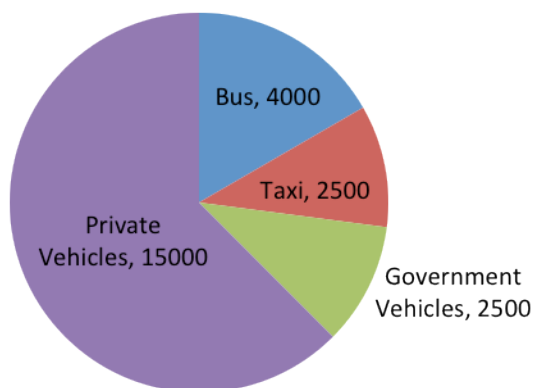
Shenzhen – Southern China's economic and technology powerhouse – was the first city to put the world's largest BEV taxi fleet on the road in May 2010. Pengcheng Electric Taxi Company, a joint venture between BYD Auto and Shenzhen Bus Group solely formed for the taxi deal, operated this 50-BEV fleet in 2010, and expanded the fleet to 300 this August during the Universiade, an international multisport collegiate event that was held in Shenzhen. The taxi is BYD's e6 crossover model, which can reach a maximum speed of 140 km/h (87 mph) and travel up to 300 kilometers (186 miles) on a single charge. According to BYD, Shenzhen's original 50-taxi fleet surpassed three million cumulative kilometers (1.86 million miles) between May 2010 and May 2011.

In addition, BYD concluded a leasing contract with Shenzhen's government to provide 300 e6 and 200 K9 BEV buses for the 2011 Universiade in August. Following the games, these vehicles were integrated into the city's public transportation system. Of the 300 BYD e6s, 250 units were integrated into the Pengcheng fleet, expanding it to 300 taxis. Another 50 e6 cars were used as shuttle sedans for important visitors. To date, the Shenzhen-BYD deal is the world's largest electric vehicle leasing agreement.

BYD produces the K9 BEV bus at its plant in Changsha, Hunan. The bus cuts emissions by 55% compared to conventional buses. The K9 is 12 meters long and 2.5 meters wide, weighs 18 tons, and has a 32-passenger capacity. It costs around 2 million yuan (US\$300,000). The K9 has already been made available for use in public transportation in Changsha and Shenzhen since January 2011. BYD claims that sales orders for the K9 have been strong, including a contract in September from the Hunan government to provide 1,000 K9 buses to its public transportation system.

In addition to the K9 electric buses provided by BYD, Wuzhoulong Motors delivered 1,511 new energy buses to Shenzhen's city government during the 2011 Universiade, including 1,350 hybrid power single deck city buses, 20 hybrid power double-deck buses, 53 electric buses, 26 electric feeder buses, 60 fuel cell track buses and 2 fuel cell buses.

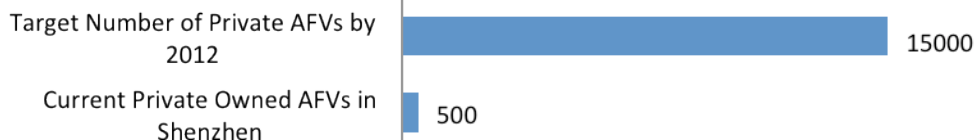
### Breakdown of Shenzhen's 24,000 AFVs Target by 2012



Shenzhen aims to have more than 24,000 AFVs by 2012, including 4,000 buses, 2,500 taxis, 2,500 government vehicles and 15,000 private vehicles. By 2015, the city government expects to have more than 100,000 AFVs on the road. According to a Shenzhen Transport Commission statement of September 25, the city currently has the world's largest AFV fleet on the road, including 2,050 hybrid and electric buses, 580 liquefied natural gas buses and 300 electric taxis. However, hybrid and electric vehicles are still a hard sell to average Chinese consumers, even with generous subsidies up to 120,000 yuan from central and local governments. The latest information shows there are about 500 privately owned AFVs in Shenzhen, far behind its 15,000 goal for the end of next year.

Shenzhen currently has six public charging stations for PHEVs and BEVs, with more than 2,345 charging piles installed in Shenzhen. The government is planning to build an additional 18 stations shortly. The city has also set up 57 charging stations for hybrid and electric buses. The charging facilities were built by

### AFVs- A Hard Sell to Consumers in Shenzhen



Meanwhile, Hertz will introduce BYD e6s to its rental car fleet in Shenzhen, making it the first global car rental company to offer EVs in the country. It initially plans to have 2 units in Shenzhen, 2 in Beijing, and 2 in Shanghai.

in Shenzhen Bus Group, a CNOOC-Potevio joint venture, and Shenzhen Power Supply Company, a subsidiary of Southern China Grid. To accommodate the growth of AFVs, Shenzhen expects to build more than 250 charging stations and 12,750 charging piles throughout the city by 2012.

While Shenzhen has primarily worked with BYD in its pioneering electric fleets program, other city governments have been actively working with other auto manufactures to deploy AFVs, as detailed in the following table. Beijing has been operating a fleet of 50 Midi electric taxis since March 2011. The Midi taxis are manufactured by Foton Motor Group, Beijing Automotive Industry Holding's commercial vehicle arm based in Beijing.

The Midi EV is a European-style minivan that can travel up to 150 kilometers (93 miles) on a single charge. Its fast charging mode takes only 30 minutes to reach 70% full; however, it could take 8 hours to fully charge with a 220V charger. Beijing expects to put 500 additional electric taxis on the road by 2012. In addition to the 50 Midi e-taxis, Foton also provided 50 Foton AUV electric buses to Beijing Public Transport Holdings this July. Meanwhile, this summer the city government put a total of 1,060 all-electric sanitation trucks into service to transport garbage and sweep streets. The Foton-manufactured trucks come in three sizes – 2 tons, 8 tons and 16 tons – and travel up to 100 kilometers (62 miles) on a full charge. Beijing plans to have 30,000 AFVs on the road by 2012 and 100,000 AFVs, including 35,000 EVs, by 2015. Meanwhile, Beijing aims to build 256 charging stations, 210 distribution stations and 42,000 charging piles by 2015. The 256 charging stations will include 18 stations for city buses and 63 stations for sanitation trucks. Hangtianqiao Charging Station, Beijing's first battery-swap station, allows 200 sanitation trucks swap batteries. One 8-ton sanitation truck can swap its battery within four minutes and one 16-ton truck can make complete this swap in eight minutes.

Haikou, the capital of south China's Hainan Province, unveiled a batch of green buses and taxis this September, including 170 hybrid buses, 30 electric buses, and 27 electric taxis. Haikou plans to increase the number of AFVs to 1,050 by 2012.

Other pilot cities are also in the process of deploying their first batches of e-taxis. For example, Jinan, the capital city of Shandong Province, has initiated a trial program to roll out 200 Chery electric taxis by the end of 2011. Jinan already has 200 hybrid buses, which were provided by Zhongtong in 2010. The city plans to deploy 1,610 AFVs by 2012. Chengdu, a booming city in southwestern China, is planning to deploy 50 e-taxis manufactured by local auto company, Sichuan Auto Industry Group, by the end of the year.

Though China is a major player in developing electric taxi fleets, other electric taxi trial programs can be found in Tokyo, Seoul, and San Francisco. Tokyo was the first city in the world to launch a 90 day e-taxi trial program in April 2010, partnering with Better Place. The three switchable battery electric taxi demonstration projects in Tokyo continued until November 2010. Better Place is also planning to launch a three-year demonstration program of

electric taxis in San Francisco and San Jose. Seoul is ready to roll out its first batch of 10 electric cabs this November. Fifty more electric taxis will be introduced next year, 150 more in 2013, and an additional 250 in 2014. Compared to these cities, China's government-led e-taxi fleets are operating at a larger scale and have longer-term commitments.

### Electric Taxi Fleets in Major Chinese Cities

City	Electric Taxi Manufacturer	EV Model	N. of EVs	Launch Date
<b>Beijing*</b>	Beiqi Foton Motor	Foton Midi	50	March, 2011
<b>Chengdu</b>	Sichuan Auto Industry Group		50*	December, 2011*
<b>Haikou</b>	Haima Auto (FAW Group)		27	September, 2011
<b>Hangzhou</b>	Zotye Auto & Haima Auto (FAW Group)	Zotye Multipla & Haima Freema	30	January, 2011
<b>Jinan</b>	Chery Auto		200*	December, 2011*
<b>Shenzhen</b>	BYD Auto	BYD e6	300	May, 2010

\*Expected

+Beijing expects 500 additional electric taxis by 2012

Ankai Bus is currently the largest provider of electric buses in China. Currently, there are more than 400 Ankai electric buses operating in cities such as Hefei, Beijing, Dalian, Hefei and Shanghai, accounting for over 80% of market share. Since January 2010, Hefei, the capital city of Anhui province, has rolled out more than 180 electric city buses produced by Ankai. Foton, another big player in the AFV bus segment, claims that it has sold 220 Foton AUV electric buses and 1,250 AUV hybrid buses. Meanwhile, BYD is an emerging player in the BEV bus business. The company has secured a contract from the Hunan government to provide 1,000 K9 buses in the near future.

In addition to the electrification of taxi and bus fleets, several companies have electrified their private fleets. Besides the aforementioned Hertz e6 fleet, Xiamen Huatian launched an EV leasing business in Xiamen this May, integrating 23 Zotye Multipla and Zotye 5008 EVs into its fleet at the same rates as non-EVs. The company aims to acquire 503 EVs made by Zotye and Kinglong by the end of 2012. Dutch-based international express delivery company TNT launched China's first EV delivery fleet in Shanghai this September. The five electric delivery vehicles are Tianyi Logistics Vehicles produced by Dongfeng Motor, one of the leading auto manufactures in China<sup>5</sup>.



A few local governments are starting to introduce electric vehicles into their government fleets. In Shanghai, the city government purchased 35 Lifan 620 EVs in May 2010, and used them as special police vehicles for the Shanghai World Expo. The Lifan 620 can travel 200 kilometers on a full charge and takes 7 hours to charge at 220 volts. The city government of Hangzhou also integrated 3 EVs into its government fleet in June. The 3 EVs, Luxgen7 SUV EV+, Luxgen7 MPV EV+, and Luxgen7 CEO EV+, were provided by Dongfeng Yulon, a partnership between Dongfeng Auto and Taiwan's Yulon Motor.

## Bumps Along the Road

Not every electric fleet experience in China has run smoothly. Shenzhen's e6 taxi fleet has had a good safety record so far. However, the e-taxi fleet in Hangzhou, the capital and largest city in Zhejiang Province, was pulled off the road for 2 months after a Zotye Multipla electric cab caught fire on the streets in mid-April. Hangzhou had integrated 30 electric vehicles into its taxi fleet in late January. Half of these were Zotye's Multipla (Langyue) model. Released last April, the compact MPV has a driving range of 200 kilometers (124 miles). The remaining 15 units are FAW's Haima Freema model, which is a compact MPV with a driving range of 160 kilometers (99 miles).

The Multipla cab accident was attributed to a battery pack issue. An investigation into the accident revealed that the vehicle's battery module had leaked and damaged the pack's insulation, leading to a short circuit that caused the fire. The battery cells were manufactured by Zhejiang Wanxiang Group, which was not held responsible for the accident. The individual cells did not present any flaws, but their systems integration with the vehicle was faulty.

Zotye accepted the investigation results and stated that it will carefully evaluate potential risks arising from the process of technology and business model innovation. "Monitoring procedures had been inefficient or neglected in the process of manufacturing, battery charging and switching, and vehicle driving," said Shao Xinhua, deputy administrator of the Hangzhou Quality Supervision and Inspection Administration. After the investigation, the Hangzhou government stated it had made appropriate adjustments to the vehicles and had evaluated the management and operation of the e-taxis. Hangzhou still aims to have 200 electric cabs by the end of the year. It is also building 56 charging stations this year and plans to have 350 charging stations by 2015.

Following the Hangzhou e-taxi incident, an electric bus caught fire while carrying passengers in downtown Shanghai this July. Fortunately, no one was injured. The bus was manufactured by Leibo New Energy, a partner of Anhui Ankai Automobile. "A

problem with the battery caused spontaneous combustion," said Yan Yuan, vice manager of Leibo New Energy, a joint venture of East China Power Grid Company, Shanghai Electric Power Company and Shanghai Ruihua Co. Ltd. The Leibo buses were introduced in Shanghai in September 2009. The bus company has suspended the operation of all its buses of this model; meanwhile, Leibo is evaluating the battery issues with its supplier. Currently, more than ten cities<sup>6</sup> are cooperating with Leibo New Energy to introduce its electric buses. The other cities have not responded to this incident.

Another issue is cost. Even though most riders were reportedly enthusiastic and satisfied with Shenzhen's e6 taxi fleet, one year after the trial program was launched the operating loss of Shenzhen's first batch of 50 electric taxis reached 7 million yuan (\$1.1 million). "Even with government subsidies, e-taxis are still much more expensive. Due to the lack of electric vehicles, the maintenance cost of e-taxis is nearly double that of regular taxis," said Du Jun, general manager of Pengcheng Electric Taxi. He was mainly referring to the higher cost of auto parts and labor to service EVs. However, Du expressed confidence that operating costs would fall as taxi fleets electrify and charging and servicing infrastructure is improved.<sup>7</sup>

China's ambitious investment in AFVs is second to none, and its ability to guide the development of a new industry is probably unparalleled in the world. Nonetheless, China will have to overcome some major obstacles before it can become the industry's leading player. Following its demonstration program of energy-efficient fleets across the nation, the government now faces the challenge of convincing individual consumers to choose greener vehicles. The fleet experience shows that sustained infrastructure development, effective safety standards, and substantial cost reduction will be key to helping overcome consumer skepticism.

Additional charts available in  
**AFVInsider** online edition:

- AFV taxi fleets in China
- AFV bus fleets in China
- AFV government fleets in China

## Notes &amp; Sources:

<sup>1</sup> According to Chinese government's policy, new energy vehicles include hybrid vehicles, electric vehicles and fuel cell vehicles.

<sup>2</sup> The initial 13 pilot cities include Beijing, Shanghai, Chongqing, Changchun, Dalian, Hangzhou, Jinan, Wuhan, Shenzhen, Hefei, Changsha, Kunming, and Nanchang.

<sup>3</sup> The 25 pilot cities include Beijing, Shanghai, Chongqing, Changchun, Dalian, Hangzhou, Jinan, Wuhan, Shenzhen, Hefei, Changsha, Kunming, Nanchang, Tianjin, Haikou, Zhengzhou, Xiamen, Suzhou, Tangshan, Guangzhou, Shenyang, Chengdu, Nantong, Xiangfan and Hohhot.<sup>7</sup> According to Chinese government's policy, new energy vehicles include hybrid vehicles, electric vehicles and fuel cell vehicles.

<sup>4</sup> The February 2009 subsidy program focused on public service vehicles, while the subsidy program unveiled in June 2010 is for individual consumers.

<sup>5</sup> Dongfeng sold 2.6 million vehicles in 2010, making it the second bestselling Chinese automaker.

<sup>6</sup> Beijing, Guangzhou, Dalian, Jinan, Qingdao, Shenzhen, Hefei, Wuhan, Kunming, Nanchang and Urumqi

<sup>7</sup> Shenzhen electric taxi fleet lost 7 million yuan in one year, Lihua Yang, Securities Times, May 11, 2011 <<http://business.sohu.com/20110511/n307220536.shtml>>



## CHINA INSIDER PERSPECTIVE

**C.C. CHAN, FATHER OF EVS IN CHINA**

"My biggest wish is to see electric vehicles running on streets and alleys of big and small cities – it's a contribution to the conservation of energy, environmental protection and sustainable mobility," said Dr. C. C. Chan<sup>1</sup>, one of the world's leading experts on electric vehicle technologies.<sup>2</sup> Currently Honorary Professor in the Department of Electrical and Electronic Engineering at the University of Hong Kong and scholar at the Chinese Academy of Engineering, Chan has been called the "Father of Asian Electric Vehicles" by *Global View Magazine* and selected as "Asia's Best Technology Pioneer" by *Asiaweek*.

Chan grew up in a Chinese family of entrepreneurs running a bus business in Indonesia. Seeing the dirty environment of auto-repair garages in his childhood, the young Chan started to wonder about the possibility of creating cleaner vehicles. Through hard work, Chan's childhood dream turned into a career in researching electric vehicles. Chan earned degrees in electrical engineering from the China University of Mining & Technology, Tsinghua University and University of Hong Kong. His book "Modern Electric Vehicle Technology" published in 2001 reviewed the latest EV technology developments and highlights the importance of EV infrastructure for EV commercialization and adoption. *Power Engineering Journal* praised it as the work of "unabashed enthusiasts for the EV," noting that it had "the ring of authority."<sup>3</sup>

In 1986 Chan founded the International Research Centre for Electric Vehicles at the University of Hong Kong with the support of the U.S. Department of Energy and co-founded the World Electric Vehicle Association in 1990. He served as a Distinguished Lecturer of the Industrial Electronic Society of the Institute of Electrical & Electronic Engineers (IEEE) in the U.S. and as visiting professor at top universities including the University of California at Berkeley, MIT, Cambridge University, Tokyo University and Tsinghua University. Chen was also selected as fellow of the Royal Academy of Engineering (UK), the Institution of Engineering and Technology (UK), the Ukraine Academy of Engineering Sciences, the Institute of Electrical and Electronics Engineers (US), and the Hong Kong Institute of Engineers. He has been working on electric vehicle research projects around the world, including in China, Japan, India, Europe and the United States. In 1993, he worked with the University of Hong Kong, Honda and Amerigon to successfully develop the U2001, an electric car with a 45 kW motor and 264V battery pack. Chan has been sharing his expertise with the industry and has served as technology advisor for Ford, Honda, Samsung and other leading corporations. While promoting international collaboration to advance EV technology, Chan brought the latest technology from abroad into Asia. Over the past 20 years Chan has been teaching

in China, sharing his electric vehicle expertise and experience.

### Chan's Perspectives on China's EV Industry

Chan is optimistic about China's electric vehicle development plan. In an interview with *Science Times* in 2010, Chan said that he is expecting China to become the "Kingdom of Electric Vehicles."<sup>4</sup> He anticipates the number of alternative fuel vehicles will reach 500,000 by 2015 in China and double to 1 million by 2020. Chan forecasts that China will lead the EV sector with an estimated 15 percent market share for hybrid and pure electric vehicle sales by 2020.

C. C. Chan thinks China has an urgent need to develop alternative fuel vehicles. "Due to serious traffic congestion and environmental deterioration, the development of electric public transportation will be the most important project in China," said Chan at the 25th World Electric Vehicle Symposium in Shenzhen. "As electric vehicles do not use engines, the electric vehicles market is the only market segment where Chinese enterprises have opportunities to lead across the world," said Chan.<sup>5</sup> Chan believes the opportunities include the research and development of electric buses. As foreign competitors already have decades of experience in building hybrid vehicles, Chan suggested China should focus on developing battery electric vehicles.

While the battery is the key component in developing electric vehicles, Chan sees two major shortcomings in Chinese electric vehicle battery technology. Chan explained, "The first one is the lack of fundamental technology research, such as temperature problems and components; the other one is the absence of an evaluation system for battery safety in low- or high-temperature environments, for example."<sup>6</sup>

In an interview with *China Investment* this August, Chan pointed out that in order to commercialize Chinese electric vehicles, China should increase its investment in the battery industry and in charging infrastructure.<sup>7</sup> The key to expanding the market would be to develop it in conjunction with the battery industry, as well as to establish a comprehensive network by integrating the EV supply chain. "To successfully promote electric vehicles, we need good products, good infrastructure, and a good business model," noted Chan.

## Chan's Perspectives on International Competition in the AFV Sector

"The United States is the first country that started to research and develop electric vehicles; however, the U.S. is facing the challenge of industrialization," said Chan. Chan believes that leading auto companies in the U.S. have no credible or sustainable strategy for alternative fuel vehicles. Whenever the economic and financial environment worsens, automakers tend to abandon their AFV development projects. He sees Japan as the most successful country in promoting the industrialization of hybrid and electric vehicles. According to Chan, there are five key factors to Japan's success in developing hybrids: Japan has a clear roadmap and strategy; the Japanese government supports the industry by

providing substantial funding; Japanese industry possesses core technologies and a strong innovation base; Japan has a strong industry alliance between auto makers and battery manufacturers; and Japanese auto makers have a better understanding of markets and consumers.<sup>8</sup>

Though Chinese AFV technology still lags behind Japan and the United States, Chan thinks China is making great progress and catching up quickly. He projects that total sales of hybrids and EVs will account for 7 % to 12% of global car sales in 2020. As mentioned above, Chan further anticipates China will surpass the rest of the world, reaching 15% of the market share in 2020. Chan noted two routes to achieving the goal of rolling out millions of EVs across the world.<sup>9</sup> One is to satisfy the needs of "sophisticated consumers" who require innovative and high precision EVs. These consumers are primarily located in the US, Europe and Japan. Another route is to attract "new consumers", mostly from China and India, where the primary concern is low cost. International collaboration between industries is key to achieving technological breakthroughs and lower production costs.

With his multicultural background, C. C. Chan strongly believes in integrating the strengths of the East and West for the advancement of science and technology. "Scientists invent things with the greatest hope that it will be used to help the society go forward and prosper. Science itself is without borders. It serves all mankind," said Chan.<sup>10</sup> At the age of 74, Chan still works actively all around the world, teaching in leading universities, giving speeches at global conferences, and providing advice to industry leaders and policy makers, in order to promote his dream: the massive industrialization of electric vehicles.

## Notes & Sources:

<sup>1</sup> C. C. Chan, also known as Qingquan Chen.

<sup>2</sup> Success stories of HKU- Professor C. C. Chan <<http://engg.hku.hk/home/people/ccchan/ccchan.htm>>

<sup>3</sup> Bio of C. C. Chan, Department of Electrical and Electronic Engineering, University of Hong Kong <<http://www.eee.hku.hk/people/ccchan.html>>

<sup>4</sup> C. C. Chen's interview with Science Time, Chinese Academy of Science, 06/08/2010 <[http://www.cas.cn/xw/zjjsd/20101006/t20100628\\_2888644.shtml](http://www.cas.cn/xw/zjjsd/20101006/t20100628_2888644.shtml)>

<sup>5</sup> Chinese automakers seek to lead global electric bus market, People's Daily, 11/09/2010 <<http://english.peopledaily.com.cn/90001/90778/90860/7193177.html>>

<sup>6</sup> C. C. Chan: Two major shortcomings of Chinese electric vehicle battery, Auto Sina, 07/21/2011 <<http://auto.sina.com.cn/news/2011-07-21/0903808022.shtml>>

<sup>7</sup> Interview with C. C. Chan, China Investment, 08/05/2011 <[http://www.qqddc.com/html/news/201108/news\\_20719\\_1.html](http://www.qqddc.com/html/news/201108/news_20719_1.html)>

<sup>8</sup> C. C. Chen's interview with Science Time, Chinese Academy of Science, 06/08/2010 <[http://www.cas.cn/xw/zjjsd/20101006/t20100628\\_2888644.shtml](http://www.cas.cn/xw/zjjsd/20101006/t20100628_2888644.shtml)>

<sup>9</sup> 2011 China Plug-In Electric Vehicle Forum: China to take own route to market, cars21.com, 03/14/2011 <<http://www.cars21.com/content/articles/53020110314.php>>

<sup>10</sup> Success stories of HKU- Professor C. C. Chan <<http://engg.hku.hk/home/people/ccchan/ccchan.htm>>

## CRITICAL PERSPECTIVE

### BCG STUDY CRITIQUE

Commentary by Carolyn Amon, Editor-in-Chief

#### **PHEV: Procrastination Has Ephemeral Value**

The Boston Consulting Group's (BCG) latest report on electric cars put a damper on EV buzz by significantly lowering its previous study's estimate on EV market penetration by 2020. While "The Comeback of the Electric Car?" report cites progress in incentivizing automakers to increase fuel efficiency and reduce emissions, it concludes that in the next decade they will principally do so by optimizing internal-combustion-engine (ICE) technologies. Thus, while automakers should still think about EVs in their long-term strategies, they are still safe for now to procrastinate on EV deployment. This conclusion is based on a number of questionable assumptions and omissions.

#### **Assumptions**

##### **1. Prohibitively high battery costs**

First, BCG assumes that EV lithium-ion batteries currently cost \$2,000 per KWh. This means that it costs EVs \$140 to \$280 for every percentage point reduction in carbon emissions, versus half those amounts for ICEs. But BCG's battery cost assumption is higher than current battery costs as reported by automakers. Over a year ago, a Deutsche Bank study had already noted "steeper-than-expected" price declines, from \$650/kWh in 2009 to bids for mid-\$400/KWh on high-volume contracts for

2011-2012. GM estimates that its current battery cost is already as low as the \$500/kWh, which is BCG's minimum estimate for 2020 and the threshold at which it claims EVs become competitive with oil prices at \$100-\$120 per barrel. Battery costs remain the primary reason for the higher upfront price of EVs, but the barrier is far lower than BCG makes it out to be, and it is coming down much faster than BCG anticipates.

##### **2. No technological breakthrough**

BCG includes the caveat that "costs could change radically" as a result of technological breakthroughs, but it does not factor any in its scenarios for 2020. If the past ten years are any guide, battery technology is likely to be optimized if not revolutionized. Already, EV manufacturers have moved from nickel-hydride to lithium-ion batteries, which still leave room for improved chemistries. Several technologies that are currently emerging would fundamentally change the way batteries operate, such as MIT's recently unveiled 'Cambridge crude' refillable battery. BCG grants ICE technology improvements the benefit of the doubt when it estimates a 20% improvement in fuel efficiency by 2020. To be fair, at least one scenario should apply similar assumptions to batteries with regard to EVs.

##### **3. Charging infrastructure roadblocks**

The BCG report mentions that "it's hard to make a business case for a public

electric charging infrastructure" from a power company's perspective. It claims that utilities would have to make high investments in a high-risk area that would take more than a decade to amortize, even if electricity rates for EV chargers were doubled. We challenge the premise that power companies should be on the hook for building any charging infrastructure at all. Why would power companies be responsible and financially liable for the development of charging stations? Oil companies don't do the same for gas stations. In fact, the private sector sees a business case for charging infrastructure, as demonstrated by start-ups AeroVironment, Coulomb, ECOtality, EV-Charge America, Milbank, Shorepower Technologies, and SolarCity. Even the corporate giants AeroVironment and GE have joined the fray. Each of these companies has teamed up with city, state and/or business partners to install chargers. BCG mentions residences, hotels, and shopping centers as necessary sites for power companies to install chargers; the aforementioned companies have partnerships in all of these areas. Moreover, EV infrastructure does not need to be as fully developed as gasoline infrastructure before EVs are more widely adopted. Indeed, most consumers could charge their vehicle at their homes and most likely during hours of off-peak demand – enhancing the efficiency of the existing electric grid – where a regular outlet would suffice.

## Omissions

### 1. Oil price volatility

BCG's scenarios assume three different oil prices, but do not address the probability of an oil shock within the next decade. The global financial crisis eased oil price pressures over the past several years, but demand is poised to resume its upward trend, driven by fast growing demand from emerging economies, and especially China. As spare capacity shrinks, the risk of a severe oil shock increases. As opposed to a scenario of gradual oil price increases, an oil shock scenario would have a much more dramatic effect on consumer preferences and be conducive to the following point.

### 2. Conversions

The BCG study's "electrification path" does not mention the option of converting ICEs into EVs. While purchasing any new vehicle is a major household expense, a conversion is only a fraction of the financial and environmental cost of a new vehicle, and furthermore qualifies for a \$1,000 federal tax rebate. Conversions could extend the life cycles of ICEs reaching the end of their lives and accelerate our national vehicle's fleet turnover to EVs.

### 3. Competitive proactivity

The BCG study recognizes that Denmark, France and Israel's ambitious EV schemes could give their automotive and power companies a competitive edge, but then concludes that unless other governments follow suit EVs "may be off to another false start". This conclusion

ignores the importance of competitive proactivity. As BCG states, EVs will eventually gain market share in the automotive market, albeit only beginning in 2020 in its view. And so the crucial issue here is not false starts, but rather head starts. Whatever automaker has the most experience with EV deployment will be best poised to take advantage of new market opportunities come 2020. At the same time, national policies matter and will determine where automakers move forward most aggressively on EV deployment.

Procrastinating on EV deployment is a short-sight strategy. Milquetoast automakers will find themselves at a competitive disadvantage if they ignore the technological, economic, environmental and national security forces that are already creating a viable market for EVs today.

## POLICY PERSPECTIVE

### EU & CHINESE ENERGY POLICY

Energy policy determines many of the opportunities and limitations that shape the deployment of alternative fuel vehicles in various markets. It plays a large part in explaining why some cities, regions, and countries have more ambitious AFV goals than others and/or are closer to achieving these goals. Domestic proponents of AFVs have long argued that US energy policy is inadequate, incoherent, or lacking altogether, and thus structurally favors the incumbent oil-fueled vehicles and infrastructure.

Three principal criticisms are leveled at US energy policymaking: it fails to effectively coordinate between the federal government and states, to take advantage of the full array of policy tools to promote alternative energy, and to address transmission and distribution bottlenecks. One way to assess the merits of these arguments and gravity of their implications is to explore how other similarly large energy markets with federal-like structures operate. The two most relevant energy markets with which to compare the US in this respect are the European Union and China. In order to

shed light on US energy policymaking and place it in a global context, we will look at:

- I. Coordination between different levels of government in the European Union and China on energy policy.
- II. Steps the EU and China are taking to transition to renewable energy resources.
- III. Their management of transmission and distribution across their territories.



## I. Energy Policy Coordination: A Work in Progress

Neither the EU nor China is technically a federation, but they are both arguably moving in that direction.

The EU is really a sui generis entity, which depending on one's perspective is either inexorably moving towards becoming the United States of Europe or alternately just a web of treaties and institutions that in the final analysis strengthen its 27 members states. The EU's policymaking process reflects this ambiguity.

There are two principal ways in which the EU makes policy: Inter-governmentalism in the traditional sense where states cooperate in areas of common interest, but remain in control of how and to what extent they cooperate. This is the prevalent form of governance on sensitive issues related to security and defense. On the other hand, with the Community Method member states give up some of their national sovereignty in the process of integration. Here, the European Council provides strategic direction; the European Commission drafts a proposal; and the Council of Ministers from the 27 governments and the directly elected European Parliament debate, amend, and pass or defeat the proposal.

The European Commission can issue either non-binding recommendations and opinions or binding regulations, directives and decisions. Regulations are the most binding form of EU law. They have legal force in every member state right away, whereas directives require that national authorities transpose measures into their national laws. The Commission then ensures that EU law is properly applied and can bring member states to the European Court of Justice if they fail to comply<sup>1</sup>.

EU Energy policy is a hybrid, combining inter-governmental coordination with the Community Method. Member states retain their right to frame their national energy policies, and a unanimous vote is needed to pass any measures involving energy taxation, conditions for energy resource exploitation, and the structuring of energy supply and choices<sup>2</sup>. Meanwhile, the Community method applies to issues related to internal energy market competitiveness, security of supply, and priority infrastructure projects<sup>3</sup>.

The EU's current policy framework is defined by the 2007 Lisbon Treaty, which for the first time added a specific chapter on energy into European primary law, and included a principle of solidarity whereby any member experiencing a severe energy supply disruption will receive assistance from other members. The Treaty states four energy goals: "ensure the functioning of the energy market; ensure security of energy supply; promote energy efficiency and energy saving and the development of new and

renewable forms of energy; and promote the interconnection of energy networks"<sup>4</sup>. The Treaty also pushes for achievement of these goals through international agreements.

**Table 1: Comparative Federal Energy Policy in the EU & China**

	EU	CHINA
Quasi-federal actors	- EU Institutions (CEU, EC & EP) - 27 member states	- Central government (CCP, NPC & State Council) - 33 provincial divisions
Energy policymaking	Inter-governmentalism & the Community method	(De-) Centralization
Policy framework	Lisbon Treaty	Twelfth Year Plan

Though lacking in transparency, China's policymaking process is simpler or in any case more direct in the sense that it is just one country with one party. As the table above shows, its system also involves many actors and layers. Increasingly, China's economy is centrally planned in name only, making its system just as difficult to understand, if not more so, than that of the EU.

The Chinese Communist Party and State Council issue guidelines every five years that set targets and policies for the whole country and then break them down for each of the provinces, which also need to submit their own five-year plan. A plenary session is then convened for the National People's Congress to rubberstamp the plan. At the provincial level, and each local level below it, there is a double leadership structure: a head of the people's government who is appointed by the provincial legislature and a party secretary who is appointed by the central government<sup>5</sup>.

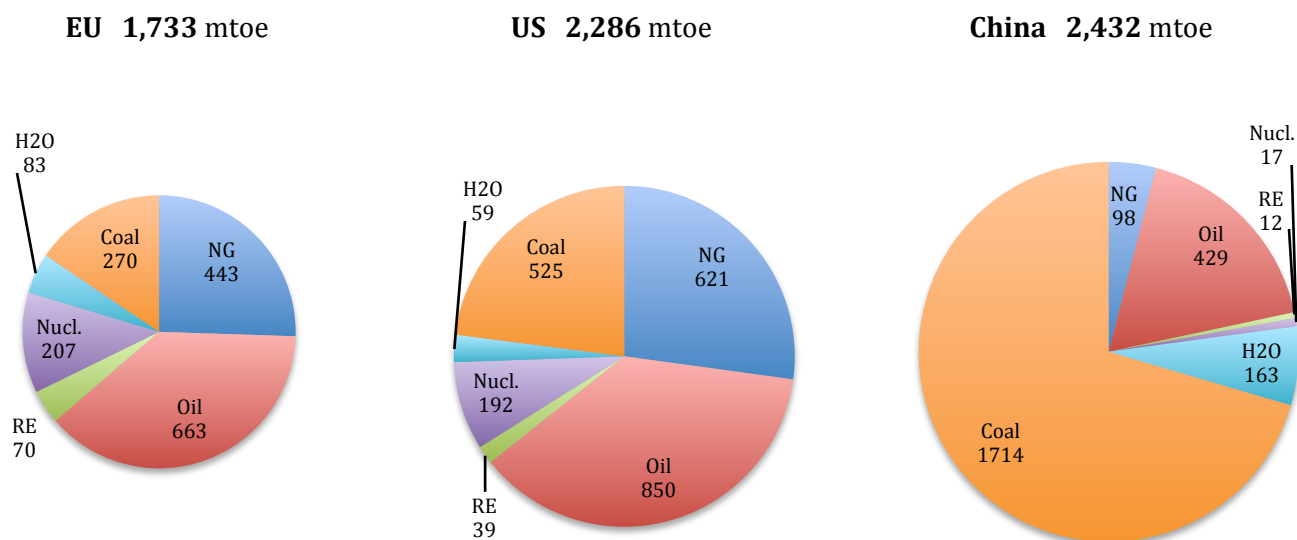
The system is designed to ensure the central government is directly represented at each level and in this sense it is a centralized system, but in fact the provinces have gained more autonomy over time and the central government often finds it difficult to implement its national goals when they compete with provincial priorities or involve cooperation among the provinces, which compete with each other too. For example, in the run-up to the five-year plans, provinces lobby the central government to secure lower targets in a zero-sum game whereby one province's lower target is another one's higher target. The central government is moving towards tailoring its targets for provinces on a more scientific and transparent basis to reduce the gamesmanship<sup>6</sup>.

The Chinese government arguably did not have a central energy policy for over a decade, since it eliminated its Ministry of Energy in 1993<sup>7</sup>. After a series of failed attempts to effectively coordinate energy policy through various agencies, in 2010 the State Council set up a high-level National Energy Commission (NEC), headed by the Chinese Premier as a “cabinet within the Cabinet”<sup>8</sup>. The NEC is responsible for drafting and coordinating a national energy development plan.

The *Twelfth Year Plan*, which covers 2011-2015 period, lays out China’s current energy policy framework and goals. It notably includes climate change for the first time as a major environmental issue. Of the seven special sectors identified for strategic investment, three are energy-related: clean energy, conservation and alternative fuel vehicles<sup>9</sup>.

To place the EU and China’s energy policies in context, the following table details energy consumption by source in these two markets and the US. It shows that the EU has the relatively most balanced energy supply diversification. The table also illustrates China’s challenges as the world’s largest energy consumer. Compared to the US and the EU it is starting with the lowest non-hydro renewable base and the highest dependence on coal.

**Chart 1: Comparative Energy Consumption in the EU, US & China** (in mtoe)



Source: BP Statistical Review of World Energy 2011

## II. Renewable Energy Transition: From Coal Bases to Wind Towers

Coal was central to the genesis of the European Union, which started as the European Coal and Steel Community, but the EU has come full circle in the sense that the goal now is to collectively reduce coal and other fossil fuel use and replace them with renewable energy sources.

The EU's Renewable Energy Directive has had two iterations. In its 2001 form, it was non-binding and only covered renewable energy in electricity generation and biofuels in transportation. Only a few countries expect to achieve their targets under this framework. The new version that was adopted in 2009 and transposed in December 2010 made some significant changes. It sets binding targets on green house gas (GHG) reduction and renewable penetration and requires the submission of National Renewable Energy Action Plans from each member state. The scope was also widened to cover all energy consumption, including heating and cooling<sup>10</sup>. The directive provides for several new "cooperation mechanisms": a member country can sell its energy surplus to another in a statistical transfer; a member state can finance a new renewable energy project in another member or third country if electricity is imported into EU and then they can statistically share the production as a joint project; member states to integrate their renewable energy plans into a single market and statistically divide the results in joint support schemes<sup>11</sup>.

According to the national renewable action plans submitted this year, almost half of the Member States are planning to exceed their own targets and be able to sell surpluses to other Member States. The EU is also providing 4.5 billion euros of co-funding with matching funds from industry and member governments to help with implementation.

As summarized in the table below the EU's target is 20/20/20, to achieve a 20% cut in greenhouse gases, a 20% cut in energy use, and a 20% renewable energy sourcing by 2020.

Additionally, the Commission has proposed an energy efficiency directive with binding measures, but its details are still being debated<sup>12</sup>.

**Table 2a: Comparative Renewable Energy Plans Consumption in the EU & China**

	EU	CHINA
2010 legislation	Renewable Energy Directive I	Renewable Energy Directive II
Key Changes	- Binding targets - Cooperation mechanisms	- Mandatory Connection - Renewable Energy Dvt. Fund
Goals	20 / 20 / 20	15 / 16 / 17

China is also in the second iteration of its Renewable Energy Law. Its first law was passed in 2005 and created a general framework for renewable energy promotion and regulation in China. As in the EU, a new version was passed at the end of 2009 and took effect in 2010. The revision made three major changes.

First, it tightened the Mandatory Connection policy, which obliges grid companies to purchase and connect any renewable energy generated in the country. The original policy had yielded poor results because of a lack of infrastructure and incentives to upgrade the grid<sup>13</sup>. For example, close to a third of China's wind capacity was not being connected to the grid and over half remained unused. Another reason some of the wind power remained unconnected was because it was originating from "rogue projects"<sup>14</sup> that the central government did not approve or even know they existed. The new version of the law requests agencies to set renewable energy targets for the grid companies, making them responsible for meeting the targets. It also includes penalties for non-compliance and mandates more detailed coordination between different levels of government through their Five-Year Plans for energy measures.

Second, the revised law has created a Renewable Energy Development Fund, which will collect surcharges on end-users' electricity bills and use them to compensate grid companies for the cost of purchasing and integrating renewables. This system will also allow the Chinese government to re-allocate funds for renewable projects in less economically developed provinces.

Finally, the government updated its feed-in tariff regime for wind, biomass and solar. For wind, the tariffs range from 7.5 to 9 cents per kwh depending on a region's wind resources. Feed-in tariffs for biomass were increased from 3.7 cents to 5.2 cents. In addition to increased feed-in tariffs for solar power, a Golden Sun program was implemented to provide capital subsidies of up to 70% for PV installations. The government has also exempted all renewable energy projects from local income taxation<sup>15</sup>.

China's goals are to achieve a 15% share of renewables, 16% cut in energy use, and 17% cut in greenhouse gas emissions by 2020.

To provide a comparative perspective, the following table displays the current portfolio of clean energy policies adopted in the EU, China, and the US. The EU and its members have adopted the full array of policies. The boxes with numbers specify how many member states have adopted the given measure for policies that only exist at the state level, as opposed to the EU level. China's policy mix reflects that its promotion of renewables energy resources is geared towards the export rather than domestic market. The US is clearly the laggard, having adopted less than half of the clean energy policies.

**Table 2b: Comparative Clean Energy Policies in the EU, US & China**

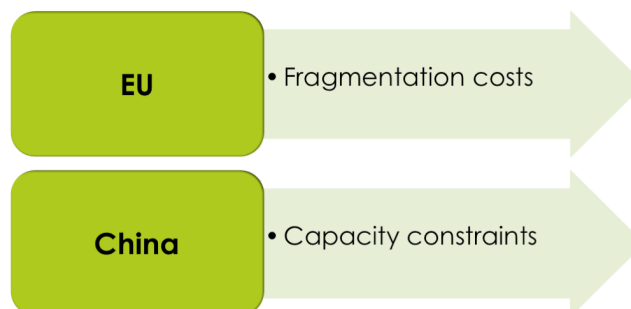
	EU	CHINA	US
<b>Auto Efficiency Standards</b>			
<b>Clean Energy Tax Incentives</b>	26		
<b>Renewable Energy Standard</b>			
<b>Green Bonds</b>			
<b>Feed-in tariffs</b>	21		
<b>Government Procurement</b>	21		
<b>Carbon Cap</b>			
<b>Carbon Market</b>			

Source: Pew Charitable Trusts & European Commission

### III. Transmission and Distribution Challenges

The EU and China both face transmission and distribution challenges, but these challenges are very different.

**Table 3: Primary Transmission & Distribution challenge in the EU & China**



For the EU the primary issue is fragmentation<sup>16</sup>. Electricity networks currently operate as national monopolies with only a small number of interconnections between the different grids, and some limited trading<sup>17</sup>. As a result, there is an up to 30% price gap in EU electricity prices<sup>18</sup>. This is a difficult area for EU members to reach a consensus since lowering the overall price would lead to higher prices in the currently cheapest areas and incur revenue losses for the grid companies.

The EU has passed a directive on grid unbundling and power market opening, but member states are delaying its implementation. In general, transmission and distribution reform has a poor implementation history: the Commission currently has over 60 infringement procedures open against EU members for failure to comply with the previous phase of this directive<sup>19</sup>.

However, the member states and Commission are cooperating on some initiatives that require an integrated strategy. The most notable are the North Seas Countries Offshore Grid Initiative for wind power and the Desertec and Solar Mediterranean plans.

China has made great strides in increasing the efficiency of its transmission and distribution network, starting with the implementation of a plant-grid separation reform in 2000. The measure separated the assets of China's electric power corporation into five power generation groups and two power grid companies - the State Grid Corporation and China Southern Power Grid Corporation.

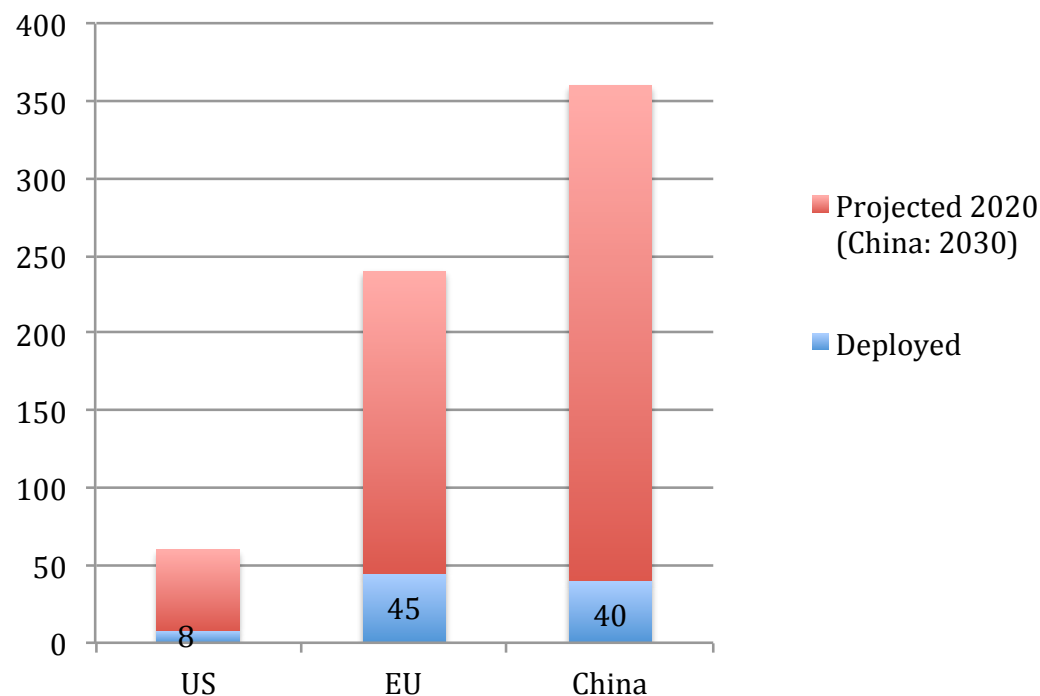
China is already the world's leading transmission and distribution market<sup>20</sup> and its State Grid Corporation is the largest power transmission and distribution company in the world. China's principal challenge is that its power resource development has grown faster than the grid. Its priority is to build more transmission capacity, especially ultra high voltage transmission, between the north and west where most of its power resources are, and the center and east where most of the demand is<sup>21</sup>. To this end, the government has committed \$40 billion to power grid development.

The EU and China have also started to develop smart grids, the next generation of transmission and distribution. While some EU member states have already launched smart grid projects, the issue is relatively new at the EU level. In fact, some countries have put their projects on hold until an EU-wide standard is adopted. There has been limited sharing of project experiences this far, as the Commission only this year completed an inventory of smart grid projects in Europe for the first time<sup>22</sup>.

China's grid companies are also working on the development of standards. State Grid Corporation has dedicated over \$100 billion to developing smart grid technology<sup>23</sup> and improving the quality of meters, which are currently much lower than that of meters in the EU or US<sup>24</sup>.

The following chart shows that China is poised to leap ahead of all competition in smart grid deployment, with 320 million meters by 2030.

**Chart 3: Smart Grid Prospects in the US, EU & China** (in millions)



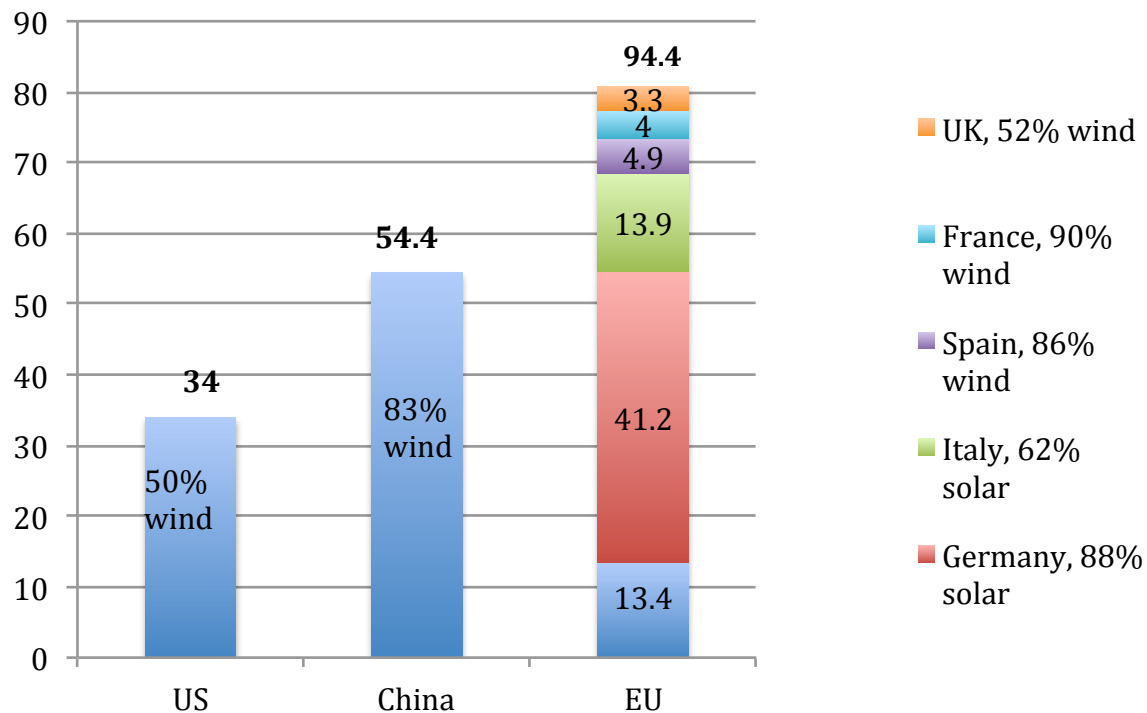
Source: European Commission, JRC, Institute for Energy, GSGF, Pike Research

## Concluding Prospects

In comparing different energy policies and goals, how can one assess which country has it right? One way is to look at where private clean energy investment is going, because this is ultimately what countries are going to need to sustain their clean energy efforts. The chart below shows that the EU as a whole is attracting the most private investment: \$94.4 billion. At a country level, China is the largest recipient at \$54.4 billion. The US lags with only \$34 billion; Germany alone, which is the size of Montana, is attracting even more: \$41.2 billion. Compared with the EU and China, US energy policy is indeed short on both effort and results.

Energy policy deficiencies have clear implications for the development of a globally competitive AFV industry. If those deficiencies are not addressed effectively in the next few years, America's energy policy could become an albatross that weighs heavily on innovators and entrepreneurs in this country.

**Private Investment 2010** (in billions of \$)



Source: Pew Charitable Trusts/ Bloomberg New Energy Finance



## Notes &amp; Sources:

<sup>1</sup> For further detail, see Neill Nugent, *The Government and Politics of the European Union* (New York: Palgrave Macmillan, 2010).

<sup>2</sup> Jan Frederik Braun, “EU Energy Policy under the Treaty of Lisbon Rules: Between a new policy and business as usual,” European Policy Institutes Network Working Paper, No. 31, February 2011, p.2.

<sup>3</sup> *Ibid.*, p. 9

<sup>4</sup> Treaty on the Functioning of the European Union, Article 194. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2008:115:0047:0199:en:PDF>

<sup>5</sup> For further detail, see Michael F. Martin, “Understanding China’s Political System,” Congressional Research Service, April 2010.

<sup>6</sup> Haibing Ma, “Can China Do a Better Job Delegating Its 2015 Energy and Emissions Targets?,” Worldwatch Institute Climate and Energy Blog, 14 January 2011. Available at: <http://blogs.worldwatch.org/revolt/can-china-do-a-better-job-delegating-its-2015-energy-and-emissions-targets/>

<sup>7</sup> The rationale for the dissolution was the ministry’s inefficient coordination. Coordination was subsequently left to the numerous energy-related ministries was left to the State Economic and Trade Commission, State Development and Planning Commission, and Ministry of Science and Technology. See Jimin Zhao, “Reform of China’s Energy Institutions and Policies: Historical Evolution and Current Challenges,” Belfer Center for Science and International Affairs, Discussion Paper 2001-20, Energy Technology Innovation Project, Kennedy School of Government, Harvard University, p. 7.

<sup>8</sup> Zhiyue Bo, “China’s New National Energy Commission: Policy Implications,” Energy Associates International Background Brief No. 504, 4 February 2010.

<sup>9</sup> KPMG China, “China’s 12th Five-Year Plan: Energy”, April 2011.

<sup>10</sup> European Commission, Communication from the Commission to the European Parliament and the Council, “Renewable Energy: Progressing towards the 2020 target”, 2011, p. 3.

<sup>11</sup> *Ibid.*, p. 12.

<sup>12</sup> “MEPs to reopen binding 2020 EU energy efficiency target debate”, Platts, 7 October 2011.

<sup>13</sup> Barbara Finamore, “China Renews its Commitment to Renewable Energy”, NRDC Switchboard Blog, 1 February 2010. Available at: [http://switchboard.nrdc.org/blogs/bfinamore/china\\_renews\\_its\\_commitment\\_to.html](http://switchboard.nrdc.org/blogs/bfinamore/china_renews_its_commitment_to.html)

<sup>14</sup> Eric Martinot and Li Junfeng, “Renewable Energy Policy Update for China”, Renewable Energy World, 21 July 2010. Available at: <http://www.renewableenergyworld.com/rea/news/article/2010/07/renewable-energy-policy-update-for-china>

<sup>15</sup> *Ibid.*

<sup>16</sup> Adrian Booth, Nuri Demirdoven, and Humayun Tai, “The Smart Grid Opportunity for Solutions Providers,” McKinsey, Summer 2010.

<sup>17</sup> “Power to the European Market”, The Economist, 11 November 2010.

<sup>18</sup> Siobhan Hall, “EU’s new energy market reforms kick in,” Platts Guide: EU Third Energy Package, 3 March 2011.

<sup>19</sup> *Ibid.*

<sup>20</sup> David Xu, Michael Wang, Claudia Wu, and Kevin Chan, “Evolution of the Smart Grid in China,” McKinsey, Summer 2010, p. 18.

<sup>21</sup> “China – energy transmission is key to industrial transformation,” Independent Power Asia, June 2010, p. 17.

<sup>22</sup> “Smart Grid projects in Europe: lessons learned and current developments,” JRC Reference Report, European Commission, 2011.

<sup>23</sup> *Ibid.*, p. 13.

<sup>24</sup> Adrian Booth, Nuri Demirdoven, and Humayun Tai, “The Smart Grid Opportunity for Solutions Providers,” McKinsey, Summer 2010, p. 49.

# Vehicle Review

## VOLT vs. LEAF

### VEHICLE TYPE

The Volt and Leaf reflect their companies' different visions of what consumers expect and need electric vehicles to deliver. GM's priority is to eliminate the problem of range anxiety. Its extended range electric vehicle achieves this by offering the same range as a conventional gasoline car and the ability to entirely run the car on gasoline. Nissan's priority is to pioneer the first mass-market all-electric car. The Leaf's battery has a greater range than the Volt and covers the average daily driving range of most Americans. The idea is that the consumer will start treating the vehicle as any other electronic device that needs to be charged the end of the day. For a consumer who drives more than 100 miles a day on a regular basis and/or cannot easily charge a vehicle at home or work, the Volt is the better pick. Consumers with average commutes and/or second cars, and green purists will want to take a closer look at the Leaf. Each model's winning features are highlighted in green in the following sections.

	<b><i>Volt</i></b>	<b><i>Leaf</i></b>
<b><i>EV Type</i></b>	Extended-Range Electric Vehicle (EREV)	Battery Electric Vehicle (BEV)
<b><i>Total Range<sup>1</sup></i></b>	375 miles	73 miles
<b><i>All-Electric Range</i></b>	35 miles	EPA rating: 73 Spectrum: 62 – 138
<b><i>Mpg Equivalent</i></b>	93 in all-electric 37 in regular mode	99

### PRICING

The Volt's hybrid approach comes with a hefty price premium. Neither is GM making a profit on these cars, nor will consumers make up for the higher price in lower costs of ownership over the average 6-year vehicle lifespan. The Leaf is also significantly more expensive than its conventional equivalent, but consumers will be able to recoup the extra cost through gasoline savings within six years. The \$7,500 federal tax break for electric vehicles make the prices much more competitive. Below the full prices are listed. Again, GM and Nissan adopted different pricing strategies. GM pared down some of the Volt's features to bring the price of the 2012 model down by more than \$1,000, while Nissan standardized some of the extra features and increased the price of its 2012 model by over \$2,500.

	<b><i>Volt</i></b>	<b><i>Leaf</i></b>
<b><i>Price 2011 / 2012</i></b>	\$40,280 / \$39,145 <sup>2</sup>	SV <sup>3</sup> \$32,780 / \$35,200 SL <sup>4</sup> \$33,720 / \$37,250
<b><i>Lease 2011 / 2012</i></b>	\$2,500 down \$350 for 36 months / \$399	\$1,999 / \$2,599 down \$350 for 36 months / \$409

## DRIVETRAIN

The Volt has less battery, but more power than the Leaf. With its 149-horsepower motor with 273 lbs./ft. of torque the Volt can accelerate from 0 to 60 mph in 9 seconds and achieve a top speed of 100 mph. It also features a sports mode for better acceleration and a mountain mode for steep inclines. The Leaf's only alternate mode is eco, which makes the car feel more sluggish but improves efficiency by around 10%. The Leaf's 104-horsepower motor with 207 lbs./ft. of torque allows for acceleration to 60 mph in 10 seconds and a top speed of 90 mph. Both cars have regenerative braking and low-rolling resistance tires. Both also offer a 100,000 mile or 8 year warranty on the battery.

	<b><i>Volt</i></b>	<b><i>Leaf</i></b>
<b><i>Battery pack</i></b>	16 kWh lithium ion battery pack	24 kWh lithium-ion-manganese-graphite
<b><i>Battery warranty</i></b>	100,000 miles / 8 years	100,000 miles / 8years
<b><i>Motor</i></b>	AC synchronous electric motor/generator 111kW/149-horsepower @ 4800 rpm 273 lb.-ft. of torque @ 0-4800 rpm	80 KW AC synchronous electric motor 107-horsepower @ 2,730-9,800 rpm 207 lb-ft of torque @ 0 – 2,730 rpm
<b><i>Top speed</i></b>	100 mph	90 mph
	0-60 in 9 seconds	0-60 in 10 seconds
<b><i>Additional Driving Modes</i></b>	Sport: for acceleration Mountain: for inclines	Eco: more efficiency
<b><i>Regenerative braking</i></b>	Yes	Yes
<b><i>Tires</i></b>	17-inch Goodyear Fuel Max low-rolling resistance lightweight wheels	16 inch Bridgestone Ecopia P205/55R16 low- rolling resistance tires

## CHARGING

The Volt's battery is able to connect to level 1 and level 2 chargers. The latter is able to fully charge the battery in 4 hours, versus 7 hours for the Leaf. However, the Leaf SL is also able to connect to a level-3 charger, which could provide an 80% charge in less than half an hour.

	<b><i>Volt</i></b>	<b><i>Leaf</i></b>
<b><i>Charger</i></b>	Left side front Level 1 & Level 2	Front center Level 1, 2 (Level 3 available for SL)
<b><i>Full charge @ 240V</i></b>	4 hours	7 hours (< 30 min. with level 3)
<b><i>Onboard charger</i></b>	3.3 kW	3.3 kW

## EXTERIOR DESIGN

Both the Volt and the Leaf are aerodynamically designed, but the Leaf weighs less and has significantly lower drag than the Volt.

	<b><i>Volt</i></b>	<b><i>Leaf</i></b>
<b><i>Curb weight</i></b>	3,781 lbs.	3,366 lbs.
<b><i>Drag coefficient</i></b>	0.43	0.29

## INTERIOR DESIGN

Although the Volt is larger than the Leaf, its T-shape battery does not allow for a middle back seat. Its backseats are more spacious than the Leaf's backseats, but the Leaf has an extra seat. The Leaf also has an extra 4 cubic feet of cargo space.

	<b><i>Volt</i></b>	<b><i>Leaf</i></b>
<b><i>Seating</i></b>	4-passenger hatchback	5-passenger hatchback
<b><i>Seating room</i></b>	<ul style="list-style-type: none"> <li>- Head front 37.8 in / rear 36.0 in</li> <li>- Hip front 53.7 in / rear 51.2 in</li> <li>- Leg front 42.1 in / rear 34.1 in</li> <li>- Shoulder front 56.5 in / rear 56.5 in</li> </ul>	<ul style="list-style-type: none"> <li>- Head front 41.2 in / rear 37.3 in</li> <li>- Hip front 51.5 in / rear 50 in</li> <li>- Leg front 42.1 in / rear 31.1 in</li> <li>- Shoulder front 54.4 in / rear 52.5 in</li> </ul>
<b><i>Battery location</i></b>	T-shape	Under rear seats
<b><i>Cargo volume</i></b>	10.6 ft <sup>3</sup>	14.5 ft <sup>3</sup>
<b><i>Other</i></b>		Built with recycled materials; 95% of components are recyclable

## ELECTRONIC FEATURES

The Volt and Leaf are both electronically advanced, featuring LCD screens that monitor gauges and track distance and driving efficiency. The Leaf allows drivers to set up digital readouts to help them drive more efficiently. Its CARWINGS system also keep track of energy use and compares results with those of other Leaf drivers. Both cars have a smartphone application that can be used to start and stop charging from a distance.

	<b><i>Volt</i></b>	<b><i>Leaf</i></b>
<b><i>LCD screens</i></b>	Tracks distance and energy used	Tracks distance and energy used; compares to all other Leaf drivers; eco-encouraging digital readouts
<b><i>Smartphone application</i></b>	OnStar & MyLink Battery level, tire pressure, lock doors, AC system, charging rate	CARWINGS State of charge, start/end charge, AC system

## SAFETY

The Volt and Leaf have equally excellent safety ratings.

	<b><i>Volt</i></b>	<b><i>Leaf</i></b>
<b><i>NCAP</i></b> <sup>5</sup>	5 stars	5 stars
<b><i>IIHS</i></b> <sup>6</sup>	2011 Top Safety Pick	2011 Top Safety Pick

## RATINGS

The Volt and Leaf are highly-rated and have won numerous awards for technological innovation and overall product design, not only when compared to other hybrids and/or electric cars, but in general automotive industry rankings as well.

The Volt's lower value proposition accounts for its lower KBB score when compared to the Leaf.

	<b><i>Volt</i></b>	<b><i>Leaf</i></b>
<b><i>Accolades</i></b>	2011 Motor Trend Car of the Year 2011 Green Car Journal Green Car of the Year North American Car of the Year Ward's Ten Best Engines	2011 World Car of the Year 2011 Kelley Blue Book Top Green Car Popular Mechanics Breakthrough Award Ward's Ten Best Engines
<b><i>Kelley Blue Book rating</i></b>	6.5/10	7.1/10

## MARKET POSITION

The Volt and Leaf were both launched in small batches and initially only in a few states. In November 2011, GM finished its national rollout; the Volt is now technically available at dealerships in every state. Nissan is accepting reservations in 23 states.

GM and Nissan sold out their 2011 models and have announced plans to ramp up production of their 2012 models. Nissan's decision to start producing Leafs at its plant in Tennessee will help reduce the waiting period between reservations and deliveries.

Volt sales outpaced Leaf sales in October by over 250 vehicles. However, to date the Leaf has outpaced the Volt by close to 3,500 vehicles sold.

	<b><i>Volt</i></b>	<b><i>Leaf</i></b>
<b><i>Manufacturing base</i></b>	Detroit	2011 model: Japan 2012 model: Smyrna, Tennessee
<b><i>Current availability</i></b>	All states	23 states: Alabama, Arizona, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Illinois, Massachusetts, Maryland, Mississippi, North Carolina, New Hampshire, New Jersey, New York, Oregon, South Carolina, Tennessee, Texas, Virginia, Washington, & Washington, DC
<b><i>October 2011 U.S. Sales</i></b>	1,108	849
<b><i>Total U.S. Sales To Date</i></b>	5,003	8,500 <sup>7</sup>

## Notes &amp; Sources:

<sup>1</sup> According to the EPA.

<sup>2</sup> Base price. Additional features available.

<sup>3</sup> The price increase from 2011 to 2012 reflects the standardization of the cold weather package: heaters for battery, mirrors, steering wheel, and seats.

<sup>4</sup> The SL has automatic headlights, fog lights, a rear-view monitor and a solar panel to charge the car's accessory battery.

<sup>5</sup> NHTSA's new car assessment program.

<sup>6</sup> Insurance Institute for Highway Safety.

<sup>7</sup> PluginCars.com, 11/17/11.

## Word of the Quarter

### SMART GRID

The U.S. power grid is aging, inefficient, vulnerable to outages, and unsuited to the diversification of our energy portfolio. A smart grid would fundamentally transform the grid through *real-time pricing*, greater interactivity between energy providers and consumers, and decentralization.

On the consumer side, *AMI* would empower consumers through smart home devices that integrate price signals into their home's energy-using systems, appliances and electronics. The smart devices would automatically modify energy use according to consumers' preferences.

Meanwhile, visualization would provide utilities with real-time information on end-use, weather conditions and other relevant information at the micro level. As a result, utilities could better manage their power to instantaneously balance supply in response to changes in demand and thus reduce the need for high-cost *peaking plants*. Overloads and outages would be more preventable. If a blackout occurred, the utility would instantly know who was affected down to the single household, and in the event that it was unable to quickly restore power communities could still draw on distributed power resources to keep essential appliances, buildings, and services powered via *islanding*.

A smart grid would facilitate the decentralized integration of plug-in vehicles and renewable energy sources. With regard to the former, the Pacific Northwest National Laboratory has calculated that if our nation's entire light-vehicle fleet were to electrify, current U.S. electricity production would already suffice to power close to three quarters of the fleet if vehicles were plugged in at night. During the day, parked electric vehicles could store power that EV owners would be able to sell back to the grid to help utilities meet peak demand. This two-way communication between EV owners and utilities would require a smart grid *V2G* technology using smart chargers.

The National Institute of Standards and Technology (NIST) has been tasked with developing common standards for Smart Grid technologies.

Full AFV glossary in English and Mandarin available in **AFVInsider** online edition.

## Trivia of the Quarter

**How much does the US spend on imported oil every day?**

Look for the answer in the next issue.



# Calendar

## AFV Events from Around the World

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EVENT NAME	DATE AND LOCATION	HOSTED BY	LINK
<b>Charging Infrastructure EV and Grid Integration 2012</b>	January 18 – 19 London, United Kingdom	London Business Conferences	<a href="http://www.ev-charging-infrastructure-2012.com/">http://www.ev-charging-infrastructure-2012.com/</a>
<b>Advanced Automotive Battery Conference 2012</b>	February 6 – 10 Orlando, Florida	AABC	<a href="http://www.advancedautobat.com/conferences/automotive-battery-conference-2012/index.html">http://www.advancedautobat.com/conferences/automotive-battery-conference-2012/index.html</a>
<b>Electric Vehicles: Understanding the Rise of EMobility</b>	February 13 – 14 London, United Kingdom	SMI	<a href="http://www.smi-online.co.uk/events/overview.asp?is=5&amp;ref=3715">http://www.smi-online.co.uk/events/overview.asp?is=5&amp;ref=3715</a>
<b>Battery Japan 2012</b>	February 29 – March 2 Tokyo, Japan	Reed Exhibitions Japan	<a href="http://www.batteryjapan.jp/en/">http://www.batteryjapan.jp/en/</a>
<b>Electric Vehicles Land, Sea and Air USA 2012</b>	March 27 – 28 San Jose, California	IDTechEx	<a href="http://www.idtechex.com/electric-vehicles-usa-12/ev.asp">http://www.idtechex.com/electric-vehicles-usa-12/ev.asp</a>
<b>EVS26</b>	May 6 – 9 Los Angeles, California	EDTA	<a href="http://events.ntpsshow.com/evs26/public/enter.aspx">http://events.ntpsshow.com/evs26/public/enter.aspx</a>
<b>Advanced Automotive Battery Conference Europe</b>	June 18 – 22 Mainz, Germany	AABC	<a href="http://www.advancedautobat.com/conferences/automotive-battery-conference-Europe-2012/index.html">http://www.advancedautobat.com/conferences/automotive-battery-conference-Europe-2012/index.html</a>

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## NEXT IN AFVINSIDER

Next issue for Spring 2012 will be out in March. Upcoming issues will focus on:

- EV **safety** issues
- **BYD**
- State & local **mandates**

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