Government incentive programs in major markets fueled a rapid increase in electric vehicle (EV) sales in 2015. Worldwide sales of EVs grew by 79% last year and the number of EVs in use surpassed 1 million.

China's plug-in electric passenger car sales grew by a factor of three in 2015, making the country the world's largest EV market.

In Europe, the EV market is starting to show signs of full-scale commercialization in countries such as Norway and the Netherlands.

Amid the EV boom, an e-mobility value chain is emerging. We are seeing innovation and new business models, including combined EV charging services/retail businesses.
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Executive Summary

This report provides an overview of the global electric vehicle (EV) market and analyzes the drivers and challenges that are impacting the adoption of these vehicles. It also analyzes the market trends and specific factors affecting the EV market in China, the US, Europe and Japan.

The global EV market saw huge growth in 2015, with worldwide sales increasing by 79% during the year and the global stock surpassing the 1-million-vehicle milestone. China was the fastest-growing EV market in 2015. The number of plug-in electric passenger cars sold in the country grew by three times last year, to over 200,000 units. Sales were 80% higher than in the US, making China the world’s largest electric passenger car market for the first time. The exceptional growth of EV sales in China over the past two years has been driven by government incentives, especially a purchase tax exemption scheme.

The US market, which used to be the largest, suffered a 4% decline in plug-in vehicle sales in 2015, which was mainly attributed to the dip in fuel costs.

In both Europe and Japan, EV sales growth outperformed that of the broader auto markets in 2015. Europe’s EV market is on its way to full-scale commercialization, but is still affected by beneficial government incentive programs, some of which are due to be phased out within the next few years. In Japan, EV sales grew by double digits in 2015, while the country’s overall auto market suffered a decline.

The development of global EV markets is leading to the emergence of an e-mobility value chain, which is giving rise to new partnerships and business models. We detail some of these in the last section of this report.
Introduction to the EV

Global EV markets have undergone rapid development over the past five years, although the electric car is not an entirely new invention.

A Brief History of the EV

The history of electric mobility can be traced back to the 19th century, when Scottish inventor Robert Anderson built the prototype electric-powered carriage in the 1830s. By the end of the 19th century, electric cars had entered the market, and were being well received in the US. According to the International Energy Agency (IEA), electric-powered cars were the top-selling road vehicles in the US in 1900, accounting for 28% of the market, and the global electric car stock reached a historical peak of 30,000 in 1912.

However, the first electric car boom soon came to an end, with the advent of light and powerful internal combustion engine vehicles and the availability of cheap fuel. By the mid-1930s, electric cars were almost extinct. They gained renewed interest in the late 20th century, against a backdrop of rising oil prices and heightened concern over air pollution caused by vehicle emissions. Since then, public and private sectors around the world have committed more to the development of electric cars, leading to a second electric car boom.

Major Categories

An EV is a vehicle that uses one or more electric motors for propulsion. Major types of EVs include battery electric vehicle (BEVs, or all-electric cars) and plug-in hybrid electric vehicles (PHEVs). Some types of PHEVs are also called extended-range electric vehicles (EREVs). Both BEVs and PHEVs are categorized as plug-in vehicles, and are different from hybrid electric vehicles (HEVs), which use both an electric motor and an internal combustion engine and cannot be recharged by being plugged in to an off-vehicle power source. HEVs use regenerative brakes to recharge batteries instead.

Source: sce.com
While HEVs came into mass production in the 1990s, marked by the launch of the Toyota Prius in 1997, plug-in vehicle sales started to pick up in 2010, following the release of the Nissan LEAF (a BEV) and the Chevrolet Volt (a PHEV).

The industry focuses on plug-in vehicles when discussing EVs and reporting related figures. In this report, “EV” refers to plug-in vehicles (PHEVs and BEVs, unless otherwise specified). These mainly comprise light-duty and passenger cars, except in China, where a large proportion of plug-ins sold are for commercial use (for example, electric buses).

Global Market Overview

2015 Was the Year of the EV

The global EV stock (cumulative sales since 2005) hit 1 million vehicles in the second half of 2015 and reached 1.26 million by the end of the year, according to the IEA. More than 565,000 plug-in vehicles—or almost half of the world’s stock—were sold in key EV markets, including North America, Western Europe, Japan and China, last year. Global sales grew by 79% last year, accelerating from 48% growth in 2014.

![Figure 1. Plug-In EV Sales in Selected Countries/Regions, 2011–2015](image)

When comparing EV sales in different countries/regions, we are comparing electric passenger car sales. Argonne National Laboratory said that 214,283 plug-in vehicles were sold in China in 2015, which exceeds the figure reported by the China Association of Automobile Manufacturers (207,382 electric passenger cars sold).

Source: US Department of Energy/Argonne National Laboratory
China was the brightest spot in the global EV market in 2015. Figures from the Argonne National Laboratory, the China Association of Automobile Manufacturers and the Electric Drive Transportation Association all indicate that sales of electric passenger cars in China surpassed those in the US in 2015, making China the largest EV market for the first time.

However, even though EV sales growth was impressive in 2015, the proportion of EVs on the world’s roads is still miniscule, at around 0.1% as of 2015, compared to the proportion of passenger cars.

The picture looks a bit better when we look at EVs’ share of new car sales in 2015 versus those already on the road. EVs’ global market share rose to 0.9% in 2015 from 0.5% in 2014 and, according to the IEA, that share was above 1% in seven countries: Norway, the Netherlands, Sweden, Denmark, France, the UK and China.

**Figure 2. EVs’ Market Share in Selected Countries (EV Sales as % of Total Auto Sales)**

![EVs’ Market Share Chart](chart)

*Source: IEA*

Norway has the highest EV market share; it jumped to 23% in 2015 from around 14% in 2014. EVs’ market share in the Netherlands increased to nearly 10% in 2015 from about 4% in 2014. The relatively fast adoption of EVs in these two countries shows that their EV markets are moving toward full commercialization.

**EV Sales Are Expected to Double Every Year Until 2020**

According to the Electric Vehicles Initiative and the IEA, there will be 20 million EVs on the road worldwide by 2020, which means that sales of EVs
are expected to double every year for the next five years and that the global EV stock will grow at a CAGR of 76% during the period. The projection is supported by production estimates for electrified powertrains, which are the engines that generate power for EVs. KPMG expects the production of powertrains to grow from 3.1 million in 2015 to 5.1 million in 2020, which would certainly meet the growing needs of the EV industry.

Figure 3. Estimated Electric Powertrain Production, 2011–2020F

![Graph showing estimated electric powertrain production from 2011 to 2020.](image)

*Source: KPMG/LMC Automotive/Statista*

**Tesla Is Leading in Range Technology, but BYD Is Leading in Sales**

A look at the performance of the major EV companies shows that Chinese brand BYD led global plug-in vehicle sales in 2015, thanks to a strong EV market in China. BYD sold 61,722 plug-in vehicles globally in 2015, while Tesla sold 50,580 and BMW said it produced more than 30,000 of its i Series electric cars.

Figure 4. Global Plug-In EV Sales, by Manufacturer, Jan.–Oct. 2015

| Units (Thou.) |
|-----------------
| 0   | 5   | 10  | 15  | 20  | 25  | 30  | 35  | 40  | 45  | 50  |
|-----------------
| BYD            | 43.1| 43.0|
| Nissan         | 36.6| 36.3|
| Mitsubishi     | 27.8| 25.5|
| Tesla          | 20.1| 17.2|
| Volkswagen     | 17.1|    |
| BMW            | 15.4|    |
| Zotye          | 15.4|    |
| Kandi          | 17.1|    |
| Ford           | 20.1|    |
| Zotye          | 20.1|    |

*Source: Statista/Business Wire*
In terms of vehicle travel range, or how far the car can travel on a single charge, Tesla was the leader in the industry in 2015, with a range of 263 miles (421 km) for the Model S. BYD’s e6 electric car has been catching up, however. The range of its updated BYD e6 model increased from around 188 miles (300 km) to 250 miles (400 km) due to an increase in battery capacity. New EV models that are expected to launch in 2017, such as Tesla’s Model 3 and Chevrolet’s 2017 Bolt, are also going to have ranges of 200 miles or more.

Figure 5. Travel Range of Selected EVs, as of July 2015

<table>
<thead>
<tr>
<th>EV Model</th>
<th>Range (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model S (Tesla)</td>
<td>263</td>
</tr>
<tr>
<td>e6 (BYD)</td>
<td>250</td>
</tr>
<tr>
<td>Kia Soul EV (Hyundai-Kia)</td>
<td>93</td>
</tr>
<tr>
<td>500e (Fiat)</td>
<td>87</td>
</tr>
<tr>
<td>Mercedes-Benz B-Class Electric Drive (Daimler)</td>
<td>84</td>
</tr>
<tr>
<td>LEAF (Nissan)</td>
<td>84</td>
</tr>
<tr>
<td>e-Golf (VW)</td>
<td>83</td>
</tr>
<tr>
<td>Chevrolet Spark EV (GM)</td>
<td>82</td>
</tr>
<tr>
<td>i3 (BMW)</td>
<td>81</td>
</tr>
<tr>
<td>Focus Electric (Ford)</td>
<td>76</td>
</tr>
<tr>
<td>SmartED (Daimler)</td>
<td>68</td>
</tr>
<tr>
<td>i-MiEV (Mitsubishi)</td>
<td>61</td>
</tr>
</tbody>
</table>

Source: CleanTechnica/Statista/Fung Global Retail & Technology

Market Drivers and Challenges

A number of factors are driving EV market growth around the world:

- **Government incentives**: Governments in major EV markets have been providing fiscal incentives—such as tax breaks and subsidies for purchasing EVs—that have proven to be key drivers of EV sales. Other incentives, such as free parking and access to bus lanes for EVs, have also boosted EV adoption.
- **Increasing awareness of environmental concerns and tightening regulations**: Regulations on CO2 emissions are being tightened around the world, which is forcing many automakers to increase their share of EV production.
- **Brands using EVs to differentiate themselves to consumers**: More manufacturers are adding EVs to their product lines to attract environmentally conscious consumers.
- **Emergence of the e-mobility value chain**: As the EV market grows, an e-mobility value chain involving players other than automakers—such as utility companies, charging infrastructure operators, mobility providers, and financial services and leasing
companies—is taking shape, and giving rise to new business models and revenue opportunities.

- **Declining battery costs:** High battery costs have challenged EV adoption, but they have been declining in recent years and are expected to decrease further. According to the US Department of Energy, EV battery costs have fallen considerably: in 2008, the cost was about $1,000 per kilowatt-hour, but by 2014, it had fallen to about $289 per kilowatt-hour. Tesla projected that, by 2020, the cost of lithium-ion batteries could decline to $100 per kilowatt-hour, which is less than half the current price.

![Figure 6. Battery Cost (Left Axis) and US Cumulative Plug-In EV Sales (Right Axis)](image)

The global EV markets are also facing significant challenges, however, including:

- **Charging infrastructure:** The key EV markets still need to build more public charging stations and make charging more convenient. The graph below shows that, globally, the number of publicly available chargers is still low, although the number of EV supply equipment outlets increased by 72% year over year in 2015, to 190,000. According to the IEA, 45 EVs are sharing one publicly available fast-charging outlet.
Figure 7. Global EV Supply Equipment Outlets (Left Axis, Thou.) and YoY % Change (Right Axis)

Private chargers are estimated, assuming that each EV is coupled with a private charger.

Source: IEA

- **Broad consumer adoption:** Many consumers still have concerns about the travel range of EV batteries, and they prefer shorter charging times.

- **Long-term effect of some government incentives being phased out:** As EV markets mature, governments in some countries will start phasing out incentives to buy EVs. For example, in China, the government intends to gradually reduce consumer subsidies for EV purchases, and the purchase tax exemption will expire by the end of 2017. In Norway, tax breaks for EVs will be maintained through 2017, but after that, some will be gradually phased out. And in the US, tax credits will start to be phased out once a manufacturer has sold more than 200,000 plug-in vehicles cumulatively since the end of 2009. While it is impossible for governments to subsidize the EV market forever, it is important that incentives are phased out in a controlled manner, so as not to disrupt market growth too much.

**Gas Prices: A Driver and a Challenge**

Oil and gas prices can either drive or inhibit EV sales. Historically, there has been a correlation between gas prices and HEV sales in the US. When gas prices declined, HEV sales also declined, and vice versa. Even though sales of plug-in vehicles in the US appear to be more resilient than those of HEVs, they still show some level of correlation with gas prices. As the market for plug-in EVs matures, the relationship could become more pronounced, mimicking that observed in the HEV market.
Geographic Analysis

In this section, we take a closer look at the domestic EV markets in China, the US, Europe and Japan, and analyze the specific factors affecting each.

China

Government incentives, including a purchase tax exemption and consumer subsidies, have been key supporting factors for the China EV market. The government, however, is planning to gradually phase out some of the incentives in coming years, which may present a challenge for the market beginning in 2018. At the same time, the government is increasing its support for building charging infrastructure.

Market Size and Trends

In China, EVs are known as “new energy vehicles” (NEVs), which include both BEVs and PHEVs. A large portion of the NEVs sold in China in 2015 were commercial vehicles (such as electric buses), which accounted for 37.4% of total NEV sales; electric passenger cars accounted for the remaining 62.6%.

The total number of NEVs sold in China in 2015 was 331,092, more than three times the number sold in 2014, according to the China Association of Automobile Manufacturers.

The Chinese government has set a target of having 5 million NEVs on the road (cumulative sales) by 2020. It has taken measures to support the continued rapid growth of NEV sales, mainly through a tax exemption
program rolled out in September 2014, which is due to expire by the end of 2017.

**Figure 9. Sales of NEVs in China, 2015**

Source: China Association of Automobile Manufacturers

In 2015, there were 207,382 electric passenger cars sold in China, an increase of more than 280% from the previous year. The number was about 80% higher than the US sales figure (in the US, 114,022 plug-in vehicles, including BEVs, PHEVs and EREV, were sold last year).

NEVs’ market share in China was about 1% higher than that of passenger cars in 2015, while their share of the commercial vehicle market was much higher, at 3.6%.

A large percentage of the EVs sold in China last year were produced domestically. China produced a total of 340,471 NEVs in 2015, which represented 1% of its total auto production. The Chinese Ministry of Industry and Information Technology has targeted a stock of 1 million domestic-brand NEVs on the roads in China in 2020.

**Figure 10. Production of NEVs in China, 2015**

Source: China Association of Automobile Manufacturers
Major Market Players

China’s EV market is dominated by domestic players, and BYD is the market leader. BYD sold 58,000 NEVs in China in 2015, accounting for about 18% of the domestic market (including electric passenger cars and NEVs for commercial use). The company expects its domestic NEV sales to almost triple in 2016, to 150,000.

Source: www.autoblog.com

Figure 11. Electric Passenger Car Market Share* in China, by Model, 2015

<table>
<thead>
<tr>
<th>Model</th>
<th>Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYD Qin</td>
<td>15.4%</td>
</tr>
<tr>
<td>BAIC E-Series EV</td>
<td>8.1%</td>
</tr>
<tr>
<td>JAC iEV</td>
<td>8.0%</td>
</tr>
<tr>
<td>BYD e6</td>
<td>7.5%</td>
</tr>
<tr>
<td>Zhidou D2</td>
<td>4.3%</td>
</tr>
<tr>
<td>Tesla**</td>
<td>3.5%</td>
</tr>
<tr>
<td></td>
<td>3.4%</td>
</tr>
<tr>
<td></td>
<td>3.1%</td>
</tr>
<tr>
<td></td>
<td>1.8%</td>
</tr>
<tr>
<td></td>
<td>1.8%</td>
</tr>
<tr>
<td></td>
<td>1.5%</td>
</tr>
</tbody>
</table>

*Based on annual electric passenger car sales
**1Q–3Q 2015
Source: ChinaAutoWeb/Fung Global Retail & Technology

China set a target of maintaining 70% market share for domestic automakers in the NEV market, according to the government’s “Made in China 2025” strategy.

The government’s massive NEV development plan benefits domestic companies more than it does foreign automakers. China set a target of maintaining 70% market share for domestic automakers in the NEV market, according to the government’s “Made in China 2025” strategy. That means foreign automakers would have some, albeit limited, room to grow their extremely low market share in the country.
Currently, Tesla is the major imported EV sold in China. Other foreign automakers mainly participate in the market through Sino-foreign joint ventures. Tesla’s sales in China were disappointing in 2015, with only 3,025 vehicles sold in the country during the first three quarters. Its full-year 2015 China revenue declined by 33% year over year, to $318.5 million.

When Tesla launched its Model S in China in 2014, the car was priced at ¥734,000 (~US$121,370 at an exchange rate of US$1 = ¥6.05). This was 50% higher than the car’s price in the US and much higher than domestic brands in China, mainly due to the high import duty and VAT. Imported cars can be twice as expensive in China versus other markets, and Tesla was already being conservative in setting its China price of the Model S, which allowed for little profit.

**Figure 12. Breakdown of Tesla Model S Price in China (USD)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipping and Handling</td>
<td>$3,600</td>
</tr>
<tr>
<td>Custom Duties and Taxes</td>
<td>$19,000</td>
</tr>
<tr>
<td>VAT</td>
<td>$17,700</td>
</tr>
<tr>
<td>China Price</td>
<td>$121,370</td>
</tr>
</tbody>
</table>

(50% higher than US price of $81,070)

*Source: Tesla*

Because it is so difficult to tap the Chinese market as a foreign brand, Tesla CEO Elon Musk has indicated that Tesla intends to set up a factory to manufacture EVs in China.

**Government Incentives**

The Chinese government has provided incentives for various EV industry participants, including automakers, suppliers, researchers and consumers. There are two key incentives affecting NEV sales growth in China:

- **NEV purchase tax exemption:** The government launched a purchase tax exemption scheme specifically for NEVs for the period of September 1, 2014–December 31, 2017. According to the China Association of Automobile Manufacturers, about 90% of NEVs sold since September 2014 have been models on the purchase tax exemption list.

- **Subsidy for consumers:** The government provided a subsidy of ¥35,000–¥60,000 (US$5,469–US$9,375) for electric passenger car purchases in 2013. The subsidy is being reduced to ¥25,000–¥55,000 (US$3,906–US$8,594) in 2016, which is still meaningful, given that some NEVs cost less than ¥200,000 (US$31,250) in China.

China’s Ministry of Finance is planning to gradually reduce consumer subsidies in coming years in order to develop a more self-reliant EV market. It plans to cut the subsidy by 20% by 2018, and 40% by 2020, from the 2016
base, and the Minister of Finance said earlier this year that the government intends to end the consumer subsidy scheme altogether in 2021.

At the same time, the Chinese government will provide fiscal support for the development of charging infrastructure. Between 2016 and 2020, the central government will give fiscal incentives to local authorities to develop, operate and upgrade charging infrastructure. To be eligible for the incentives, local authorities need to fulfill a number of criteria, including promoting NEVs, designing comprehensive NEV policies and promoting fair market practices, i.e., levying no procurement restrictions on foreign brands. Cities and provinces with more severe air pollution will have higher NEV promotion targets.

Industry participants should pay attention as the purchase tax exemption and consumer subsidies are phased out, and assess whether local authorities can adequately make up for the ending of these programs by promoting NEVs more heavily.

Challenges

Apart from the consumer adoption issues all EV markets face, such as high battery costs and concerns about battery travel range, China’s EV market faces some challenges that are specific to the country:

- China’s development of its charging grid lags that of other markets. According to the National Development and Reform Commission, there were only 780 EV charging stations and 31,000 charging pillars in China at the end of 2014. The Chinese government has set a target to build more than 12,000 charging stations and 480,000 charging pillars by 2020.
- EVs are still expensive for consumers in China.
- Sales growth has been driven by tax exemption subsidies.
- Imported EVs are not eligible for domestic subsidies, and they face high import duty and VAT rates (25% import duty and 17% VAT; exact rates vary for different imports).

United States

The US has been leading the global EV market in terms of plug-in EV stock. According to the IEA, plug-in EV stock in the US was the highest in the world in 2015, at 404,090, accounting for one-third of the global stock. However, in terms of annual sales of plug-in vehicles, the US lagged China in 2015.

Market Size and Trends

Overall vehicle sales in the US grew by 5.8% year over year in 2015, to 17.4 million. Sales of plug-in vehicles, however, declined by 4% year over year, to 114,022, against a backdrop of low gas prices. Plug-in vehicles’ market share remained flat in 2015, at 0.7%. Automakers such as BMW and Ford have introduced turbocharged engines that provide better fuel economy and lower emissions, which also pressured sales last year. Nevertheless, Navigant Research projected that plug-in vehicles sales in North America will exceed 1.1 million annually by 2024.
A number of upgraded EV models are set to launch in the coming year, which could support the US market and help it regain stable growth. Some of these are all-electric cars with relatively high ranges of 200 miles or more, and are priced below $40,000. The Tesla Model 3, expected in 2017, will have a range of 215 miles, and the 2017 Chevrolet Bolt EV will have a range of more than 200 miles. Other new PHEV models include the 2016 and 2017 Chevrolet Volt and the Volvo XC90 T8.

**Major Market Players**

Tesla, Nissan and Chevrolet are the leaders in the US plug-in EV market. In 2015, Tesla’s Model S became the best-selling plug-in EV in the US, with 26,200 cars sold.

The Nissan LEAF was the best-selling plug-in EV in the US in 2014, but its market share shrunk from 25% in 2014 to 15% in 2015. Sales of the car declined from 30,200 units in 2014 to 17,269 in 2015.

Chevrolet Volt unit sales also declined, from 18,805 in 2014 to 15,393 in 2015, and the model’s market share declined from 16% in 2014 to 14% in 2015.
Government Incentives

Government support for the EV market in the US includes tax credits, nonmonetary incentives such as high-occupancy vehicle lane access, and grants and investment from the government to develop the market:

- **Tax credits**: According to the Energy Improvement and Extension Act of 2008, buyers of new EVs can enjoy a $2,500–$7,500 tax credit, depending on the car’s battery capacity. The tax credit will phase out once a manufacturer sells 200,000 EVs in the US.

- **Other incentives**: Plug-in vehicles with special state-issued license plates may use high-occupancy vehicle lanes regardless of the number of passengers and are exempt from parking fees charged by state or county authorities.

- **Federal grants**: President Obama pledged $2.4 billion in federal grants in 2010 to support 48 advanced battery and electric drive projects. Part of this was given to manufacturers to expand battery-recycling capacity and produce electric drive components.

- **Investment to address EV adoption barriers**: The Department of Energy invested $225 million in 2013 and 2014 through the “EV Everywhere” program to support R&D to reduce EV costs, improve charging infrastructure and promote consumer acceptance.
Challenges

The US EV market faces the common consumer adoption challenges we mentioned earlier, such as limited charging stations and battery travel range. According to a recent survey byNavigant Research, 36% of respondents cited a lack of charging infrastructure or other charging inconvenience as the main reason for not switching from a gas- to an electric-powered car.

Charging Infrastructure

According to the Department of Energy’s Alternative Fuels Data Center, as of June 2016, there were 13,720 electric charging stations and 33,891 charging outlets in the US. The number of charging stations in the US is much higher than in China. The US also has a large number of charging outlets, but, due to its size, the country is not as saturated as Japan is in terms of EV charging point density.

Europe

Europe saw significant growth in EV sales in 2015, although it was not as dramatic as in China. The Netherlands led the Western European countries within the EU in terms of sales growth. Sales in some Eastern European countries grew rapidly in 2015, while plunging in others.

Even though the European Commission suggested that the EV market in Europe is now ready to move from a testing and experimenting stage to full-scale commercialization, the market still depends on support policies to some extent and is vulnerable to changes in such policies.
Market Size and Trends

According to the European Automobile Manufacturer’s Association, sales of EVs (including BEVs, PHEVs, EREVs and fuel-cell EVs) in the EU grew by 108.8% year over year in 2015, to 146,161 vehicles. Plug-in EV sales growth was much higher in the EU than was hybrid electric car sales growth (23.1%). Sales of other alternative-fuel vehicles (natural gas vehicles and LPG-fueled vehicles) declined by 8.4% year over year.

Sales of alternative-fuel vehicles (including EVs and HEVs) totaled 582,135 units in 2015, up 20% from the previous year. These represented 4.2% of total passenger car registrations in the EU, while EVs alone accounted for 1.1% of new passenger car registrations in 2015.

Figure 15. EV Sales in Europe, 2015

![EV Sales in Europe, 2015](chart)

*BEVs, PHEVs, EREV and fuel-cell EVs

**EVs, HEVs and other alternative-fuel vehicles

*Source: European Automobile Manufacturers’ Association

Sales by Country

EV sales in the Netherlands grew by 193.4% year over year in 2015, to 43,441, making it the European country with the highest EV sales during the year.

The EV market in Eastern Europe is underdeveloped, and sales tend to fluctuate by country in the region. EV sales in Hungary grew by 233.3% in 2015, to 130, but in Estonia, sales declined by 90%, to 34, during the year.
Norway and the Netherlands led EV adoption in Europe (in terms of market share) in 2015, and adoption in both countries has been driven by incentives. The Netherlands’ CO2-based vehicle taxation scheme features high rebates for vehicles that emit less than 50 g/km of CO2, which has contributed to its strong EV market. Fiscal incentives provided by the government in Norway have also underpinned the strong market in that country.

**Major Market Players**

Mitsubishi, Nissan and Renault have led Europe’s EV market. In the first months of 2016, sales of the Mitsubishi Outlander slightly outpaced those of the Nissan LEAF and the Renault ZOE, but in 2015, Renault had the highest market share, with overall EV sales of 23,086 vehicles (up 49% year over year). Sales of the Renault ZOE reached 18,453 in 2015, increasing by 68% year over year and making it the market leader.
Figure 17. EV Sales in Europe, by Model, Jan.–Apr. 2016

Source: CleanTechnica

Government Incentives

European countries with high EV adoption rates tend to have more supportive policies and fiscal incentives than countries with lower adoption rates. According to the European Automobile Manufacturers’ Association, some of the countries providing purchase and tax incentives for EVs in 2016 are the Netherlands, Germany, France and the UK:

- In the Netherlands, vehicles emitting 50g CO2/km or less are exempt from the annual circulation tax. EVs are also exempt from the country’s registration tax.
- In Germany, EVs are exempt from the annual circulation tax for a period of 10 years from first registration.
- In France, regions have the option to make alternative-fuel vehicles exempt from the registration tax (either totally or at 50%). Also, EVs are exempt from any company car tax. Since January 2016, a bonus of €6,300 has been granted for any vehicle emitting 20g CO2/km or less.
- In the UK, EVs are exempt from the annual circulation tax. Since April 2010, pure electric cars have been exempt from any company car tax.

Norway has been implementing generous EV incentives, such as a VAT exemption on EV purchases. Its 2015 budget revision maintained many incentives (including tax breaks) for EVs until 2017, but after that, some incentives will be gradually phased out. For example, after 2017, the VAT exemption incentive will gradually decline.

The European Commission suggested that supportive EV policies can gradually be reduced once costs come down and EVs become a common choice for the mainstream market.
Challenges

A major challenge for the European EV market is the need for harmonized standards for EV charging systems. The region has worked to integrate the charging system for EVs into Europe’s electricity networks. A number of major auto manufacturers, including Audi, BMW, Daimler, Ford, General Motors, Porsche and Volkswagen, have collaborated in recent years in forming a system that integrates all charging configurations. While some standards have already been achieved, the industry is now working to further harmonize EV technology and standards not only in Europe, but also between the EU and the US.

Charging Infrastructure

The EU’s Clean Power for Transport Directive set a target of 800,000 publicly accessible EV charging stations throughout Europe by 2020. The Netherlands, Germany, France and the UK are all leading countries in charging infrastructure deployment. The Netherlands had roughly 1.1 charging stations per vehicle as of 2013, the highest in the world at the time.

Western Europe has better charging station coverage than Eastern Europe does, but some Eastern European countries are making advances in EV infrastructure development. For example, Estonia officially opened its nationwide EV fast-charging network in 2013.

Japan

Market Size and Trends

Japan’s car market suffered a 9.3% decline in 2015. New car sales dropped to 5,046,511 during the year, according to Japan’s Automobile Dealers Association. However, EV sales were strong despite the weakness of the auto market. Argonne National Laboratory data show that plug-in vehicle sales in Japan grew by 51.6% year over year, to 46,339 in 2015.

According to the IEA, Japan’s EV market share was 0.6% last year. However, a passenger car market survey conducted by the Japan Automobile Manufacturers Association in 2015 indicated that 30% of respondents are interested in “next-generation” alternative-energy vehicles. The survey also found that more than 60% of respondents were aware of hybrid and electric vehicles, and around 40% were interested in self-driving cars.

Major Market Players

The Nissan LEAF electric car has been the EV market leader in Japan, which is also Nissan’s home. The LEAF was one of the first mainstream, mass-marketed EVs, and it has remained a best-seller, with cumulative global sales of more than 200,000 units since it was launched in 2010. Almost 65,000 LEAFs have been sold in Japan.
Figure 18. EV Sales in Japan, by Model, Launch Date–Apr. 2016

Source: Mitsubishi/Toyota/Inside EVs

**Government Incentives**

In Japan, EVs buyers enjoy tax breaks on tonnage, acquisition and ownership taxes. The tax break amount depends on the fuel efficiency and type of vehicle. Vehicles that are 20% more fuel efficient than the 2015 standards are eligible for the maximum tax reduction. The tonnage and acquisition tax break period was extended in 2015, and will now last through 2017.

**Charging Infrastructure**

Japan has relatively better EV charging infrastructure than other major EV markets. A 2015 survey by Nissan indicated that there were more than
40,000 electric car recharge points in Japan. That is in comparison to 34,000 gas stations nationwide. According to IHS, Japan had more than 2,800 DC fast-charging stations using CHAdeMO (the Japanese fast-charging standard) as of 2015, and accounted for about 50% of CHAdeMO stations worldwide.

Future Development: Innovative Business Models and E-Mobility

The automobile and related industries have been working toward further innovations in EV, battery and charging technologies. They are aiming to reduce battery costs, lengthen battery travel range and improve charging speed in order to address consumers’ main concerns.

Industry participants are also looking at new approaches and business models, capturing opportunities in the evolving e-mobility ecosystem. Many of the new opportunities lie in the area of EV charging:

- **Infrastructure**: Some car manufacturers are playing a role beyond car production and are entering the infrastructure area. For example, Tesla has developed Supercharger stations for its cars.
- **Car sharing**: Car sharing has become a global phenomenon and it is impacting the EV market. Car-sharing services attract customers who are interested in using an EV occasionally for low cost, without bearing the full cost and responsibility of owning one.
- **Battery leasing**: In addition to offering EV leasing, some manufacturers have been experimenting with battery leasing, offering consumers the choice of buying the car outright or leasing the battery pack, which makes up a significant part of the cost of BEVs.
- **Battery swapping**: Battery swapping can provide a quick recharge alternative for EV drivers and solve the long-charging-time issue.
- **Charging-point installation and maintenance**: Some companies are providing services for private charging, including installing charging points at homes and offices and providing maintenance services.
- **Smart grid**: Increased EV adoption has led to the need for smart grid applications that can manage the charging needs of the growing number of EVs.
- **Using RFID in charging services**: Charging-services providers are giving customers RFID passes for identification, payment and billing.
- **Charging apps**: Charging apps can consolidate multiple RFID cards from different service providers and provide information such as availability of charging stations and charging prices.
- **Operating charging infrastructure in combination with retail**: There is a business case for operating charging outlets in combination with a retail component such as vending machines or convenience stores. Tesla is reportedly in talks with East Coast convenience store and gas station chain Sheetz regarding the installation of Supercharger stations for Tesla vehicles.

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Conclusion

Demand for EVs has grown tremendously over the past five years, most notably in 2015. EV sales growth outperformed overall auto sales growth in most of the major EV markets in 2015, including Europe, China and Japan, and global EV stock is forecasted to increase to 20 million vehicles by 2020.

Yet the EV market faces challenges that could inhibit its growth. As EV markets grow, government incentives in some countries, such as China and Norway, are gradually being phased out. With less government support, broad consumer adoption will require further technological development to lower battery costs and EV prices, and to lengthen the EV battery travel range.

That being said, advances in the industry have led to an e-mobility value chain that is giving rise to new business models, including EV sharing, battery leasing and services, and combining retail with charging infrastructure. We expect to see dynamic development in the EV industry over the next five years, including innovations that upend our understanding of transportation and mobility.