# FACT SHEET

# *Electric vehicles*

## Key points

- ***Electric vehicles represent alternatives to conventional, high-emission technologies in a low carbon green growth economy.***
- ***National targets demonstrate public commitment and send encouraging signals to the private sector that long-term investments will be secure.***
- ***Electric vehicles are subject to the same challenges confronting the adoption of green technologies and need support to compete with their brown counterparts.***

## Electric vehicles explained

There are two types of electric vehicles:

- **Electric vehicles (EVs):** Battery-powered vehicles use an electric motor for propulsion and batteries for electricity storage. The energy in the batteries provides all of the motive and auxiliary power on board of the vehicle. Batteries can be recharged via grid electricity, brake energy recuperation or via off-grid sources, such as photovoltaic panels.
- **Plug-in hybrid electric vehicles (PHEVs):** Hybrid electric vehicles use both an engine and a motor, featuring sufficient battery capacity to store electricity generated by the engine or by brake energy recuperation. The batteries power the motor when needed, provide auxiliary motive power to the engine or even allow the engine to be turned off at low speeds.[1]

## How they work

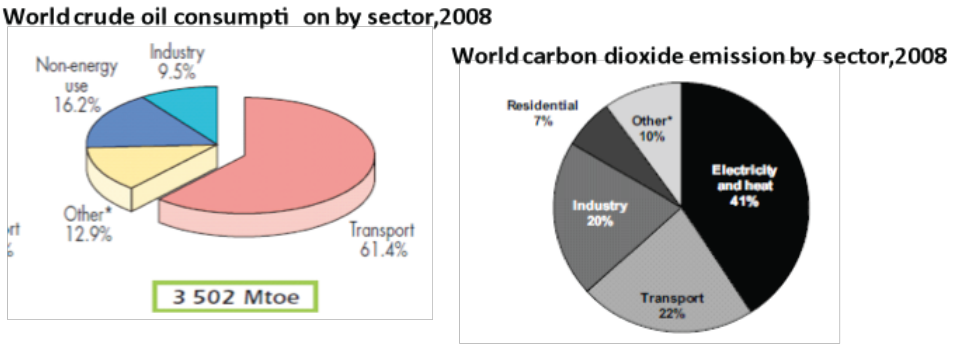
Electric vehicles are considered viable substitutes for conventional vehicles, which are the biggest oil consumers [2], and the second-largest carbon dioxide emitters [3] globally (figure 1). Because electric vehicles avoid or reduce the use of fossil fuels, they are destined to be part of the low carbon green growth solution.

[1] International Energy Agency (IEA), *Technology Roadmap: Electric and Plug-in Hybrid Electric Vehicles* (Paris, OECD/IEA, 2009). Available from www.iea.org/papers/2009/EV_PHEV_Roadmap.pdf (accessed 26 January 2012).

[2] International Energy Agency (IEA), *2010 Key World Energy Statistics* (Paris, OECD/IEA, 2010). Available from www.iea.org/textbase/nppdf/free/2010/key_stats_2010.pdf (accessed 26 January 2012).

[3] International Energy Agency (IEA), $CO_2$ *Emissions from Fuel Combustion Highlights* (Paris, OECD/IEA, 2011). Available from www.iea.org/co2highlights/co2highlights.pdf (accessed 26 January 2012).

**Figure 1: Global crude oil consumption and carbon dioxide emission by sector, 2008**




*Source:* International Energy Agency, *Key World Energy Statistics* (Paris, 2010); and International Energy Agency, *Carbon Dioxide Emissions from Fuel Combustion* (Paris, 2010).

## Strengths in adopting electric vehicles

Electric vehicles provide three important benefits:

- **Decreased demand for crude oil:** Both types of electric vehicles consume less fossil fuel than conventional vehicles. The International Energy Agency estimates that if electric vehicle sales reach 5 million per year by 2020, the resulting 20 million electric vehicles on the road at that point will avoid oil consumption of 0.4 million barrels a day.[4]
- **Reduced greenhouse gas emissions:** Electric vehicles offer the prospect of zero-vehicle emissions of greenhouse gases and air pollutants. This is a hugely important advantage over conventional vehicles.[5]
- **A value chain that generates jobs:** The development of a domestic market and industries for electric vehicles can attract numerous green finance investments in either the direct production or its related industries and services.

## Challenges to adopting electric vehicles

- **High cost:** The cost of electric vehicles is likely to remain substantially higher than that of conventional vehicles for at least the next five to ten years and will be the main challenge for competing with fossil fuel vehicles.
- **The reliability of electric vehicle technology:** The next biggest drawback of electric vehicles is the low energy and power densities of the batteries compared with liquid fuels.
- **The availability of infrastructure:** Public recharging infrastructure for electric vehicles is very limited or non-existent in most cities. A few cities have made the leap and installed a significant system of recharging infrastructure as part of pilot projects and other programmes.
- **Transforming consumer habits:** Consumer acceptance of electric vehicles is a critical factor determining the ultimate success or failure of the technology. The fact that electric vehicles lag behind their conventional counterparts in terms of performance and recharge convenience is an important reason for consumers to turn their back on an otherwise viable green solution.

## Implementing strategies

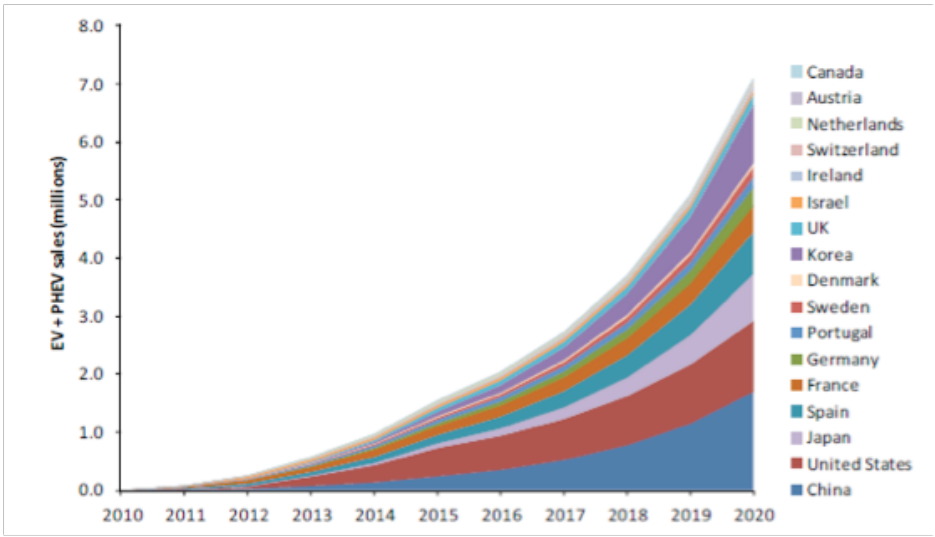
Because electric vehicles are relatively novel, technological applications and government policies are crucial in helping to establish a stable market for them and to encourage customers to make the switch. The following policy options are important steps that governments can take to promote this green industry sector:

[4] International Energy Agency (IEA), *Transforming Global Markets for Clean Energy Products: Energy Efficient Equipment, Vehicles and Solar Photovoltaics* (Paris, OECD/IEA, 2010). Available from www.iea.org/papers/2010/global_market_transformation.pdf (accessed 26 January 2012).

[5] International Energy Agency (IEA), *Energy Technology Perspectives 2010: Scenarios & Strategies to 2050* (Paris, OECD/IEA, 2010). Available from www.iea.org/Textbase/nppdf/free/2010/etp2010_part1.pdf (accessed 26 January 2012).

**Set national targets:** Since the 1990s, several countries have adopted national targets to increase the number of electric vehicles in use. The International Energy Agency estimates that the global sales will reach 7 million per year by 2020 as a result of compliance with the national targets in 17 countries (figure 2).[6]

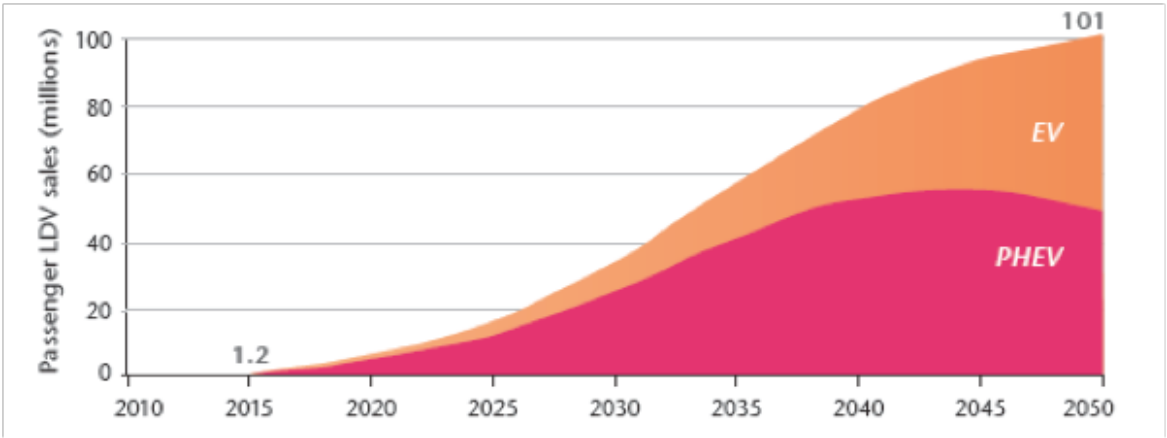
**Figure 2: Aggregated national targets for electric vehicles (millions per year)**




*Source:* International Energy Agency, *Clean Energy Progress Report* (Paris, 2011).

Create a roadmap. A roadmap is a useful tool for policymakers to sketch a comprehensive strategy that will help them expedite a desired policy. It is basically a handbook on how to achieve a national target and thereby helps to select appropriate implementing actions and to track the achievements. The International Energy Agency published an electric vehicle technology roadmap in 2009, which provides useful information about future trends to both the public and governments (figure 3). It features the so-called BLUE map scenario, which describes how the deployment and distribution of electric vehicles have to change in order to halve the amount of CO2 emissions by 2050, compared with 2005 levels.

**Figure 3: Annual global electric and plug-in hybrid electric vehicles in the BLUE map scenario**




Source: International Energy Agency, *Technology Roadmap: Electric and Plug-in Hybrid Electric Vehicles* (Paris, 2009).

[6] International Energy Agency (IEA), *Clean Energy Progress Report* (Paris, OECD/IEA, 2011). Available from http://iea.org/papers/2011/CEM_Progress_Report.pdf (accessed 26 January 2012).

**Provide incentives:** Some of the practical difficulties for the widespread use of electric vehicles, such as their high costs, low performance and the lack of necessary recharging infrastructure, have to be bridged with the help of government incentives. This is necessary as long as the conventional brown technologies do not reflect the real environmental or social price they inflict and thus can be purchased on the market at lower prices than their green counterparts. Policy options that are currently being introduced also focus on improving the affordability of existing electric vehicles through grants and purchase incentives.

**Accelerate R&D process:** For electric vehicles, it is crucial to reduce battery costs and improve the performance and safety through technical innovation.

**Develop the charging infrastructure:** It is critical to provide a reliable and convenient electricity supply for electric vehicles. The charging infrastructure must be available and applicable to home-based systems and the public recharging stations must be conveniently located.

**Table 1: Policy options to accelerate the adoption of electric vehicles**

| Vehicle and fuel price related | Not cost-related |
|---|---|
| Rebate system at the time of vehicle purchase | Guarantees for re-sale values and battery replacements |
| Favourable financing terms, battery leasing to minimize upfront and monthly costs | Differential treatment for EVs and PHEVs in terms of regulations |
| Differential carbon dioxide-based fuel taxes | Additional credits under regulatory systems |
| Reductions in highway tolls and other vehicle fees | Electric-drive vehicles favoured by strong regulations addressing pollutants |
| Incentives for providing recharging infrastructure in commercial public areas | Initial introduction electric vehicles in government fleets to help boost sales for manufacturers |
| Sublimation of the cost of recharging infrastructure for households and apartment buildings | Public transport vehicles, two- and three-wheeled vehicles, exploit electric vehicles in these segments to promote them among consumers and increase the scale of battery production |
| | Direct provision of recharging infrastructure in public areas |

*Source:* Alfred Wiederer and Ronald Philip, *Policy Options for Electric Vehicle Charging Infrastructure in C40 Cities* (2010).

As noted in figure 2, 17 countries have already set a national target for electric vehicle sales and issued a series of polices to reach their goal (table 2). Although the promotion strategies have yet to be adjusted to the specific market, infrastructure features and the consumer base in each country, they are still illustrative examples for other countries considering their own framework for promoting electric vehicles.

**Table 2: Electric vehicle policies in several countries**

| Country | Sales target | Fiscal incentives | Other comments |
|---|---|---|---|
| **China** | Production of 500 000 cars by end of 2011 | Up to USD 8 800 per vehicle | Incentives available in 12 Chinese cities |
| **France** | Up to 2 million stock by 2020; 50 000 purchase order for government fleets | USD 6 300 (EUR 5 000) tax credit per vehicle | Total funding of USD 1.9 billion (EUR 1.5 billion) includes funding for four million recharging points by 2020, battery production |
| **Japan** | About 1 million sales by 2020 (based on 20% share of LDV sales target) | Up to USD 14 000 (JPY 1.3 million) per vehicle | Fiscal incentives can change frequently |
| **Germany** | 1 million total stock by 2020 | No direct incentives at this time | USD 350 million (EUR 285 million) for infrastructure development and battery R&D |
| **Spain** | 250 000 sales by 2014 | Up to USD 7 500 (EUR 6 000) per vehicle | Primary focus on Madrid, Barcelona, Seville |
| **United Kingdom** | 1.5 million stock by 2020 | Up to USD 7 500 (GBP 5 000) per vehicle | Total funding of USD 375 million (GBP 250 million) for low-carbon transport |
| **United States** | 1 million total stock by 2015 | Up to USD 7 500 per vehicle | US DOE providing R&D funding and grants of over USD 2 billion |

*Source:* International Energy Agency, *Transforming Global Markets for Clean Energy Products: Energy Efficient Equipment, Vehicles and Solar Photovoltaics* (2010).

## Further reading

*The EV/PHEV Roadmap* (Paris, International Energy Agency, 2009).

*Transforming Global Markets for Clean Energy Products: Energy Efficient Equipment, Vehicles and Solar Photovoltaics* (Paris, International Energy Agency, 2010). Available from www.iea.org/papers/2010/global_market_transformation.pdf