STUDY

E-Mobility Index Q3 2015

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1 Key takeaways from the E-Mobility Index for Q3 2015

> While the competitive situation in respect of **industry** remains largely unchanged, France has taken the lead in terms of **technology**. With regard to the **market**, Japan has dropped from second to fourth place, and growth in the USA has also slowed significantly. France has increased its lead still further, while Germany has moved into third place on the back of strong growth. However, the average market share of xEVs in the seven leading automotive nations is stagnating at below 1%.

> The lack of coherent sales concepts is partly responsible for the weak sales figures. OEMs are not doing enough to win customers over to BEVs and PHEVs. Strategies are lacking for creating lasting incentives for dealers to sell low-emission vehicles.

> xEVs are still underperforming on key customer criteria, especially range. Besides developing a new generation of cells with higher energy density, considerable savings are possible by reducing the energy consumption of auxiliary electric devices, especially in the area of climate control.

2 Summary comparison of the competitive positions of the world's seven leading automotive nations

In terms of **technology**, France has overtaken Japan and is now in pole position. Behind this improvement lies a shift in the model mix of French OEMs in favor of smaller BEVs that offer good value for money. Japan is losing out by comparison because its OEM product portfolios exhibit only marginal technical development in the medium term. Japanese OEMs have no plans to roll out BEVs and PHEVs on a broad basis; instead, their strategy is to focus on full hybrids, which are not covered by this index. In the meantime, Germany is fast catching up with the three leading countries thanks to the growing share of smaller, more affordable PHEVs. As a result, German and French OEMs score almost exactly the same in the index despite their very different strategies: German OEMs focus on a broad-based rollout of more technically sophisticated but lower (electrical) range PHEVs, whereas their French rivals focus on small BEVs marketed at aggressive prices. All other countries remain at the same technical level as before, resulting in an ongoing stabilization of the overall competitive landscape in terms of technology (Figure 4).

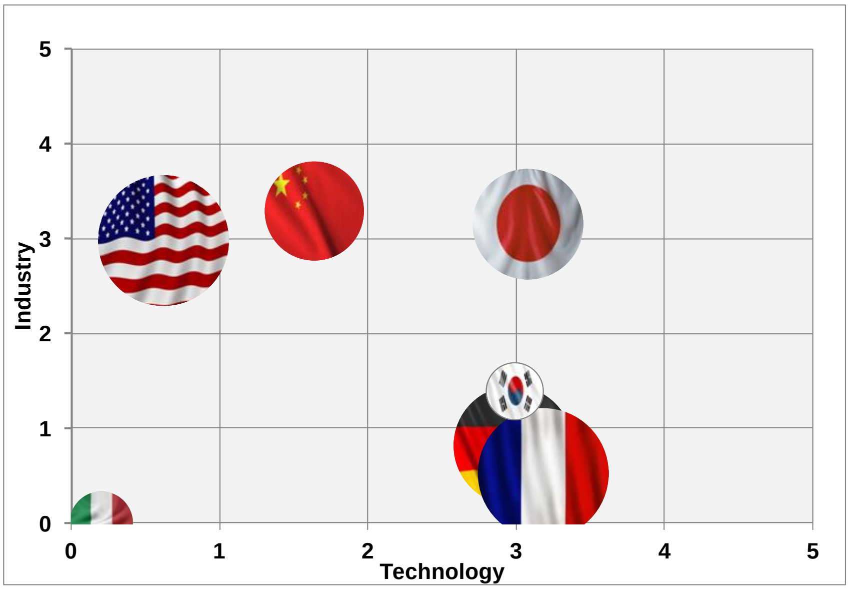
The situation regarding the many R&D funding programs for e-mobility remains largely unchanged over the previous period. Significant movement is not expected until the end of the year when the next round of programs come to an end in certain countries (Figure 5).

In **industry**, China has improved its position strongly. The country profits doubly: first from strong growth in xEVs, which – excepting a few international niche models – is fed largely by domestic production, and then again from the attendant increase in value creation by local cell manufacturers. Japan, on the other hand, has lost out significantly in terms of share of value creation in global xEV production. However, the slump in its domestic market remains partially cushioned by the production capacity that Japanese OEMs have set up in Europe and America. While German OEMs have profited from growing market shares in their core European markets, they have managed to gain market share in the USA and Asia only with a few pure-play electric models (Figure 6).

In terms of cell production, weight is also shifting toward China. In the medium term, however, the vehicle mix in China will likewise shift toward PHEVs, so China's share of global cell production will not grow to the same extent as its share of vehicle sales. Sales of xEVs are down strongly in the American and Japanese markets, impacting especially forcibly on Japanese cell manufacturers. However, Korean cell manufacturers must also prepare themselves for lower sales in the medium term. Their clients, mainly from Germany, are shifting strongly toward PHEVs, which makes them worse customers than French and American OEMs, who are more focused on BEVs (Figure 7).

In terms of the **market**, sales are down in the biggest markets, namely the USA and Japan. In all other markets sales are up substantially on the previous period. The Japanese market has experienced a strong slump, the country falling from second to fourth position, behind third-placed Germany. The situation in Japan is partly caused by their lack of new models, but also reflects the lower strategic importance of BEVs and PHEV in Japanese OEMs' portfolios. France was the only country to make it over the 1% mark, putting it well ahead of a stagnating USA. Germany and China have continued to catch up with the leaders. However, the fact that German OEMs have not achieved greater market penetration despite their broader range of xEVs compared to their French, Japanese and American competitors indicates that xEVs are still niche products in all markets. The major growth impetus that would anchor e-mobility in the seven leading automotive nations long term is still nowhere to be seen (Figure 8).

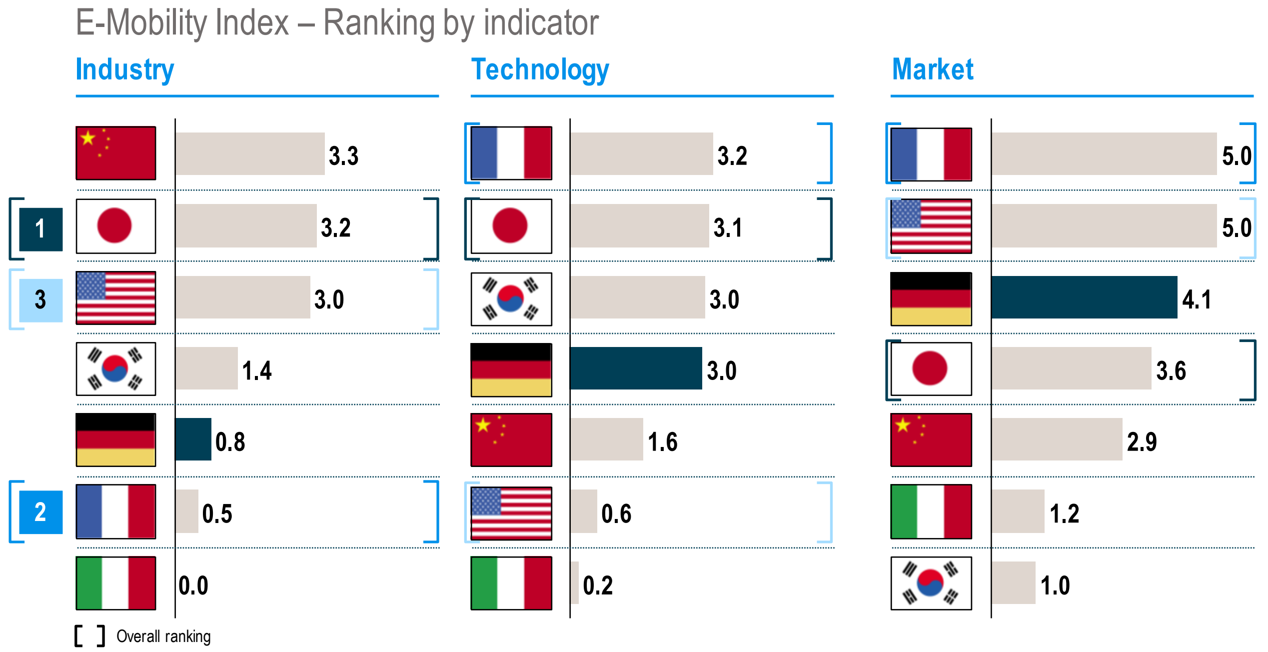
Figure 1: Japan remains well ahead in pole position – Other nations are catching up, particularly in terms of industrial added value



1) Circle size shows EV/PHEV share of total vehicle market

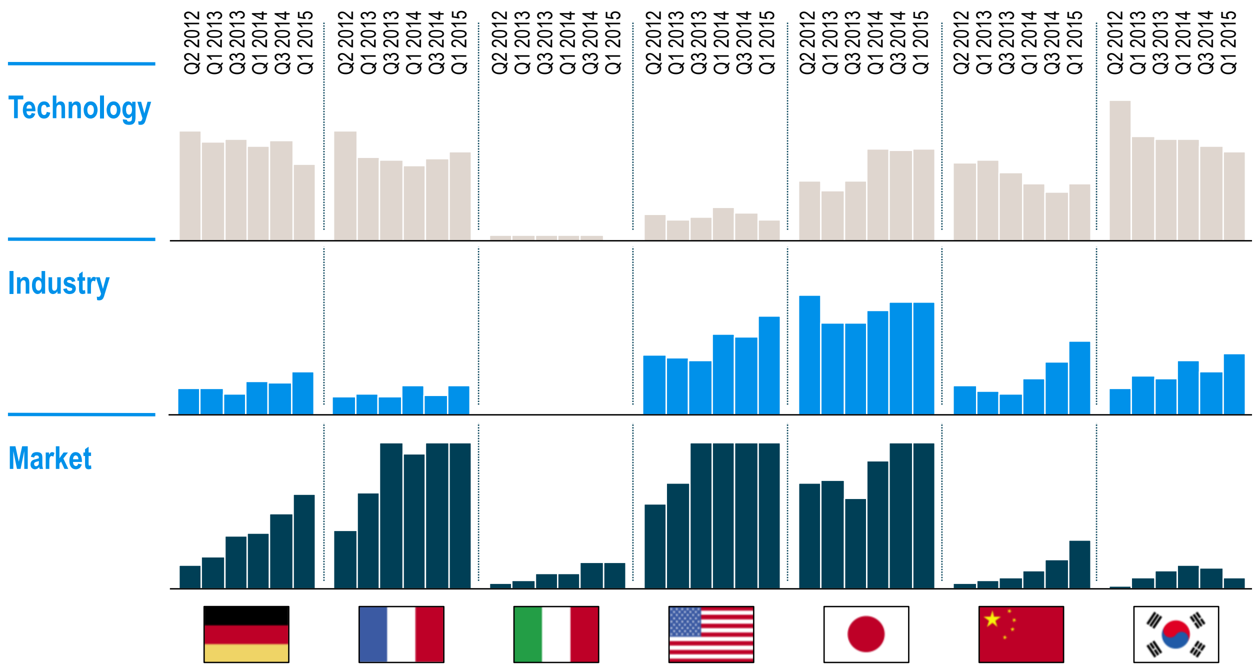
Source: fka; Roland Berger

Figure 2: Japan is top-positioned in all indicators – France moves into second place



Source: fka; Roland Berger

Figure 3: While the market and industry indices develop positively mostly everywhere, technological development remains highly uneven



Source: fka; Roland Berger

3 Detailed analysis

3.1 Challenges in operationalizing fleet emission targets

OEMs can only pass a small share of the higher technology costs of xEVs on to customers. Consequently, the margins on such vehicles will remain smaller than for conventional vehicles in the foreseeable future. Given the new limits on fleet emissions coming in gradually in Europe, the USA and Japan in the period to 2021, and the potential related fines for OEMs, vehicle manufacturers face a double challenge: They must be sure to reach their individual targets (to avoid the fines) while at the same time being careful to overachieve them by as little as possible (to minimize the resulting loss of profits).

Strategically, most OEMs have responded with a highly modularized xEV architecture that will enable them to offer a BEV or PHEV variant in all vehicle classes in the medium term. Yet they lack coherent sales concepts for achieving the required powertrain mix in their sales. The comparatively high product costs associated with xEVs imply that OEMs should position them at the top end of the price spectrum, but most models lack clear USPs. xEVs hardly figure in advertising or rental business. Moreover, dealers currently have little incentive to actively sell customers PHEVs or BEVs rather than higher-margin models and optional equipment.

Simply offering dealers commissions on sales of xEVs would not go far enough, however, as it would ignore the seasonal, economic and regional effects on powertrain and fleet mix. Moreover, trying to steer dealers by focusing purely on sales figures would introduce a high level of complexity, drastically limiting dealers' room for maneuver. To create long-term planning security, individual OEMs could potentially introduce a sort of CO_2 credits system in which dealers would build up tradable credits at the beginning of each year (and from one year to the next). A model of this type would restrict dealers' autonomy much less and also greatly reduce the amount of time and effort OEMs spend trying to manage dealers.

3.2 Focus on the USA

The US is the single largest market for xEVs in the world today. This development is surprising considering that US emissions legislation by and large does not necessitate wide adoption of xEVs. In fact, the higher average curb weight of US vehicles vis-à-vis European, Japanese or Chinese cars makes lightweight construction significantly more attractive for OEMs than electrification in most segments. This is particularly true for pickup trucks, where an attendant increase in hauling and payload capacity can create additional value for the customer.

However, as the current slowdown in US xEV sales demonstrates, persistently low petrol prices (compounded by a federal gas tax that hasn't been raised since 1993 and that does not increase with inflation) still severely limit the market potential for xEVs – even in seemingly favorable environments. For the most part, xEV adoption remains a highly localized phenomenon in both a geographical and sociographical sense: US buyers of BEVs and PHEVs typically live in urban centers where (1) range anxiety is of significantly lower importance than, for example, in rural areas, (2) initial xEV acceptance is already high (usually incumbent upon strong public environmental concerns), (3) purchasing incentives complement above-average incomes, (4) public charging facilities are numerous and usually available free of charge and (5) xEVs enjoy privileges such as access to commuter lanes. As a result, xEV sales remain highly regionally differentiated, with the market share of BEVs and PHEVs for example in California amounting to four times the national average.

In the end, outside the few areas where the confluence of the factors just named has created comparatively favorable xEV ecosystems, the automotive norm is still characterized by conventional powertrains. xEVs hardly figure in most dealer showrooms. For while local governments have created direct incentives for new car buyers to choose an xEV, dealers are not similarly incentivized to present customers with alternative powertrains. In view of the significantly higher margins to be realized on the sales of vehicles with conventional powertrains and especially SUVs, both dealers and manufacturers alike have little incentive to actively sell xEVs to customers. In the US as elsewhere, the result is that purchasing incentives, while creating a sizeable xEV market on the surface, have done little to sustainably move the automotive industry as a whole toward actively anchoring e-mobility in society.

3.3 Optimization/redesign of auxiliary devices

The increasing electrification of powertrains places a new emphasis for vehicle developers on the energy requirements – and hence efficiency – of auxiliary devices. Especially in the case of PHEVs and BEVs, auxiliary devices that consume a lot of power have a direct, tangible impact on customers, in that they reduce the vehicle's range. Moreover, it would be wrong to assume that the weight and cost of traction batteries will fall sufficiently in the future to allow today's auxiliary devices to continue being used in their current state of development while at the same time fulfilling customers' range and price requirements.

Next to the electric brake system, lighting system, component cooling system and any other auxiliary electric devices such as an active roll stabilization system, it is the climate control system that consumes the most energy in vehicles. The passenger compartment climate control system in the currently available PHEVs and BEVs works on the basis of central heating or cooling within an air conditioning unit, as in traditional combustion-engine vehicles. The power demand of heating or cooling auxiliaries can be several kilowatts, at times surpassing the mean power requirement at the vehicle wheel during test cycles such as the NEDC and WLTC (Figure 9). In summer, a conventional air conditioning unit with an electric air conditioning compressor is used in xEVs. But in winter, electric heating systems are used as the electric drivetrain does not generate a sufficient amount of waste heat. The electric power requirement of the heating system is roughly equivalent to the required heating capacity, so the impact on range is significant, particularly when the outside temperature is low. A heat pump system can help, cutting the power required to heat the cabin by a factor of two to four. However, in extreme winter conditions the heat exchanger can ice up, and then the cabin has to be warmed up via a redundant electric heating system – effectively canceling out the efficiency gains delivered by the system. Heat pump systems are likely to continue to grow in popularity over the coming years. But besides trying to resolve the problem of the heat exchanger icing up, the focus should be on pushing innovations aimed at raising the efficiency of passenger compartment climate control (Figure 9).

4 Methodology

The relative competitive position of individual automotive nations is compared to that of the others on the basis of three key indices:

> **Technology:** The current status of technological development in vehicles made by indigenous OEMs and the support for vehicle development provided by national subsidy programs

> **Industry:** The regional value added in the automotive industry by national vehicle, system and component production

> **Market:** The size of the national market for electric vehicles based on current customer demand

Roland Berger and fka weigh the individual indices (value range 0-5) and combine them to form the E-Mobility Index (Figure 10). The E-Mobility Index makes it possible to compare the competitive positions of the world's seven leading automotive nations (Germany, France, Italy, the US, Japan, China and South Korea), juxtaposing their individual automotive markets on the basis of uniform global standards. The E-Mobility Index thus reveals the extent to which individual nations are able to participate in the market that e-mobility is creating. The criteria applied are assessed as discussed below.

Technology

> Technological performance and value for money of electric vehicles that are currently available on the market or are soon to be launched
> National e-mobility R&D programs. Only research grants and subsidies are taken into account (but not credit programs for manufacturing, budgets for purchase incentives, etc.)

Industry

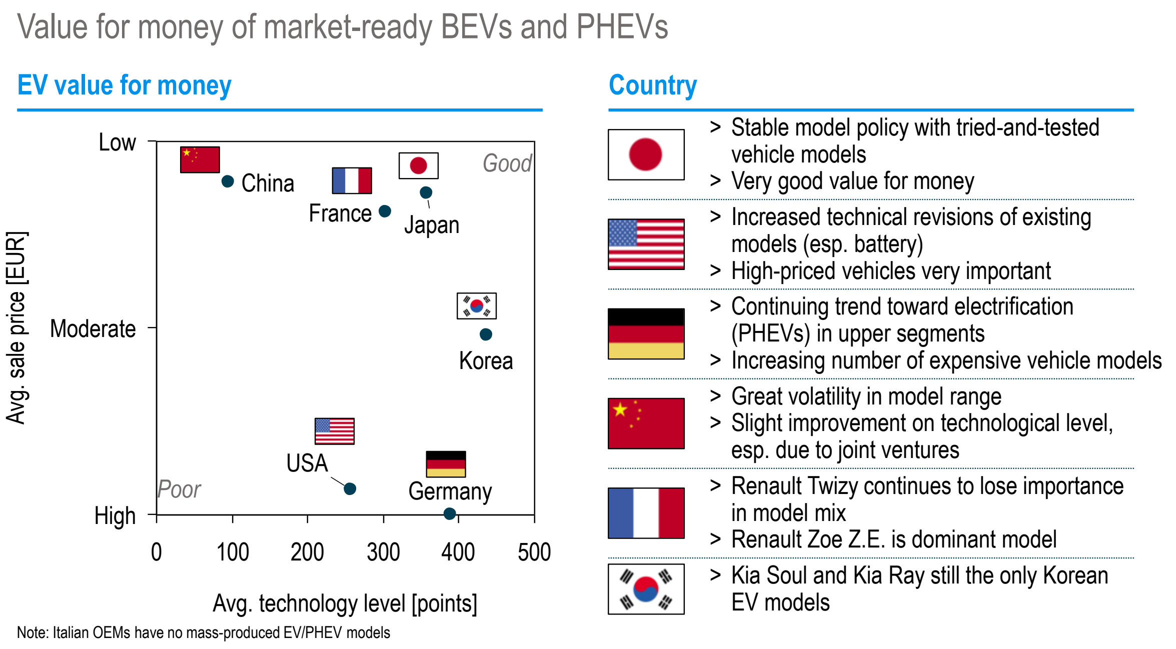
> Cumulative national vehicle production (passenger cars, light commercial vehicles) for the period 2013-2017, taking account of BEVs and PHEVs
> Cumulative national battery cell production (kWh) for the period 2013-2017

Market

> Electric vehicles' current share of the overall vehicle market (over a twelve-month period)

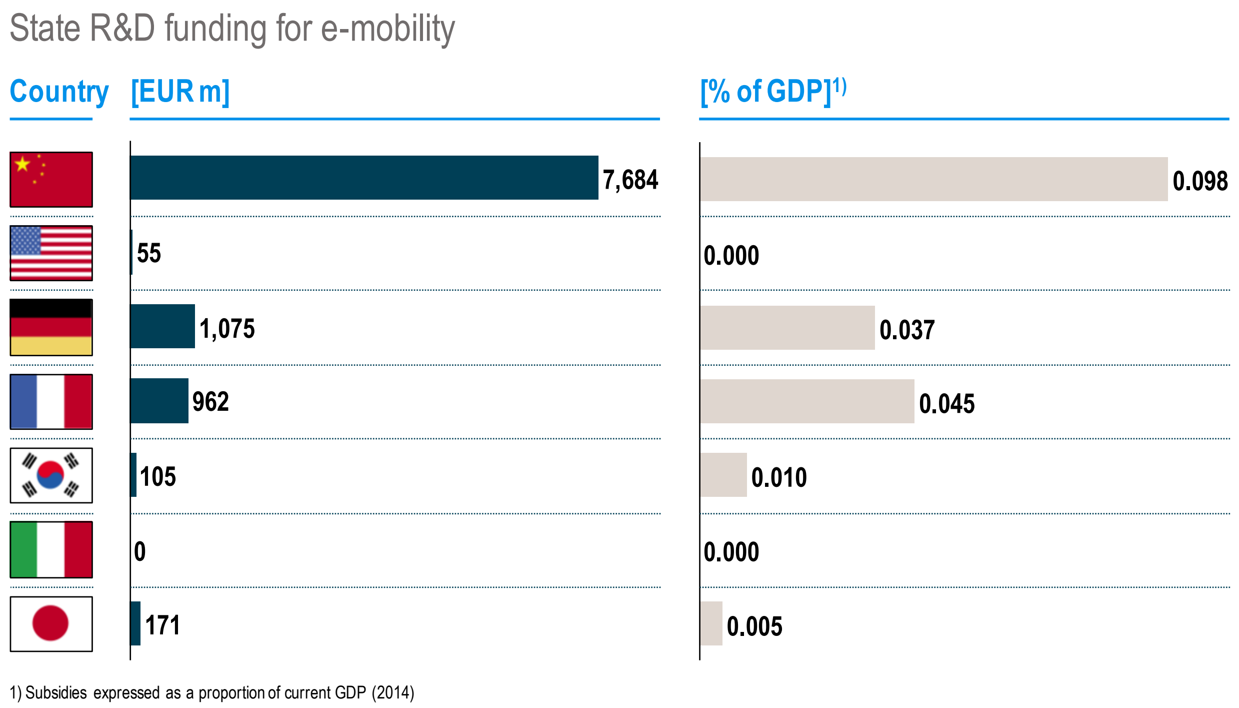
The E-Mobility Index for Q1 2014 was the first to include 2016, while the Q1 2015 Index was the first to include 2017. The additional volume is reflected in higher scores for industry in all markets. However, this does not affect the shifts between markets, and the E-Mobility Index's comparability with previous indices is thus not compromised.

Figure 4: Technology levels are relatively stable and few new models are being launched (except in China) – Germany and France are seeing higher prices due to shifts in the model mix



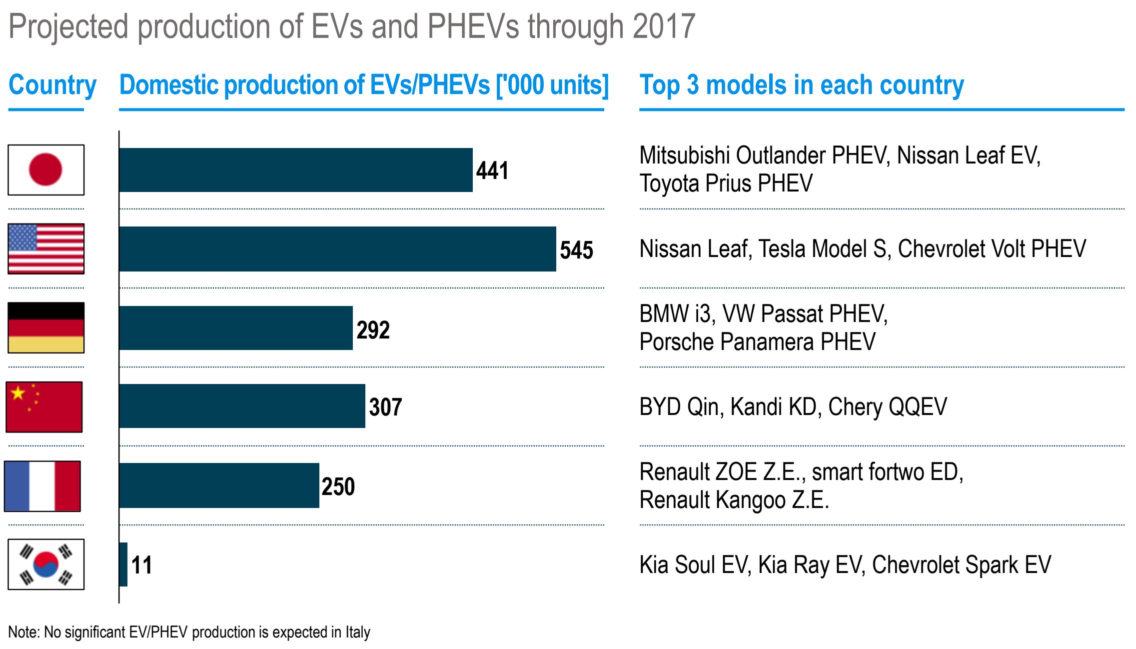
Source: fka; Roland Berger

Figure 5: R&D subsidies are declining strongly in most automotive nations – Japan is the only country that has increased subsidies, albeit only slightly – China continues to invest massively



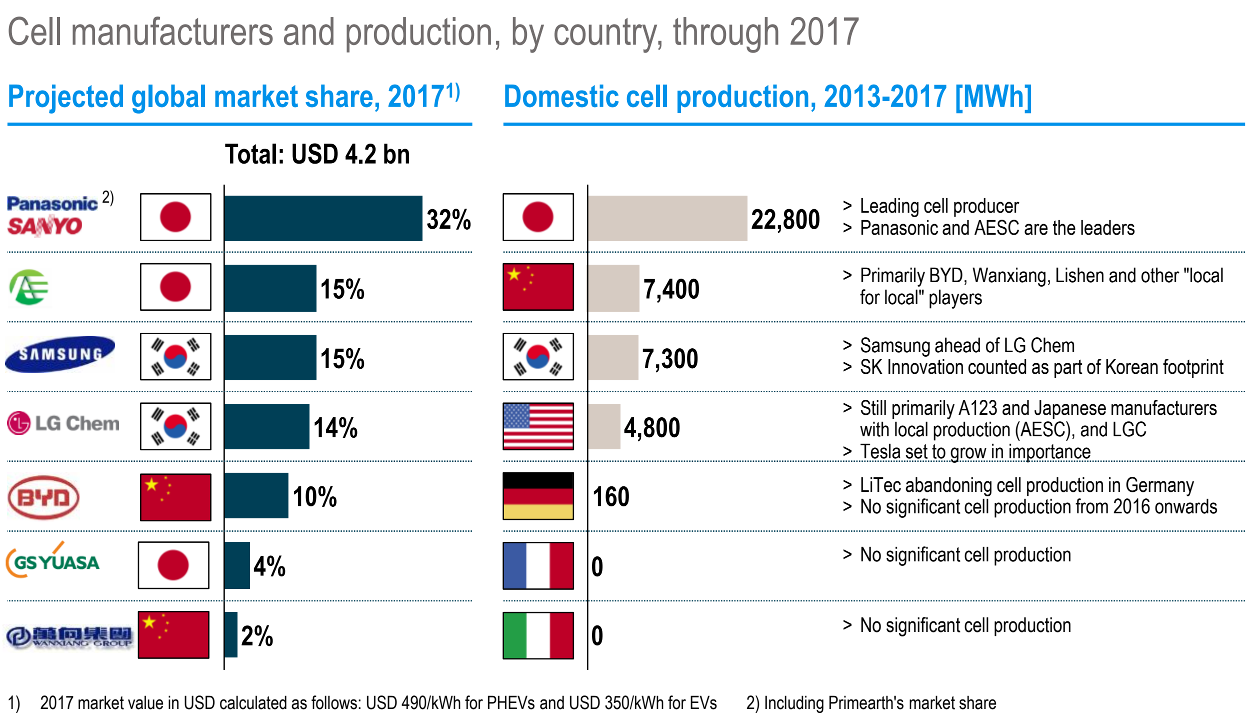
Source: fka; Roland Berger

Figure 6: The US leads the way in vehicle production – Almost all markets have seen increased volume numbers – Korea is down



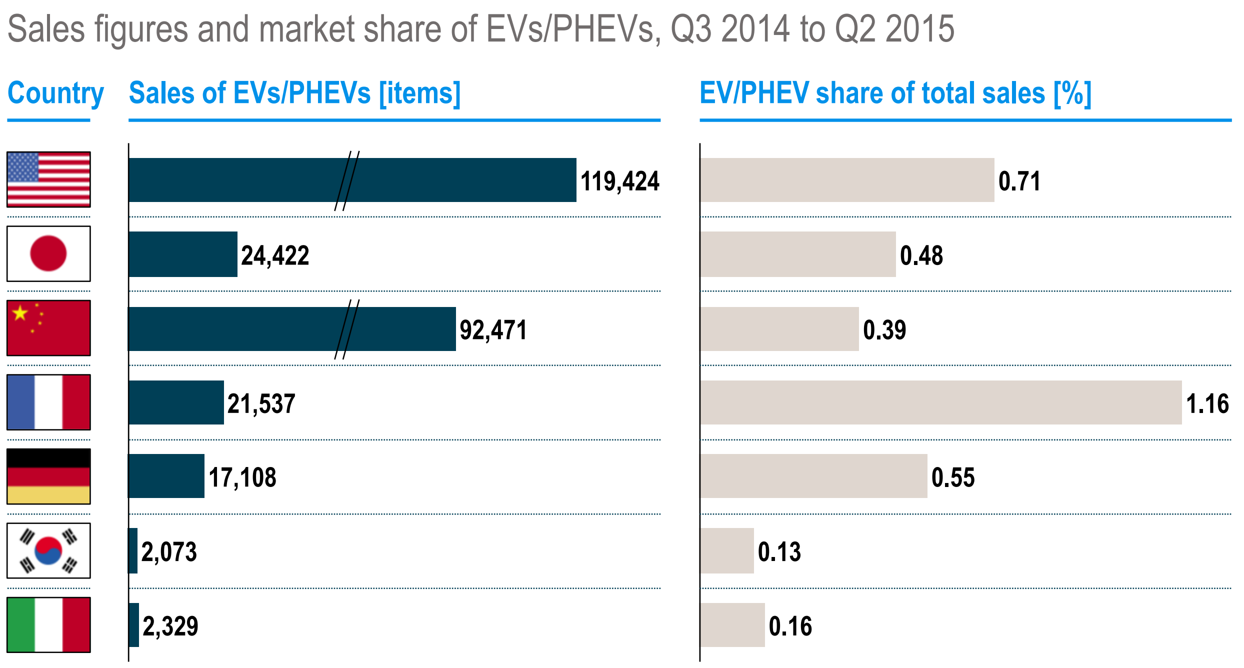
Source: fka; Roland Berger

Figure 7: Japan remains in pole position and China moves into third place – Samsung has made strong gains with European OEMs



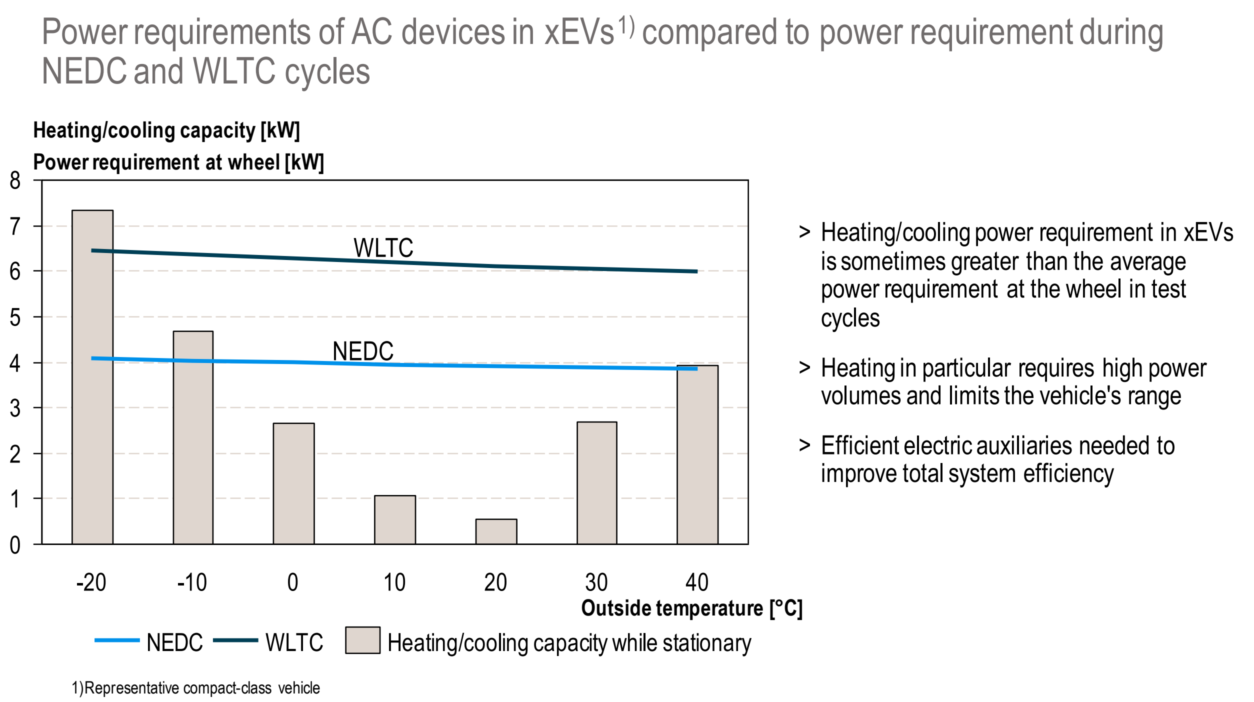
Source: fka; Roland Berger

Figure 8: China has doubled its sales of EVs compared to the prior period – Korea is yet to take off



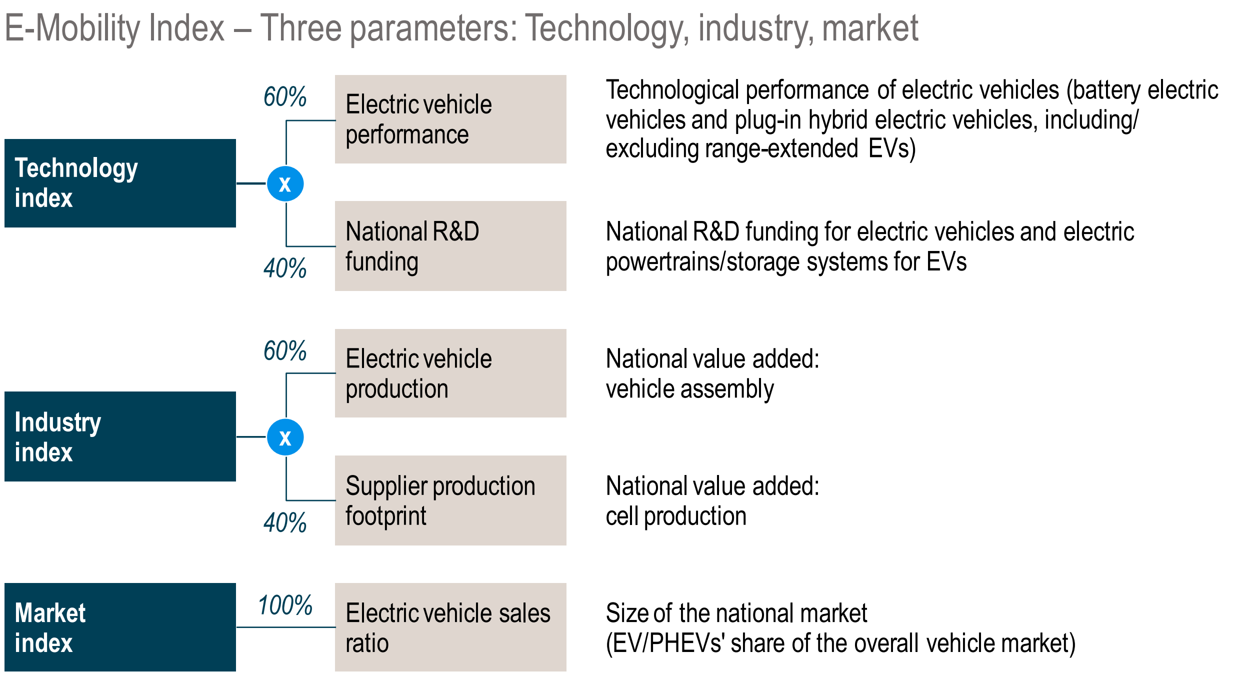
Source: fka; Roland Berger

Figure 9: Auxiliary electric devices in xEVs – Power requirements are comparable with the powertrain in the cycle



Source: fka; Roland Berger

Figure 10: The E-Mobility Index compares automotive nations on the basis of three parameters



Source: fka; Roland Berger

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