“New Energy Vehicles”

Developments in China, the Netherlands and prospects for Sino-Dutch cooperation in the field of commerce and policy
## Colophon

<table>
<thead>
<tr>
<th>Place</th>
<th>Beijing</th>
</tr>
</thead>
</table>
| Assigned by | Embassy of the Kingdom of the Netherlands  
              Infrastructure & Environment Department  
              Innovation Department |
| Author(s)   | Merijn Drenth (intern) |
| Cover       | Photography by ECNS |
# Index

**Preface**..................................................................................................................................................5

**Summary**..................................................................................................................................................6

**Introduction**...............................................................................................................................................7

**Chapter one – New energy vehicle developments in the Netherlands: Goals & policies**.........................................................9

- Goals.........................................................................................................................................................9
- Policies......................................................................................................................................................9
- Subsidies and fiscal incentives....................................................................................................................10
- Industry and innovation.............................................................................................................................11
- Charging infrastructure..............................................................................................................................11
- Results.......................................................................................................................................................12
- Number of registered NEVs in the Netherlands.........................................................................................12
- Amount of charging points in the Netherlands........................................................................................13

**Chapter two – New energy vehicle developments in the Netherlands: Industry & entrepreneurship**.................................................................14

- Development Dutch NEV sector................................................................................................................14
- Charging infrastructure and smart grids....................................................................................................15
- Propulsion technology and components....................................................................................................16
- Manufacturing and conversion....................................................................................................................17
- Services......................................................................................................................................................18
- International footprint................................................................................................................................19

**Chapter three – New energy vehicle developments in China: Goals & central policies**........................................................................20

- Production volumes passenger and commercial vehicles (1999 – 2017)..............................................20
- Pollution, securitization and market leadership.........................................................................................20
- Authoritative sources.................................................................................................................................21
- Ministries...................................................................................................................................................22
- Organizations............................................................................................................................................23
- International cooperation..........................................................................................................................23
- Goals.........................................................................................................................................................24
- Central policies.........................................................................................................................................24
- Results.......................................................................................................................................................25
- New passenger NEV sales.........................................................................................................................27
- Policy shift: from support to coercion.......................................................................................................28

**Chapter four – New energy vehicle developments in China: Regional policies & protectionism**........................................................................30

- NEV sales per province (2017)..................................................................................................................30
- Regional policies.......................................................................................................................................31
- Prominent cities.........................................................................................................................................31
- Local protectionism.................................................................33
- Market share of OEMs in Chinese cities (2015).................................33
- Largest NEV markets of Chinese OEMs (2015)...................................34
- National protectionism................................................................35
- Best-selling passenger models China (2017)....................................35
- A brighter future?........................................................................36

Chapter five – Market opportunities for the Dutch new energy vehicle sector in China...38
- Charging infrastructure and smart grids...........................................38
- Propulsion technology and components............................................40
- Manufacturing and conversion.........................................................41
- Services.......................................................................................42
- China’s unique market.................................................................42
- Concluding remarks.................................................................43

Conclusion and recommendations.........................................................45

Company appendix........................................................................49
- The Netherlands............................................................................49
- Dutch charging infrastructure companies....................................49
- Dutch component and conversion companies...............................51
- Dutch NEV manufacturers.........................................................52
- Dutch providers of NEV-related services.....................................53
- China.........................................................................................54
- Chinese passenger NEV manufacturers......................................54
- Chinese electric bus manufacturers.............................................55
- Chinese NEV battery manufacturers............................................56
- Chinese charging infrastructure companies..............................57
- Chinese manufacturers and suppliers of components................59
- Chinese providers of NEV-related services..................................61

Sources.........................................................................................62
- Articles, publications and websites..............................................62
- Interviews..................................................................................68
- Cover, charts and figures............................................................69
- Conferences and seminars.........................................................70
Preface

Regarding the developments of new energy vehicles in China, opinions are mixed. On the one hand, the speed with which this country pushes its companies to develop this sector and the positive effect thereof on the global transfer to greener mobility is welcomed. On the other hand, there are concerns about the quality of technologies used, the market barriers and policy instruments like subsidies, to promote vehicle sales.

These different perspectives were advocated during the seminar on new energy vehicles hosted by the Embassy of the Kingdom of the Netherlands in Beijing in June 2018.

Foreign and Chinese experts came together to discuss the state of this emerging sector in China. The participants reflected on the analysis of effects of policies as well as on foreign business opportunities in this new sector in China. A key document used for this analysis was the research report Embassy intern Merijn Drenth compiled in the first months of 2018.

His assignment is the result of an increasing interest from both the Dutch Ministry of Infrastructure and Water Management and the Ministry of Economic Affairs and Climate to work together with China on this important topic, both policy wise as well as economically. To achieve a fruitful cooperation and to develop a proper strategy, it is necessary to have a good overview of policy and market development and of the numerous ministries, affiliated organizations, cities and companies active in this field. It’s just as important to know what the Netherlands has to offer and how interests can be aligned.

Because, no matter one’s perspective, the ongoing fast developments that take place, both in China and in the Netherlands, justify closer cooperation between our countries to boost adaptation of New Energy Vehicles worldwide.

We expect this report to offer valuable insights to bring the cooperation further.

Friday October 5, we will continue to discuss in Den Haag how to go from here. This report will be the basis for that discussion.

Feel free to contact us when you’re interested to join our journey.

Taake Manning - Counsellor for Innovation, Technology and Science
Anne te Velde - Counsellor Infrastructure and Environment

Beijing, September 2018
Summary

The number of electric vehicles is growing fast. Nevertheless, only a few countries are responsible for the deployment of most of these “new energy vehicles” (NEVs). The Netherlands and China can be counted among these pioneers. Their ambitious goals and policies kick-started the emergence of de-carbonized car and transport fleets that are essential for achieving the climate goals that both countries vowed to achieve when signing the Paris Agreement in 2015. As a result, China has grown to become the largest NEV market in the world, while the Netherlands has the highest charging point per car ratio in the world. In addition, both countries have developed promising NEV industries.

**The Netherlands:** As a result of policies that focus on fiscal incentives, innovative pilots, entrepreneurship and charging infrastructure, the Netherlands has seen the emergence of a relatively large NEV fleet. These forces have also contributed to the development of an NEV industry that is internationally renowned and can be subdivided in four clusters: infrastructure & smart grids, containing companies that are considered to be global market leaders; manufacturing & conversion, the largest cluster; propulsion technology & components, the fastest growing cluster; and services, focusing mainly on mobility and payment.

Although NEV developments in the Netherlands rank among the world’s most impressive, NEV sales have recently slowed down and the Netherlands now faces the risk of losing its leading position as countries all over the world see their NEV fleets surge. In contrast, the NEV targets in the Netherlands have gone up and if the country wants to achieve its ambitious climate goals, it will have to increase its commitment towards NEVs and work together with other governments to scale up sales and bring down the costs. For its NEV industry, the decline in growth poses a risk as well. In order to maintain their prominent positions, Dutch companies will have to expand their international activities and cater to markets that are determined to shape the future of NEV mobility.

**China:** The country that is destined to determine the global pace and future of NEV adoption is China. In just a few years, China has become the world’s largest market and producer of NEVs, charging infrastructure and lithium-ion batteries by far. Generous purchase subsidies and benefits for buyers of NEVs and the deployment of massive bus and car fleets are the main driver for these developments. However, China’s determination to leapfrog foreign vehicle manufacturers and become the market leader of the future car industry has also led to a large degree of protectionism. Currently, non-Chinese brands constitute only 4% of China’s entire NEV fleet and this is mostly due to protectionism.

**Sino-Dutch cooperation:** Despite China’s protected market, prospects for Sino-Dutch cooperation in the field of NEVs – both economic and political – are nevertheless present and necessary. For Dutch businesses too, the Chinese market will be essential to participate in, as it will be the first one to achieve large-scale production capacity of NEVs. Protectionism is predominantly focused on OEMs, and prospects for Dutch companies on the Chinese market are present as a result. The most prevalent opportunities are for companies that focus on key components or specialize in hydrogen mobility. In fact, the clusters propulsion technology & components and manufacturing & conversion already have a fairly large presence in China but could use more support from relevant Dutch government agencies. Prospects for the cluster charging infrastructure & smart grids are currently less promising but could be improved. Lastly, companies in the services cluster are unlikely to succeed as they are too small and localized to succeed on the Chinese market. More political cooperation is needed, as it has the potential to bring both countries closer to their climate goals and maximize business opportunities for Dutch companies. Collaboration is currently limited but growing and the potential for cooperation can be found at the subnational level, rather than at the national level as the Chinese government is careful and restrained when it concerns commitments in the form of bi- and multilateral partnerships.
Introduction

It is without a doubt that clean vehicles are becoming increasingly important for consumers, governments and automotive companies alike. The most obvious reasons for this are the threatening prospects of climate change and levels of air pollution that, in some areas of the world, are truly problematic. Because full-electric vehicles (BEVs) and fuel cell (hydrogen) electric vehicles (FCEVs) do not emit any toxic gasses, they have – together with plug-in hybrid vehicles (PHEVs) – the ability to reduce air pollution levels and contribute to the mitigation of human-induced climate change.

However, the benefits of BEVs, FCEVs and PHEVs (which are collectively called “new energy vehicles” – NEVs – in China and will be addressed as such throughout this report) do not end here. For governments, electric and fuel cell mobility takes away many of the uncertainties that come with fossil fuels. Unlike gas and oil, electricity and hydrogen are forms of energy that can be produced from numerous sources and, most importantly, within one’s borders. This is important, because far too often, the scarcity and unequal distribution of fossil fuels has led to political conflicts and economic crises. Thus, many governments regard them as a liability for their national security.

Governments worldwide have therefore formulated targets and policies to accelerate the research, the adoption of NEVs. Combined with a growing consumer awareness in favor of these green(er) cars, manufacturers all over the world are now increasingly devoting their attention towards NEVs. The result is that the production and sales of NEVs experiences double digit growth rates with every passing year. Even though it is impossible to say when sustainable engines will have replaced internal combustion engines, there is no question that they eventually will do so. Nevertheless, developments with regard to NEVs vary a lot per country. In 2017, 88% of all NEV sales took place in three East Asian countries, various European countries and the United States, while little to no development had taken place in the rest of the world.¹

The Netherlands is one of the countries that is at the forefront of NEV adoption. It has consistently boasted one of the highest NEV market shares throughout the past years and with more than 43,000 new NEVs in 2015, it even occupied a third position globally in terms of absolute sales numbers.² This has been the result of ambitious climate goals that aspire to de-carbonize every segment of Dutch society and complementary policies that stimulate the widespread adoption of NEVs and the distribution of charging infrastructure. But these Dutch goals and policies have also had another important effect: the creation of a NEV (related) industry. Governmental support for R&D, innovation and business cases have contributed to the development of a new sector that has branched out internationally over the past years.

Thus, a first glance at NEV developments in the Netherlands reveals a story of success and progression. Nevertheless, there are significant challenges that the Netherlands has to overcome. After an impressive head start, NEV sales figures and market shares in the Netherlands have started to decline since 2015, whereas most other countries have experienced growth. If the Netherlands wants to maintain a leading position in the adoption of NEVs and, most importantly, if it wants to reach its climate goals, the Netherlands will have to increase its commitment towards the de-carbonization of the mobility sector. However, the Netherlands cannot do this on its own terms. The technology required for NEVs is still relatively expensive and very much dependent on financial stimuli and although the Netherlands is determined to play its part in tackling these issues, it is too small to achieve this on a national level.

Thus, when the Rutte III cabinet took office in the fall of 2017, it stressed that international cooperation was essential if the government’s ambitious climate goals of 2020, 2025, 2030 and 2050 were to be achieved. Regional coordination within the framework of the European Union (EU) is an obvious example, but not enough.

Only through global coordination can the adoption of NEVs be scaled up and accelerated and bring both the Netherlands and the world one step closer to a sustainable world. Through its membership of global organizations like the Zero Emission Vehicle Alliance, the IEA Hybrid and Electric Vehicle Technology Collaboration Programme and the Transport Decarbonisation Alliance, the Netherlands has already taken its first steps to achieve this goal. However, these partnerships are predominantly Western and do not reflect the global message of the Paris Climate Accords to their fullest extent.

One country that has asserted itself as the absolute frontrunner in NEV is the People’s Republic of China. The most populous country in the world has gone over great lengths to stimulate NEV development in every way possible and has now established itself as the largest NEV market in the world by far. In short, China will, without a doubt, set the stage for future NEV development and the enormous magnitude of its expanding car market has already transformed China into the first country where NEVs are being produced and introduced on a large scale. Cooperation with China on a political as well as economic level is thus of primary importance if the Netherlands wants to reach its goals and prepare its small, but highly developed NEV industry for the future.

The function of this report, is to stimulate Sino-Dutch cooperation in the realm of NEVs and is thereby a direct result of the Dutch government’s goal to maximize international NEV cooperation in both the political as well as the economic realm. Policy coordination is needed now and for many years to come, but eventually, market forces will have to take over and both the Dutch government and its automotive industry will have to increase ties with China if they want to maintain their leading position and contribute to and survive in the global car industry of the future.

This report, commissioned by the Department of Infrastructure and Water Management and the Innovation-Attaché Network at the Embassy of the Netherlands in Beijing, will thus explore the developments of NEVs in China on a political and economic level and identify the possibilities, challenges and obstacles for Sino-Dutch cooperation. Before this can be done, it is essential to provide a clear understanding of Dutch goals and policies as well as the strong and weak points of the NEV industry that emerged out of it.

The first chapter of this report will therefore provide an overview of Dutch goals and policies regarding the implementation of NEVs; while in the second chapter, the emergence, composition and international potential of the Dutch NEV sector will be discussed. This will provide a better understanding of the nature of NEV developments in the Netherlands and will help to identify successful aspects of Dutch policy and industry that could be interesting for policy exchange with China; In the third chapter, the focus will shift to China and the country’s NEV goals and central policies in order to provide a solid understanding of the motivations and foundations of Chinese rapid NEV growth; the fourth chapter will do the same with regional policies and will also pay attention to protectionism that Dutch policymakers and companies should be aware of, because it might have negative implications for Sino-Dutch cooperation; the fifth chapter will, on the basis of the previous chapters, identify opportunities and obstacles that Dutch companies might encounter in China; lastly, the concluding part of this report will provide recommendations for Dutch policymakers on how to establish and facilitate Sino-Dutch NEV cooperation and reflect on the future progress of NEVs in China and the implications that might occur alongside it.
Chapter one

New energy vehicle developments in the Netherlands: Goals & policies

Goals and policies that aim to accelerate the adoption of NEVs in the Netherlands are currently rooted in three sources: the 2015 Paris Climate Accords, various EU-guidelines (i.a.: Renewable Energy Directive, Fuel Quality Directive, Clean Power for Transport, the Sustainable Urban Mobility Package and the 2nd Clean Mobility Package) and domestic factors that are the result of public opinion, political decisions and economic considerations. In the Netherlands this has led to the publication of various roadmaps that have mapped out a multi-track strategy with goals up and until 2050.

Goals

The most important of these goals are formulated in the SER Energy Accords (2013), the LEF Sustainable Fuel Vision (2014), the Energy Agenda (2015) and climate goals of the Rutte III administration (2017). The overall ambition of this administration is to reduce CO2 emissions with 49% by 2030 and with 95% by 2050. In 2016, the estimated CO2 emission levels in the Netherlands stood at 195 Mton and will thus have to be reduced with 186 Mton to a mere 11 Mton by 2050. Currently, 27% of the CO2 emissions are caused by transport and mobility and this means that a lot will have to change in the Dutch vehicle fleet. Therefore, the following targets have been formulated:\footnote{Planbureau voor de leefomgeving, ‘Analyse regeerakkoord Rutte-III: Effecten op klimaat en energie’ (2017) 4, 32. 4 Ministerie van Infrastructuur en Waterstaat, ‘Beleidscontext rond duurzame mobiliteit’ (2017). 5 Anco Hoen and Harold Meerwaldt, ‘Klimaatbeleid voor mobiliteit op de kaart,’ CE Delft (2017) 3. 6 TKI Nieuw Gas: Topsector Energie, ‘Contouren van een Routekaart Waterstof’ (2018) 67.}

200,000 BEVs and PHEVs on Dutch roads in 2020; 1 million BEVs and PHEVs on Dutch roads in 2025; all public transport buses should be NEVs by 2025; 3 million BEVs and PHEVs on Dutch roads in 2030; all new passenger car sales should be NEVs by 2030; and all vehicles with internal combustion engines (ICEVs) should be replaced by NEVs in 2050.

In addition, the Netherlands has also formulated some targets for fuel cell vehicles with the publication of a hydrogen roadmap in March 2018. Some targets of this roadmap are:

The construction of 10 to 12 hydrogen refueling stations by 2020; 60 hydrogen buses on Dutch roads in 2020; and 2,000 FCEVs on Dutch roads by 2020.\footnote{TKI Nieuw Gas: Topsector Energie, ‘Contouren van een Routekaart Waterstof’ (2018) 67.}

Policies

In order to achieve these goals, the central and local governments have pursued policies that emphasized the development of market growth through subsidies and fiscal incentives, the establishment of a NEV (-related) industry via the stimulation and support of innovation and promising business cases and the distribution of charging infrastructure. In addition, the Dutch approach is also characterized by its support for biofuels as a transitory solution for passenger cars and as mid- to long-term solution for
heavy-duty transport. The government has assigned some 47 million euros for the period 2018-2020 in order to support these policies.  

Subsidies and fiscal incentives

Arguably the most influential policies for NEV market growth in the Netherlands are subsidies and fiscal incentives that can be obtained through the purchase of NEVs. Striking is that these incentives are less focused on private buyers of NEVs and dedicated much more to the increase of vehicles in the commercial sector or towards consumers who obtain their vehicle through company lease. Also notable is that PHEVs have been excluded from the most important incentives in recent years.

Low fiscal addition for car lease: roughly 16% (1.27 million euros) out of 8 million Dutch car users lease a car through the companies or organizations that they work for. An additional 22% of the monthly vehicle costs will usually be charged as a fiscal measure to compensate for private use of the vehicle. However, for BEVs and FCEVs this fiscal addition is only 4%, which can save car leasers hundreds of euros per month. PHEVs used to have the same benefits as BEVs and FCEVs until 2015, but currently pay the regular 22%.  

Exemption from vehicle registration tax: consumers of both BEVs and FCEVs are exempt from tax registration called the BPM. PHEVs pay in accordance with the amount of CO2 that their internal combustion engines emit per gram/km.

Exemption from road tax: BEVs and FCEVs in the Netherlands are exempt from road tax, while PHEVs pay 50% of the regular tax when they emit no more than 50 grams of CO2 per km.

Purchase subsidies for companies: businesses that invest in an electric company fleet and/or charging points can make use of investment allowances. The MIA arrangement covers up to 36% of company investments in BEVs and FCEVs and covers 0 to 27% of investments in PHEVs depending on the performance of their internal combustion engine. The Vamil arrangement will even cover up to 75% of investment costs when it concerns charging piles or FCEVs.

Regional incentives: the various regions and municipalities of the Netherlands also offer fiscal incentives and subsidies for NEVs. Cities like Amsterdam and the Hague offer purchase subsidies up to 10,500 and 5,000 euros respectively for commercial vehicles. The city of Rotterdam offers up to 2,500 euros to car owners that exchange old ICEVs for a new BEV. Amsterdam has also introduced a policy that dictates that only e-taxis can make use of the city’s most lucrative taxi stands.

---

14 Gemeente Amsterdam, ‘Schone taxi’s voor Amsterdam, (accessed 10 August 2018) https://www.amsterdam.nl/veelgevraagd/?productid=%7B91A37F05-2971-4952-BE48-C6E0836AFD3B%7Dcase_%7BA28F4E58-4B00-4BF4-809D-542FF46C91E8%7D.
Industry and innovation

The transition from ICEVs to NEVs in the Netherlands entails much more than mere market stimulation. Given the fact that the Netherlands is home to a thriving and well-developed automotive sector (this will be discussed in more detail in chapter 3), the Dutch government also acknowledges the potential and opportunities that NEVs have to offer to Dutch industries. As a result, the Dutch government is actively stimulating its automotive industries to go green.

**RVO innovation credit:** companies or entrepreneurs with promising and challenging innovations can obtain financial or technical support from the government when innovation projects cannot yet be fully supported by a company’s own resources or the market. Given the infant phase that the NEV market and industry find themselves in, the innovation credit has been given to many NEV initiatives.

**Green Deals:** an important stimulus of NEVs that the Netherlands has come up with are the so-called Green Deals. Citizens, companies, organizations, and local and regional governments with innovative ideas can appeal to the central government to get assistance in order to implement their idea or solution in society. The government’s role within these Green Deals varies and can exist of financial support, the lifting of judicial and legislative restrictions, input of knowledge and access to relevant networks. One example is the Green Deal Zero Emission City Logistics that strives to make Dutch city centers zero emission by 2025. Through this framework, multiple companies and municipalities have worked together to launch pilots with delivery vans, trucks and even tour boats to work towards this goal.

Charging infrastructure

Range anxiety is currently a significant hurdle that hampers the popularization of NEVs. The visibility of charging infrastructure can remedy this, and the Dutch government has therefore stressed its importance by adopting a “charging pile follows car” approach and formulated policies accordingly. The fact that companies can get back up to 75% of their charging point investments through the Vamil regulation (see above) already hinted at the importance of charging infrastructure, but many more measures are in place to ramp up the number of charging points.

A National Platform on Charging Infrastructure (NKL) has been set up to launch innovative projects that help implement charging stations on a broader level while simultaneously bringing down the costs. The earlier mentioned Green Deals focus to a large degree on charging infrastructure pilots. Through the Green Deal Accessible Public Charging Infrastructure, for example, numerous lucrative pilots have been initiated by governments and companies. Very important as well is the regional focus on the distribution of infrastructure. This is most notable in the cities of Amsterdam, Utrecht or Eindhoven, that have policies in place that guarantee public charging availability for every electric car within a certain radius. Eindhoven, for example has set the mark at 300 meters.

An example of one such lucrative pilot can be found in the city of Utrecht, where a borough and various companies have worked together to install a network of solar-powered smart charging station. Shared NEVs that are plugged in at these stations can act as energy storages whose energy can be discharged and used for other purposes when direct solar power is not available.

---

Results

The emphasis on market growth, innovation, industry and the distribution of charging stations has led to several developments. First, the NEV fleet of the Netherlands has experienced a growth rate that has placed the country among the largest NEV markets in Europe and even the world. With annual market shares of 9.7% in 2015 and 6.4% in 2016 the Netherlands occupied a second position behind Norway (22.4% and 29% respectively) in both years. In 2017, the NEV market share of the Netherlands receded to 2.7% which was still good for a fourth position globally, but a look at the absolute sales numbers shows that the 2017 sales are roughly a quarter (11,070) of what they were in 2015 (43,770). In contrast, market shares and absolute sales numbers of the vast majority of other countries have been going up in recent years.¹⁹

This regression can be explained by the termination of subsidies and fiscal incentives for PHEVs as explained above. Whereas 41,230 PHEVs had been sold in 2015, only 2,450 left the Dutch dealers in 2017 and this illustrates how dependent NEVs still are on fiscal incentives. The developments of BEVs, however, are more positive. In comparison with 2016 (3,740), sales in 2017 have more than doubled (8,630) and the market share of BEVs in the Netherlands was third only (2.1%) to those of Norway and Iceland.

Number of registered NEVs in the Netherlands (accumulative)

<table>
<thead>
<tr>
<th>Type</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>June 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEV</td>
<td>4,161</td>
<td>6,825</td>
<td>9,368</td>
<td>13,105</td>
<td>21,115</td>
<td>29,210</td>
</tr>
<tr>
<td>PHEV</td>
<td>24,512</td>
<td>36,937</td>
<td>78,163</td>
<td>98,903</td>
<td>98,217</td>
<td>97,946</td>
</tr>
<tr>
<td>FCEV</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>43</td>
<td>41</td>
</tr>
<tr>
<td>Light truck</td>
<td>669</td>
<td>1,258</td>
<td>1,460</td>
<td>1,628</td>
<td>2,210</td>
<td>2,586</td>
</tr>
<tr>
<td>Heavy duty</td>
<td>39</td>
<td>46</td>
<td>50</td>
<td>66</td>
<td>81</td>
<td>85</td>
</tr>
<tr>
<td>Bus</td>
<td>73</td>
<td>80</td>
<td>94</td>
<td>168</td>
<td>296</td>
<td>327</td>
</tr>
<tr>
<td>Total</td>
<td>29,454</td>
<td>45,146</td>
<td>89,135</td>
<td>113,900</td>
<td>121,962</td>
<td>131,972</td>
</tr>
</tbody>
</table>

Figure 1 (Source Nederland Elektrisch)

The process of NEV adoption in the Netherlands thus reveals that subsidies and other financial stimuli are essential. This is due to the fact that the purchase price of NEVs is still much higher than ICEVs, mostly because of the fact that lithium-ion batteries are still relatively expensive. For example, in August 2018, a new gasoline-driven Volkswagen Golf in the Netherlands could be purchased at a bottom price of 22,720 euros while the Volkswagen e-Golf (a BEV) was priced at 38,600 euros.²⁰ As a result, the average total cost of ownership (this includes purchase costs, fuel, depreciation, taxes, VAT, insurances, subsidies, maintenance and interest) for a passenger BEV in the Netherlands during the first three years, while driving 20,000 km per year, was 705 euros a month. The total cost of ownership for diesel and gasoline cars amounted to 686 and 605 euros respectively. Nevertheless, the declining costs of lithium-ion batteries and the fact that NEVs are cheaper in maintenance and fuel costs have led to a steady decline in the total cost of ownership of NEVs over the past years.²¹

Policies also have an important impact on the deployment of charging infrastructure. The emphasis on the “charging pile follows car” approach proves to be successful as it was estimated that roughly

---

114,000 charging points existed throughout the country by the end of 2017, which gives the Netherlands the highest charger to car ratio in the world.\textsuperscript{22} 34,616 of those chargers are publicly accessible, which, in absolute numbers, is exceeded only by China and the United States.\textsuperscript{23}

**Amount of charging points in the Netherlands (accumulative)**

<table>
<thead>
<tr>
<th>Type</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>June 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public &amp; semi-public</td>
<td>5,770</td>
<td>11,860</td>
<td>17,786</td>
<td>26,088</td>
<td>32,875</td>
<td>33,616</td>
</tr>
<tr>
<td>Fast charging station</td>
<td>106</td>
<td>254</td>
<td>465</td>
<td>612</td>
<td>755</td>
<td>920</td>
</tr>
<tr>
<td>Private charging piles</td>
<td>18,000*</td>
<td>28,000*</td>
<td>55,000*</td>
<td>72,000*</td>
<td>80,000*</td>
<td>87,500</td>
</tr>
</tbody>
</table>

*the amount of private charging piles are estimates.

Fiscal and financial incentives have thus played a major role in the relative fast growth rate of NEVs and charging points in the Netherlands. In turn, this process has led to another form of growth: namely, that of a Dutch NEV (-related) industry.

Although an increase in NEV-related commerce is a natural inference from the growth of a nation’s electric car fleet, the earlier mentioned Green Deals and Innovation Credits have proven to be essential for the emergence of an innovative and promising industry that is currently expanding internationally. Good coordination and cooperation between governments and businesses through the framework of pilots have achieved much more than just to pull companies into the realm of NEVs and stimulate innovation and entrepreneurship. It has, among other things, taught both parties about the playing field in which NEVs operate and what governments can provide or do to assist the industry.

Green Deals have, for example, helped to eradicate judicial hurdles and resulted in manuals that can be used by local and regional governments to facilitate NEVs, like the Open Charge Point Protocol and the Open Charge Point Interface that have set the norms and standards for the Dutch vehicle charging network. Another important feature of these policies is that they can help Dutch companies to obtain an international footprint. The launch of eight electric buses by the company Ebusco in the city of Paris, for example, was partially accomplished by the RVO innovation credit and the program Partners in International Business that helped this company to expand internationally. The success of the Dutch efforts to stimulate the growth of a NEV (-related) industry has been acknowledged by the European Commission that in March 2018 launched the Innovation Deal, an initiative that is directly inspired by the Green Deals.\textsuperscript{24}

A steady growth of NEVs, charging infrastructure, supportive policies have thus contributed to the emergence of a promising NEV (-related) industry that is growing domestically while also spreading its wings abroad. The next chapter will discuss in more detail what this industry looks like and which clusters are the most successful and promising, so as to get a better understanding what companies, products and services have potential opportunities on the Chinese market.

\textsuperscript{22} Nederland elektrisch, ‘Verkoopcijfers’ (accessed 9 July 2018) [https://nederlandelektrisch.nl/actueel/verkoopcijfers](https://nederlandelektrisch.nl/actueel/verkoopcijfers).


Chapter 2

New energy vehicle developments in the Netherlands

Industry & entrepreneurship

As a result of a relatively large and steadily increasing NEV fleet, the highest charging point to car ratio in the world, supportive policies that stimulate both innovation and entrepreneurship and the existence of a strong automotive sector, the Netherlands has witnessed the emergence of a promising NEV (-related) industry in recent years. This chapter will provide a better understanding of what the green mobility sector in the Netherlands entails and identify four clusters within this industry that show the highest growth rates and have the most promising prospect of expanding their activities abroad.

In 2015 and 2016, the NEV sector in the Netherlands grew with roughly 40%, reaching a production volume of more than one billion euros in 2016 and another 320 million euros in added value. At the end of 2016, the sector numbered 3,700 new fulltime jobs that were predominantly occupied by individuals with degrees in higher education. The Green Deal Electric Mobility 2016 – 2020 has formulated the ambition to create 10,000 fulltime jobs in the NEV sector by 2020, a goal that can be realized if the current growth continues.25

But what exactly does the NEV sector in the Netherlands look like? Much like the traditional automotive sector, the NEV sector exists of a wide range of activities, products and services that differ greatly from one another. They have therefore been divided in four clusters: the first one is propulsion technology & components; the second is charging infrastructure & smart grids; the third is manufacturing & conversion and the last cluster is services. The function of this chapter is to provide a better understanding of what these clusters entail and where the most promising developments have taken place. Given that the goal of this report is to assess whether the NEV sector has any potential in China, special attention will be given to the international ambitions and activities that these clusters have, as well as the companies in it.

The Emphasis of the Dutch government on charging infrastructure has contributed to the fact that roughly 12% of the world’s chargers were located in the Netherlands by the end of 2017. This has obviously turned the country into an important market for charging infrastructure, but it has kick-started the emergence of a related industry as well. Charging infrastructure in the Netherlands is considered to be the most advanced in the world and most of it has been produced by Dutch startups and companies.

Whereas activities of the charging infrastructure cluster were initially preoccupied with hardware, it is increasingly expanding into the realm of broader services. In addition, more companies have expanded their activities abroad.

The charging cluster itself can be divided in three categories: first, there are the charging companies that own the infrastructure and sell the electricity needed for electric vehicles; the second category exists of companies that develop and manufacture charging systems for the market; lastly, there are those companies that provide payment systems and mobility services. In all three areas the Netherlands is well-represented both domestically as well as abroad.

**Infrastructure and electricity:** The companies Allego and Fastned are notable examples of the first category and have gained concessions for hundreds of fast charging stations in the Netherlands. Both have also expanded into other European countries, most notably Germany, the other Benelux countries and the United Kingdom, making them the market leader in Western Europe. Fastned has signed an agreement with Transport for London in order to provide the Greater London Area with a network of fast chargers, while Allego has been assigned to coordinate two large EU projects – Ultra-E and Fast-E – that aim to establish a fast charging network in the European Union.

**Charging systems:** An undisputed market leader in the development and production of chargers as well as a provider of smart charging services is the company EV-box. With offices in Amsterdam, New York, Antwerp, London and Paris, they have attained a global footprint and have installed more than 50,000 charging piles in more than 980 cities. They are furthermore responsible for the entire charging infrastructure of Amsterdam and Rotterdam. Even larger is the company Newmotion, whose charging network of more than 70,000 charging piles throughout Europe is the largest outside of China. Alongside these giants are other well-performing companies such as Alfen. Their subsidiary ICU Charging Equipment produces chargers for the Benelux, France, Germany and the United Kingdom. By 2017, 35,000 chargers were distributed by Alfen throughout Europe.

As a result of the high demand for charging infrastructure and the government’s focus on innovative solutions, some Dutch companies make chargers that do not just make wall boxes or charging stations. In order to make better use of limited space and to integrate charging stations within the public sphere, the companies of Streetplug and Ecotap developed chargers that can be integrated within roads and streetlights respectively. Furthermore, Rotterdam currently has a pilot with wireless charging.

**Services:** As became apparent above, companies like EV-box and the Newmotion also provide services alongside charging piles. However, there are companies that focus solely on smart charging and payment systems. The company Jedlix, for example, provides smart charging solutions for households. By charging a car during specific hours, smart charging companies enable NEVs to charge when electricity prices are at their cheapest rates. This requires partnerships between smart charging and grid companies. Jedlix, for example, has partnered up with one of the Netherlands’ largest grid companies Eneco in order to exploit the conjuncture in energy prices and drive down charging costs for customers. Newmotion has founded a similar partnership with grid company TenneT.

---

Especially now that the grid is getting increasingly powered by fluctuating solar and wind energy, the demand for smart charging solutions is increasing. The solar charging pilot in Utrecht that was mentioned in the previous chapter is such an example. NEVs that are plugged in at these stations can be discharged and used as de facto energy sources when energy provided by solar panels is unavailable. Aside from smart charging, companies in this category also focus specifically on payment systems. Travelcard and Vandebron, for example, provide charging cards or keychains that offer easy payment solutions throughout the Netherlands and even Europe.

International acknowledgement: Combined, the many Dutch companies that provide innovative charging hardware and services have turned the Netherlands into one of the frontrunners when it comes to charging infrastructure. The Netherlands has been named as the number one country in this regard by prominent consultancy firms Roland Berger and Chicago-based Navigant Consulting. According to the former’s Automotive Disruption Radar of 2017, the Netherlands is the country that leads in accommodating new forms of mobility (autonomous, connected, electric and shared driving). A major reason for this, according to Roland Berger, is that the “Netherlands [is] clearly leading in EV infrastructure.” Navigant Consulting stressed in 2016 that the companies EV-box and the Newmotion were the leading companies in the global charging pile sector.

Propulsion technology and components

Although the Netherlands is most renowned for its charging infrastructure, it is in fact the cluster propulsion technology & components that has seen the most progress. From 2015 to 2016, the sector has seen a 67% increase in added value, a 43% production growth and the amount of fulltime jobs rose with 44%. Unlike charging infrastructure, this cluster is heavily rooted in the traditional automotive industry and for many players manufacturing for NEVs constitutes but a minor part of their overall operations. Drive train technology, range extenders and management systems are often still in the research and pilot phase.

Nevertheless, this cluster too contains some iconic players that occupy market leader status, albeit in the traditional automotive sector. NXP-semiconductors is the international market leader in the field of automotive chips and virtually every car in the world has their products in it. As innovative leaders, they profit from the shift towards and integration of new forms of mobility (autonomous, connected and of course electric driving). These require new and advanced power electronics and as innovative leaders of automotive semiconductors, NXP is in a good position to lead the vanguard of this transition.

Another market leader in automotive industry is the paint, coatings and chemical giant AkzoNobel. The exterior of an NEV might require the same paint job as that of an ICEV, but there are more specific reasons why the emergence of NEVs is of growing importance for companies like AkzoNobel and DSM, another multinational coating company from the Netherlands. As a result of growing NEV fleets worldwide, the demand for lithium-ion batteries is rising. However, range anxiety, battery longevity and performance issues still withhold many from purchasing NEVs. Research into battery performances has therefore increased and it has become apparent that battery coatings can influence the performances of battery electric vehicles. One example is the publication of a scientific article by the University of California in Riverside in 2017. In it, researchers argued that the life-span and range of lithium-ion batteries could be increased dramatically when a specific coating was being applied. This illustrates

the potential impact that coatings can have on (the future of) ZEVs and how international players like AkzoNobel and DSM could profit from the transition towards ZEVs.

**Components:** Some Dutch companies that exclusively focus on the automotive sector have also made a shift towards NEVs in recent years and currently manufacture a wide variety of high quality products. The company PEEC Power, for example, has developed a range extender that helps to improve the range of an electric vehicle and reduce range anxiety of consumers. Prodrive Technologies is also increasingly focusing on NEVs and specializes in the production of inverters and converters for NEVs and is developing a system for wireless charging as well. Punch Powertrain is manufacturing high quality gearboxes for PHEVs and drivelines for BEVs, while e-Traction produces powertrain components and systems. Teesing has been a producer of FCEV components for many years, they export filling nipples, tubes and components for hydrogen refueling stations. The high quality and worldwide value of these products is reflected by the global footprint that the aforementioned companies have. Their key components for NEVs are distributed throughout the world and are already being applied on a large scale.\(^3^1\)

**Hydrogen:** Due to its relative large natural gas reserves, the Netherlands has always had a well-developed natural gas sector. However, this sector has been under increasing pressure due to earthquakes that are the result of the extraction of gas. The sector, including its automotive branch, is therefore increasingly interested in hydrogen because of its similarities with natural gas (especially CNG) and because hydrogen – when produced through solar and wind energy – does not emit any CO2 and is eligible for subsidies and government support.

**Battery management:** Another notable development within this cluster is the increasing focus on the re-use and recycling of vehicle batteries. The Ministry of Infrastructure and Water Management and Auto Recycling Nederland have cleared the way for companies to re-use batteries legally. A result of this is the launch of the so-called V-Storage program by bus maker VDL Groep and Scholt Energy Control in 2016. V-Storage turns former bus batteries into flexible energy storages and is currently being used as such by grid companies. A similar project has been launched by the Amsterdam football stadium in 2017 where 280 used Nissan Leaf batteries will act as an energy storage for solar panels located on the roof of the stadium.\(^3^2\)

**Manufacturing and conversion**

The manufacturing and conversion of vehicles is the NEV industry’s largest cluster in terms of production and added value as well as the number of fulltime jobs. As the name implies it concerns companies that manufacture full-fledged NEVs or companies that specialize in converting ICEVs into NEVs.

**Manufacturing:** The most notable development that can be observed is the rise of electric bus manufacturing in the Netherlands. Many countries, including the Netherlands, regard the electrification of public transport as the first phase of transitioning towards ZEVs. This is illustrated by the Netherlands’ goal to replace all of its 5,000 bus with electric counterparts by 2025 (meaning that, on average, 700 buses will have to be electrified every year until 2025). The relative early focus of Dutch towns and cities on electric buses paved the way for a likewise early focus of the country’s bus makers on such buses.

As a result, VDL Bus & Coach managed to evolve into the market leader of Western European. Although they mostly produce for the domestic market, their buses also operate in Germany and

---

\(^3^1\) Rijksdienst voor Ondernemend Nederland, ‘Verzilvering Verdienpotentieel Elektrisch Vervoer,’ 29. 
\(^3^2\) Ibidem, 29-30.
Luxembourg and soon in France, Norway, Sweden and Switzerland as well. In March 2018, the company launched 100 units at and around Amsterdam airport, making them responsible for Europe’s largest electric bus fleet.\(^{33}\) VDL itself has been surprised by the surging demand for electric buses. Until recently, they considered them to be an interesting complementary project, but now expects to build electric buses only for the Dutch market from around 2022 onwards.\(^{34}\) Electric Buses are not the only NEVs that VDL produces. Back in 2011, four fuel cell buses were produced for two German cities.

Another prominent Dutch bus maker that manufactures and exports electric buses abroad is Ebusco. Their models are currently driving around in France, Germany, Norway, Switzerland and in various Dutch cities.

The Netherlands is also home to various companies that manufacture electric trucks. GINAF is one such company. They produce full electric trucks for urban and regional logistics with a 105 to 300 km range. In 2018, VDL and DAF, the Netherlands’ largest manufacturer of trucks, launched a 40 ton full electric model that marked the first step of large scale electrification of heavy-duty transport in the Netherlands. Another example is Terberg Benschop, a manufacturer of specialized trucks that has developed a full-electric yard and port tractor.

Although commercial use of solar-powered vehicles is seen by many as a scenario of the distant future, a startup from the Netherlands has produced a passenger model that will enter the market in 2019, making the Lightyear One the first commercial solar car in the world. The developers of this car are former students of the Technical University of Eindhoven that, for years now, has spearheaded the research and development of solar mobility.

**Conversion:** The Netherlands is home to a wide range of companies that specialize in transforming ICEVs into NEVs. Aside from manufacturing, the aforementioned companies GINAF and Terberg Benschop also convert regular trucks into e-trucks while Emoss specializes solely in conversion. They transform existing buses into NEVs and has worked together with Dutch companies, most notably Heineken and Albert Heijn, to electrify their existing fleet delivery trucks and vans. Hytruck offers similar services and is currently developing a way to develop hydrogen trucks as well. They are not the only converters that focus on fuel cells, the company Hymove converts existing buses into hydrogen buses by placing a fuel cell range extender in a vehicle. In the city of Breda, a hydrogen garbage truck was launched by E-Trucks Europe. Holthausen counts as a good example of the increasing interest that gas sector has in hydrogen. Their expertise of placing biogas systems in trucks has given this company a solid basis for understanding the technical complexities of hydrogen mobility. As a result, they have successfully converted a Tesla S model into a hydrogen vehicle called the Hesla.

**Services**

The rapid growth of NEVs and the infrastructure they depend on has created a lucrative niche of companies that offer finance, payment and mobility and consultancy services. Services that support the use of charging infrastructure have already been discussed briefly, but the rise of electric mobility, especially in combination with autonomous, connected and shared driving, has given birth to a much broader range of service companies.

**Car sharing:** Various Dutch car sharing concepts with a focus on NEVs have popped up all over the Netherlands. Watt Car, for example, has introduced 49 Nissan Leafs to the island of Terschelling. The small size and limited network of roads on the island make car ownership less convenient and shared cars therefore come in handy for inhabitants as well as for the many tourists that visit the island.


\(^{34}\) Rijksdienst voor Ondernemend Nederland, ‘Verzilvering Verdienpotentieel Elektrisch Vervoer,’ 18-19.
different platform for car sharing is eCARSHARE, a Dutch company that owns 75 cars for shared use in the province of Limburg. Startup Amber goes a step further and aims to introduce cars in their shared fleet that are not just electric but autonomous as well. In 2018 they aim to launch autonomous BMW i3 models and they have announced that in 2021 they will introduce their own autonomous vehicle, the Amber One.

**Taxi:** Aside from car sharing there are also several taxi companies that have electrified their entire fleets and some car lease companies, like MisterGreen, Electric Lease and NuElektrisch focus solely on NEVs.

**Consultancy:** A very different NEV-related service is consultancy. The early rise of NEVs and charging infrastructure in the Netherlands have resulted in consultancy firms with a lot of experience in the field of e-mobility. For example, they assist companies and governments with advice about the roll-out of charging infrastructure or provide strategies that help with the transition towards a NEV fleet. Some names are APPM, EV Consult, Overmorgen and FIER.

**International footprint**

A combination of factors – an early focus on NEVs, supportive policies that emphasize the importance of infrastructure, relative high NEV sales and a traditionally strong automotive sector – has resulted in the fact that the Netherlands boasts an advanced and promising NEV sector that has already acquired an international footprint in some areas. Many manufacturers and suppliers have been active abroad for years due to their roots in the traditional automotive industry and now their NEV (-related) products too are finding their way into the international markets.

However, the charging infrastructure cluster proves that newcomers are also able to conquer the international markets. As a testing lab for innovative charging solutions, the Netherlands has helped these companies to fine-tune their products and conquer the international markets. Only the service sector has a distinct local footprint and the companies within it focus mostly on the domestic market.

This chapter has thus demonstrated that the Netherlands is home to an expanding NEV (-related) industry that has the potential to expand abroad and, in many instances, has already done so. Having witnessed these positive developments while also recognizing that the NEV sector requires assistance to improve its opportunities abroad, the Dutch government has established the [Steering Committee on the Internationalization of Dutch e-mobility](#). This committee is tasked with aiding and facilitating the international activities of the NEV sector and identify potential markets. Therefore, a logical next step is to explore whether the products and services of the Dutch NEV industry appeal to the Chinese market. As the world’s largest NEV market, China provides many opportunities in theory, but it remains to be seen whether this is also the case in practice. The subsequent chapter will therefore provide an overview of NEV developments in China and provide a better understanding of its market, its policies and other dynamics that could enable or obstruct Dutch companies.
Chapter three

New energy vehicle developments in China

Goals & central policies

The People’s Republic of China is the world’s largest vehicle market in the world since 2009, but to call this a relatively new phenomenon would be an understatement. Some thirty years ago, only around 200,000 thousand vehicles were sold on an annual basis and this figure would gradually rise to around 2 million in 2000. After that, China’s car sales really started to take off and currently stand at more than 29 million sales annually. In comparison, the world’s second largest vehicle market – the United States – is only two thirds of that of China with 17.5 million sales in 2017.

This impressive growth has been the result of a booming economy that experienced growth rates of around 10% for over three decades. Every year, millions of China’s 1.4 billion inhabitants, are joining the ranks of a middle class that is estimated to contain some 550 million people by 2022. The importance of car ownership to the increasingly affluent Chinese society has also given rise to a car industry whose production figures equal that of the country’s sales volume, making China the largest car producer in the world as well.

![Production volumes passenger and commercial vehicles (1999 - 2017)](image)

Pollution, securitization and market leadership

China’s growing car fleet has, to a large degree, been positive for its economy and citizens, but has also given rise to some serious challenges and obstacles that explain the central government’s devotion

---


37 China’s middle class, the segment of the country’s population that can afford to purchase a vehicle, earns roughly 7,700 to 29,000 euros on an annual basis; Business Insider, ‘China’s middle class is exploding,’ 27 August 2016 (accessed 11 July 2018) [http://www.businessinsider.com/chinas-middle-class-is-exploding-2016-8](http://www.businessinsider.com/chinas-middle-class-is-exploding-2016-8).
towards NEVs. An obvious example of one of these problems is air pollution. Many of China’s megacities are frequently plagued with dense clouds of smog that are estimated to kill around one million people every year.\textsuperscript{38} In addition, the surging amount of ICEVs on China’s roads has contributed to China’s infamous status as the world’s largest emitter of CO2 and therefore a major source of human-induced climate change.\textsuperscript{39}

Another major issue for the central government is the country’s growing dependence on imported oil. Until 1993, China had been a net exporter of crude oil, but nowadays it has to import 65% of its oil from regions that are predominantly unstable. Moreover, the vast majority of this imported oil has to be shipped through two chokepoints (the Straits of Hormuz and Melaka) and the hotbed that is the South China Sea. The importance that Beijing attaches to the safeguarding of its energy should not be underestimated. China experienced firsthand the consequences of dependency on oil imports during the Korean War and the subsequent Sino-Soviet Split in the 1950s, when China’s most important oil suppliers (the United States and the Soviet Union) cut off the flow of oil to China, thereby paralyzing its industrialization and military capabilities. With the discovery of vast oil reserves in 1958, China vowed to never become oil dependent again and is now investing astronomical amounts of money to return to the secure position it had from 1963 until 1993. The Belt and Road Initiative is such an example, but the transition towards electric and fuel cell vehicles too is to a very large extent the result of China’s determination to control its energy flows as much as possible.\textsuperscript{40}

The last important reason why the central government of China favors the adoption of NEVs has to do with its own vehicle industry. Despite being the largest vehicle producer in the world, the overwhelming majority of cars produced in China are destined for domestic use and Chinese brands have repeatedly failed to attract foreign buyers. Moreover, more than 50% of these domestically produced cars were sold under a foreign brand as Chinese consumers tend to regard these to be of superior quality compared to Chinese brands.\textsuperscript{41} For the central government, the dominance of foreign OEMs is not ideal as China seeks to become a global leader in this field. Here too, NEVs seem to offer the solution to China’s problems. While Chinese ICEVs seem to chronically lag behind their German and Japanese counterparts (often as a result of their inferior quality or unattractive branding) the infant phase in which NEVs find themselves provides an opportunity for China’s car industry to leapfrog foreign competitors and become a market leader of what many consider to be the car industry of the future.\textsuperscript{42} As a result the Chinese government is determined to lead the vanguard of car electrification.

\textbf{Authoritative sources}

In order to accelerate the transition from ICEVs to NEVs and eradicate the obstacles that are described above, the Chinese government has formulated a wide-ranging set of goals and policies. Given China’s centralized and hierarchical governmental structure, these are almost always a response to the general directions that the highest authoritative sources set out. Examples are:

\textbf{Speeches and statements by the country’s president, Xi Jinping:} whenever the president expresses his wish to implement or alter a policy or process in a televised performance, concrete policies that adhere to these wishes often would follow soon after. Xi has repeatedly mentioned the strategic importance of NEVs and thereby incentivizing policymakers to regard NEVs as a primary focus;\textsuperscript{43}

\textbf{The Five-Year Plans of the Communist Party of China:} these comprehensive publications determine China’s overall strategy for a period of five years. In the current 13\textsuperscript{th} Five Year Plan (2016 – 2020),

\begin{itemize}
  \item \textsuperscript{38} The Guardian, ‘China tops WHO list for deadly outdoor air pollution,’ 27 September 2016 (accessed 11 July 2018) \url{https://www.theguardian.com/environment/2016/sep/27/more-than-million-died-due-air-pollution-china-one-year}.
  \item \textsuperscript{39} Reuters, ‘Who are the world’s biggest polluters ?,’ 2 June 2017 (accessed 11 July 2018) \url{https://www.reuters.com/news/picture/who-are-the-worlds-biggest-polluters-idUSRTXRKSL}.
  \item \textsuperscript{40} Daniel Yergin, \textit{The Quest : Energy, Security, and the Remaking of the Modern World} (2011) 197-198;
  \item \textsuperscript{41} China Daily, ‘Chinese brands outstrip rivals in market share,’ 25 September 2017 (accessed 11 July 2018) \url{http://www.chinadaily.com.cn/business/motoring/2017-09/25/content_32449686.htm}.
  \item \textsuperscript{42} Yunshi Wang et al., ‘China’s electric car surge,’ \textit{Energy Policy} 102 (2017) 486-490, 486.
\end{itemize}
NEVs have been coined as an emerging industry that must play a primary role in China’s economic development and, as a result, ministries have devoted policies and investments towards it.44

*Publications by the State Council:* the chief executive authority of the country, the State Council, has published various policy directions that have greatly impacted the course of NEV development in China. Very influential was the Development Plan of Energy-Saving and New Energy Vehicles Industry, China’s first roadmap. It stated that an annual production capacity of two million NEVs should be realized by 2020 and five million by 2025. In addition, it formulated technical requirements regarding top-speeds, range and battery performance.45

Whereas the three sources above provide general directions for all Chinese goals and policies, it is the responsibility of ministries and government agencies to oversee that the demands of the highest authorities are being adhered to. With regard to NEVs, there is not one specific ministry that oversees and implements all NEV-related goals and policies. Before we will continue to discuss the most important goals and policies, this report will first provide an overview of the most important governmental organizations that are responsible and/or influential for the development of NEVs.

**Ministries**

The Ministry of Industry and Information Technology (MIIT): MIIT is currently the most prominent ministry with regard to the implementation of NEVs. MIIT has formulated many of the most important goals and policies and is considered to be the ministry that is *de facto* responsible for the development of NEVs.

The National Development and Reform Commission (NDRC): this macroeconomic management agency under the State Council has broad administrative and planning control over the Chinese economy and has been the architect of several of the most important NEV policies. In fact, it was arguably the most influential ministry during the early years of NEV development, but MIIT has taken over that position in recent years. During the 2018 National People’s Congress, NDRC lost its responsibility over climate change and low-carbon growth to the Ministry of Ecology and Environment and, as a result, might have lost more of its influence over NEV development.46

The Ministry of Science and Technology (MoST): as its name implies, MoST is mostly responsible for research and innovation and has overseen several programs and pilots during the last twelve years. It has also launched various research centers that conduct research on NEVs.

The Ministry of Ecology and Environment (MEE): being responsible for environmental protection and climate change in China, this ministry often cooperates with other Chinese ministries to formulate and implement stricter fuel standards for ICEVs and stimulate the promotion of new energy vehicles.

The Ministry of Finance (MoF): being in charge of the national budget and fiscal policies, economic regulations and overall government expenditure, MoF is mostly responsible for the amount of funding and subsidies that NEVs and related projects receive.

The Ministry of Public Security (MPS): this Ministry is responsible for the NEV license plates that have been introduced in many Chinese cities.

---


Organizations

Behind the ministries that ratify and implement goals and policies, there are also several organizations that wield a large amount of influence over the development of NEVs in China. These organizations are virtually all concerned with R&D and policy advise. Some notable examples are:

The China Automotive Technology and Research Center (CATARC): this authoritative research organization functions as the primary automotive think-tank for MIIT. A wide range of China’s most influential NEV policies (especially those that have been published by MIIT) have been originally formulated and proposed by CATARC. As a result, CATARC’s footprint on NEV development is significant.

The Development Research Center of the State Council (DRC): as the primary think-tank for China’s most authoritative administrative body, DRC has a significant influence in what direction China’s NEV goals and policies are going. They regularly publish policy and working papers wherein they inform the State Council on the successes, obstacles and overall development of NEVs and provide complementary policy recommendations.

The Chinese Society of Automotive Engineers (SAE China): this national academic organization with 39 branches throughout China is predominantly concerned with the sustainable development of China’s automotive industry. Following “Made in China 2025” (which will be discussed below), they published the “Technology Roadmap for Energy-Saving and New Energy Vehicles,” a comprehensive guideline for NEVs in cooperation with MIIT.

The China Automobile Innovation Centre: this influential think-tank has been mostly preoccupied with the re-use and recycling of NEV batteries. The increasing demand for lithium batteries poses a huge challenge for China to deal with and the China Automobile Innovation Centre has been tasked explore and come up with innovative solutions that help to address this problem.

China EV100: this organization includes more than 140 organizations, governments, companies and universities that play an influential role in the development of NEVs in China. Together they aim to advance research, development and deployment of NEVs throughout China and influence Chinese policies.

The National New Energy Vehicle Technology Innovation Center: established in 2018, by MoST, this Beijing-based think-tank is relatively new, but is likely to have a significant impact on NEV development in China. Involved in this center are 21 of China’s leading NEV manufacturers and R&D institutions, including Beijing’s BAIC Group, Geely, BYD, Baidu and Tsinghua University.

Tongji University: as one of China’s leading universities and located in China’s NEV capital, Shanghai, Tongji University is a leading authority in R&D in the field of NEVs. The university has established various centers and institutes that focus on NEVs: the Clean Automotive Engineering Center, the School of Automotive Studies and the Collaborative Innovation Center for Intelligent New Energy Vehicles.

Tsinghua University: this university’s New Energy Vehicle Center is an authoritative source on the R&D of NEVs within China and beyond. Its researchers have regularly been involved in influential studies together with various American universities including Harvard University and the Massachusetts Institute of Technology.

---

**International cooperation**

Lastly, there are various international partnerships that China is involved in. These too have proven to be influential on Chinese policymaking as well. One of China’s most important policies, the NEV Mandate Policy (which will be discussed below), has been directly influenced by the Californian Zero Emission Vehicle Regulation.

**Electric Vehicle Initiative (EVI):** this multi-government policy forum is dedicated to accelerate the adoption of NEVs worldwide. It was launched in 2010 by the Clean Energy Ministerial, a high-level dialogue among energy ministers from the world’s major economies, including China. Out of this came the EV 30/30 campaign in 2017. This initiative aims to speed up the deployment of NEVs and target at least 30 percent new NEV sales by 2030. Chinese participants of this campaign are Beijing, Rugao, Shenzhen and Yangcheng while the Netherlands is represented through Amsterdam, The Hague, Rotterdam and Utrecht.

**China-U.S. ZEV Policy Lab:** this Sino-Californian platform mainly focusses on the study, exchange and proposal of NEV-related policies. Both CATARC and the NDRC are involved within this platform.

**The Innovation Center for Energy and Transportation (ICET):** is another Sino-Californian think-tank with an office in Beijing that is partially funded by the MEE and is focused on the de-carbonization of mobility. Institutions involved in ICET are the NDRC and Tsinghua and Xiamen University.

**Goals**

Currently, two roadmaps can be regarded as the overarching policy guidelines for China’s NEV policies:

**The Mid-to-Long Term Development Plan of Auto Industry:** this roadmap was published in 2017 by MIIT, NDRC and MoST and is an updated version of the State Council’s Development Plan of Energy-Saving and New Energy Vehicles Industry (2012), while also taking into account MIC2025 (see below). It states that an annual sales and production capacity of 2 million NEVs should be reached in 2020 and 7 million by 2025. To illustrate this ambition, China’s annual NEV production and sales in 2015 stood at 340,471 and 331,092 respectively and grew to 794,000 produced and 770,000 sold vehicles in 2017.50

**Made in China 2025 (MIC2025):** Drafted by MIIT and CATARC and published by the State Council, this document aims to comprehensively upgrade China’s industry and do away with its reputation as a manufacturer of inferior products. The goal of MIC2025 – that regards NEVs as one of the pillars of China’s future industry – is twofold: to enable China’s industry to occupy the highest parts of the global production chains and to raise domestic content share of core components and materials to 40% by 2020 and 70% by 2025. These goals have caused a fair amount of controversy and suspicion among foreign governments and companies alike. Some fear that MIC2025 will herald a return to protectionism and undermine the progress that foreign companies, the automotive sector in particular, have made in the past decades. In fact, it is considered to be one of the instigators of the Sino-American trade war that is in full swing around the time of writing. The implications for foreign NEVs are rather ambiguous: the document states that 70% of all NEVs produced and sold in China in 2020 should be of Chinese origin, while in 2025, that share should rise to 80%. However, these shares are based on the 2015 NEV targets that aimed at sales volumes of 1 and 5 million units for 2020 and 2025 respectively. As was mentioned above, targets have been raised to 2 and 7 million and the question remains whether the envisioned NEV shares in MIC2025 apply to the new targets as well.51

**The Guidance for Developing Electric Vehicle Charging Infrastructure for 2015 – 2020:** this document, published by NDRC, MIIT and two other ministries, is China’s main roadmap for the roll-out of a

---


charging infrastructure. The plan aims to realize several charging corridors in the east of the country, containing 800 inter-city fast-charging stations. In addition, the Guidance divides China in three regions and provides them with tailor-made targets for 2020: 7,400 public charging stations and some 2.5 million charging points have to be constructed in the eastern provinces; 4,300 public charging stations and 2.2 million in the central and northeastern provinces; and 400 public charging stations as well as a 100,000 charging points will have to be completed in western China, Ningxia and Guangxi province.52

**The Fuel Cell Vehicle Technology Roadmap:** was published in 2016 as a part of the SAE China’s “Technology Roadmap for Energy-Saving and New Energy Vehicles.” This roadmap is China’s first comprehensive guideline for FCEVs and includes various goals and targets for 2020, 2025 and 2030. It aims to have 5,000 FCEVs on Chinese roads by 2020 and one million by 2030. It also formulates the goal of constructing more than 100 hydrogen refueling stations by 2020 and more than 1,000 by 2030. In addition, the roadmap has formulated various goals with regard to vehicle performance and hydrogen production and transportation.

**Central policies**

The roadmaps that were discussed above reveal very ambitious goals and targets that some discard as unrealistic.53 Notwithstanding, the policies that support these roadmaps are equally ambitious. China’s most important NEV policies will be discussed below:

**Private and fleet purchase subsidies:** In addition to purchase subsidies for commercial NEVs, the Chinese central government, unlike the Dutch government, also offers purchase subsidies to passenger NEVs. In 2009, when subsidies were made available for the first time, purchase subsidies could cover up until 50% of the total vehicle costs. The subsidies were initially meant to support the Ten-City-Thousand-Vehicle Initiative (see next chapter) but were later fine-tuned for national use and tied to technical requirements in order to ramp up the performances of NEVs.54 Due to marginal progress, subsidies were extended in 2013 and since 2016, when sales number had begun to surge rapidly, purchase subsidies are being phased down gradually up and until 2020, when they are planned to be abolished.

At the time of writing, the following subsidy regulations had just come into effect (June 2018):

Central subsidies are increased for NEVs with a range per charge of 290km, subsidies for NEVs with a range per charge from 145 to 290km are significantly decreased and subsidies for NEVs with a range per charge less than 145km are eliminated.55 Provided that PHEVs rarely exceed the 145km range, they are now virtually excluded from central subsidies.

Aside from range requirements, the height of the new subsidies also depends on battery pack density. Battery pack densities of over 140 watt hours per kg receive up to 20% more subsidy, battery pack densities of 120 watt hours per kg or less, receive 40% less subsidy and battery pack densities under 105 Watt hours per kg receive no subsidy.

As a result, the average height of purchase subsidies for NEVs in China, as of 12 June 2018, ranges from 15,000 CNY (roughly 1.915 euros) to 60,000 CNY (roughly 7665 euros) per vehicle.

**The Temporary Management Regulation for Corporate Average Fuel Consumption (CAFC):** China’s fuel standards focus on ICEVs rather than NEVs, but they do have a significant impact on the latter’s development. Drafted by CATARC, this policy sets fuel consumption limits for passenger vehicles

---

53 Embassy of the Kingdom of the Netherlands in Beijing, ‘Seminar on new energy vehicles’ (14 June 2018); David Tyfield and Dennis Zuev, ‘Statics, dynamism and emergence of the e-mobility system in China: A power relational perspective,’ Technological Forecasting & Social Change 126 (2018) 259-270, 263; Wang et al., ‘China’s electric car surge,’ 490.
based on vehicle curb weight distribution across a manufacturer’s fleet (average fleet target is 5.0L/100km by 2020). Additionally, there is a vehicle-maximum fuel consumption limit that individual car types may not exceed. This policy, currently in Phase IV (GB19578-2014), allows for passengers’ cars with a pure electric range of 50km or more to be counted five times their weight. In other words, these cars are able to disproportionately drive down the corporate-average fuel consumption (CAFC) for a given company that produces these vehicles. This flexibility is intended to incentivize the production of fuel cell, electric, and plug-in hybrid vehicles.56

The NEV Mandate Policy: announced by MIIT in September 2017, the NEV Mandate Policy has far-reaching implications for all OEMs that have production plants and HQs in China. This legislation dictates that OEM’s in China have to acquire a sales volume of at least 10% in NEV credits in 2019 and 12% in 2020 (passenger vehicles only). Each NEV is worth a certain number of NEV credits depending on range and energy efficiency and/or rated power of fuel cell systems. The best performing NEVs can get a maximum of five credits with BEVs (who enjoy a credit average of 3.2) being favored over PHEVs (average of 2 credits per vehicle). Given that ICEVs are good for one credit per vehicle, this means that a 10% and 12% market share in NEV credits will roughly translate to a de facto NEV market share of around 3% in 2019 and 4% in 2020. NEV credit surpluses can be sold to OEM’s with a credit deficit.57

The Measures on the Joint Management of CAFC and NEV Credits: also released by MIIT and alongside the NEV Mandate Policy, this policy aligns CAFC with the Mandate Policy.58 OEMs can apply their NEV credit surplus to compensate when they fall short of their CAFC mandate. Excellent CAFC results can, however, not be used to compensate for an NEV credit deficit.59

Results

Together, these policies constitute the core of China’s governmental attempts to accelerate the adoption of NEVs. As we can see below, China has seen a dramatic surge in the sales of NEVs over the past years and currently constitutes more than half of the global market. China’s accomplishments regarding NEVs are without a doubt impressive and the country is, in many regards, leading the global transition from ICEVs to NEVs. Aside from its absolute sales numbers, its market share has increased as well from 0.4% in 2014 to 2.2% in 2017.60

According to the China association of Automobile Manufacturers (CAAM) 794,000 NEVs were produced in 2017, whereas 777,000 were sold. To be more specific: 478,000 passenger BEVs were produced and 468,000 were sold, while 114,000 passenger PHEVs were produced and 111,000 were sold. In addition, 202,000 commercial and public transport vehicles were produced whereas 198,000 were sold, the majority of them being BEVs.61

Currently, most studies find that electric vehicles do not represent a cost-effective mobility option compared to ICEVs. One study from 2015 said that, even with subsidies, fiscal incentives and tax exemptions, NEVs were still 1,4 times more expensive than ICEV counterparts over a 3-year period based on a driving distance of 16,500 km per year. The study argued that it would take until 2031 before NEVs in China would be as cost-effective as ICEVs without subsidies.62 Another study drew a similar

conclusion but noticed important differences between cities. Taking three of China’s best-selling BEVs (BAIC EV200, JAC iEV5 and BYD e6) and comparing them to similarly sized ICEVs (BAIC SHENBAO D50, JAC HEYUE A30 and BYD M6), this study also took into account a comprehensive set of factors such as purchase, maintenance, insurance and operating costs as well as resale value, subsidies, tax (exemption) and license plate auctioning. Assuming that these vehicles would drive 12,000 km per year and were in operation for 10 years, the study concluded that BEVs in general were more expensive than ICEVs, but that in some cities the total cost of ownership was almost similar due to the height of local subsidies. In first-tier cities – like Beijing and Shanghai – in particular, the expensive license plate regulations for ICEVs (see next chapter) were decisive in bringing down the costs of BEVs to a level similar of that of ICEVs. For example, in Beijing, the total cost of ownership for the JAC A30 and iEV5 models hovered slightly above 100,000 RMB (12,750 euro). However, without the financial benefits for BEVs, the life-cycle costs for the JAC iEV5 would have been more than 200,000 RMB (25,570 euro).

Electric buses: An area in which China absolutely dominates is that of electric buses and minibuses. In 2017, sales numbers were slightly above 100,000 units (BEVs constituting an 85% share), resulting in a total amount of 370,000 electric buses on China’s roads. In comparison, it is estimated that some 2,100 electric buses are currently in circulation in Europe, Japan and the US.

FCEVs: Least visible (both in relative as well as absolute numbers) is China’s FCEV fleet. According to the EV Global Outlook 2018, the US had the largest FCEV stock at the end of 2017 with 3,500 units, followed by Japan (2,300 units) and the EU (1,200 units). The exact number of FCEVs in China is unknown, but in 2017, 657 FCEVs were sold, and we can therefore assume that China’s FCEV fleet is likely to be slightly smaller than that of the EU. Notwithstanding, it is expected that China’s FCEV fleet will grow significantly in the coming years. Many hydrogen projects have been announced since the launch of the FCEV roadmap and CATARC officials disclosed that the roll-out of FCEVs and hydrogen

---

refueling stations are now policy targets of many municipalities.\(^65\) In addition, the Chinese government has invested some two billion euro in hydrogen R&D in 2017, while the EU and its member states combined spend some 200 to 250 million euros annually.\(^66\)

**Charging infrastructure**: according to various sources, China counted only 232,000 private chargers by the end of 2017.\(^67\) Given that China’s current NEV stock counts almost two million, this would indicate that the charger to vehicle ratio is very low. Private charging scarcity is supported by a survey of the University of California in Davis, claiming that only 45% of their Beijing respondents indicated that they had access to a private charger. However, another survey by the China Electric Vehicle Charger Infrastructure Promotion Alliance indicates that close to 80% of all NEV users owns a private charging pile.\(^68\) Possible reasons for the low number of private charging stations will be discussed in more detail in chapter 5. According to the Global EV Outlook 2018, the number of publically accessible chargers is only slightly lower than that of private chargers. In 2017, there were 213,903 public chargers, of which 130,508 were slow chargers and 83,395 were fast chargers.

This would make China the absolute frontrunner when it comes to the absolute number of public chargers. Nevertheless, the same UC Davis survey claims that only 41.5% of Beijing respondents agreed that “it’s easy to find a charging place around the residential community.” According to one scientific article, this relative shortage of publically accessible charging stations is the result of the Ten-Cities- Thousand-Vehicles program’s (see next chapter) emphasis on charging stations that are targeted at **fleet applications**. The research states that they are either geographically remote for private users or technologically incompatible for private cars.\(^69\) In addition to charging stations, China also plans to deploy 12,000 battery swap stations.\(^70\)

**Batteries**: lithium-ion batteries, the batteries that are used in PHEVs and BEVs play a key role in China’s strategy to become the frontrunner of the global NEV industry. The Chinese government has invested heavily in this sector and seven of the world’s twelve largest lithium-ion battery pack manufacturers are currently Chinese. Of these companies, BYD is currently the largest in China, but with comprehensive governmental support it is said that Contemporary Amperex Technology Ltd., (CATL) will become the largest battery manufacturer in the world by 2020, ahead of Tesla, BYD and LG Chem.\(^71\) In order to safeguard the rise of their NEV battery empires, Chinese companies have made aggressive moves to acquire lithium deposits throughout the world and it is estimated that China has already acquired 90% of the capacity to refine and process raw cobalt.\(^72\) Right now, roughly 60% of the world’s lithium-ion battery manufacturing capacity is controlled by Chinese companies and they are set to control future capacity as well.\(^73\)

**Policy shift: from support to coercion**

China’s commitment to NEVs is pushing the central government towards a daunting challenge, especially with regard to purchase subsidies. China might have the largest NEV fleet in the world, but its generous purchase subsidies and regional incentives (these will be discussed below) bear almost full responsibility for this growth. Moreover, a 2.2% market share might be relatively high, but is still only slightly higher than that of countries whose policies are far less comprehensive than that of China. This is significant because China’s policies are considered to be the world’s most ambitious alongside those

---

\(^{65}\) Zhang Changling (Automotive Technology and Research Center) ‘Interview’ (21 May 2018).


of Norway, whose 2017 NEV market share of 39.2% puts that of China to shame. Many experts (including individuals that were interviewed for this report) are therefore skeptical about China’s potential to reach its production and sales targets without subsidies.

However, maintaining – let alone increasing – subsidies after 2020 would be unsustainable as it is estimated that China’s purchase subsidies alone would cost Beijing some 12.8 billion euros in that year if China’s target of two million sold NEVs would be reached. In addition, an unforeseen side-effect of the subsidies is large-scale fraud and cheating. In 2015, 66% of all sold NEVs consisted of micro EVs that obtained up to 100.000 CNY (12.750 euro) in subsidies but had a market value of less than 50.000 CNY (6.370 euro). Another widespread illegal activity is the production of ghost fleets that have been sold on paper only. We can only guess at the magnitude of this problem as reports range from 8.015 vehicles claimed by the government (concerning a three-year period from 2013 to 2016) to the 76.000 cases that were claimed by a widely circulated report that had reported on the year 2015. If this report were to be true, as much as 22.4% of all 2015 would have been ghost vehicles. Whatever the number, one should take into account that China’s sales figures are most likely to be contaminated to at least some degree by cases of fraud and that the number of actual produced and sold cars is likely to be lower than the official figures of the China Association of Automobile Manufacturers.

As a result, central NEV policies are currently shifting from support to coercion (phasing out subsidies and replacing them with NEV credit mandates). But the government’s envisioned strategy to solve the subsidy problem by gradually replacing them with NEV mandates and fuel standards has also been met with skepticism. In surveys, many (potential) consumers of NEVs state that subsidies and regional incentives (license plates in particular, see next chapter), rather than ecological considerations, are the main drivers for purchasing an NEV. In fact, the world’s largest manufacturer of NEVs, BYD, saw its profits plunge with 34% in 2018’s first quarter after subsidies were lowered in the beginning of this year. Nevertheless, these challenges, uninvited side-effects and nuances do not take away the fact that China has taken bold steps and is now the undisputed frontrunner when it comes to large-scale adoption and production of NEVs.

---

75 Dominik Declercq, ‘Seminar on new energy vehicles’ (Beijing, 14 June 2018); Tyfield and Zuev, ‘Statis, dynamism and emergence of the e-mobility system in China, 263; Wang et al., ‘China’s electric car surge,’ 490.
76 Wang et al., ‘China’s electric car surge,’ 488.
77 Ibidem, 488.
Chapter four

NEV developments in China
Regional policies & protectionism

When taking a better look at China’s internal market, one can see that the eastern provinces are disproportionately well represented on the NEV market.

Figure 6 (Source: China Automotive Technology and Research Center)

A partial explanation for this is the regional discrepancy in economic development and median income. The wealthier provinces in the east make up some 85% of all NEV sales in China, while NEV deployment in Western China is virtually non-existent. Another glance at the chart above is that the provincial-level cities of Shanghai, Beijing and Tianjin rank among the best performing regions, even though their population levels are much lower. As centers of China’s economy, wealth and innovation, it is expected that NEV development takes place in cities. Nevertheless, just 30 out of China’s 100 metropolitan centers with more than one million inhabitants represented 84% of the country’s entire NEV market, while those same cities made up ‘only’ 26% of China’s total car sales. 80

The reason for this is twofold: these cities where the locations of the central government’s first NEV pilots; and their municipalities were the first to adopt local policy packages that helped to stimulate the growth of their local NEV markets.

Ten Cities, Thousand Vehicles Program (TCTV): this program, launched by the MoF and the MoST in China’s 13 largest cities in 2009, is one of the oldest and most important initiatives in the history of China’s NEV policies. The goal of this initiative is to experiment with and stimulate NEV adoption without the pressures of the market. It also prioritizes public transport and transport services through the creation of electric fleet programs in both sectors and stimulates municipalities to experiment with creative policies that assist cities to adhere to national goals and targets. 81 As a result, Chinese cities have a large degree of autonomy in the pursuit of NEVs. In 2016, 88 cities had joined the program and constituted the entire Chinese NEV market. In addition to the central policies, all these cities have created their own policy packages.

Regional policies

The 88 “new energy vehicle cities” in China have a broad range of direct and indirect incentives in place to stimulate the development of NEVs. The most important of these measures are:

**Local subsidies:** many Chinese cities offer local fleet and purchase subsidies in addition to the central subsidies. These can at most be 50% of the central subsidies (30,000 CNY or 3.800 euros) and often apply for all NEVs, with the exception of Beijing and Qingdao, where PHEVs are barred from obtaining subsidies. Important to note is that NEVs on the central subsidy catalogue do not automatically apply for local subsidies. Municipalities have often formulated their own unique set of technical and/or administrative requirements that vehicles or OEMs have to adhere in order to qualify for additional local subsidies. In addition, while central subsidies are scheduled to disappear after 2020, local subsidies are not. This does not mean that they are guaranteed to remain in place. In 2017, the central government had planned to abolish local subsidies due to rampant local protectionism (this will be explained in more detail below).

**License plate incentives:** In some Chinese cities, NEVs can get special green license plates that come with multiple benefits and are without a doubt one of the most important incentives alongside purchase subsidies. In fact, multiple surveys argued that, in some cities, license plate incentives were cited as more important than purchase subsidies. The reason for this has to do with the fact that regular license plates in several cities can only be obtained through lotteries or auctions at very high prices (up to 100,000 CNY or roughly 13,000 euros), while an NEV license costs around 125 CNY on average (16 euros) and is even free in some cities. In addition, NEV license plates are exempted from road rationings that are in place in several Chinese cities (in various megacities, regular cars are prohibited from driving once a week or when pollution levels are exceptionally high).

**Public transport and car-sharing programs:** Similar to the Netherlands, many Chinese cities regard the electrification of public transport as a first important step towards a broader transition from ICEVs to NEVs. As a result, many Chinese cities have stimulated and financed the introduction of electric buses and taxis. Some cities have also launched electric car-sharing initiatives and car rental services that help to familiarize car users with NEVs. As we will see below, the emphasis on public transport and car-sharing programs have resulted impressive results.

**Other incentives:** aside from local subsidies and special license plates that come with benefits for NEVs, there are numerous other incentives that stimulate the adoption of NEVs. The most common are: vehicle tax incentives, reduced parking fees, designated parking lots, charging fee reductions, charger subsidies, vehicle replacement subsidies, reduced car insurance fees, road toll incentives, bus lane access and electric car rental subsidies.

**Prominent cities**

Beijing, Shanghai and Shenzhen rank among the earliest and best performing NEV cities in China, but also worldwide. As first-tier cities, they count as models for many other Chinese cities.

**Beijing**

<table>
<thead>
<tr>
<th>Type</th>
<th>BEV</th>
<th>PHEV</th>
<th>FCEV</th>
<th>Passenger</th>
<th>Bus</th>
<th>Commercial</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sold in 2017</td>
<td>59,879</td>
<td>691</td>
<td>30</td>
<td>50,543</td>
<td>6,169</td>
<td>3,888</td>
<td>60,600</td>
</tr>
</tbody>
</table>

In 2015, Beijing handed out local subsidies (only to BEVs) that were up 100% that of central subsidies. Now that the central government has dictated that local subsidies can only be as high as 50% of the

---

central subsidies, Beijing has changed their height accordingly. Arguably more important than subsidies are the 60,000 special license plates that the municipal government grants to BEV users every year (owners of ICEVs have to participate in a license plate lottery with a very slim chance of getting one).

In a survey by CATARC, 64% of 200 individual BEV owners indicated that NEV license plates were the most important factor in their decision to purchase BEVs and 52% said that they would have bought an NEV if Beijing had not issued these license plates. Other measures that Beijing has are exemption from vessel and vehicle tax; charging fee reductions; exemption from purchase restrictions; light-duty ICEV restrictions from entering Beijing’s fifth ring road during weekdays; and taxi purchase and usage fee reductions. The latter incentive has been linked to Beijing’s current project that aims to replace all of the city’s 69,000 taxis with BEVs. In a similar fashion, Beijing has succeeded in its goal to introduce 4,500 electric public transport buses by the end of 2017 and is now aiming to reach the 10,000 mark in 2020.

### Shanghai

<table>
<thead>
<tr>
<th>Type</th>
<th>BEV</th>
<th>PHEV</th>
<th>FCEV</th>
<th>Passenger</th>
<th>Bus</th>
<th>Commercial</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sold in 2017</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Counting 178,658 NEVs and 127,700 charging points (public and private), Shanghai is considered to be the NEV capital of the world. Its purchase subsidies for private consumers and fleets used to favor PHEVs but are increasingly focusing on BEVs. PHEVs can get up to 30% of central subsidies, while BEVs get up to 50%.

Like in Beijing, the NEV license plate is often cited as the most important driver of NEV adoption as it bypasses Shanghai’s expensive license plate auction system. Aside from that, NEVs enjoy free parking in Shanghai’s city center; discounted public charging fees (NEV owners pay only 32 CNY or 4 euros when charging their car at a public station); exemption for vessel and vehicle tax; taxi purchase and usage fee reductions and battery recycle subsidies (up to 1,000 CNY or 127 euros per battery for OEMs). Shanghai is home to the world’s largest NEV car-sharing program. The company EV Card owns more than 30,000 NEVs for shared use in some 40 cities and the majority of these cars can be found in Shanghai.

### Shenzhen

Shenzhen has enjoyed a lot of admiration from all over the world in recent years and is often called the Silicon Valley of Asia. It is home to many digital and high-tech companies like Huawei and Tencent as well as the world’s largest manufacturer of NEVs, BYD and the vast majority of China’s lithium-ion battery producers. Sales volumes for 2017 are unavailable, but according to figures of the International Council on Clean Transportation, Shenzhen occupied the third place in absolute numbers behind Shanghai and Beijing respectively in 2015 (18,000 units) and 2016 (48,000 units).

Given that Shenzhen’s province – Guangdong – led the 2017 sales volumes with a large margin, we can assume that the first-tier city performed very well. Moreover, with 14,409 new electric buses, Guangdong acquired almost twice as much as the province with the second-highest electric bus sales, Hunan (7,830 electric buses). This high figure is indisputably the result of Shenzhen’s most well-known

---

85 Wang et al., ‘China’s electric car surge,’ 488.
policy achievement. In the fall of 2017, the city was the first in the world to successfully electrify its entire bus fleet (16,359 units) after the government had set this target a few years earlier. Shenzhen is determined to do the same with all of its taxis before the end of 2018, possibly becoming the second city ever to do so (the city of Taiyuan in Shanxi province was the first).

Aside from its ambitious fleet programs, Shenzhen also has in place other incentives: Purchase subsidies up to 50% of central subsidies; license plate incentives; equipment investment subsidies for companies; R&D subsidies; service trade subsidies; import subsidies; first-hour free parking for NEVs; charging fee cap at 0.45 CNY (0.6 euro) per kilowatt (which is even lower than what Shanghai offers); a one-time vehicle usage subsidy in addition to the purchase subsidy of 10,000 to 20,000 CNY (1.275 euros to 2.545 euros); subsidies for public charging infrastructure; and battery recycling subsidies based on battery capacity.

Local protectionism

The ambitious targets, comprehensive policies and impressive NEV growth rates in Chinese cities make them the ideal markets for manufacturers and suppliers of NEVs, their components and related products. They certainly are to some extent, but – as was already mentioned briefly – not for everyone.

The figures below and on the next page show how some brands dominate the markets of specific Chinese cities and this is far from coincidental. In Wuhu, for example, Chery is virtually the only player in town and also happens to be headquartered there. Lifan’s domination in Chongqing is due to its production plants in that city, while its headquarters are in Zhengzhou. BAIC is from Beijing and JAC and JMC are headquartered in Hefei and Nanchang respectively. Automaker Kandi has production plants in Huzhou and Haikou and is headquartered in Hangzhou, which is also its largest market. Zotye has production plants in Xiangtan, Yichun and Changsha. Zhidou has production plants in Lanzhou and Ningbo and is headquartered in Linyi. It was already mentioned that BYD is an OEM based in Shenzhen while it happens to have a manufacturing plant in the city of Xi’an.

Market share of OEMs in Chinese cities (2015)

These are quite obviously signs of local protectionism. Cities with subsidy catalogues in place formulated all kinds of criteria that coincidentally favored their local OEMs. In fact, until 2013, not one city had given subsidies to non-local NEVs and it was not until the government dictated that at least 30% of local subsidies should be handed to non-local models, that this changed somewhat. As was mentioned, Beijing and Qingdao are China’s only two cities to exclude PHEVs from their catalogue.

Source: International Council on Clean Transportation

---

This favors Beijing’s, one of the few OEMs that happens to have no PHEVs models. BAIC also happens to have a manufacturing base in Qingdao. But even for non-local producers of BEVs it is hard to acquire subsidies in Beijing. Up until recently, most OEMs even had to pay the Beijing municipal government a substantial sum in order to be put on the catalogue.90

Figure 8 (Source: International Council on Clean Transportation)

In 2015, Hefei lifted the minimum electric range requirements to 150 km, which was almost twice the range requirements for the central subsidies. This excluded mainstream models like Zhidou and Kandi but included the J3EV and J5EV models by local carmaker JAC. Shenzhen even requires NEVs to have an electric range of over 300 km, a criterion that only the BYD e6 model could achieve at the time that this requirement was put in place. In addition, Shenzhen requires non-local OEMs to establish sales subsidiaries with assets worth at least 50 million CNY (6.3 million euros) in the city. This is the main reason why the central government wanted to abolish local subsidies. If OEMs face competition in their largest markets, then innovation and well thought out market strategies are unlikely to prevail.

The chart below shows the major sales territories of OEMs in 2015 (more recent figures are hard to come by as OEMs tend to be very secretive about detailed sales figures). In many instances, their most important markets are also home to their headquarters or a manufacturing base. Only for BYD and JAC Motors the most important market were cities where they did not have a facility.

**Largest NEV markets of Chinese OEMs (2015)**

<table>
<thead>
<tr>
<th>BYD</th>
<th>Kandi</th>
<th>Zhidou</th>
<th>Zotye</th>
<th>BAIC</th>
<th>SAIC</th>
<th>JAC</th>
<th>Chery</th>
<th>Lifan</th>
<th>Denza</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shanghai 49%</td>
<td>Hangzhou 32% HQ</td>
<td>Linyi 15% HQ</td>
<td>Changsha 40% MB</td>
<td>Beijing 65% HQ</td>
<td>Shanghai 96% HQ</td>
<td>Beijing 53%</td>
<td>Wuhu 44% HQ</td>
<td>Chongqing 62% HQ</td>
<td>Shenzhen 65% HQ</td>
</tr>
<tr>
<td>Shenzhen 25% HQ</td>
<td>Haikou 7% MB</td>
<td>Lanzhou 14% MB</td>
<td>Qingdao 21% MB</td>
<td>Shanghai 15%</td>
<td>Shanghai 14%</td>
<td>Shanghai 22%</td>
<td>Beijing 10%</td>
<td>Chengdu 10%</td>
<td>Shanghai 4%</td>
</tr>
<tr>
<td>Xi’an 6% MB</td>
<td>Tianjin 7%</td>
<td>Guangzhou 13%</td>
<td>Wuhan 9%</td>
<td>Qingdao 6% MB</td>
<td>Shenzhen 7%</td>
<td>Shenzhen 24% MB</td>
<td>Beijing 28%</td>
<td>Chengdu 24% MB</td>
<td>Shenzhen 28%</td>
</tr>
<tr>
<td>Tianjin 4% MB</td>
<td>Kunming 7%</td>
<td>Qingdao 10%</td>
<td>Xiangtan 7% MB</td>
<td>Shenzhen 4%</td>
<td>Hefei 7% HQ</td>
<td>Linyi 7%</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Guangzhou 4% MB</td>
<td>Huzhou 6% MB</td>
<td>Changsha 9% MB</td>
<td>Yichun 5% MB</td>
<td>--</td>
<td>Wuhan 6% MB</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Beijing 4%</td>
<td>Guangzhou 6%</td>
<td>Ningbo 8% MB</td>
<td>Linyi 4% MB</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Linyi 5%</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Chengdu 5%</td>
<td>Hangzhou 5% MB</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Shenzhen 4%</td>
<td>Wuhu 4%</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Taiyuan 4%</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Figure 9 (Source: International Council on Clean Transportation)

---

90 René Bohnsack, ‘Local niches and firm responses in sustainability transitions,’ 27.
National protectionism

The fact that the Chinese government wants to root out local protectionism does not mean that central policies are devoid of protectionism. While more than half of the market share of ICEVs is made up out of foreign brands, only 4% of NEVs sold in China in 2017 were of foreign origin. Of this 4%, the vast majority were Tesla models. Whereas requirements for local subsidies are the source of local protectionism, so are requirements for central subsidies the main reason why the NEV share of foreign OEMs in China is so marginal. the Recommendation Catalogue (the NEV subsidy catalogue), issued by MIIT, has formulated various prerequisites that NEV models have to adhere in order to be eligible for subsidies. These virtually disqualify all foreign brands and vehicles. Right from the beginning, when subsidies were made available for passenger NEVs in 2010, the central government excluded conventional hybrids from the catalogue because no domestic carmaker made commercially viable hybrids at the time and subsidies could therefore only benefit foreign OEMs, especially Japanese companies.91

Imported vehicles too are not eligible for subsidies.92 This is significant due to the fact that, up until July 2018, the Chinese government charged a 25% import tariff on imported cars (currently, this is 15% for most imported vehicles, with the exception of American models – who enjoyed the lower tariffs for just five days when the escalating Sino-American trade conflict moved China to reverse tariffs for American vehicles back to 25%). Excluded from subsidies and with a 15 to 25% price increase, most foreign NEVs are unable to compete with Chinese counterparts (Tesla, whose cars are currently all imported, forms an exception to the rule due to its status as a luxury brand). High import tariffs have moved virtually all non-Chinese OEMs to open up production plants in China. However, OEMs that want to do so have to establish a 50/50 joint venture with a Chinese counterpart with whom they have to share their technology and operational strategies. As a result, virtually all Audis, Volkswagens, Toyotas and Nissans that can be seen on the Chinese roads today are locally produced and in collaboration with their local partners. The reason why one sees plenty of regular Volkswagen Magotans (the Chinese version of the Passat) but not a single NEV version of it, has to do with the fact that joint ventures are not eligible for central subsidies if they manufacture their NEVs under a foreign brand. Instead, they have to establish whole new one and this disables the very important branding aspect that foreign OEMs depend on.

![Best-selling passenger models China (2017)](image)

Figure 10 (Source: Clean Technica)

91 René Bohnsack, ‘Local niches and firm responses in sustainability transitions,’23.
92 Ibidem, 25.
Another sign of protectionism is that models with non-Chinese NEV batteries are excluded from subsidies as well. One important aspect of China’s desire to become the global NEV market leader are its investments in a domestic battery industry. Currently, three out of the seven largest lithium-ion battery producers in the world are Chinese (BYD, Wanxiang and Lishen) and all of them have ambitious goals to become global leaders. Their products are, however, considered to be inferior to those of their Asian competitors Panasonic and LG, so in order for the Chinese companies to catch up (or that is the idea at least), the Chinese government has barred foreign battery makers from the NEV market.93

The combination of central and local protectionism and the MIC2025 policy has made it virtually impossible for foreign OEMs to compete with the local players and foreign OEMs were concerned about their future in China when MIIT announced its NEV Mandate Policy in the fall of 2017. Many foreign OEMs had, up until then, not really bothered with NEVs in China, but most of them have now announced that they will launch NEVs in the upcoming years. However, because they cannot release them under their mother brands, it will be a challenge for these models to compete with much better established local ones.

**A brighter future?**

Despite the virtually impossible position that most non-Chinese manufacturers of NEVs find themselves in, there is a case to be made that their prospects will be better in the not too distant future and that the Chinese NEV market is opening up.

Throughout this report, it has become clear that protectionism surrounding NEVs is predominantly linked to the central and local subsidies and at least the central ones are scheduled to be phased out entirely by 2020. It is yet unclear what will happen to the local subsidies, but given their tendency to facilitate local protectionism and slow down innovation and healthy competition, the central government’s earlier attempt to do away with them, it is possible that the former will not outlast the central subsidies for very long. Moreover, unlike central subsidies, regional subsidies can be given to imported vehicles (Beijing has included Tesla’s S and X models in its subsidy catalogue) and since all large brands have production plants in China and have partnered up with Chinese OEMs, it would be unthinkable that Shanghai – to name but one example – would not give subsidies to Volkswagen models (Volkswagen has partnered up with SAIC, a Shanghai-based brand, and has its headquarters as well as a production plant in Shanghai).

**Introduction foreign brands:** A sign that non-Chinese OEMs have confidence in the post-subsidy future is that many of the major brands have recently announced to release NEVs under their own brands around 2020. During Chinese premier Li Keqiang’s visit to Germany in July 2018, Volkswagen announced that it aims to sell around 1,5 million NEVs in China by 2025 under local brands, but also under its foreign brands Volkswagen, Audi, Skoda and Seat.94 Similar announcements have been made by Honda and Toyota who also announced to launch NEVs under their own brands by 2020,95 while Nissan is scheduled to launch a model as soon as 2018. BMW even announced that it would manufacture and export its iX3 electric crossover in and from China to Europe and not the other way around like it currently does with its i3 model.96

**Market liberalization...** It was already mentioned that, as of July 2018, import tariffs were lowered from 25 to 15%, but around the same time another major development took place. A week after

---


president Xi Jinping expressed his wish to see the joint venture mandate abolished, the MIIT published a roadmap wherein it announced the gradual phasing out of this regulation that had been in place since 1994. Non-Chinese OEMs that only produce NEVs are the first ones allowed to establish full-owned operations on the Chinese mainland as of 2018. As a result, Tesla said that it would establish a production plant in China and recently announced the construction of second one. In 2022, the joint venture mandate will be completely abolished when manufacturers of passenger ICEVs will be allowed to settle in China without a local business partner.

A final sign that hints towards the gradual liberalization of the Chinese NEV market is the fact that the central government is implicitly acknowledging that its protectionist policies have backfired. The generous central subsidies and the protectionist local subsidies have given birth to a multitude of small NEV builders that depend to a significant degree on financial support from the government. In some cases, the primary business model was to earn profits by obtaining subsidies rather than selling cars. Aside from this, the dependence on subsidies and the sheltered environment in which they operate have resulted in low-quality vehicles that are identical to one another and lack the innovative progress that the central government is looking for. Aside from phasing out its subsidies and introducing the NEV Mandate Policy, the government is also letting go of some of its stagnant state-owned companies by cutting their financial support and urging them to attract private investors.97

...Or not? Many developments thus hint at a market that will soon see an increase of foreign OEMs and many agree. Nevertheless, other experts are much more skeptical. During a seminar that was organized by the Embassy of the Netherlands in Beijing, one speaker and expert on the Chinese automotive industry commented on the current trends in China’s automotive market. He said that every mentioning by China that it is opening up is a mere lip service and that the only progress visible in China, are incremental market improvements or modifications of problematic Chinese regulations that should have never been issued in the first place.98 He continued to explain this by referring to the lifting of the joint venture mandate and the lowering of the import tariffs that had, allegedly, come twenty years too late. By now, OEMs and other automotive companies have already established good partnerships that they do not want to abandon and the fact that most non-Chinese OEMs have localization rates of almost a 100% makes the lowering of tariffs de facto insignificant for them. Aside from Tesla’s announcement to set up shop in Shanghai, this observation rings true, as virtually all non-Chinese OEMs reaffirmed the importance of their partnerships. For example, a senior executive of General Motors plainly stated that GM would not be successful in China on its own and stressed the importance of its partnership with SAIC.99 Thus, foreign companies are likely to strengthen their partnerships rather than abandoning them. In fact, many foreign companies that are not even obliged to partner up, often choose to do so in China, because they feel compelled to do so if they want to expand their operations in China.

Another obstacle that optimists will have to keep in mind is the MIC2025 policy. Its goal is to increase the number of Chinese cars and products within the NEV industry and, as a result, the central government might push forward other protectionist regulations as long as China’s market is not yet self-supportive. However, one other speaker at the seminar on NEVs reminded the audience that MIC2025 is not a binding document and should be interpreted as a call to arms for Chinese OEMs to perform better and increase their competitiveness in order to challenge non-Chinese companies through the market, rather than by means of protectionism. According to him it seemed contradictory to open up the market in order to stimulate more competition and healthy innovation by the Chinese companies by subsequently barring OEMs again and thereby stifling the performance growth of Chinese NEVs.100

98 Stefan Bernhart, ‘Seminar on new energy vehicles’ (Beijing, 14 June 2018).
100 Declercq, ‘Seminar on new energy vehicles’ (Beijing, 14 June 2018).
Chapter five

Market opportunities for the Dutch NEV sector in China

It became clear in the previous chapter that non-Chinese brands make only make up 4% of NEVs in China and that the lion share of this small percentage consists of Tesla models which, in China, are viewed less as environment friendly NEVs than as luxury cars with brand appeal. Nevertheless, how bleak the current position of non-Chinese NEVs might be, there is a realistic chance that foreign brands might be increasingly represented on the NEV market from 2020 onwards.

But how about the Dutch NEV industry? What are the possibilities for companies within the industry’s four clusters? After all, the Netherlands does not have any large OEMs and neither protectionism from subsidies nor a system of ZEV credits does not affect charging stations, components or services. The only Chinese policy that seems to be threatening for Dutch products is MIC2025 but, as was discussed in the previous chapter, this policy might very well be a loose goal rather than a binding regulation. So, from the onset, prospects for Dutch companies look much brighter.

In this chapter, it will be argued that there are indeed opportunities for the Dutch NEV industry, but it will also become clear that opportunities are only evident in specific areas and that for some clusters, possibilities to set up lucrative businesses in China are very slim. First, the specific opportunities and obstacles for the four Dutch clusters in China will be discussed and this chapter will end with a more general explanation of the Chinese market and what elements impact the functioning of foreign enterprises.

Charging infrastructure and smart grids

Given the alleged shortage of charging points (13% of respondents of the UC Davis survey mentioned in the previous chapter said to charge their NEV via an unsafe fly-line from their home wall outlets101) in China and the fact that Dutch companies are considered to be the global market leaders, one would assume that the Chinese market would have plenty of opportunities in store for Dutch charging infrastructure companies. This, however, seems not to be the case.

Absence of activities in China: The first observation that can be made is the complete absence of Dutch charging infrastructure companies in China. Prominent players like EV-Box and Heliox have a global footprint, but not a single one of them is active in China. This is not because these companies have not yet explored their opportunities in China. In fact, virtually all large players have been involved in company and state visits or have attended conferences in China in order to explore the potential of the Chinese market. Nevertheless, none of them came back with any business deals, let alone plans to set up shop in China.102

One company that has explored the Chinese market but did not see any opportunities is Fastned. As was explained in the second chapter, Fastned owns infrastructure and sells the electricity that is needed for NEVs. This is a very localized practice because it is a service business wherein language, knowhow of cultural practices and the acquisition of permits are of key importance and this is exactly what makes that the cons outweigh the benefits. Linguistic and cultural barriers are general obstacles for non-Chinese companies that aim to do business in China. Many Chinese consumers and entrepreneurs do not speak any language other than Chinese and a business and consumer culture that is vastly different

---

101 Wang et al., ‘China’s electric car surge,’ 488.
102 Dick de Jongste and Leon Liang (Teesing), ‘Interview’ (8 June 2018).
than that of the European market makes it much harder for a company like Fastned to be successful in China. Even more difficult is the acquisition of permits and the purchase of infrastructure in China. In the Netherlands, the power grid is privatized, in China this is not the case. China’s grid is almost completely owned by the Chinese state through two gigantic electric utility companies: the State Grid Corporation of China (responsible for the masterplan of providing national charging infrastructure) and the China Southern State Grid Company. These two state-owned enterprises operate virtually all charging stations on the country’s roads and highways, leaving only residential, office or commercial real estate open for private investment.  

Private and smart-charging: However, providers of charging systems will find that these markets also lack attractiveness. The vast majority of the urban population in China lives and works in high-rise buildings and do not own their own parking spaces. In many cities, property management companies are required by law to provide residents with a personal (underground) parking space, which is a very expensive endeavor. The efforts of local governments to formulate similar requirements with regard to charging piles has been met with fierce resistance by property management companies and has been unsuccessful so far.

An additional hurdle that undermines smart-charging solutions in particular is that electricity prices in China are much cheaper than in European countries (some 0.07 eurocents per kilowatt hour compared to 0.28 eurocents in Germany). This reduces the incentives for consumers to invest in smart-charging systems and another possible obstacle is that it has been said that Chinese NEV owners make use of the high availability of security guards at residential areas. For small fees these guards make sure that all NEV owners have their cars charged during the cheap nightly hours at charging points in or around the residence. These inconveniences come on top of the fact that smart-charging is likely to be uninteresting for most of China’s state-owned electricity companies in general. Whereas Dutch grid company Eneco regards spin-off smart-charging startup Jedlix as a strategy to draw NEV buyers away from competitors, the monopoly position of state-owned electricity providers makes a similar approach in China redundant. In any case, the difficulties with private charging is probably the reason why charging infrastructure in China is much more focused on the roll-out of large-scale fast-charging stations and experiments with battery-swapping.

Hardware: Regarding market opportunities for charging infrastructure, this only leaves hardware on the table of options, but even here the possibilities are likely to be ambivalent. Charging piles made and sold in the Netherlands tend to be much more expensive than Chinese charging piles. Shenzhen-based Chargerlink, for example, sells products that are similar to Dutch charging piles for about a quarter of the price. Slow-chargers are, after all, not much more than basic charging outlets and do not require state of the art technology to provide electricity to an NEV. If anything, Dutch producers of charging piles and wall boxes should anticipate an influx of much cheaper Chinese products into the Netherlands in the future. In order to prepare for such an event and drive the prices of their own products down, Dutch companies could consider moving their production sites to China and export to the European market from there.

Fast-charging hardware, on the other hand, is one of the few areas where non-Chinese chargers seem to be doing well. The most cited example is the supercharging network that Tesla has built throughout China’s largest population centers, but an even larger network has been rolled out by the European multinational ABB in cooperation with NEV manufacturer Denza. With 12,000 stations built in 2016,  

---


104 Tyfield and Zuev, ‘Statis, dynamism and emergence of the e-mobility system in China,’ 263.


106 Michiel Langezaal (Fastned) ‘Interview’ (4 July 2018).

ABB was the only non-Chinese company to reach the top five of fast-charging companies in China in terms of quantity.\textsuperscript{108} ABB’s success has to do with the often unreliable and inferior quality of Chinese fast-chargers, that require more complex technology than regular chargers (a lot more power is required for fast-charging), which makes the AC/DC converter a lot bigger and heavier – some 400 kg –requiring it to be outside of the car and thus within the fast-charger itself.

That being said, ABB did face some obstacles. Their Chinese clients demanded large quantities of fast-chargers in a very short time-span (this seems to be a recurring phenomenon in China that companies should be aware of) and were less inclined to pay generously for ABB’s high-quality products. Thus, ABB had to re-design their fast-chargers and take out or replace expensive components to make their product cheaper, but without losing much of its quality.\textsuperscript{109}

\textbf{Propulsion technology and components}

In comparison to the former cluster it appears that the opportunities for the cluster Propulsion technology and components is much more promising. In fact, an impressive number of companies are already active in China and many of them have been for quite some time. On top of this, China lowered the import tariffs of car components from 10 to 6\% in July 2018, which is excellent news for suppliers who, unlike OEMs, still export to China in large quantities.\textsuperscript{110}

In fact, NXP has been active in China since 1986 and with 14 offices throughout China and some 7,000 employees, China is their largest branch and market. In an interview the company stated that, as innovative and market leaders in automotive chips, they face little competition from domestic players, due to them lagging behind in the semiconducting industry. They currently provide power electronics for NEV batteries and welcome the transition towards NEVs – especially in combination with the rise of autonomous, connected and shared forms of mobility – with confidence. The company is, however, thoughtful of the MIC2025 policy that has identified emergence of a domestic semiconducting industry as a priority. In practice, this means that NXP seeks to safeguard its intellectual property and leading technology, making sure that it will not be copied by Chinese competitors.

\textbf{Components}: Coating companies AkzoNobel and DSM have been active in China as well. AkzoNobel’s largest powder coatings plant opened in the spring of 2018 in Changzhou and will serve the automotive industry among other industries.\textsuperscript{111} Chinese regulations surrounding coatings and chemicals might in fact be one of the few areas where policies benefit non-Chinese companies. In recent years, the central government has cracked down on companies that violated environmental regulations.\textsuperscript{112} AkzoNobel and DSM are in a good position to adhere to these regulations and combined with their global footprint, experience in China and leading position in the coatings market, they are much better equipped to lead the way in this area and perhaps battery coatings in the future.

Manufacturers of NEV components, e-Traction and Prodrive Technologies, are the living proof of the demand for high quality NEV products in China: e-Traction was able to expand to China after the Chinese Tanhas Group acquired all of their shares in 2016. Their electric drivetrains for buses are now rolling off the assembly line in a newly opened production plant in Hubei province, while their R&D

\begin{footnotesize}
\textsuperscript{108} EE News Automotive, ‘ABB in top five suppliers of charging stations in China,’ 16 June 2016 (accessed 24 July 2018) 

\textsuperscript{109} Langezaal, ‘Interview’ (4 July 2018).

\textsuperscript{110} Automotive News China, ‘China lowers tariffs on imported vehicles to 15\%,’ 3 July 2018 (accessed 24 July 2018) 

\textsuperscript{111} AkzoNobel, ‘AkzoNobel’s largest powder coatings plant opens in China,’ 29 May 2018 (accessed 24 July 2018) 

\textsuperscript{112} Reuters, ‘Chinese chemical producers curb output on new round of inspections,’ 7 May 2018, (accessed 24 July 2018) 
\end{footnotesize}
department remains in the Netherlands. Prodrive expanded to China independently and owns a plant in Suzhou. Their NEV products for the Chinese market are currently in the R&D phase and scheduled to leave the assembly lines in 2020. Like NXP, Prodrive expressed the challenge of safeguarding their technology and intellectual property from being copied.

Teesing has been active in the Chinese natural gas sector for years and with the support of the Dutch government they have been involved in a large natural gas project in China. However, due to the disappearance of government support for natural gas in 2015 and new ambitions, their focus has shifted towards hydrogen. Their largest client, the Langfang-based ENN Group, is increasingly interested in hydrogen and Teesing’s expertise in this field has resulted in the fact that their hydrogen tubes and filling nipples for FCEVs and hydrogen refueling stations can be found throughout China. In fact, Teesing said that virtually all FCEVs in China have their products in them. The company is quite positive that there is a market for Dutch key hydrogen components in China. Teesing voiced the same concerns as NXP and Prodrive and also advised that companies should be aware of the large quantities that Chinese clients are inclined to demand over a short period of time. According to them it is not recommended to promise quantities that are simply unfeasible and that suppliers would do well to demand an exclusive distributor agreement and a certificate for payment as well.

**Manufacturing and conversion**

The prospects for this cluster are rather mixed. For the most prominent industry, the manufacturing of electric buses, the possibilities are virtually non-existent. The Chinese electric bus industry and market are much larger (370,000 units) than their European counterparts (approximately 1.000 units). Although VDL Bus & Coach might be the market leader in Western Europe, they are not in a position to satisfy the much larger demand of buses in China. An additional hurdle is the fact that the implementation of public transport in China is to a large degree dependent on decisions made by municipalities and regional governments. Electric buses are, much more than passenger NEVs, an easy way for China to bolster its domestic NEV industry and therefore prone to protectionism. A scenario wherein Dutch electric buses will be produced for the Chinese market seems very unlikely. If anything, Chinese electric buses are likelier to compete with VDL and Ebusco for the Dutch market than the other way around (in fact, electric buses made by BYD are already operating at Amsterdam Airport). That being said, VDL also produces electric bus components and these are much more likely to succeed on the Chinese market (e-Traction, for example, produces electric drivetrains for Chinese buses).

**Hydrogen conversion:** With regard to the conversion sector, prospects are more promising but only for hydrogen. In 2017, Arnhem-based companies HyMove and Nedstack have partnered up with Wuhan-based companies Huaxia and Dongfeng Motors in order to convert regular Chinese heavy-duty vehicles to FCEVs. HyMove produces fuel cell systems in China, while Nedstack exports its key components from the Netherlands. This Sino-Dutch collaboration also signifies a special partnership between Arnhem and Wuhan, the capital of Hubei province, as both cities are hydrogen hotspots and foster that reputation through investments in hydrogen-related activities. The big investments and increasing attention that hydrogen receives in China might be interesting for Dutch companies in general. Despite their ambitions, many Chinese companies have a lack of experience and expertise in the field of hydrogen and Dutch companies might benefit from this. Especially in the less-developed regions of China hydrogen is said to be high on the agenda. The large coal and steel plants there produce large quantities of hydrogen, which could be converted to hydrogen-based fuels and electricity.

---


amounts of hydrogen as a waste product and the much colder winters undermine the performances of BEVs.116

Services

The cluster ‘services’ is unlikely to be successful on the Chinese market. The reason for this has to do with the fact that car and ride sharing, city logistics, lease, payment and taxi services are often very localized and require a thorough understanding of the Chinese market and its consumers. Besides, the country already has a highly advanced array of financial, payment and mobility services in place that differ greatly from those in the Netherlands and are integrated within the platforms of digital giants such as Tencent and Alibaba. In addition, the already restrictive Chinese market is even more closed to foreign companies whose services depend on gaining access to the more sensitive parts of China’s digital infrastructure (maps, finance, payment, etcetera).

The experience of ridesharing giant Uber might be the most striking example why NEV-related service companies from the Netherlands are unlikely to succeed in China. When Uber first entered the Chinese market, its revenues were fairly positive and Uber even benefited from the poor quality of the services of its main competitor, Didi Chuxing. However, Uber eventually drew the shortest straw and had to bail out of China in 2016 after Didi had improved its product and, more importantly, received huge financial investments from (partially) state-owned funds while also merging with another Chinese competitor. The crucial blow to Uber was when Alibaba and Tencent partnered up with Didi, effectively disabling Uber from making use of China’s primary facilitators of digital payment in China, WeChat pay and Alipay.117 Uber’s short-lived adventure in China is far from an isolated case. Many foreign providers of services (eBay, Groupon and Home Depot) have attempted to conquer the Chinese market in the past but failed miserably.

China’s unique market

The Chinese market is very different from other markets in many respects. The country has been cut off from the rest of the world for a long time and it is only since a few decades that international trade and commerce have made their way into China. More than a billion consumers and an expanding economy have lured countless foreign companies to China ever since. Hoping to get a slice of its gigantic market. Many of them were unsuccessful due to their failure to localize their operations. Instead of catering towards the Chinese market, they often made the mistake of trying to alter the market and apply the same strategy to China as they would have used for other countries. Such an approach has proven to be unsuccessful in many instances.118 Indeed, successful companies in China, like NXP, have almost completely decentralized their Chinese operations. NXP China operates as a de facto independent company and is Chinese in almost every aspect except for their products. Contrasting the success of NXP is the failure of eBay. While this e-commerce giant was expanding successfully to numerous countries, it left China with its tail between its legs in 2010 after it had been struggling there for eight years. eBay’s failure is often attributed to its global strategy and top-down governance structure, meaning that overseas operations were being managed along similar lines by people from the head office in California. As a result, eBay was unable to integrate Chinese culture and consumer habits

116 Yi Chen (Tongji University) and Huiping Liu (Shanghai Municipal Development and Reform Research Institute) ‘Sino-Dutch Round Table on New Energy Vehicles,’ (14 April 2018); Zhang, ‘Interview’ (21 May 2018).
117 Quartz, ‘Uber is complaining that it has been scrubbed from WeChat in China,’ 24 August 2015, (accessed 25 July 2018) https://qz.com/486060/uber-is-complaining-that-it-has-been-scrubbed-from-wechat-in-china/.
118 Tom van Dillen, ‘Seminar on new energy vehicles’ (Beijing, 14 June 2018).
into its product and failed to compete with immensely popular Taobao, a local counterpart that was launched a year after eBay had entered the Chinese market in 2002.119

**Joint ventures:** The unique and challenging nature of the Chinese market has led many non-Chinese companies to establish joint ventures with local companies. Through this way it is much easier for the former to gain access to the right contacts within central and regional governments, to gain the trust of potential business partners and gain a better understanding of the intricacies of the Chinese market. Much more than in Europe, a productive relationship in China is based on trust, bonding through rituals, entertainment and the exchange of gifts and favors and partnerships with local players can help to smoothen these processes. This is the reason why some view the phasing out of the joint venture mandate for OEMs by the central government as a symbolic gesture rather than a concrete step away from protectionism and towards market liberalization. Many companies – including NXP, HyMove and Nedstack, that are not obliged to partner up, have all done so in order to improve their chances on the Chinese market.

**Global footprint:** Nevertheless, there are numerous examples of non-Chinese companies that seem to function just fine without a joint venture and success in China depends to a large degree on a company’s ability to make itself interesting for the Chinese market. During the aforementioned NEV seminar, the importance of a global footprint was mentioned as being very important. “It was said that companies with experience on the international market should utilize this to their advantage, as this is being considered of enormous importance by potential business partners from China. This has to do with reputation, but also because it is interesting for Chinese companies to expand internationally themselves. Dutch companies with a global footprint could offer and share their knowledge and knowhow of the international market and provide Chinese companies with international ambitions with a window of opportunity to get to know the global market and how to operate internationally.”120

It was also noted that Chinese consumers demand and appreciate new and innovative products that are instantly available. If it is not instantly there or working, it is much less interesting for the Chinese consumer. 121 This echoes the experiences of companies like ABB and Teesing, who noted the short-term demand of large quantities of cheap, high quality products. While ABB solved this challenge by re-designing its fast-chargers, Teesing – a smaller company – stressed the importance of moderation and clearly formulated business contracts.

**Concluding remarks**

The Chinese NEV market provides interesting but relatively limited opportunities for the Dutch NEV industry. For suppliers of NEV components, the opportunities are most abundant: they suffer from little regulative barriers and offer high quality products that many Chinese counterparts are unable to match. As a result, the cluster ‘propulsion technology and components’ already has a significant presence in China and is likely to grow further in the future as a result of the rapid increase in NEVs and the possible penetration of non-Chinese NEVs into the market. Notable is the Chinese growing interest in hydrogen. Not only has this been lucrative for suppliers of FCEV components, but also for companies that specialize in vehicle conversion. Nevertheless, even these companies should keep in mind the unpredictable nature of Chinese regulations and legislation like MIC2025. Government regulations in general are the primary reason why non-Chinese OEMs are currently invisible on the Chinese NEV market. Especially in the realm of public transport, the market is extremely closed and subsidized to the

---


120 Van Dillen, ‘Seminar on new energy vehicles’ (14 June 2018).

121 Ibidem.
extent that the Dutch manufacturers of electric buses would not be able to compete with their much larger Chinese counterparts.

Prospects are currently not very abundant for most of the charging infrastructure and smart grid cluster as well. Factors like state-owned grids, difficulties with the placement of private infrastructure and the lack of interest for smart-charging strips the possibilities for this cluster down to fast-charging hardware. Regular charging piles and wall boxes are being sold in China at much cheaper prices and instead of trying to compete with these products in China, Dutch companies should be aware of the possibility that China will bring the competition to the Netherlands. Moving the production of hardware to China might therefore be interesting for companies that want to drive-up competition in the Netherlands.

Finally, this report concludes that China is an outright uninteresting market for providers of services. With its own unique payment systems, consumer behavior that differs enormously from that of the Netherlands and limited access to digital infrastructure that the Chinese government considers as sensitive, it will be not be worth the trouble for a sector that is on itself already very localized.
Conclusion and recommendations

Future growth: In this report it became clear that China has established itself as the undisputed frontrunner of NEV adoption and is very likely to maintain this position in the years to come. According to the International Energy Agency, the global NEV fleet will count some 125 million units by 2030 (compared to 3.1 million by the end of 2017) and as much as 220 million units if global NEV targets were to be reached. Whatever the number will be, the IEA is confident that China and Europe will lead the vanguard of global NEV adoption and estimates that, by that year, about 26% of China’s total car fleet will be composed of NEVs while in Europe, they will constitute a 23% share. Given that China’s total car park numbered some 180 million units by the end of 2017 and is still growing with almost 30 million car sales a year, the total number of NEVs on Chinese roads might rise to 70 million by 2030. As became clear, however, this rapid growth of NEVs currently relies heavily on subsidies and other (financial) incentives and with average market shares of 1 to 3% in even the best performing countries (Norway and Sweden forming the sole exceptions), this will remain the case for some years to come. The very optimistic estimates of the IEA, Bloomberg New Energy Finance and PricewaterhouseCoopers, especially in China’s case, should be interpreted carefully and critically. China’s achievements in the field of NEVs have been impressive, in particular because it is the only middle-income country that has obtained an NEV market share of more than 0.1%. From that point of view, a market share of 2.2% in 2017 can be deemed impressive. However, given that China’s NEV policies have been far more ambitious and far-reaching than those of most other countries, a 2.2% market share could also be considered meagre if one looks at Norway’s market share of 39.2%, the only country that has policies of a similar aggressiveness as those of China.

The tipping point: The modest share of NEVs worldwide is largely due to the fact that a NEV’s most expensive feature – its lithium-ion battery – currently outweighs the benefits of the lower fuel and maintenance costs that NEVs have over ICEVs. Nevertheless, since the 1990s NEV batteries have been declining significantly in price due to the increase in mobile phone use and now the increase of NEV adoption as well. The improved quality of battery chemistries, higher density levels and a lower reliance on cobalt as well as the increase in production capacities of battery manufacturing (providing economies of scale) are driving down the costs of these batteries significantly with every year. It is hard to say when the tipping point will occur, but various authoritative sources estimate that NEVs will equal ICEVs in price attractiveness around the year 2025. The IEA draws this conclusion from the fact that OEMs have formulated much bolder NEV targets in that year in comparison to targets in 2020, while Bloomberg NEF argues that 2025 will be the year that the average battery pack price of 100 USD per kilowatt hour (widely seen as the financial tipping point in the adoption of NEVs) will be reached.

There is thus reason to entertain the possibility that market forces will take over NEV adoption around 2025. As was mentioned above, the fuel and maintenance costs are already lower for NEVs and currently, micro EVs can already be more financially attractive for consumers if fuel prices and daily distances driven are high. It was already mentioned that China is pushing hard to become the world’s leading lithium-ion battery pack manufacturer alongside its ambition to become the top dog of the global NEV industry and its seven largest companies are currently responsible for around 60% of the more

than 100 gigawatt-hours per year that are globally produced. By 2023, it is estimated that the global capacity will rise to 150 gigawatt-hours per year and China’s share of this output is likely to increase.\textsuperscript{126}

However, the aforementioned tipping point is a global tipping point and one has to keep in mind that that the prices of ICEVs, gasoline and oil in China are cheaper than in most other countries with a relative high amount of NEVs. Although its sheer size and increasing wealth have given China a large middle class, it is nevertheless true that income inequality in China is much larger than in other countries that are leading in NEV adoption. It is therefore not unthinkable that NEVs might equal ICEVs in price at a later moment. For example, in 2031 as the 2015 study on the total cost of ownership of NEVs in China predicted (see page 26). That being said, price attractiveness is not all that counts. As was being mentioned, range anxiety, due to a lack of charging infrastructure (visibility), is a major barrier for car consumers to purchase a NEV and needs to be addressed more ambitiously if China wants to de-carbonize its car park.

\textbf{The importance of Sino-Dutch cooperation}: Whether China’s aggressive focus on NEVs will yield the results that the central government in Beijing is eyeing is up for debate, but it is without a doubt that China will set the stage for future NEV development. It is essential for the Netherlands to increase its cooperation with China and work together so that both countries stand a bigger chance to reach their climate goals and NEV targets. Whereas China’s size has the potential to scale up NEV production and propel NEVs into the mainstream, the high-quality products of the Netherlands could help China to transform its NEVs – often coined as unreliable and of low quality – into state of the art vehicles of the future.

Both increased international cooperation and domestic commitment towards NEVs is of utmost importance due to some worrying developments in the Netherlands. Despite a head-start that resulted in the world’s largest market share of chargers and one of the largest NEV stocks in the world, the leading position of the Netherlands has somewhat declined from the end of 2015 up and until the summer of 2018 (when this report was written). While many countries see their NEV sales increase, the Netherlands is one of the few countries that saw a decrease and it is running the risk of becoming a follower instead of leader if it is unable to return to its previous success. Thus, the Netherlands will have to step up its game if it wants to sell NEVs only by 2030, reach its climate goals and maintain a globally acknowledged NEV industry.

As a small country, the Netherlands’ impact within the development of NEVs is likely to decline, now that larger countries (for example: France, Germany, South Korea and the UK) are catching up. As a result, the Netherlands will have to establish international partnerships if it wants to make itself more visible, achieve its NEV and climate goals and increase the opportunities of the Dutch NEV industry outside of the country. It has already done this through memberships like the Zero Emission Vehicle Alliance, the IEA Hybrid and Electric Vehicle Technology Collaboration Programme, the Transport Decarbonisation Alliance, as well as the EU itself. With China too, the Netherlands already has a partnership through the Electric Vehicle Initiative, an intergovernmental forum wherein countries share policy ideas and formulate commitments that increase the adoption of NEVs. In addition, during the Dutch state and company visit to China in April 2018, Sino-Dutch political cooperation was increased during a round table on NEV policies, which will most likely lead to the Netherlands joining the ZEV Policy Lab, a policy research and exchange framework, alongside China and the US during the Global Action Climate Summit in California in September 2018.

These developments will undoubtedly contribute to the de-carbonization of these countries and are the first concrete steps of Sino-Dutch cooperation in the field of NEVs. Within these frameworks the efficiency of NEV adoption can be improved through the exchange of policies, the organizing of round

tables, pilots, joint research and state visits. Now that the Netherlands is likely to join the ZEV Policy Lab, it is not unthinkable that the country will have the potential to inspire Chinese policymaking. CATARC – the MIIT’s think-tank on automotive issues and China’s representative organization within the ZEV Policy Lab – modelled its NEV Policy Mandate after the Californian ZEV Program.

The Netherlands, for example, could introduce China to its Green Deals and help China improving the problems that China has with its charging infrastructure. By doing so, the Netherlands could contribute to the reduction of range anxiety in China and bring the country one step closer to its NEV targets. Such cooperation could perhaps even increase business opportunities for Dutch charging companies that currently stand little chance of succeeding in China.

Reversely, the Netherlands could learn a lot from China as well. If the Netherlands wants to decarbonize all its public buses by 2025, it would do well to draw inspiration from China’s example. The Embassy and the Consulate General of the Netherlands in Beijing and Guangzhou could, for example, organize company visits to Shenzhen, the global capital of electric buses and learn from companies like BYD and Haylion that have been responsible for many of the 16.359 electrified buses that drive around in the city.

**Cooperation with subnational governments:** The EVI and the ZEV Policy Lab can also be used as diving boards to facilitate NEV cooperation between China and the rest of the world. The Netherlands could aim to involve China in international partnerships such as the ZEV Alliance by inviting China as an observer and actively nurture and expand ties with relevant ministries and organizations. Regarding the ZEV Alliance specifically, China has been rather reluctant to commit itself in a national capacity, but since the ZEV Alliance also contains subnational members, it would be recommendable to seek cooperation with province-level entities as well. China as a nation is relatively closed, but regions like Shanghai and Guangdong are much more open to the world and, with large NEV fleets and prominent companies, they would prove to be valuable allies in the field of NEVs. Another potential candidate would be Hainan. Although the island province in the south of China is a relatively small player in the field of NEVs, it has recently formulated ambitious goals and targets to accelerate the use of greener vehicles. Like Guangdong and Shanghai, Hainan Province is known to be flexible and open-minded and would thus prove a more potential candidate for ZEV Alliance membership than more developed, but closed provinces like Zhejiang or Shandong.

**City-level partnerships** could also be nourished. It was already mentioned that Arnhem-based companies HyMove and Nedstack have partnered up with Huaxia and Dongfeng Motors from Wuhan, in order to convert regular Chinese heavy-duty vehicles to FCEVs. This in itself is already an example of the impact that political cooperation can bring about, as Arnhem and Wuhan have been twin cities since 1999. However, the fact that both cities identify themselves as centers of hydrogen could be utilized more specifically as well and the Netherlands Business Support Office (NBSO) in Wuhan makes it convenient to foster a partnership like this.

**Cooperation with Belgium:** However, partnering up with China in a bilateral or multilateral framework will not be enough for the Dutch NEV industry. The Netherlands is after all a fairly small player when compared to countries like Germany, whose OEMs produce a quarter of China’s cars and whose brands enjoy a well-established reputation in China. If the Dutch government aims to increase the opportunities for its companies, it would do well to partner up with Belgium and organize missions to China, share stands during exhibitions or send joint delegations to conferences. Belgium too has a small, but highly advanced automotive industry that is increasingly looking towards NEVs. As neighbors and economic partners within the Benelux framework, this makes sense. The Benelux countries have already pledged to become a zero-emission region when they signed a declaration to streamline and integrate their
charging infrastructure. In the realm of hydrogen too, close cooperation already exists by means of the Hydrogen Region 2.0. In this framework, the Netherlands and Flanders have initiated various hydrogen pilots in an effort to integrate cooperation in the field of hydrogen and stimulate the growth of their relatively small, but promising hydrogen companies. In addition, many Dutch NEV companies like Allego and EV-Box have offices in Belgium and Punch Powertrain can even be coined as being both Belgian and Dutch. Initially established as a subsidiary of DAF passenger vehicles, the company has its roots in the Netherlands, its headquarters in Belgium and recently expanded significantly by acquiring and integrating Dutch-based Drive Train Innovations (DTI) within its company. The Netherlands and Belgium therefore have plenty of reasons to cooperate outside of their jurisdictions as well, because together they make up one of the largest economies of Europe.

**Conclusion:** To conclude, more cooperation with China, both politically and economically, is necessary if the Netherlands wants to reach its ambitious NEV targets, address human-induced climate change and maintain the prominent status of its NEV industry. As the world’s largest car market and producer, China has the impact to steer the global vehicle industry in the direction it wants to, and China is heading towards NEVs and is doing so in a rapid pace. Even though China’s ambitions and policies might be too ambitious for its own good, they are nevertheless forcing many OEMs to commit to NEVs simply because of the fact that the government of the largest vehicle market in the world is demanding them to do so.

For many major OEMs, China is either their largest or one of their largest markets and one of the few that is still expanding at an enormous rate. As a result, it does not matter whether the NEV Mandate Policy proves to be successful or counterproductive for China and its car industry, because all major OEMs, both domestic and foreign, have announced the launch of NEVs anyway. This means undoubtedly that their rise will be led by China and that China’s NEV market will, to a very large degree, determine the future of the automotive industry worldwide.

The Netherlands will have to pay more attention to China than it currently does if it wants to uphold its prominent position. The NEV industry might still be a niche in much of the world, but in China the roll-out of NEVs and NEV-related products is heading towards economies of scale in a very fast pace and the Netherlands will have to jump on the Chinese bandwagon if it wants to scale up its NEV sector and prepare itself adequately for the future. Besides the fact that China already is a lucrative market for the high-quality products that Dutch companies have to offer, it is also necessary because the growing production capacity of Chinese companies might pose a threat to Dutch electric bus and charging pile manufacturers in the not too distant future.

However, most importantly is that climate change will not wait for the adoption of NEVs. The world will have to work more closely if they want to reach their climate goals on time and, as the most populous and most polluted country in the world with an ever-growing appetite for cars, NEV adoption in China will contribute to the wellbeing of Dutch citizens as well. Sino-Dutch cooperation in the field of NEVs and climate change mitigation in general is therefore a necessity and should be proactively pursued by the Dutch government without delay.

---

# Company appendix

## The Netherlands

### Dutch charging infrastructure companies

<table>
<thead>
<tr>
<th>Company</th>
<th>Product or service</th>
<th>Areas served</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfen</td>
<td>Developer and producer of charging pile hardware and provider of related services (smart charging, back-end management, remote control and maintenance)</td>
<td>Benelux, France, Germany and the UK</td>
<td><a href="https://alfen.com/">https://alfen.com/</a></td>
</tr>
<tr>
<td>Allego</td>
<td>Owner of pan-European network of almost 8,000 charging points. Provider of (fast) charging solutions an EV cloud services. Coordinator of European fast charge and ultra-fast charge projects</td>
<td>Belgium, Germany, the Netherlands and the UK</td>
<td><a href="https://www.allego.nl/">https://www.allego.nl/</a></td>
</tr>
<tr>
<td>Cohere</td>
<td>Developer and producer of smart charging systems and offers smart charging solutions</td>
<td>Germany, the Netherlands and the UK</td>
<td><a href="https://maxem.io/">https://maxem.io/</a></td>
</tr>
<tr>
<td>Ecotap</td>
<td>Developer and producer of (integrated) charging pile hardware for cars, bicycles and (mobility) scooters and provider of payment services</td>
<td>Germany, the Netherlands and Switzerland</td>
<td><a href="https://www.ecotap.nl/">https://www.ecotap.nl/</a></td>
</tr>
<tr>
<td>E-Flux</td>
<td>Provider of charging piles, smart charging solutions and payment services</td>
<td>Netherlands</td>
<td><a href="https://www.e-flux.nl/">https://www.e-flux.nl/</a></td>
</tr>
<tr>
<td>Eneco</td>
<td>Grid company and provider of charging piles and related services</td>
<td>Netherlands</td>
<td><a href="https://evcompany.eu/">https://evcompany.eu/</a></td>
</tr>
<tr>
<td>Enexis</td>
<td>Grid company and provider of smart charging solutions</td>
<td>Europe</td>
<td><a href="https://www.smartcharging.nl/en/">https://www.smartcharging.nl/en/</a></td>
</tr>
<tr>
<td>EV Company</td>
<td>Provider of charging systems and accessories, payment solutions and services</td>
<td>Netherlands</td>
<td><a href="https://evcompany.eu/">https://evcompany.eu/</a></td>
</tr>
<tr>
<td>EV-box</td>
<td>Developer and producer of charging pile systems, accessories and provider of related services (smart charging and payment solutions, maintenance and trainings)</td>
<td>Europe, North America and the Middle East</td>
<td><a href="https://www.evbox.com/">https://www.evbox.com/</a></td>
</tr>
<tr>
<td>Fastned</td>
<td>Owner of a fast charging infrastructure network</td>
<td>Germany, the Netherlands and the UK</td>
<td><a href="https://fastned.nl/">https://fastned.nl/</a></td>
</tr>
<tr>
<td>Fillie</td>
<td>Developer and producer of charging systems</td>
<td>Europe</td>
<td><a href="https://www.fillie.nl/">https://www.fillie.nl/</a></td>
</tr>
<tr>
<td>Provider</td>
<td>Services Description</td>
<td>Locations</td>
<td>Website</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>----------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>FLOW charging</td>
<td>Provider of charging piles and payment solutions and services.</td>
<td>Belgium and the Netherlands</td>
<td><a href="https://www.flowcharging.com/">https://www.flowcharging.com/</a></td>
</tr>
<tr>
<td>Greenflux</td>
<td>Provider of smart charging solutions, services and charging piles</td>
<td>Germany, the Netherlands, Norway, UK, US and 6 other countries</td>
<td><a href="https://www.greenflux.nl/">https://www.greenflux.nl/</a></td>
</tr>
<tr>
<td>Heliox</td>
<td>Developer and producer of charging systems for public transport and vehicles in the construction, mining and port industries. Provider of charging solutions and related services</td>
<td>Europe, India, Japan, New Zealand, Singapore and Turkey</td>
<td><a href="https://www.heliox.nl/">https://www.heliox.nl/</a></td>
</tr>
<tr>
<td>Jedlix</td>
<td>Provider of smart charging solutions and services</td>
<td>The Netherlands</td>
<td><a href="https://www.jedlix.com/">https://www.jedlix.com/</a></td>
</tr>
<tr>
<td>Last Mile Solutions</td>
<td>Provider of smart charging solutions</td>
<td>Europe</td>
<td><a href="https://www.lastmilesolutions.com/">https://www.lastmilesolutions.com/</a></td>
</tr>
<tr>
<td>NL MAB</td>
<td>Provider of charging piles and payment services</td>
<td>The Netherlands</td>
<td><a href="http://www.nlma.nl/">http://www.nlma.nl/</a></td>
</tr>
<tr>
<td>NewMotion</td>
<td>Developer and producer of charging systems hardware and provider of related services (smart charging and payment solutions)</td>
<td>Belgium, France, Germany, the Netherlands, Norway and the UK</td>
<td><a href="https://newmotion.com/">https://newmotion.com/</a></td>
</tr>
<tr>
<td>Nuon</td>
<td>Grid company and provider of charging piles and payment services</td>
<td>Netherlands</td>
<td><a href="https://www.nuon.nl/">https://www.nuon.nl/</a></td>
</tr>
<tr>
<td>Streetplug</td>
<td>Developer and producer of integrated charging hardware</td>
<td>The Netherlands and France</td>
<td><a href="https://www.streetplug.nl/">https://www.streetplug.nl/</a></td>
</tr>
<tr>
<td>Oplaadpunten.nl</td>
<td>Provider of payment solutions and services</td>
<td>The Netherlands</td>
<td></td>
</tr>
<tr>
<td>Pitpoint</td>
<td>Main focus on clean fuels, but Pitpoint also develops, produces and manages charging piles</td>
<td>Europe</td>
<td><a href="https://www.pitpoint.nl/">https://www.pitpoint.nl/</a></td>
</tr>
<tr>
<td>Power Research</td>
<td>R&amp;D of fast-charging technology</td>
<td>Worldwide</td>
<td><a href="http://www.pr-electronics.nl/">http://www.pr-electronics.nl/</a></td>
</tr>
<tr>
<td>Electronics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prodrive Technologies</td>
<td>Main focus on vehicle components, but Prodrive is developing wireless charging systems as well</td>
<td>Worldwide</td>
<td><a href="https://prodrive-technologies.com/">https://prodrive-technologies.com/</a></td>
</tr>
<tr>
<td>TenneT</td>
<td>Grid operator and charging services provider in cooperation with NewMotion</td>
<td>Netherlands</td>
<td></td>
</tr>
<tr>
<td>Travelcard</td>
<td>Offers payment solutions for public charging</td>
<td>The Netherlands</td>
<td><a href="https://travelcard.nl/">https://travelcard.nl/</a></td>
</tr>
<tr>
<td>We Drive Solar</td>
<td>Public-private initiative that offers solar charging solutions and shared cars that are used partially as energy storage</td>
<td>The Netherlands</td>
<td><a href="http://www.wedrivesolar.nl/">http://www.wedrivesolar.nl/</a></td>
</tr>
<tr>
<td>ViriCiti</td>
<td>Tailored monitoring solutions for the charging of NEV fleets</td>
<td>Europe</td>
<td><a href="https://www.viriciti.com/">https://www.viriciti.com/</a></td>
</tr>
</tbody>
</table>
Vandebron | Provides smart charging and payment solutions as well as charging piles | The Netherlands | https://vandebron.nl/  

---  

**Dutch component and conversion companies**

<table>
<thead>
<tr>
<th>Company</th>
<th>Product or service</th>
<th>Areas served</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>AkzoNobel</td>
<td>Developer and producer of vehicle Coatings and developer of hydrogen plants and infrastructure</td>
<td>Worldwide</td>
<td><a href="https://www.akzonobel.com/">https://www.akzonobel.com/</a></td>
</tr>
<tr>
<td>Cleantron</td>
<td>R&amp;D, manufacturer of cleantech battery packs for light-EVs</td>
<td>Europe</td>
<td><a href="http://cleantron.nl/">http://cleantron.nl/</a></td>
</tr>
<tr>
<td>DSM</td>
<td>Developer and producer of vehicle Coatings</td>
<td>Worldwide</td>
<td><a href="https://www.dsm.com/">https://www.dsm.com/</a></td>
</tr>
<tr>
<td>E-Traction</td>
<td>Developer and manufacturer of Electric in-wheel motors and powertrain components for electric vehicles, including trucks and buses</td>
<td>Offices in China and the Netherlands and supplier for German OEMs, global footprint</td>
<td><a href="http://www.e-traction.eu/">http://www.e-traction.eu/</a></td>
</tr>
<tr>
<td>Emoss</td>
<td>Developer and producer of electric powertrains</td>
<td>Active throughout Europe and in New Zealand</td>
<td><a href="http://www.emoss.nl/">http://www.emoss.nl/</a></td>
</tr>
<tr>
<td>E-Trucks Europe</td>
<td>R&amp;D, manufacturing of electric powertrains for lorries</td>
<td>Europe</td>
<td><a href="https://e-truckseurope.com/">https://e-truckseurope.com/</a></td>
</tr>
<tr>
<td>Gear Chain</td>
<td>Developer and producer of continuously variable transmissions, drivelines and controls</td>
<td>Worldwide</td>
<td><a href="http://www.gcinet.nl/en/">http://www.gcinet.nl/en/</a></td>
</tr>
<tr>
<td>Industrial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ginaf</td>
<td>Conversion of trucks into electric trucks</td>
<td>Europe</td>
<td><a href="https://ginaf-durable.com/">https://ginaf-durable.com/</a></td>
</tr>
<tr>
<td>Holthausen</td>
<td>Developer of hydrogen refueling infrastructure and conversion of ICEVs into FCEVs</td>
<td>Europe</td>
<td></td>
</tr>
<tr>
<td>HyMove</td>
<td>Conversion of buses, trucks and vans into FCEVs</td>
<td>China, Europe</td>
<td><a href="http://www.hymove.nl/">http://www.hymove.nl/</a></td>
</tr>
<tr>
<td>Hytruck</td>
<td>Conversion of trucks and delivery vehicles into FCEVs</td>
<td>Netherlands</td>
<td><a href="http://www.hytruck.nl/">http://www.hytruck.nl/</a></td>
</tr>
<tr>
<td>Nedstack</td>
<td>R&amp;D, manufacturer of PEM fuel cells for automotive applications</td>
<td>China, Europe</td>
<td><a href="http://nedstack.nl/">http://nedstack.nl/</a></td>
</tr>
<tr>
<td>NXP Semiconductors</td>
<td>Developer and producer of automotive chips and power electronics for EV batteries</td>
<td>Worldwide</td>
<td><a href="https://www.nxp.com/">https://www.nxp.com/</a></td>
</tr>
<tr>
<td>Company</td>
<td>Products</td>
<td>Areas served</td>
<td>Website</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pecc-Power</td>
<td>R&amp;D, manufacturing of range extenders for NEVs</td>
<td>Europe</td>
<td><a href="http://www.pecc-power.com/">http://www.pecc-power.com/</a></td>
</tr>
<tr>
<td>Power Research Electronics</td>
<td>R&amp;D and manufacturing assistance of power electronics, battery packs and electric engines</td>
<td>Worldwide</td>
<td><a href="http://www.pr-electronics.nl/">http://www.pr-electronics.nl/</a></td>
</tr>
<tr>
<td>Prodrive Technologies</td>
<td>Developer and producer of components for ZEVs including converters and inverters</td>
<td>Worldwide, with automotive operations in Germany and the Netherlands. Other offices in China, Israel and the United States</td>
<td><a href="https://prodrive-technologies.com/">https://prodrive-technologies.com/</a></td>
</tr>
<tr>
<td>Punch Powertrain</td>
<td>Developer and manufacturer of electric powertrains.</td>
<td>Offices in Belgium, France, Germany, China, India, Iran, Malaysia and the Netherlands, global footprint</td>
<td><a href="https://www.punchpowertrain.com/">https://www.punchpowertrain.com/</a></td>
</tr>
<tr>
<td>Strukton Embedded Solutions</td>
<td>Developer of automotive modules for electric drive lines</td>
<td>Benelux</td>
<td><a href="https://www.struktonrail.nl/">https://www.struktonrail.nl/</a></td>
</tr>
<tr>
<td>TASS International</td>
<td>R&amp;D in minimizing emissions in autonomous driving</td>
<td>Worldwide</td>
<td><a href="https://tass.plm.automation.siemens.com/">https://tass.plm.automation.siemens.com/</a></td>
</tr>
<tr>
<td>Terberg Benschop</td>
<td>Conversion of trucks into electric trucks</td>
<td>Worldwide</td>
<td><a href="https://www.terbergbenschop.nl/">https://www.terbergbenschop.nl/</a></td>
</tr>
<tr>
<td>TNO</td>
<td>R&amp;D, engineering and testing of road vehicles, vehicle systems and components, mainly related to safety, environment and transport efficiency.</td>
<td>Worldwide</td>
<td><a href="https://www.tno.nl/en/">https://www.tno.nl/en/</a></td>
</tr>
</tbody>
</table>

**Dutch NEV manufacturers**

<table>
<thead>
<tr>
<th>Company</th>
<th>Products</th>
<th>Areas served</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amber</td>
<td>R&amp;D and development of autonomous EV</td>
<td>Netherlands</td>
<td><a href="https://www.driveamber.com/">https://www.driveamber.com/</a></td>
</tr>
<tr>
<td>Burton Car</td>
<td>R&amp;D of luxury hydrogen/fuel cell car</td>
<td>Netherlands</td>
<td><a href="https://www.burtoncar.com/">https://www.burtoncar.com/</a></td>
</tr>
<tr>
<td>DAF</td>
<td>R&amp;D, manufacturing of NEV trucks</td>
<td>Europe</td>
<td><a href="http://www.daf.com/en">http://www.daf.com/en</a></td>
</tr>
<tr>
<td>Ebusco</td>
<td>R&amp;D, manufacturing of city buses</td>
<td>Europe</td>
<td><a href="https://ebusco.eu/">https://ebusco.eu/</a></td>
</tr>
<tr>
<td>Ece Cars</td>
<td>Import and manufacturing of BEVs</td>
<td>Netherlands</td>
<td><a href="http://www.ececars.nl/">http://www.ececars.nl/</a></td>
</tr>
</tbody>
</table>
### Dutch providers of NEV-related services

<table>
<thead>
<tr>
<th>Company</th>
<th>Product</th>
<th>Areas served</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amber</td>
<td>Car sharing of NEVs and is currently in R&amp;D phase for an autonomous NEV fleet</td>
<td>Netherlands</td>
<td><a href="https://www.driveamber.com/">https://www.driveamber.com/</a></td>
</tr>
<tr>
<td>Beamrz</td>
<td>Ride sharing company</td>
<td>Netherlands</td>
<td><a href="https://www.beamrz.com/">https://www.beamrz.com/</a></td>
</tr>
<tr>
<td>Buurauto</td>
<td>Car sharing company</td>
<td>Netherlands</td>
<td><a href="http://www.buurauto.nl/">http://www.buurauto.nl/</a></td>
</tr>
<tr>
<td>eCARSHARE</td>
<td>Car sharing company operating NEVs in the province of Limburg</td>
<td>Netherlands</td>
<td><a href="http://www.ecarshare.nl/">http://www.ecarshare.nl/</a></td>
</tr>
<tr>
<td>MisterGreen Electric</td>
<td>Provider of NEV lease services</td>
<td>Europe</td>
<td><a href="https://www.mistergreen.nl/">https://www.mistergreen.nl/</a></td>
</tr>
<tr>
<td>MyWheels</td>
<td>Car sharing company</td>
<td>Netherlands</td>
<td><a href="https://mywheels.nl/">https://mywheels.nl/</a></td>
</tr>
<tr>
<td>Picnic</td>
<td>Online supermarket with NEV fleet</td>
<td>Netherlands</td>
<td><a href="https://www.picnic.nl/">https://www.picnic.nl/</a></td>
</tr>
<tr>
<td>Senfal</td>
<td>Offers energy trading software for the commercial market, predicting of energy consumption and prices on the energy market</td>
<td>Europe</td>
<td><a href="https://senfal.com/">https://senfal.com/</a></td>
</tr>
<tr>
<td>Snappcar</td>
<td>NEV rental company</td>
<td>Netherlands</td>
<td><a href="https://www.snappcar.nl/">https://www.snappcar.nl/</a></td>
</tr>
<tr>
<td>Taxi Electric</td>
<td>Taxi company operating BEVs</td>
<td>Netherlands</td>
<td><a href="https://www.taxielectric.nl/">https://www.taxielectric.nl/</a></td>
</tr>
<tr>
<td>ViriCiti</td>
<td>Monitoring and collecting of usage data for NEV fleets</td>
<td>Europe</td>
<td><a href="https://www.viriciti.com/">https://www.viriciti.com/</a></td>
</tr>
<tr>
<td>V-tron</td>
<td>Provider of monitoring, data and car sharing services</td>
<td>Benelux, Germany</td>
<td><a href="http://v-tron.nl/">http://v-tron.nl/</a></td>
</tr>
<tr>
<td>Watt Car</td>
<td>Car sharing company operating NEVs on the island of Terschelling</td>
<td>Netherlands</td>
<td><a href="https://schylge.wego.nu/">https://schylge.wego.nu/</a></td>
</tr>
<tr>
<td>We Drive Solar</td>
<td>Car sharing initiative</td>
<td>Netherlands</td>
<td><a href="http://www.wedrivesolar.nl/">http://www.wedrivesolar.nl/</a></td>
</tr>
</tbody>
</table>
China

The companies listed below do not include all Chinese companies, but rather the most prominent ones.

### Chinese passenger NEV manufacturers

<table>
<thead>
<tr>
<th>Company</th>
<th>Important markets</th>
<th>Headquarters</th>
<th>Vehicle types</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYD</td>
<td>Shanghai, Shenzhen, Xi’an, Tianjin, Guangzhou, Beijing</td>
<td>Shenzhen, Guangdong Province</td>
<td>Micro EVs, Sedans, SUVs</td>
<td><a href="http://www.byd.com/">http://www.byd.com/</a></td>
</tr>
<tr>
<td>Byton</td>
<td>Shanghai, Nanjing, Beijing</td>
<td>Nanjing, Jiangsu Province</td>
<td>SUVs</td>
<td><a href="https://www.byton.com/">https://www.byton.com/</a></td>
</tr>
<tr>
<td>Changan</td>
<td>Chongqing</td>
<td></td>
<td>Micro EVs, Sedans, SUVs</td>
<td><a href="http://www.globalchangan.com/">http://www.globalchangan.com/</a></td>
</tr>
<tr>
<td>Chery</td>
<td>Wuhu, Shanghai, Beijing, Linyi, Tianjin</td>
<td>Wuhu, Anhui Province</td>
<td>Micro EVs, SUVs,</td>
<td><a href="http://www.cheryinternational.com/">http://www.cheryinternational.com/</a></td>
</tr>
<tr>
<td>DearCC</td>
<td>Shaoxing, Zhejiang Province</td>
<td></td>
<td>Micro EVs</td>
<td><a href="http://www.dearcc.cn/">http://www.dearcc.cn/</a></td>
</tr>
<tr>
<td>Denza</td>
<td>Shenzhen, Beijing, Shanghai</td>
<td>Shenzhen, Guangdong Province</td>
<td>Luxury cars</td>
<td><a href="http://www.denza.com/">http://www.denza.com/</a></td>
</tr>
<tr>
<td>GAC</td>
<td>Guangzhou, Guangdong Province</td>
<td></td>
<td>SUVs</td>
<td><a href="https://www.gac-motor.com/">https://www.gac-motor.com/</a></td>
</tr>
<tr>
<td>Great Wall</td>
<td>Baoding, Hebei Province</td>
<td>Sedans, SUVs</td>
<td></td>
<td><a href="http://www.gwm-global.com/">http://www.gwm-global.com/</a></td>
</tr>
<tr>
<td>Hawtai</td>
<td>Beijing</td>
<td></td>
<td>Micro EVs, Sedans, SUVs,</td>
<td><a href="http://en.hawtaimotor.com/">http://en.hawtaimotor.com/</a></td>
</tr>
<tr>
<td>Kandi</td>
<td>Hangzhou, Haikou, Tianjin, Kunming, Huzhou, Guangzhou, Linyi, Chengdu, Shenzhen</td>
<td>Hangzhou, Zhejiang Province</td>
<td>Micro EVs, SUVs</td>
<td><a href="http://www.gleagleev.com/">http://www.gleagleev.com/</a></td>
</tr>
<tr>
<td>Lifan</td>
<td>Chongqing, Zhengzhou, Chengdu</td>
<td>Chongqing</td>
<td>Micro EVs, Sedans</td>
<td><a href="http://www.lifanmotors.net/">http://www.lifanmotors.net/</a></td>
</tr>
<tr>
<td>Company</td>
<td>Headquarters</td>
<td>Vehicle types</td>
<td>Areas served</td>
<td>Website</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------</td>
<td>---------------------------------------------------</td>
<td>-------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>NIO/Weilai</td>
<td>Shanghai</td>
<td>Luxury sports car, SUVs</td>
<td></td>
<td><a href="https://www.nio.io/">https://www.nio.io/</a></td>
</tr>
<tr>
<td>SAIC</td>
<td>Shanghai</td>
<td>Shanghai</td>
<td>Sedans, SUVs</td>
<td><a href="http://www.saicmotor.com/">http://www.saicmotor.com/</a></td>
</tr>
<tr>
<td>Soueast</td>
<td>Linyi, Fujian Province</td>
<td>Sedans, SUVs</td>
<td></td>
<td><a href="http://en.soueast-motor.com/">http://en.soueast-motor.com/</a></td>
</tr>
<tr>
<td>Zhidou</td>
<td>Linyi, Lanzhou, Guangzhou, Qingdao, Changsha, Ningbo, Shenzhen, Hangzhou, Wuhan, Taiyuan</td>
<td>Linyi, Shandong Province</td>
<td>Micro EVs</td>
<td><a href="http://en.evcar.com/">http://en.evcar.com/</a></td>
</tr>
<tr>
<td>Zotye</td>
<td>Changsha, Qingdao, Wuhan, Xiangtan, Yichun, Linyi</td>
<td>Yongkang, Zhejiang Province</td>
<td>Micro EVs, SUVs</td>
<td><a href="http://www.zotyeglobal.com/">http://www.zotyeglobal.com/</a></td>
</tr>
</tbody>
</table>

**Chinese electric bus manufacturers**

<table>
<thead>
<tr>
<th>Company</th>
<th>Headquarters</th>
<th>Vehicle types</th>
<th>Areas served</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfa Bus</td>
<td>Jiangyin, Jiangsu Province</td>
<td>City buses</td>
<td>China</td>
<td><a href="https://alfabus.en.china.cn/">https://alfabus.en.china.cn/</a></td>
</tr>
<tr>
<td>Ankai</td>
<td>Hefei, Anhui Province</td>
<td>City buses, coaches</td>
<td>Worldwide</td>
<td><a href="http://www.ankai.com/">http://www.ankai.com/</a></td>
</tr>
<tr>
<td>Bonluck Bus</td>
<td>Nanchang, Jiangxi Province</td>
<td>City buses, coaches</td>
<td>Americas, China, Europe</td>
<td><a href="http://www.bonluckbus.com/">http://www.bonluckbus.com/</a></td>
</tr>
<tr>
<td>BYD</td>
<td>Shenzhen, Guangdong Province</td>
<td>City buses, coaches</td>
<td>Worldwide</td>
<td><a href="http://www.byd.com">http://www.byd.com</a></td>
</tr>
<tr>
<td>FAW</td>
<td>Chanchun, Jilin Province</td>
<td>City buses, coaches</td>
<td>China, Eastern Europe, Myanmar and US</td>
<td><a href="http://www.faw.com/">http://www.faw.com/</a></td>
</tr>
<tr>
<td>Foton</td>
<td>Beijing</td>
<td>City buses Coaches, Heavy-duty trucks, Light-duty trucks, Mini buses</td>
<td>Worldwide</td>
<td><a href="http://www.foton-global.com/">http://www.foton-global.com/</a></td>
</tr>
<tr>
<td>GAC</td>
<td>Guangzhou, Guangdong Province</td>
<td>City buses, coaches</td>
<td>China, Europe</td>
<td><a href="http://www.gac.com.cn/">http://www.gac.com.cn/</a></td>
</tr>
<tr>
<td>Guangtong Bus</td>
<td>Zhuhai, Guangdong Province</td>
<td>City buses, mini buses</td>
<td>Worldwide</td>
<td><a href="http://www.chinatongbus.com/">http://www.chinatongbus.com/</a></td>
</tr>
<tr>
<td>King Long</td>
<td>Xiamen, Fujian Province</td>
<td>City buses, coaches, mini buses</td>
<td>Worldwide</td>
<td><a href="http://king-long.com/">http://king-long.com/</a></td>
</tr>
<tr>
<td>Lian Fu</td>
<td>Shenzhen, Guangdong Province</td>
<td>City buses, coaches</td>
<td>China</td>
<td><a href="http://www.lianfungroup.com/en/">http://www.lianfungroup.com/en/</a></td>
</tr>
<tr>
<td>Sunwin</td>
<td>Shanghai</td>
<td>City buses, coaches</td>
<td>China</td>
<td><a href="http://www.sunwinbus.com/">http://www.sunwinbus.com/</a></td>
</tr>
<tr>
<td>Yixing Electric Automobile</td>
<td>Linyi, Shandong Province</td>
<td>City buses, coaches, mini buses</td>
<td>China</td>
<td></td>
</tr>
<tr>
<td>YueXi</td>
<td>Hangzhou, Zhejiang province</td>
<td>City buses, coaches, mini buses</td>
<td>Africa, Central Asia, China, South America, Southeast Asia</td>
<td><a href="http://en.yuexibus.com/">http://en.yuexibus.com/</a></td>
</tr>
<tr>
<td>Company</td>
<td>Headquarters</td>
<td>Products</td>
<td>Areas served</td>
<td>Website</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------</td>
<td>----------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BYD</td>
<td>Shenzhen, Guangdong</td>
<td>Lithium-ion battery R&amp;D, manufacturing</td>
<td>Worldwide</td>
<td><a href="http://www.byd.com">http://www.byd.com</a></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CALB</td>
<td>Luoyang, Henan</td>
<td>Bus battery manufacturing</td>
<td>Americas, China, East Asia, Europe, Oceania</td>
<td><a href="http://en.calb.cn/">http://en.calb.cn/</a></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CATL</td>
<td>Ningde, Fujian</td>
<td>Lithium-ion battery manufacturing</td>
<td>Worldwide</td>
<td><a href="http://www.catlbattery.com/en/">http://www.catlbattery.com/en/</a></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chiway Battery</td>
<td>Shenzhen, Guangdong</td>
<td>Lithium-ion battery manufacturing</td>
<td>China, Europe, Hong Kong, Southeast Asia, Taiwan</td>
<td><a href="http://www.chiway-battery.com/about.html">http://www.chiway-battery.com/about.html</a></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPEC Power</td>
<td>Shenzhen, Guangdong</td>
<td>Large-size lithium-ion battery R&amp;D, manufacturing</td>
<td>China</td>
<td><a href="http://www.cpecpower.com/">http://www.cpecpower.com/</a></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DingTai Battery</td>
<td>Shenzhen, Guangdong</td>
<td>Lithium-ion battery pack manufacturing</td>
<td>Worldwide</td>
<td><a href="http://www.dtbattery.com">http://www.dtbattery.com</a></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guoxuan</td>
<td>Hefei, Anhui</td>
<td>Bus battery manufacturer</td>
<td>Worldwide</td>
<td><a href="http://www.hfgxgk.com/">http://www.hfgxgk.com/</a></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lian Innovative</td>
<td>Shenzhen, Guangdong</td>
<td>Lithium-ion battery design, R&amp;D, manufacturing, engineering</td>
<td>Canada, China, Middle East</td>
<td><a href="http://lianinno.com">http://lianinno.com</a></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lishen</td>
<td>Tianjin</td>
<td>Lithium-ion battery R&amp;D, manufacturing</td>
<td>Worldwide</td>
<td><a href="http://www.lishen.com.cn/">http://www.lishen.com.cn/</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sacred Sun</td>
<td>Qufu, Shandong</td>
<td>Design, development, production of power storage solutions</td>
<td>Worldwide</td>
<td><a href="http://www.sacredsun.com/">http://www.sacredsun.com/</a></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shida Batteries</td>
<td>Foshan, Guangdong</td>
<td>Lithium polymer battery, Ni-MH rechargeable</td>
<td>Worldwide</td>
<td><a href="http://www.shida-batteries.com">http://www.shida-batteries.com</a></td>
</tr>
<tr>
<td>Company</td>
<td>Headquarters</td>
<td>Products</td>
<td>Areas served</td>
<td>Website</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Sincpower</td>
<td>Qinhuangdao, Hebei Province</td>
<td>Lithium-ion battery, battery pack R&amp;D, manufacturing</td>
<td>China, Middle East</td>
<td><a href="http://www.xcgdbattery.com/">http://www.xcgdbattery.com/</a></td>
</tr>
<tr>
<td>Topband</td>
<td>Shenzhen, Guangdong Province</td>
<td>LiFePO4 battery cells, PCN.BMS, battery packs manufacturing</td>
<td>China, India, Israel</td>
<td><a href="http://www.topband-c.com">http://www.topband-c.com</a></td>
</tr>
<tr>
<td>Vaima Battery Industrial</td>
<td>Shenzhen, Guangdong Province</td>
<td>Lithium-ion power battery pack manufacturing</td>
<td>China, Europe, North America, Southeast Asia</td>
<td><a href="http://www.vaima.com.cn/">http://www.vaima.com.cn/</a></td>
</tr>
<tr>
<td>Vision Batteries</td>
<td>Shenzhen, Guangdong Province</td>
<td>Valve-regulated lead acid battery, lithium-ion battery R&amp;D, manufacturing</td>
<td>China, Europe, US, Southeast Asia</td>
<td><a href="http://www.vision-batt.com/">http://www.vision-batt.com/</a></td>
</tr>
<tr>
<td>Wina</td>
<td>Shouguang, Shandong Province</td>
<td>Prismatic cell and battery application for buses</td>
<td>China and North America</td>
<td><a href="http://en.winabattery.cn/">http://en.winabattery.cn/</a></td>
</tr>
<tr>
<td>Yaheng Battery</td>
<td>Shanghai</td>
<td>Automobile sealed lead-acid storage battery, UPS storage battery and EV electromotive tool storage battery manufacturing</td>
<td>China</td>
<td><a href="http://www.yahengbattery.com">http://www.yahengbattery.com</a></td>
</tr>
<tr>
<td>Yuntong Group</td>
<td>Zhongshan, Guangdong Province</td>
<td>Lithium-ion battery manufacturing</td>
<td>China</td>
<td><a href="http://www.yuntong-batt.com/">http://www.yuntong-batt.com/</a></td>
</tr>
</tbody>
</table>

**Chinese charging infrastructure companies**

<table>
<thead>
<tr>
<th>Company</th>
<th>Headquarters</th>
<th>Products</th>
<th>Areas served</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIT Huahuang Electric Vehicle Technology</td>
<td>Beijing</td>
<td>R&amp;D, manufacturing of vehicle network control technologies, electric drive and transmission technology, integrated power</td>
<td>?</td>
<td><a href="http://www.huachuangev.com/">http://www.huachuangev.com/</a></td>
</tr>
<tr>
<td>Company</td>
<td>Location</td>
<td>Products</td>
<td>Region</td>
<td>Website</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Carls Relay</td>
<td>Shanghai</td>
<td>PDU EV relay supplier for Tesla, BMW</td>
<td>China</td>
<td><a href="http://www.carls-relay.com/">http://www.carls-relay.com/</a></td>
</tr>
<tr>
<td>Chargerlink</td>
<td>Shenzhen, Guangdong Province</td>
<td>R&amp;D, manufacturing of charging systems and charging solutions</td>
<td>China</td>
<td><a href="http://www.chargerlink.com/">http://www.chargerlink.com/</a></td>
</tr>
<tr>
<td>China Southern Power Grid</td>
<td>Guangzhou, Guangdong Province</td>
<td>Charging grid owner and operator</td>
<td>China</td>
<td><a href="http://eng.csg.cn/home/">http://eng.csg.cn/home/</a></td>
</tr>
<tr>
<td>Ebusbar</td>
<td>Shenzhen, Guangdong Province</td>
<td>Bus bar, charging connector, charging terminal, high voltage, connector and cell connector R&amp;D, manufacturing</td>
<td>China</td>
<td><a href="http://www.ebusbar.net/">http://www.ebusbar.net/</a></td>
</tr>
<tr>
<td>GH Energy</td>
<td>Chongqing</td>
<td>R&amp;D, manufacturing of charging systems and software</td>
<td>China</td>
<td><a href="http://www.ghed.com.cn/">http://www.ghed.com.cn/</a></td>
</tr>
<tr>
<td>Scitech</td>
<td>Beijing</td>
<td>Research and consultancy i.a. charging solutions</td>
<td>International</td>
<td><a href="http://www.scitech.org.cn/">http://www.scitech.org.cn/</a></td>
</tr>
<tr>
<td>Clou Power China</td>
<td>Shenzhen, Guangdong Province</td>
<td>R&amp;D, manufacturing, distribution of fast charging systems and grid operator</td>
<td>China, Europe, South America</td>
<td><a href="https://www.clouglobal.com/">https://www.clouglobal.com/</a></td>
</tr>
<tr>
<td>State Grid Corporation China</td>
<td>Beijing</td>
<td>Charging grid owner and operator</td>
<td>China</td>
<td><a href="http://www.sgce.com.cn/">http://www.sgce.com.cn/</a></td>
</tr>
<tr>
<td>Titans</td>
<td>Zhuhai, Guangdong Province</td>
<td>R&amp;D, manufacturing of (fast) charging solutions, battery swap systems</td>
<td>China, North America</td>
<td><a href="http://www.titans.com.cn/">http://www.titans.com.cn/</a></td>
</tr>
</tbody>
</table>
## Chinese manufacturers and suppliers of components

<table>
<thead>
<tr>
<th>Company</th>
<th>Headquarters</th>
<th>Products</th>
<th>Areas served</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company</td>
<td>City, Province</td>
<td>Activities</td>
<td>Location</td>
<td>Website</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Haylion Technologies</td>
<td>Shenzhen, Guangdong</td>
<td>R&amp;D and providing of autonomous and electrification solutions of electric buses</td>
<td>China</td>
<td><a href="http://www.haylion.cn/">http://www.haylion.cn/</a></td>
</tr>
<tr>
<td>INVT</td>
<td>Shenzhen, Guangdong</td>
<td>R&amp;D, manufacturing of NEV control products and solutions, NEV main motor control units, auxiliary motor control units, DC/DC and drive motors</td>
<td>Worldwide</td>
<td><a href="http://www.invt-vehicle.com/">http://www.invt-vehicle.com/</a></td>
</tr>
<tr>
<td>Lvkon</td>
<td>Suzhou, Jiangsu Province</td>
<td>R&amp;D and manufacturing of automated mechanical transmission drive motors for NEVs and power assemblies for BEVs</td>
<td>?</td>
<td><a href="http://www.lvkon.com/">http://www.lvkon.com/</a></td>
</tr>
<tr>
<td><strong>Company</strong></td>
<td><strong>Headquarters</strong></td>
<td><strong>Products</strong></td>
<td><strong>Areas served</strong></td>
<td><strong>Website</strong></td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------</td>
<td>--------------</td>
<td>-----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Yantai Chungway</td>
<td>Shenzhen, Guangdong Province</td>
<td>R&amp;D, manufacturing of lithium-ion battery pack automatic fire extinguishing system</td>
<td>China</td>
<td><a href="http://www.chungway.com/">http://www.chungway.com/</a></td>
</tr>
</tbody>
</table>

**Chinese providers of NEV-related services**

<table>
<thead>
<tr>
<th><strong>Company</strong></th>
<th><strong>Headquarters</strong></th>
<th><strong>Products</strong></th>
<th><strong>Areas served</strong></th>
<th><strong>Website</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Car2share</td>
<td>Hangzhou, Zhejiang Province</td>
<td>NEV car sharing company</td>
<td>Beijing, Chengdu, Guangzhou, Hangzhou, Shanghai, Shenzhen</td>
<td><a href="http://www.car2share.com.cn/">http://www.car2share.com.cn/</a></td>
</tr>
<tr>
<td>Didi Chuxing</td>
<td>Beijing</td>
<td>Ride hailing company planning to release an NEV fleet in 2020</td>
<td>China</td>
<td><a href="https://www.didiglobal.com/">https://www.didiglobal.com/</a></td>
</tr>
<tr>
<td>Company</td>
<td>Location</td>
<td>Type</td>
<td>Cities</td>
<td>Website</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------</td>
<td>-------------------------------</td>
<td>-------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>EV Card</td>
<td>Shanghai</td>
<td>NEV car sharing company</td>
<td>Beijing, Chengdu,</td>
<td><a href="http://www.evcard-sh.com/">http://www.evcard-sh.com/</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chongqing, Shanghai</td>
<td></td>
</tr>
<tr>
<td>Pony Car</td>
<td>Shenzhen, Guangdong Province</td>
<td>NEV car sharing company</td>
<td>Shenzhen</td>
<td><a href="http://iponycar.com/">http://iponycar.com/</a></td>
</tr>
<tr>
<td>Togo</td>
<td>Beijing</td>
<td>NEV car sharing company</td>
<td>Beijing, Guangzhou,</td>
<td><a href="http://www.mytogo.com/">http://www.mytogo.com/</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shanghai, Shenzhen,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Weihai</td>
<td></td>
</tr>
</tbody>
</table>
Sources

**Articles, publications and websites**


• Business Insider, ‘China’s middle class is exploding’ (27 August 2016) http://www.businessinsider.com/chinas-middle-class-is-explooding-2016-8.


• China Daily, ‘Beijing’s electric buses to number 10,000 by 2020’ (2 August 2017) http://www.chinadaily.com.cn/china/2017-08/02/content_3033439.htm.


• Dealer Leasing, ‘Cijfers over de leasebranche,’ https://www.dealerleasing.nl/artikelen/cijfers-over-de-leasebranche.


• Electrek, ‘World’s largest electric vehicle maker BYD sees sales drop 34% after China reduced subsidies’ (8 May 2018) https://electrek.co/2017/05/08/byd-electric-vehicle-sales-drop-china/.


• Financial Times, ‘China puts a stop to electric-car gold rush’ (27 June 2017) https://www.ft.com/content/891d8264-5016-11e7-bfb8-997009366969.
• Financial Times, ‘Electric cars: China’s battle for the battery market’ (5 March 2017) https://www.ft.com/content/8c94a2f6-fded-11e6-8d8e-a5e3738f9ae4.

• Financial Times, ‘Electric cars: China’s highly charged power play’ (12 October 2017) https://www.ft.com/content/00b36a30-a4dd-11e7-9e4f-7f5e6a7e98a2.


• Li, Shengyin, et al., ‘A multi-period optimization model for the deployment of public electric vehicle charging stations on network,’ Transportation Research Par C 65 (2016) 128-143.


• Quartz, ‘Uber is complaining that it has been scrubbed from WeChat in China’ (24 August 2015) https://qz.com/486060/uber-is-complaining-that-it-has-been-scrubbed-fromwechat-in-china/.


• Reuters, ‘China’s recyclers eye looming electric vehicle battery mountain’ (23 October 2017) https://in.reuters.com/article/china-batteries-recycling/insight-chinas-recyclers-eye-looming-electric-vehicle-battery-mountain-idINKBN1CS0EQ.


• Reuters, ‘Who are the world’s biggest polluters?’ (2 June 2017) https://www.reuters.com/news/picture/who-are-the-worlds-biggest-polluters-idUSRTXRKSI.


• TKI Nieuw Gas: Topsector Energie, ‘Contouren van een Routekaart Waterstof’ (2018).


• Tyfield, David, and Dennis Zuev, ‘Stasis, dynamism and emergence of the e-mobility system in China: A power relational perspective,’ Technological Forecasting & Social Change 126 (2018) 259-270.


• Wang, Ning et al., ‘Effectiveness of policy incentives on electric vehicle acceptance in China: A discrete choice analysis,’ Transportation Research Part A 105 (2017) 210-218.


• Xinhua, ‘Electric buses run on Beijing street’ (22 October 2018) [http://www.xinhuanet.com/english/2017-10/22/c_136698327.htm](http://www.xinhuanet.com/english/2017-10/22/c_136698327.htm).


**Interviews**

• Benders, Nienke (Venture IQ) 29 May 2018.

• Biebuyck, Bart (Fuel Cells and Hydrogen Joint Undertaking) 16 March 2018.


• Changling, Zhang (China Automotive Technology and Research Center) 21 May 2018.

• Cui, Hongyang (International Council on Clean Transportation) 17 April 2018.

• Geraets, Maurice (NXP Semiconductors) 25 May 2018.

• Harborn, Mats (Scania) 18 May 2018.

• Ibold, Sebastian (German Society for International Cooperation, GIZ) 7 May 2018.

• Jongste, Dick de, and Leon Liang (Teesing) 8 June 2018.

• Kleingeld, Menno (VDL Enabling Transport Solution) 11 June 2018.
• Langezaal, Michiel (Fastned) 4 July 2018.

• Mazzocco, Ilaria (John Hopkins University) 25 May 2018.

• Nedopil, Christoph (German Society for International Cooperation, GIZ) 31 May 2018.

• Russo, Bill (Automobility Ltd.,) 29 May 2018.

• Schaap, Dirk, (Ministry of Infrastructure and Water Management of the Netherlands) 2 March 2018.

• Schijndel, Thomas van (Prodrive Technologies) 11 June 2018.

**Cover, charts and figures**

• Cover: China.org.cn, ‘Beijing to replace all taxis with new energy vehicles’ 24 February 2017 (accessed 17 August 2018) [http://www.china.org.cn/china/2017-02/24/content_40353867.htm](http://www.china.org.cn/china/2017-02/24/content_40353867.htm).

• Figure 1: Nederland Elektrisch, ‘Verkoopcijfers’ (accessed July 2018) [https://nederlandelektrisch.nl/actueel/verkoopcijfers](https://nederlandelektrisch.nl/actueel/verkoopcijfers).

• Figure 2: Nederland Elektrisch, ‘Verkoopcijfers’ (accessed July 2018) [https://nederlandelektrisch.nl/actueel/verkoopcijfers](https://nederlandelektrisch.nl/actueel/verkoopcijfers).

• Figure 3: Rijksdienst voor Ondernemend Nederland, ‘Verzilvering verdienpotentieel Elektrisch Vervoer’ (2017) 12.


• Figure 6: China Automotive Technology and Research Center, ‘Courtesy by CATARC’ (March 2018).


• Figure 10: Clean Technica, ‘2017 China Electric Car Sales Blow World Out of the Water – BAIC EC-series is a Superstar’ (January 2018) [https://cleantechnica.com/2018/01/29/2017-china-electric-car-sales-blow-world-water-baic-ec-series-superstar/].

**Conferences and seminars**

• Bernhart, Stefan (Embassy of the Federal Republic of Germany) *Seminar on New Energy Vehicles* (Beijing, 14 June 2018).

• Changling, Zhang (China Automotive Technology and Research Center) *Bluebook Conference on Vehicular Hydrogen Industry* (Beijing 29 June 2018).

• Chen, Yi (Tongji University) *Sino-Dutch Round Table on New Energy Vehicle Policies* (Shanghai, 14 April 2018).

• Declercq, Dominik (European Automobile Manufacturers Association) *Seminar on New Energy Vehicles* (Beijing, 14 June 2018).

• Dillen, Tom van (Greenkern) *Seminar on New Energy Vehicles* (Beijing, 14 June 2018).

• Ebbers, Haico (Nyenrode Business University) *Book presentation* (Beijing 1 June 2018).

• Haifeng, Fang (China Automotive Technology and Research Center) *Workshop on Three Revolutions in Transportation* (Beijing, 19 June 2018).

• Huang, Yonghe (China Automotive Technology and Research Center) *Sino-Dutch Round Table on New Energy Vehicle Policies* (Shanghai, 14 April 2018).

• Jianping, Jimmy Hu (Haylion) *Roundtable on Future Mobility* (Beijing, 16 April 2018).

• Keqiang, Li, (Tsinghua University) *Workshop on Three Revolutions in Transportation* (Beijing, 19 June 2018).

• Li, Grace (Research Center for Electric Vehicle Industry SIAC) *Sino-Dutch Round Table on New Energy Vehicle Policies* (Shanghai, 14 April 2018).

• Liu, Bin (China Automotive Technology and Research Center) *Sino-Dutch Round Table on New Energy Vehicle Policies* (Shanghai, 14 April 2018).

• Liu, Huiping (Shanghai Municipal Development & Research Institute) *Sino-Dutch Round Table on New Energy Vehicle Policies* (Shanghai, 14 April 2018).

• Liu, Jianhua (Shanghai New Energy Vehicle Promotion Office) *Sino-Dutch Round Table on New Energy Vehicle Policies* (Shanghai, 14 April 2018).

• Passier, Gerben (Ministry of Infrastructure and Water Management of the Netherlands) *Sino-Dutch Round Table on New Energy Vehicle Policies* (Shanghai, 14 April 2018).
• Pichler, Bernd (ICONIQ Motors) *Roundtable on Future Mobility* (Beijing, 16 April 2018).

• Retzer, Sandra (German Society for International Cooperation, GIZ) *Seminar on New Energy Vehicles* (Beijing, 14 June 2018).

• Wang, Yunshi (University of California, Davis) *Sino-Dutch Round Table on New Energy Vehicle Policies* (Shanghai, 14 April 2018) and: *Workshop on Three Revolutions in Transportation* (Beijing, 19 June 2018).

• Wit, Els de (Ministry of Infrastructure and Water Management of the Netherlands) *Sino-Dutch Round Table on New Energy Vehicle Policies* (Shanghai, 14 April 2018).

• Zhang, Chengbin (EV100) *Sino-Dutch Round Table on New Energy Vehicle Policies* (Shanghai, 14 April 2018).