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The Race to Transport Electrification:

National Electric Vehicle Policies around the World

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Key Points in This Report:

- A spreadsheet accompanying this report provides a summary of EV policies around the world.
- In the last year, countries have moved quickly to set policies to encourage EVs for the passenger car fleet, but also for heavy-duty vehicles (mainly buses), two- and three-wheelers and even for e-rickshaws and tuk-tuks!
- More than 45 countries have set or are setting national targets for EVs the majority of which appear to enter into force around the 2030 timeframe.
- Countries are setting targets, not mandates, to send a clear signal to the auto industry.
- Developed economies, particularly in Europe, are linking CO2 to fiscal incentives. Some, such as France and Italy, employ "bonus-malus" schemes.
- Over 75 countries have set some kind of fiscal policy or policies to encourage EV uptake that might include: tax incentives for vehicle purchase, tax reductions/VAT exemptions, import duty reduction or elimination, subsidies and other related policies.
- 11 countries plan to ban ICEVs as another policy pathway toward encouraging EV uptake.
- What about the U.S., which is hardly mentioned in this report? My view is that the EV market in the U.S. will develop slowly, so slowly, that I project just 10% EVs in new LDV sales by 2040. Why? Because while the rest of the world is tracking toward decarbonization, the U.S., under the Trump Administration is tracking toward deregulation. That will impact the market for decades to come.

Introduction

While a small percentage of overall global car sales, the growth in electric vehicle (EV) sales in the last six years has been astounding, and some proponents and policymakers are intent on this trend continuing as a way to combat air pollution and reduce GHG emissions in line with Paris Agreement targets. In the case of China, some EU member states and the U.S., another driver for these vehicles is supporting their domestic auto industries and encouraging their growth and pursuit of new markets.

In summary, the EV fleet is growing but still only makes up 0.2% of the passenger car fleet. But this could change quickly. One way it can change? Policy. Governments in both developed and emerging economies appear to be rallying around electrification in passenger cars, but also other transport modes such as buses, two- and three-wheelers and even rickshaws.

Policies, decreasing battery technology costs (which presumably drives down vehicle costs) and consumer interest could accelerate EV uptake globally and many in the oil and investment banking industries, as well as NGOs, expect that to happen with the market taking off sometime in the 2030 timeframe (depending on the analysis). But it could go in the other direction as well, especially if EV costs do not reach parity with internal combustion engine vehicles (ICEVs) quickly enough. As a general matter, I believe the key guideposts for members to watch are:

1. Policy developments (both targets/mandates for EVs and/or charging infrastructure);
2. Battery technology costs and whether they decline to a level that puts an EV in parity with a conventional ICEV, which a number of analysts (including me) would put at about US$75-100 kWh (see post Mar. 25, 2019);
3. Infrastructure growth and development;

4. Increasing consumer interest and acceptance, especially as the auto industry prepares to offer many different EV model types for consumers to choose from in the next few years in key markets such as China, North America and the EU.

This report focuses on national policies being set or contemplated around the world to support EV uptake. A previous post (see link above) focused on battery technology costs. Future posts will focus individually on infrastructure and consumer reactions/interest and market development in EVs globally. Countries are moving quickly to set EV policies that tend to focus on:

- National targets for EVs;
- Various types of fiscal policies for EV;
- Tightening fuel economy standards;
- Banning or phasing out ICEVs (which may be coupled with national EV targets);
- Other types of policies that are preferential toward EVs.

This report reviews existing EV policies that have been set, highlights new developments for some countries over the last year and reviews the status of car bans. Accompanying this report is a spreadsheet, adapted from UN data, that attempts to summarize EV policies around the world.[1] Some interesting trends I observe include the following:

- More than 45 countries have set or are setting national targets for EVs the majority of which appear to enter into force around the 2030 timeframe. A few are around 2020, and a few others are in the 2040-2050 timeframe.
- Interestingly, these are targets, not technically mandates. China, for now at least, remains the only country with a true ZEV target. Countries appear to want to encourage EVs and create certainty for the auto industry while avoiding setting a mandate.
- More than 75 countries have set different types of fiscal policies for EVs. Emerging economies are more likely to enact policies centered around reducing or eliminating import duties for EVs, while developed economies with deeper pockets are setting a range of different policies from tax incentives/exemptions, subsidies and other policies. Setting taxation for vehicles based on CO2 is a powerful policy European countries are beginning to use to make ICEVs more expensive than EVs, such as France, Israel, Italy, Mauritius, Norway and Thailand. (See post Apr. 4, 2019)

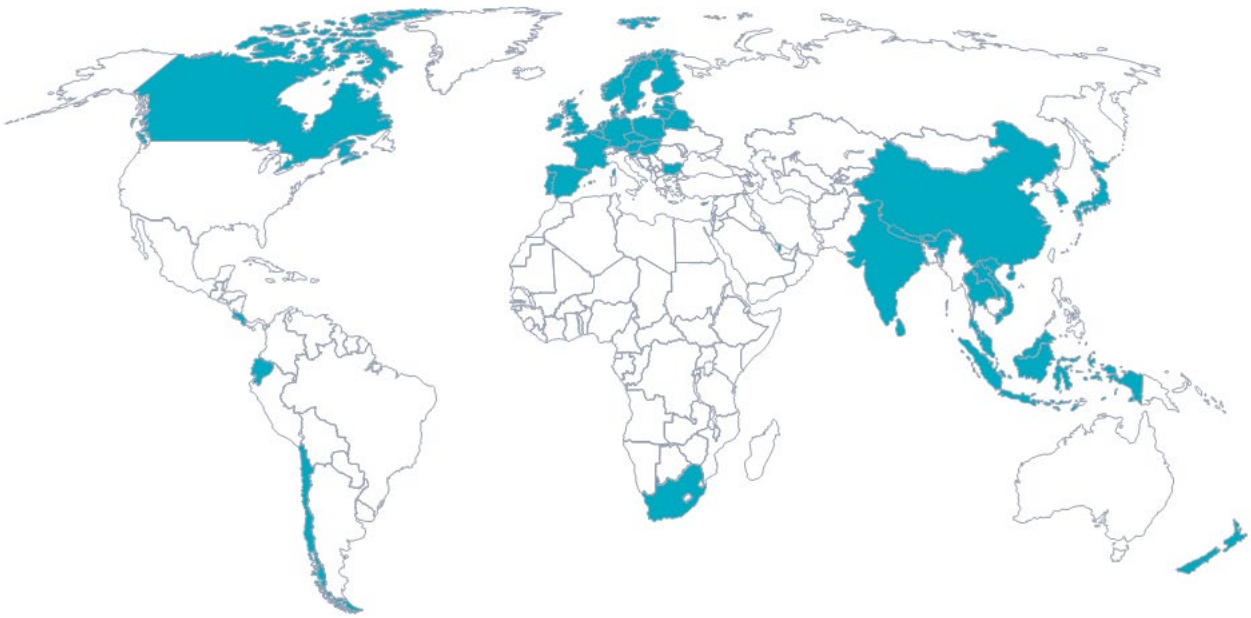
[1] See United Nations, Global Electric Vehicle Policy Database, last accessed June 14, 2019 at https://www.unenvironment.org/resources/publication/global-electric-vehicle-policy-database. NOTE: I have done my best to not only adapt the UN database, but to edit, update and correct it as there were many inaccuracies, mistakes and omissions. There are bound to be things I have missed. If so, please let me know to improve the integrity of this work. I plan to do my best to keep this updated for members going forward on at least an annual basis.

Existing EV Policy

Official Action Plans & Other Policies

Countries are beginning to set policies and develop official action plans to encourage the uptake of these vehicles which are primarily directed to battery electric (BEV), but also plug-in hybrid (PHEV) and to a much lesser extent, hydrogen fuel cell electric vehicles (FCEVs) . In the last year, national action has significantly increased in this area; more than 45 countries now have developed official action plans on EVs. Most of these countries have set hard targets and timelines. Some, such as Chile, India, Laos, include targets for other transport modes beyond passenger cars, such as two- and three-wheelers and electric buses. Other countries have set targets for infrastructure development. The attached spreadsheet summarizes these official action plans, but generally countries are setting targets for LDVs (with a few countries setting targets across modes) and infrastructure. Figure 1 summarizes these policies for countries marked in blue.

Figure 1: Official Action Plans on EVs



Source: Compiled by Future Fuel Strategies citing data from the United Nations Electric Mobility Database, 2019
Note: The EU also has a target to half the use of "conventionally -fuelled" cars in urban transport by 2030; phase them out in cities by 2050 and achieve essentially C02-free city logistics in major urban centers by 2030.

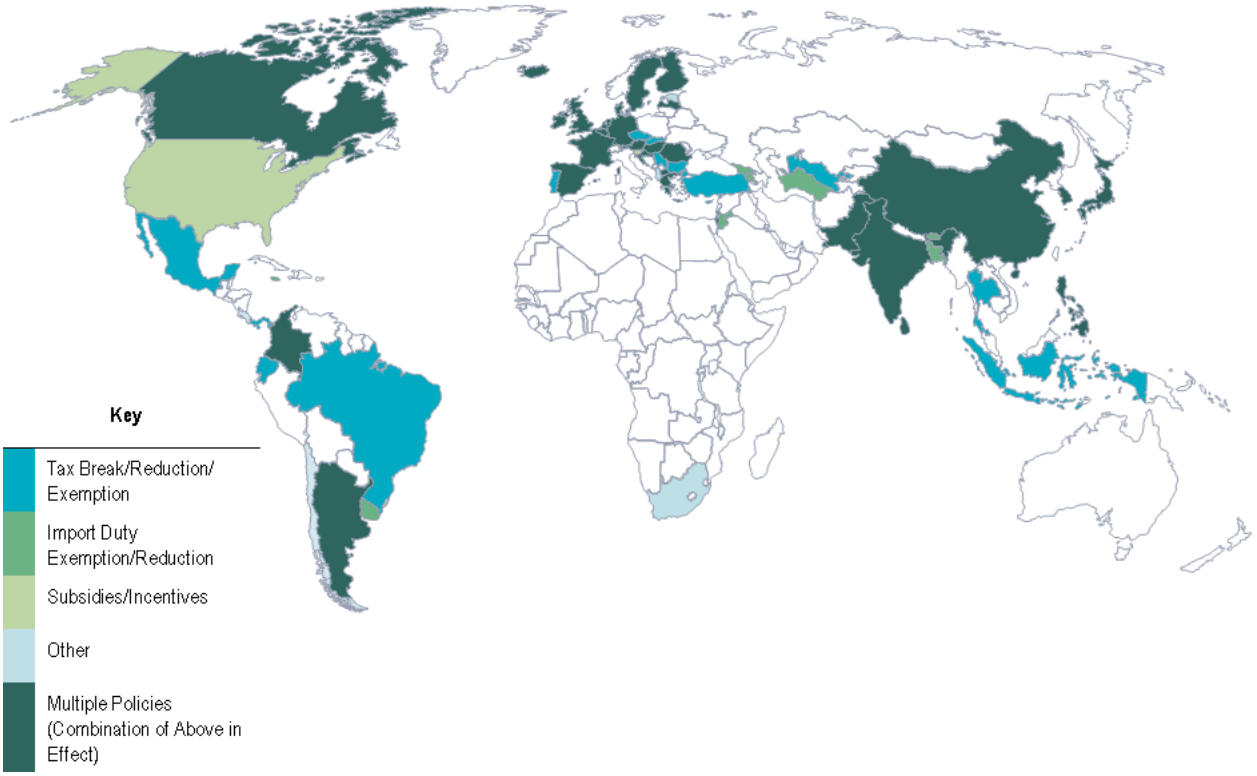
Some example policies, to give members a sense of what countries are doing, include the following:

- **Cabo Verde**: Guarantee the penetration rate of electric vehicles in 2% until 2030
- **Costa Rica**: Aims for 37,000 new EVs within 5 years
- **Finland**: 250,000 EVs by 2030; 7,000 publicly accessible charging stations by 2020

- **France**: 2 million EVs by 2020
- **Germany**: (1) by 2020, 1 million electric cars on German roads; (2) by 2030, only zero-emission passenger vehicles will be approved; by 2050, make all passenger vehicle sales EVs
- **Indonesia**: 20% market share of EVs by 2025
- **Japan**: Target of 1mill EV cars (2020 + sales share target 50-70% (2030)
- **Malaysia**: Electric Mobility Flagship program aims to have 1,000,000 EVs on the road, along with 2,000 electric buses and 125,000 charging stations in the country by 2030
- **Qatar**: "The "Green Car Initiative" is being spearheaded by the ministries of transport and energy, as well as state utilities provider Kahramaa. The goal is to increase the number of electric or hybrid vehicles to four percent by 2022. By 2030, the aim is to ensure at least 10 percent of all cars in Qatar operate on electricity, not fuel.
- **Thailand**: Get 1.2 million electric vehicles on its roads within the next two decades (2036)

Over 75 countries have set some kind of fiscal policy or policies to encourage EV uptake that might include: tax incentives for vehicle purchase, tax reductions/VAT exemptions, import duty reduction or elimination, subsidies and other related policies. These countries are shown in Figure 2.

Figure 2: Countries with Fiscal Policies Encouraging EV Uptake



Source: Compiled by Future Fuel Strategies citing data from the United Nations Electric Mobility Database, 2019

Some example fiscal policies, to give members a sense of what countries are doing, include the following:

- **Ecuador**: The Ecuadorian Government has created several tax incentives to facilitate the entry of EVs into the market. EVs that cost less than US$40,000 are exempt from import tariffs that can vary between 15% and 35% of the value of the vehicle depending on its origin. Likewise, the Internal Consumption Tax (ICE), does not apply to electric or hybrid vehicles up to US$35,000. Electric or hybrid vehicles with values over US$35,000 have reduced taxes on the ICE payment, compared to motorized vehicles of similar value. The environmental tax on pollution, based on the displacement and age of all land vehicles (including motorcycles) has a tariff discount of 20% for hybrid but does not count for EVs. In addition, electric or hybrid vehicles whose taxable rate is up to US$35,000 will not pay VAT; and vehicles that exceed this value, will pay a VAT of 12%.
- **Finland**: Pure EVs always pay the minimum rate of the CO2 based registration tax.
- **Iceland**: The country imposes no purchase tax, no annual tax, provides a VAT exemption, free parking in addition to local incentives.
- **Japan**: A new subsidy scheme was introduced in 2016 that grants progressively higher subsidies as the electric range of the model increases, with the maximum subsidy set at JPY 850,000 (US$ 7,000). For example, for a Nissan Leaf with a 30-kWh battery, the purchase incentive amounts to JPY 330,000 (US$ 3,000).
- **Mexico**: EV owners are currently exempt from a "new vehicles" tax, a yearly vehicle ownership tax and environmental inspection requirements.
- **Nepal**: Prime Minister Sushil Koirala's Cabinet with the Environment Ministry taking the lead, drafts the first major progressive EV tax reform. It reduces custom duty to 10 percent for private, and 1 percent for public EVs (from the existing 40 percent). The new policy also imposes zero percent excise duty on import of all types of large electric vehicles to be used for public transportation stays.
- **South Africa**: Electronic Vehicle Industry Road Map (EVIRM)- The government will reimburse EV manufacturers 35% of their production cost over a period of three years. Producers will have to locally produce a minimum of 5,000 electric cars in order to qualify for the proposed rebate. On the consumer side the countries provides a personal income tax rebate, lower VAT and reduced registration costs.
- **Turkmenistan**: Electric vehicles are exempt from custom duties and hybrid vehicles have tax concessions of 50%.

Other important ancillary policies include:

- **R&D**: Research, development and demonstration (RD&D) of innovative technologies.
- **Public procurement**: The International Energy Agency (IEA) has noted that fleet procurement is an important means of encouraging early EV uptake, noting that fleet operators, both public and private, can contribute significantly to the deployment of EVs, first from demand signals that they send to the market, and second thanks to their broader role as amplifiers in promoting and facilitating the uptake of EVs by their staff and customers. For example, this is happening in cities in the U.S. and China that have committed to purchasing electric buses for public transport.
- **Access restrictions**: Waivers on regulations that limit the availability of license plates for ICE vehicles, exemptions from access restrictions to urban areas (this is directly related to diesel car bans), exemptions from usage fees for specific portions of the road network, dedicated parking and access to publicly

available charging infrastructure, allowances to access bus lanes and high-occupancy vehicle (HOV) lanes.

Existing National ZEV Mandates

China, the U.S. state of California and the Canadian province of Quebec have implemented mandates requiring zero emission vehicles (ZEVs). China remains the only country at this time that has set a specific requirement for ZEVs. Its New Energy Vehicle (NEV) policy sets a minimum requirement for the auto industry to produce NEVs such as PHEVs, BEVs and FCEVs and allows credit trading. The program sets annual mandatory minimum requirements on the number of NEV credits that need to be earned, which can happen either through producing or importing new energy cars or through the purchase of NEV credits from other manufacturers who have excess credits. Credits can only be earned if the vehicle meets minimum range requirements, and depends on the vehicle's range and energy efficiency level. The number of credits allocated is also capped at a maximum for each vehicle type, shown in Table 1.

Table 1: Minimum Range Requirements and Credits Per Electric Vehicle under China's NEV Credit System

Vehicle Type	BEV	PHEV	FCEV
Minimum Range (Km)	100	50	300
NEV Credit Range Per Vehicle	1-6	1-2	2-5

Note: The number of credits per vehicle for a BEV is calculated as: (0.012 x electric range + 0.8) x efficiency adjustment factor. For a PHEV, the calculation is: 2 x efficiency adjustment factor. For a FCEV: 0.16 x FCEV system rated power x efficiency adjustment factor. The adjustment factor is 1 if the vehicle's energy consumption in kilowatt-hour per 100 kilometers (kWh/100 km) relative to its kerb mass in kilograms (kg) is within the reference value range. If it is higher or lower compared with the reference value range, the efficiency adjustment factor is either 0.5 or 1.2 respectively (1.2 only in the case of BEVs). The reference value range is 12-20 kWh/100 km for a BEV with a kerb mass of 800 kg. The maximum number of credits to be earned is capped for each vehicle type to the maximum presented in this table.

Source: Compiled by Future Fuel Strategies citing data from IEA and ICCT, 2018

The target of the NEV credit mandate is 10% of the passenger car market in 2019 and 12% in 2020. These are not actual sales shares, since electric cars can get a rating of more than one credit point, as the table above shows. The total number of EVs that are required to be produced and imported under the mandate is affected by the mix of electric powertrains and related performance of the NEVs. This affects the average number of credits allocated to the NEVs produced and imported.[2]

China also offers a purchase subsidy. However, the ultimate amount of the subsidy depends on three things: (1) the vehicle range in kilometers (km); (2) the energy efficiency in kilowatt-hour per 100 km (kWh/100 km); and (3) battery pack energy density in Watt-hour per kilogram (Wh/kg). Moreover, in February 2018, the

[2] A good example is provided by IEA. "For example, if the average credits allocated per NEV produced or imported in 2020 were to have a value of two, the mandate would require a combined production and import of approximately 1.7 million electric cars, or a 6% electric car market share; if the average number of credits allocated per vehicle is four, the total electric car production would be lower, at 0.9 million electric cars and a 3% electric car market share."

program was amended, lowering the subsidy for PHEVs and low-range BEVs (< 300 km), and increasing it for long-range BEVs (>300 km).

The state of California also has implemented a ZEV requirement that nine other U.S. states are following: Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Vermont. The California program requires for 1.5 million ZEVs in California by 2025 and establishes several milestones on the pathway toward this target. Several U.S. states offer fiscal incentives: Washington, Hawaii, Oregon, Vermont, Colorado, Maryland, Connecticut, New York and Massachusetts.

What's New in EV Policy Setting in the Last Year

A number of countries are setting and continuing to set policies to encourage and require EV uptake. In the last year countries such as Canada, China, EU (as a region), France, India, Japan and South Korea. To give members a sense of how policy is evolving, especially over the last year, I have included an update for some key markets: Canada, China, EU, France, India, Japan and South Korea. Policy seems to be moving in three areas: (1) tougher fuel economy as a way to foster EV uptake (e.g. EU, Japan), (2) establishing and/or strengthening EV targets (e.g. Canada, China, France, India) and (3) establishing or increasing incentives (e.g. Canada, India).

Canada

At the beginning of 2019, Canada's federal government announced new deployment targets for zero-emissions cars: 10% of new sales by 2025, 30% by 2030 and 100% by 2040. Negotiations between the federal government and provincial governments are underway to establish how each province and territory will contribute to the commitments. To support the EV targets, the federal government has enacted a number of measures that include:

- A budget allocation of CAD300 million (US$225 million) over three years for a federal purchase incentive on a ZEV car of up to CAD5000 (US$3,750).
- CAD5 million (US$3.8 million) over five years to induce OEMs to supply ZEVs to the domestic market.
- A 100% accelerated capital cost allowance for medium- and heavy-duty ZEVs purchased by businesses.
- A budget allocation of CAD130 million (US$100 million) over five years to deploy new chargers (and hydrogen refueling stations).
- A budget allocation of CAD120 million (US$90 million) to support the deployment of a coast-to-coast network of EV fast chargers (together with natural gas refueling along key freight corridors and hydrogen stations in metropolitan centers), to develop codes and standards aligned with the U.S. and to fund research and development (R&D) of next generation charging technologies.

- The allocation of part of the CAD800 million (US$590 million) strategic innovation fund to stimulate ZEV manufacturing in Canada.[3]

China

In addition to the NEV program noted above, the Chinese government has taken other recent steps over the last year to further encourage the development of its EV market. In February 2019, the State Administration of Market Supervision and the National Standardization Administration Committee announced a national voluntary standard for "energy consumption rate limits for electric vehicles," the world's first technical standard for specific energy consumption for BEVs.[4] The voluntary standard sets maximum energy consumption requirements in kilowatt-hours per 100 kilometers (kWh/100 km) for 16 weight classes for vehicles up to 2,510 kilograms (kg). There are two phases, where phase 2 is a tightening of the recommended phase 1 standard. The first phase will be implemented July 1, 2019 and is based on existing passenger models that entered the Chinese market in 2019. The second phase is recommended for implementation in 2020. All models in 2019 already meet the phase 1 limit and 80% of the models meet the phase 2 limits.[5]

China also has a national New Energy Vehicle Subsidy Program, updated each year, which supports the adoption of EVs. The level of subsidy allocated though this program depends on three characteristics (vehicle range, energy efficiency and battery pack energy density) and is intended to stimulate innovation and induce consolidation in the battery manufacturing industry. A program amendment in February 2018 lowered the subsidy level for PHEVs and low-range BEVs (<300 km) and increased the levels for long-range BEVs (>300 km). In April 2019, the government announced a modification that goes further. Starting in late June 2019, the overall amount of subsidies available to the car industry will be scaled back and subsides will focus on the battery electric cars with the best performance.

The BEV subsidy for driving ranges of 400 km and above will be cut by half to RMB25,000 (US$3,700) per vehicle, and EVs need to have a range of at least 250 km compared with 150 km previously to qualify for any subsidy at all.[6] For commercial vehicles, a mileage requirement is also a prerequisite for receiving a subsidy. A portion of the subsidy will be paid at the vehicle sale/purchase, but the full subsidy amount can only be claimed if the vehicle reaches a mileage of 20,000 km within two years.[7] Overall, subsidies on purchases of EVs, including buses and trucks will be scaled back in stages. As of January 2019, investment in newly built

[3] Government of Canada, Zero Emission Vehicles, 2019 at http://www.tc.gc.ca/en/services/road/innovative-technologies/zero-emission-vehicles.html.
[4] Government of China, Notice on Printing and Distributing the Interim Measures for the Administration of Recycling and Utilization of Power Battery for New Energy Vehicles, Ministry of Industry and Information Technology, 2018 at http://www.gov.cn/xinwen/2018-02/26/content_5268875.htm.
[5] Sohu, "Electric Vehicle Fuel Economy Standard Will Be Introduced", 2018 at www.sohu.com/a/297465294_100233147?sec=wd.
[6] IEA, "Global EV Outlook 2019" at https://www.iea.org/publications/reports/globalevoutlook2019/.
[7] Id.

independent enterprises producing ICE cars and ICE car companies (listed by the Chinese government) with poor energy consumption performance are banned.[8]

European Union

I will be covering EU developments in EVs in a separate post in July as part of the "Future of Diesel" series. However, over the past year, several significant policy instruments were approved by the EU institutions. They include fuel economy standards for passenger cars and heavy-duty vehicles. I have covered these two policies in depth, so I won't reiterate them here. (see reports Nov. 14, 2018, Oct. 17, 2018, Oct. 4, 2018, Sept. 18, 2018) In February 2019, the European Council and the European Parliament reached a provisional agreement on a revision of the Clean Vehicles Directive of 2009 (2009/33/EC). The reform increases the minimum target levels for public procurement for clean LDVs, trucks and buses for 2025 and 2030.

The binding requirements are expressed as minimum percentages of clean vehicles in the total number of road transport vehicles covered by the aggregate of all procurement contracts and public service contracts. The specific minimum percentages differ by country. For LDVs, member states must reach a share between 17.6% and 38.5% by 2025. For buses, member state targets range from 24% to 45% (2025) and from 33% to 65% (2030) and half of the minimum target for the share of clean buses has to be fulfilled by procuring zero emissions vehicles (i.e. buses without an internal combustion engine). For trucks, targets range from 6% to 10% (2025) and from 7% to 15% (2030).

The Energy Performance Buildings Directive (EPBD) was approved in May 2018. It requires Member States to specify minimum requirements for charging infrastructure in new and renovated buildings by March 2021.[9] For new or renovated non-residential buildings, the EPBD mandates at least one-fifth of the parking places to be equipped with conduits allowing the installation of chargers. Moreover, at least one charging point needs to be installed if more than ten parking places are available. For new or renovated residential buildings with more than ten parking places, all parking places need to be prepared with conduits for future chargers. The EPBD has to be implemented within national building codes in order to take effect. Spain, France and Portugal already had charging infrastructure mandates within their national building codes before the EPBD update.[10]

[8] Id.
[9] European Commission, Clean Mobility: Commission Welcomes European Parliament Adoption of New CO2 Emission Standards For Cars and Vans to Reduce Pollution and Improve Air Quality, Press Release Database, 2019 at http://europa.eu/rapid/press-release_IP-19-1869_en.htm.
[10] Government of France, Decree n° 2016-968 of 13 July 2016 Related To The Charging Infrastructure of Electric Vehicles or Plug-In Hybrid and the Facilities or Bike Park During the Construction of New Buildings, 2016 at http://www.averefrance.org/Uploads/Documents/1468860827ed6bb57e980cf9e0be18453638a79929-D%C3%A9cret%2013%20juillet%202016.pdf. See also Government of Spain, Energía Facilita El Despliegue De Puntos De Recarga De Los Vehículos Eléctricos (Energy Facilitates the Deployment Of Charging Points for Electric Vehicles), Ministry of Industry, Commerce and Tourism, 2017 at http://www.mincotur.gob.es/es-ES/GabinetePrensa/NotasPrensa/2017/Paginas/gestor-carga-20171115.aspx and IEA, Hybrid and Electric Vehicles: The Electric Drive Commutes, 2016 at http://www.ieahev.org/assets/1/7/2016_IA-HEV_BOOK_web_(1).pdf.

France

France has designed incentives so that the number of new electric vehicles sold in 2022 is 5 times higher than in 2017. In particular, a bonus-malus scheme rewards or penalizes the purchase of cars depending on their CO2 emissions level and since the beginning of 2018, the bonus is exclusively dedicated to EVs. A vehicle conversion premium is also in place, supporting the replacement of an old GHG-emitting vehicle with a cleaner one. In May 2018, the French Government and the French automotive sector signed an agreement to achieve its EV targets. Moreover, France will continue to support the installation of charging points available to the public, and a national plan will be promulgated by 2020 to encourage localities to do so with the goal to reach 100,000 charge points by 2022.

India

In February 2019, the government approved the proposal for implementation of the "Faster Adoption and Manufacturing of Electric Vehicles in India Phase II" (FAME Phase II) scheme that reduces the upfront purchase price of hybrid and electric vehicles. The Phase II scheme includes the allocation of a US$1.4 billion budget to encourage the uptake of electric vehicles and will be implemented over a period of three years from April 2019. It scales up the earlier FAME scheme, which was launched in 2015. The emphasis of Phase II will be on public and shared transportation. It includes incentives for electric three- and four-wheelers (including rickshaws), as well as for buses, where the incentives are mainly applicable to those vehicles used for public or shared transportation or for commercial purposes. In the case of electric two-wheelers, the incentives are targeted to private vehicles. To encourage more advanced technologies, it is indicated that the incentives only apply to those vehicles using advanced battery chemistries such as a lithium-ion battery, although it is not clear which chemistries are excluded from the incentive.

India's FAME Phase II scheme includes substantial commitments for charging infrastructure. Specifically, it sets an indicative target of 2,700 charging stations in cities above 4 million inhabitants, fast charging stations along major highways at an interval of about 25 km each and ultra-fast charging stations every 100 km.[11] India's FAME Phase II policy has also allocated INR 10 billion (Indian rupees, US$145 million) between 2019 and 2022 to EVSE deployment. This is nearly 10% of its total budget. India also updated its Model Building By-Laws from 2016 to mandate 20% of parking space within residential and non-residential complexes must provide EV charging infrastructure and placed a cap on the maximum tariff that can be asked by a public charging station (15% above the average cost of supply).[12]

India's Energy Efficiency Services Limited (EESL) aims to replace 500,000 government cars over a period of three to four years (India Energy Efficiency Services Limited, n.d.). In September 2017, EESL put out its first public EV procurement tender for 500 electric cars, followed by another tender for 10,000 electric cars in

[11] Government of India, Cabinet approves scheme for FAME India Phase II, 2019 at http://pib.nic.in/newsite/PrintRelease.aspx?relid=189081.
[12] See id. See also Government of India, Amendments in Model Building By-Laws (MBBL - 2016) for Electric Vehicle Charging Infrastructure, 2019 at http://pibphoto.nic.in/documents/rlink/2019/feb/p201921501.pdf.

March 2018.[13] However, in January 2019 the plan to complete the distribution of the first lot of 10 000 electric cars ordered for government use was delayed for a second-time to September 2019, as only 10% of the order, initially expected to be delivered by June 2018, had been delivered.[14]

Japan

In March 2019, the Ministry of Economy, Trade and Industry (METI) and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) introduced new fuel economy standards for heavy vehicles running on diesel, including trucks and buses.[15] According to the regulation, new trucks and other heavy vehicles should have a fuel economy of 7.63 kilometers per liter (km/L) by 2025 (implying an efficiency improvement of 13.4% relative to the 2015 standards), and a level of 6.52 km/L for buses by 2025 (implying an efficiency improvement of 13.4% relative to the 2015 standards). The regulation has relevance for electric mobility due to its capacity to improve efficiency, but it does not have specific provisions for EVs. Japan also updated its fuel economy standard for LDVs to align it with the 2030 next generation vehicle target. The update sets a limit of 25.4 km/L (3.9 L/100 km), calculated with the Worldwide harmonized Light-duty Test Cycle (WLTC), tightening the 2020 limit of 19.4 km/L (5.2 L/100 km) and opening up the scope for increased vehicle electrification.[16]

In April 2018, METI launched a strategic commission for a “new era of automobiles", which is developing a long-term goal and strategy for the Japanese automotive industry to tackle climate change. An interim report of the strategic commission outlines a 2050 goal to reduce 80% of GHG emissions per vehicle produced by Japanese automakers (Government of Japan, 2018). For passenger vehicles, the ambition outlined in the interim report is more ambitious at 90% reduction of GHG emissions per vehicle to be achieved with a 100% market share of EVs (HEVs, PHEVs, BEVs or FCEVs). Importantly, METI's strategic commission specifies that its goal is to realize well-to-wheel zero emissions, thus linking the strategy to its efforts to fully decarbonize the energy supply (electricity and hydrogen).[17] The strategy also states the ambition to stimulate innovation in terms of “how vehicles are used", for example looking into concepts such as mobility as a service (MaaS), and connected and autonomous driving.

[13] Id.
[14] Saluja, N., "EESL Plan to Finish First Lot of E-Cars Delayed," The Economic Times, 2019 at https://economictimes.indiatimes.com/industry/auto/eesl-plan-to-finish-first-lot-of-e-carsdelayed/articleshow/67331483.cms.
[15] Government of Japan, New fuel efficiency standards for trucks and buses formulated, Ministry of Economy, Trade and Industry, 2019 at http://www.meti.go.jp/english/press/2019/0329_003.html.
[16] Government of Japan, New fuel Consumption Standard Values of Passenger Cars Were Presented, 2019 at http://www.meti.go.jp/press/2019/06/20190603003/20190603003.html.
[17] Government of Japan, METI Releases Interim Report by Strategic Commission for the New Era of Automobiles, Ministry of Economy Trade and Industry, 2018 at http://www.meti.go.jp/english/press/2018/0831_003.html.

South Korea

Korea aims to have 430,000 BEVs and 67,000 FCEVs on the road by 2022.[18] In 2019, the objective is to register 46,000 passenger cars and more than 1,300 heavy-duty BEVs, and initiate hydrogen-fuelled public buses in seven major cities, including Seoul and Busan.[19] Tax rebates per EV (including BEVs and FCEVs) are capped at a maximum of KRW 5.3 million (Korean won, US$4,500).[20] The number of low-carbon vehicles that can benefit from national subsidies (available on the top of the tax rebates) increased from 32,000 vehicles in 2018 to 57,000 in 2019.[21] BEV subsidies per vehicle are capped at a maximum of KRW 19 million (US$16,400, up from KRW 14 million [US$12,000] in 2018) and PHEVs at KRW 5 million (US$4,300).[22]

The government targets for 2022 are 10,000 fast EV chargers (with 1,200 added in 2019) and 310 refueling stations for FCEVs (46 added in 2019).[23] In 2019, the deployment of chargers will benefit from subsidies of KRW 3.5 million (US$3,000) for publicly accessible slow chargers, KRW 1.3 million (US$1,200) for private chargers26 and KRW 0.4 million (US$350) for portable chargers. For fast chargers, subsidies were at KRW 35 million (US$30,000) in 2018. Fast chargers are restricted to collective entities and not available for private individuals.

Car Bans and Fuel Economy as ZEV Policy Drivers

The ban of international combustion engine vehicles (ICEVs) may be serving as an incentive, of sorts, to develop the EV market. (see post Mar. 3, 2019) China, France, India, Israel, Netherlands, Norway, Scotland, Slovenia, Sri Lanka, Sweden and the United Kingdom and India have so far announced such a ban or phase out. Most of them take effect by 2030. Many are vague on important details such as whether hybrid vehicles are included in the bans. China's ban does not have a specific phase out date.

Table 2: Cities/Countries that Have Taken Recent Action to Ban or Limit ICEVs

City, Country	Summary
Athens, Greece	Diesel cars and vans banned by 2025

[18] Government of Korea, Ministry of Environment's Policy Briefing on Promoting Environment Friendly Vehicles in 2019, Ministry of Environment, 2019 at http://www.me.go.kr/home/web/board/read.do?boardMasterId=1&boardId=935880&menuId=286. See also Manthey, N., "South Korea to Boost Electric Vehicle Industry," Dec. 12, 2018 at http://www.electrive.com/2018/12/18/southkorea-to-boost-electric-vehicle-industry/.
[19] Government of Korea, The Eco-Friendly Car ...100,000 Outlook This Year, Ministry of Environment, 2019 at www.korea.kr/news/pressReleaseView.do?newsId=156315712.
[20] Korea Environment Corporation, EV Portal – Electric Vehicle Tax Benefit, 2019 http://www.ev.or.kr/portal/saletex?pMENUMST_ID=21548.
[21] Government of Korea, Ministry of Environment's Policy Briefing On Promoting Environment Friendly Vehicles in 2019, Ministry of Environment, 2019 at http://www.me.go.kr/home/web/board/read.do?boardMasterId=1&boardId=935880&menuId=286.
[22] Id.
[23] Id.

City, Country	Summary
Auckland	Signed FFSD[24]
Bangalore, India	Investing heavily in public transport and converted its 6,000 buses to CNG while discouraging car use
Barcelona, Spain	All cars older than 20 years old banned from 2019; exploring the "superblock" concept (more green spaces and less street) to clean up its air and to reclaim space from road transportation; signed FFSD
Birmingham, United Kingdom	Signed FFSD
Capetown, South Africa	Signed FFSD
China	Plans to ban ICEVs but has specified no timeline
Copenhagen, Denmark	The city has prioritized bikes over cars and has closed to vehicles for decades, long before the car ban issues came to the fore. Copenhagen prioritizes bikes over cars and now has more cycles than people. Signed FFSD.
Curitiba, Brazil	Has invested heavily in public transport; currently nearly 70% of the city goes to work by public transport
France	Ending the sale of ICEVs by 2040
Greater Manchester, United Kingdom	Signed FFSD
Hanoi, Vietnam	Plans to ban motorbikes by 2030
Heidelberg, Germany	Signed FFSD
Helsinki, Finland	The Finnish capital plans to drastically reduce the number of cars on its streets by investing heavily in better public transport, imposing higher parking fees, encouraging bikes and walking and converting inner city ring roads into residential and walking areas.
Honolulu, U.S.	Signed FFSD
India	Plans to replace all ICEVs with EVs by 2030
Ireland	Ending the sale of conventional ICEVs by 2030
Israel	Ending the sale of conventional ICEVs by 2030 in favor of natural gas vehicles and EVs
London, United Kingdom	Has instituted policies to require cleaner buses, incentives to encourage taxi drivers to choose cleaner vehicles (i.e. ZEVs), added bike lanes and has started the ultra low emission zone (ULEZ) a year early, in 2018. Under the ULEZ

[24] A number of cities have signed on to Bloomberg Philanthropies-backed C40 Initiative's "Fossil Fuel Streets Declaration" (FFSD) announced late last year around the COP24 talks. The declaration provides that signatories procure only zero-emission buses from 2025 and ensure a major area of its city is zero emission by 2030 by taking the following steps:

- Transform cities through people-friendly planning policies.
- Increase the rates of walking, cycling and the use of public and shared transport that is accessible to all citizens.
- Reduce the number of polluting vehicles on streets and transition away from vehicles powered by fossil fuels.
- Lead by example by procuring ZEVs for city fleets as quickly as possible.
- Collaborate with suppliers, fleet operators and businesses to accelerate the shift to zero emissions vehicles and reduce vehicle miles in our cities.
- Publicly report every two years on the progress the cities are making towards these goals.

City, Country	Summary
	program, all cars, motorcycles, vans, minibuses, buses, coaches and heavy goods vehicles (HGVs) will need to meet exhaust emission standards (ULEZ standards), or pay a daily charge, when travelling in central London. Considering restricting parking spaces in the city, pay-per-mile road pricing for some vehicles, car-free days and zones. Also signed FFSD.
Los Angeles	Signed FFSD
Madrid, Spain	Diesel cars and vans banned by 2025
Medellin, Colombia	Signed FFSD
Mexico City	Diesel cars and vans banned by 2025; new regulations to eliminate parking requirements in buildings signed in June 2017; signed FFSD
Milan, Italy	Plans to make the city "diesel free" by 2030; signed FFSD
Munich, Germany	Considering legislation to ban all diesel ICEVs from the city center
The Netherlands	By 2030, all new cars in the Netherlands must be zero emission.
New Delhi, India	Has banned all new large diesel cars and SUVs with engines of more than 2,000cc and is phasing out thousands of diesel taxis; vehicle registrations for diesel ICEVs made at least 10 years ago will be canceled or won't be renewed
Norway	Has set a goal (not a ban) that all new cars sold by 2025 should be zero (electric or hydrogen) or low (plug-in hybrids) emission vehicles. This is a very ambitious but feasible goal with the right policy measures.
Oslo, Norway	Initially created car-free zones, but citizen backlash caused city managers to rethink this policy and now the city is eliminating parking spaces; signed FFSD
Oxford, UK	Signed FFSD
Paris, France	Diesel cars and vans banned by 2025; has already banned all diesel cars manufactured before 2000; bans cars in many historic central districts on weekends; imposes odd-even bans on vehicles; makes public transport free during major pollution events and encourages car and bike-sharing; a long section of the Right Bank of the river Seine is now car-free and a monthly ban on cars has come into force along the Champs-Elysées. Signed FFSD.
Quito, Ecuador	Signed FFSD
Rome, Italy	Diesel cars banned from the city's center by 2024; signed FFSD
Rotterdam, the Netherlands	Signed FFSD
Santa Monica, U.S.	Signed FFSD
Santiago, Chile	Signed FFSD
Scotland	Ending the sale of conventional ICEVs by 2032
Seattle, WA, USA	Signed FFSD
Seoul, South Korea	Signed FFSD
Slovenia	Ending the sale of conventional ICEVs by 2030
Sri Lanka	Aiming to convert the ICEV fleet to EVs by 2040
Stockholm, Sweden	Signed FFSD
Stuttgart, Germany	Plans in 2018 to ban diesel cars that do not emissions standards from entering the city on days when pollution is heavy
Sweden	Ending the sale of conventional ICEVs by 2030
Taipei	Signed FFSD
Tokyo, Japan	Ending the sale of conventional ICEVs by 2040

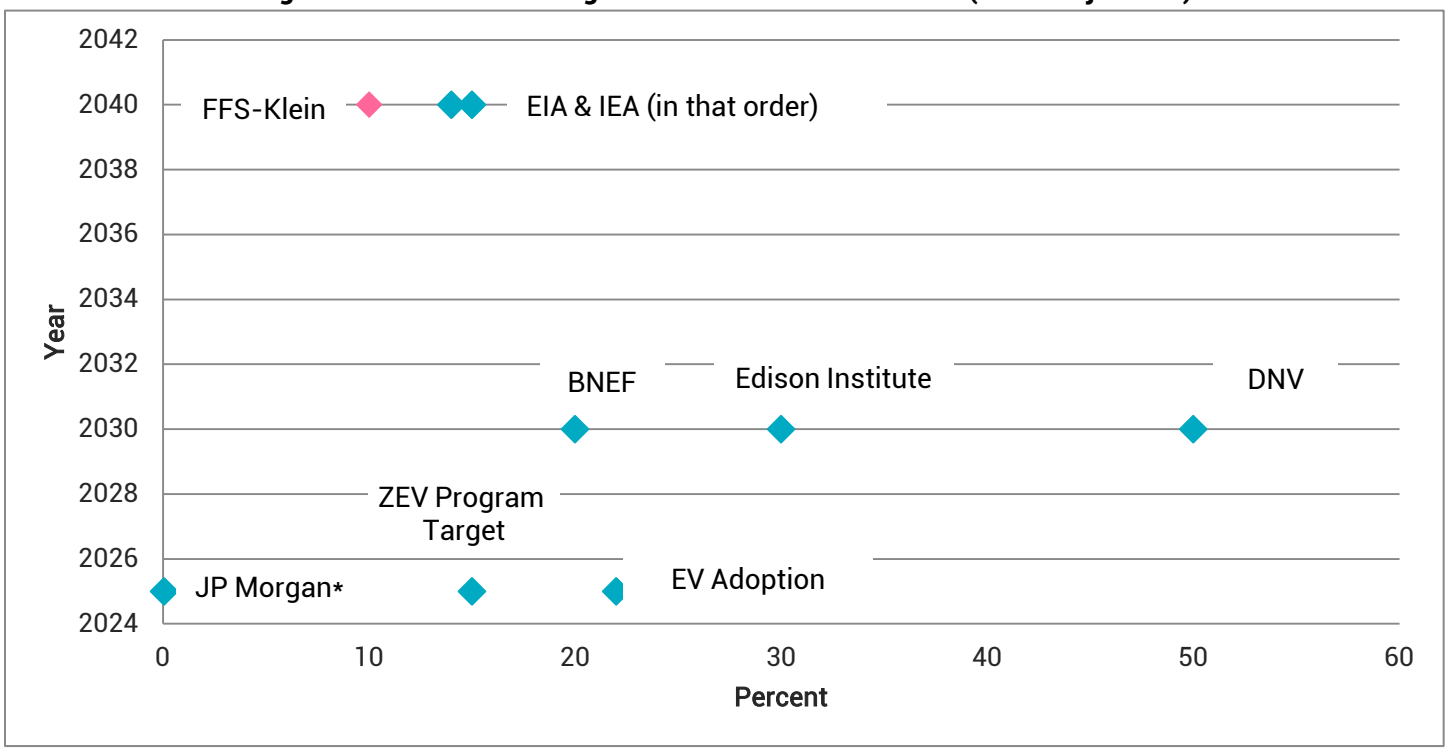
City, Country	Summary
United Kingdom	Ending the sale of conventional ICEVs by 2040 (i.e., presumably hybrid vehicles will still be allowed)
Vancouver, Canada	Signed FFSD
Warsaw, Poland	Signed FFSD
West Hollywood, U.S.	Signed FFSD
Zurich, Switzerland	Has capped the number of parking spaces in the city, only allows a certain number of cars into the city at any one time, and is building more car-free areas, plazas, tram lines and pedestrianized streets.

Source: Future Fuel Strategies, updated June 2019

Conclusion: Hey, What about the U.S.?

What about the U.S. barely mentioned in this report until now? My view is that the U.S. EV market will grow more slowly than other industry analysts project, mainly because there is no strong federal policy or national vision driving the market beyond a federal tax credit for EVs (which President Trump has vowed to find a way to end). To give members a sense of what I see versus what other analysts see, Figure 3 compares different analysts' projections of new LDV sales in the U.S. for 2018 projections (I will update this analysis for 2019 at the end of the year). I project a mere 10% penetration of EVs in new LDV sales by 2040.

Figure 3: EVs as a Percentage of New LDV Sales in the U.S. (2018 Projections)



Source: Compiled by Future Fuel Strategies citing data from these organizations, April 2019. Pink diamond: My projection, which does not include hybrid electric vehicles. All projections focus on battery electric and plug-in hybrid electric

*vehicles. *The JP Morgan estimate does not include hybrid electric vehicles, which make up the bulk of its 2025 penetration estimate.*

Stringent fuel economy standards that had been proposed by former President Obama's administration have long since been scrapped (see report Sept. 18, 2018) and such policy no longer serves as a driver for EV uptake as it does in China, the EU and soon, Japan. In fact, less stringent standards will likely be set in 2019 but I expect will be litigated for years. In short, stringent fuel economy standards will not likely be set until the late 2020s and even perhaps into the 2030s and that will impact sales of EVs. No other U.S. federal policy to support the uptake of EVs is contemplated at this time. Most of the 10% estimate I show will be seen in California because of its Zero Emission Vehicle (ZEV) mandate as well as in the states that implement the mandate. I do not believe state policy setting on EVs will be enough to overcome the lack of a national vision/plan on EVs.

Further, I believe the current presidential political situation in the U.S. will be the single largest determinant of the EV market over the next 10 years. If President Trump wins another term, all bets are off: a pathway toward dismantling and deregulation that impacts the fuels/vehicles markets generally and EVs critically will continue until 2025-2026. Another strong determinant will be the conservative make up of the U.S. Supreme Court, set in 2018 with the controversial appointment of Justice Brett Kavanaugh. Will such a court strike down:

- Future progressive fuel economy policies?
- California's ability to set its own fuel economy or other fuel/vehicle policies?
- Future climate change policies (e.g. carbon tax) that may drive the EV market?
- Progressive electrification policies (ZEV mandates and targets)?
- Cities' abilities to diverge from state and federal policy setting in the area of transport?

To really see significant uptake of EVs in the U.S. (or any) LDV market the way some analysts predict in Figure 3, a national vision or policies really have to be set now. Such policies need to be comprehensive, such as what Norway has done (see post Apr. 4, 2019). China is another example through its NEV program. I see no such pathway for the U.S. right now.