



Electric Vehicle Initiative

Transport stream: Session 11

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Jakarta, 19 July 2018



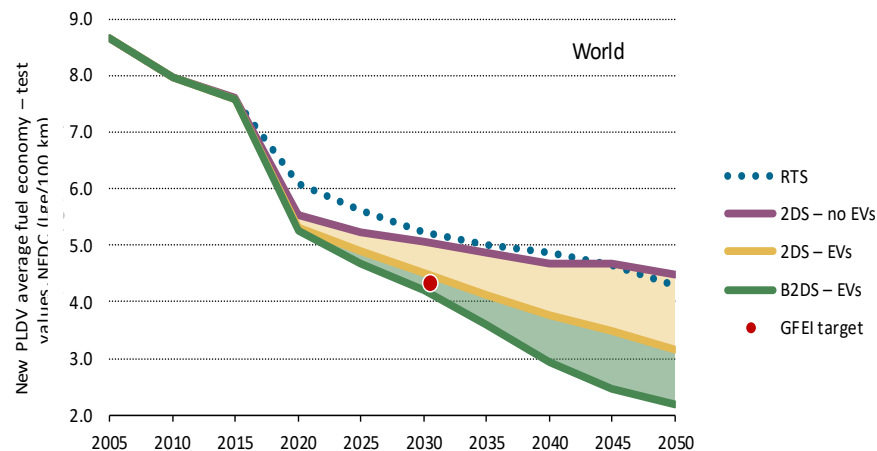
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- **The policy context is changing rapidly**
 - **Changes in global test procedures** used to measure fuel economy and pollutant emissions of LDVs make it more challenging to meet regulatory requirements from ICEs
 - Some of the **major global vehicle markets** (China, EU and India) are **adopting policies that clearly support the uptake of EVs**
 - Announcements from governments include **commitments for an EV market share increase in by 2030** ([EV30@30 CEM Campaign](#)) and **the ICE phase out in the 2030s/2040s** (France, India, the Netherlands, Norway, the UK)
- **Battery technologies are evolving**
 - Prospects for future developments confirm the encouraging signs in cost and performance improvements observed over the past decade
- **The automotive industry is mobilising investments**
 - Several **OEMs announced plans to deploy EVs**, and a number of them indicated **deployment targets for the 2020 to 2025** time frame

EVs need to play a central role in scenarios meeting the ambition of the Paris Agreement, given

- the **need for a major deployment of zero-emission technologies for LDVs** in 2050
- the **strong decarbonization of the power sector** (already on its way, with 60% of the new power generation capacity added in 2016 coming from renewables and major announcements to abandon coal)
- the **pivotal role of EVs for the facilitation of the clean energy transition**, and namely the integration of variable renewables in the energy mix

Contribution of EVs for fuel economy improvements in IEA scenarios



Source: IEA analysis based on scenarios developed for the [Energy Technology Perspectives 2017](#) report

GFEI partners are aware of the significant benefits offered by EVs

- EVs clearly offer the best efficiency advantage over the conventional ICE powertrains
- EVs promote a shift from petroleum fuels to electricity, helping to diversify the transport energy mix
- EVs are a pivotal technology for the facilitation of the clean energy transition
- EVs are the most effective solution for the reduction of local pollution
- PEVs allow for net savings over the vehicle life and, if battery costs approach USD 100/kWh, allow to achieve cost parity with ICEs even for first owner economics, even with current mileage, in many global regions

Electric Vehicle Initiative

Electric Vehicles Initiative (EVI)

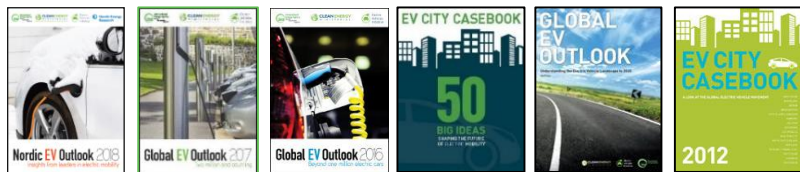


Multi-government policy forum dedicated to conducting collaborative activities that support the design and implementation of domestic electric vehicle (EV) deployment policies and programs

In 2010, EVI was one of several initiatives launched under the CEM

Currently co-chaired by Canada and China, and coordinated by the IEA

Released several analytical publications, demonstrating leadership to strengthen the understanding of the opportunities offered by electric mobility to meet multiple policy goals



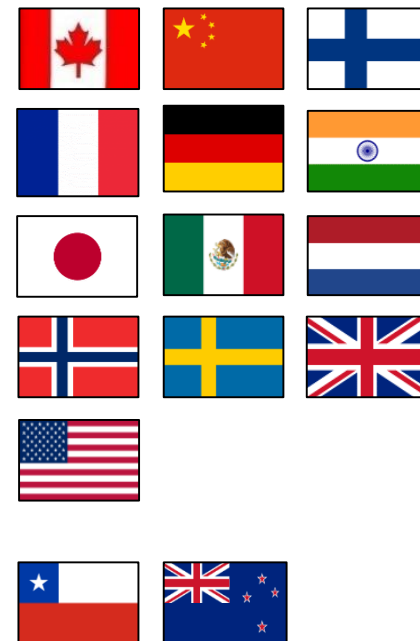
Instrumental to mobilize action and commitments ([Paris Declaration on Electro-Mobility and Climate Change](#) at COP21, [Government Fleet Declaration](#) at COP22)

Launched the [EV30@30 Campaign](#) in June 2017

Now launching the **Pilot City Programme**

Also working with the **Global Environment Facility** on the preparation of a project for the support of EV policy-making in developing regions

Members



in 2018



- Designed to accelerate the global deployment of electric vehicles
- Sets a collective aspirational goal to reach 30% sales share for EVs by 2030
- Launched at the 8th CEM meeting, in Beijing, by Minister Wan Gang

Implementing actions include:

- Supporting the deployment of chargers and tracking its progress,
- Galvanising public and private sector commitments for electric vehicle (EV) uptake in company and supplier fleets
- Scaling up policy research and information exchanges
- Supporting governments in need of policy and technical assistance through training and capacity building
- **Establishing the Global EV Pilot City Programme, aiming to achieve 100 EV-Friendly Cities over five years**
- Supported by several partners

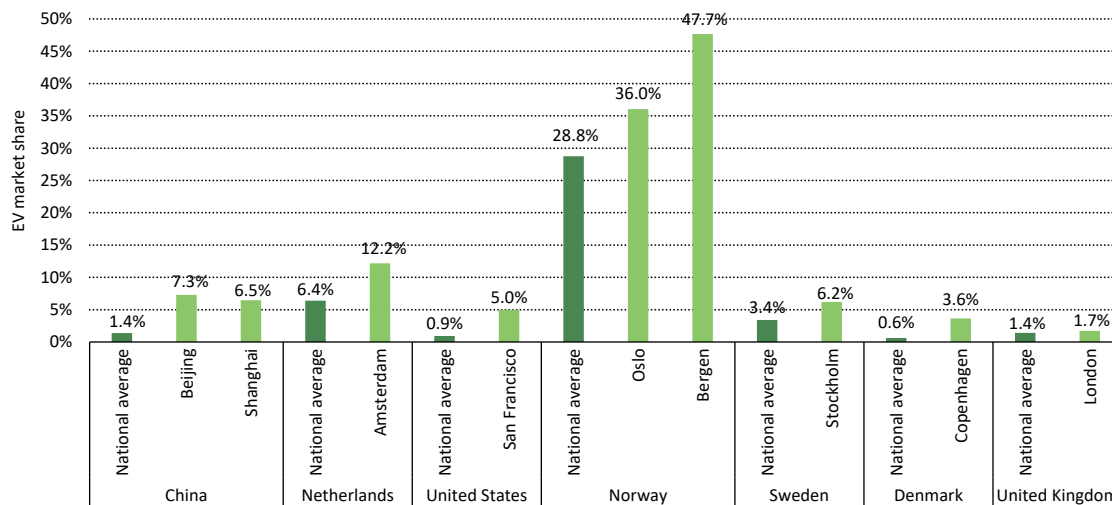


Members



Cities can be a privileged space for EV support and deployment

Market share of electric cars in leading EV countries compared to EV-friendly cities, 2016:



(Nearly one third of global electric car sales took place in just 14 cities in 2015)

- "Cities have been at the **forefront** of stimulating EV deployment"
- "Leading EV cities have shown that, as a result of **dedicated local policies** complementing national EV policy schemes, they can create a **favourable environment** for EV use and **reduce consumer barriers**"
- "Cities can have a **leadership** role in developing and testing **innovative** policy actions before widespread adoption" *(Global EV Outlook 2017, IEA)*

Cities have a unique role to play in supporting EVSE rollout and in implementing measures enhancing the value-proposition of driving electric. They act as innovation test-beds for the future of mobility

Topics

- Urban planning
- Infrastructure and charging technology
- Mass transit (including electric buses)
- Mobility as a service (including car and ride sharing)



Activities

- Support greater **dialogue** with and provide **support** to municipal governments
- Identify **good practices** and facilitate their **replication** and improvement
- **Monitor and report** progress : data and information sharing among PCP members
- Engage in the organization of the **Pilot City Forum**

Goal

- 100 EV-Friendly Cities within five years

Almost 30 cities have already joined to date

Country	Cities
Canada	Calgary, Halifax Regional Municipality, Stratford, Surrey, Richmond, Winnipeg
China	Beijing, Rugao, Shanghai, Shenzhen, Yancheng
Finland	Helsinki, Espoo, Oulu, Tampere, Vantaa
Japan	Aichi, Kanagawa and Kyoto Prefectures; Tokyo Metropolitan Government
Netherlands	Metropolitan Region Amsterdam and G4 Cities (Utrecht, Amsterdam, the Hague, Rotterdam)
Norway	Bergen (upcoming), Oslo
Sweden	Stockholm
Thailand	Betong (interested), Nonthaburi (interested)
United Kingdom	Dundee, London
United States	New York City

Recent activities

EV Pilot City Forum in Helsinki, May 28-29, 2018

- First **exchange event of the PCP**, allowing to facilitate **networking** and **communication** across interested stakeholders



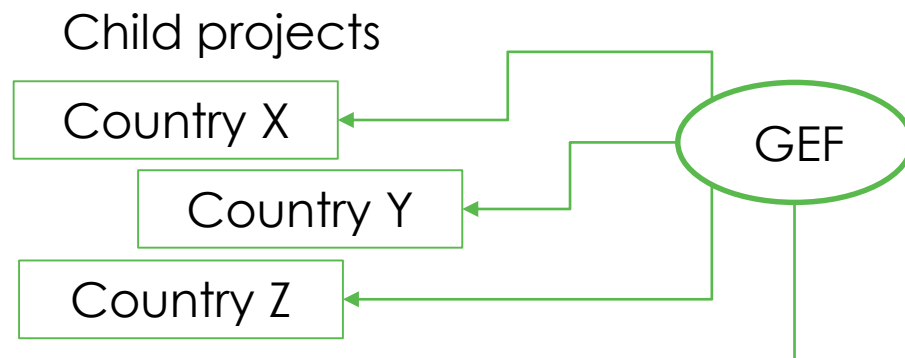
Global Environment Facility project on EV policy implementation



- GEF expression of interest, project under elaboration between UNEP and IEA
- Strong alignment with the EV30@30 Campaign, esp. on capacity building items
- Opportunity to widen EVI reach (Latin America, Africa, Central and South-East Asia, and Central and Eastern Europe)
- Structure: global (parent) component linked with several national (child) projects
- Total GEF funding allocation close to 100 Million
- Need for co-funding commitments

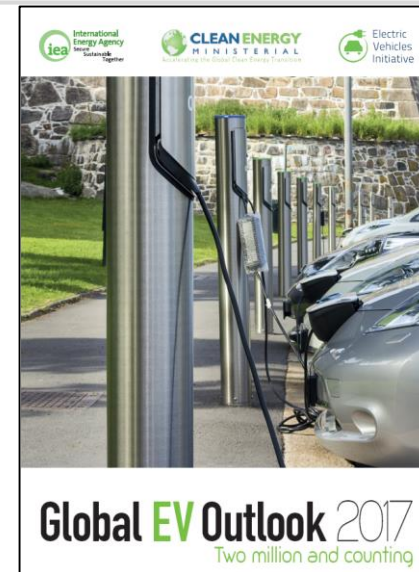
Global project (policy matrix)			
	Vehicles (by mode)	Chargers	Power system
National
Local

+ pilot (selected countries)



- GEVO: Annual EVI report drafted at IEA

- Data reporting (EV stock, sales, EVSE, battery costs)
- Policy analysis and TCO assessment
- CO₂ impact and role of EVs in low carbon scenarios (2030 timeframe)
- Insights on grid integration



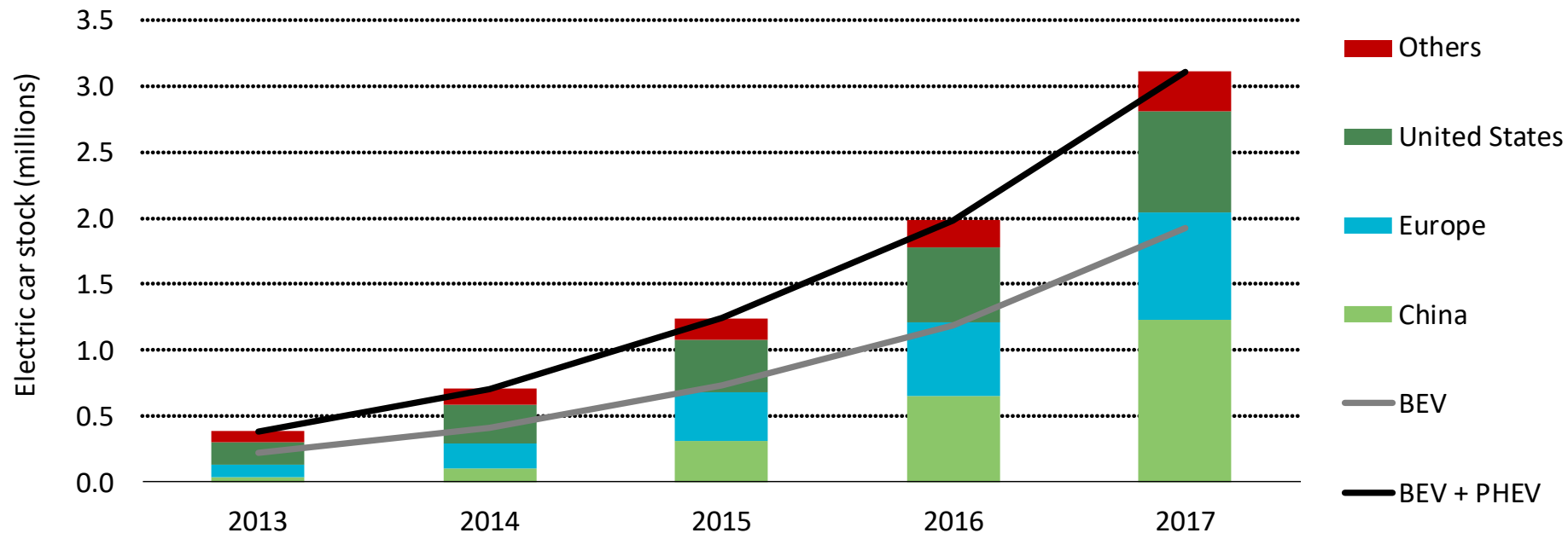
- NEVO:

- One-off publication, released March 2018
- Insights from market leaders
- Successes and lessons learnt, consumer behaviour, overview of EVSE and grid stakeholders and key challenges
- Key takeaways as an inspiration to other countries?

- EVI flagship report by the IEA
- 2018 edition includes
 - Data reporting (EV stock, sales, EVSE, battery costs)
 - Overview of existing policies
 - Battery technology and cost assessment
 - Implications on the TCO of road vehicles – *across many modes*
 - Role of EVs in low carbon scenarios (2030 timeframe)
 - Electricity demand, oil displacement & GHG emission mitigation
 - Battery material demand
 - Policy recommendations
- 2018 edition also paired with the Nordic EV Outlook 2018
 - Focus on one of the most dynamic global regions for EV uptake
 - Opportunity to learn on policy efficacy and consumer behaviour

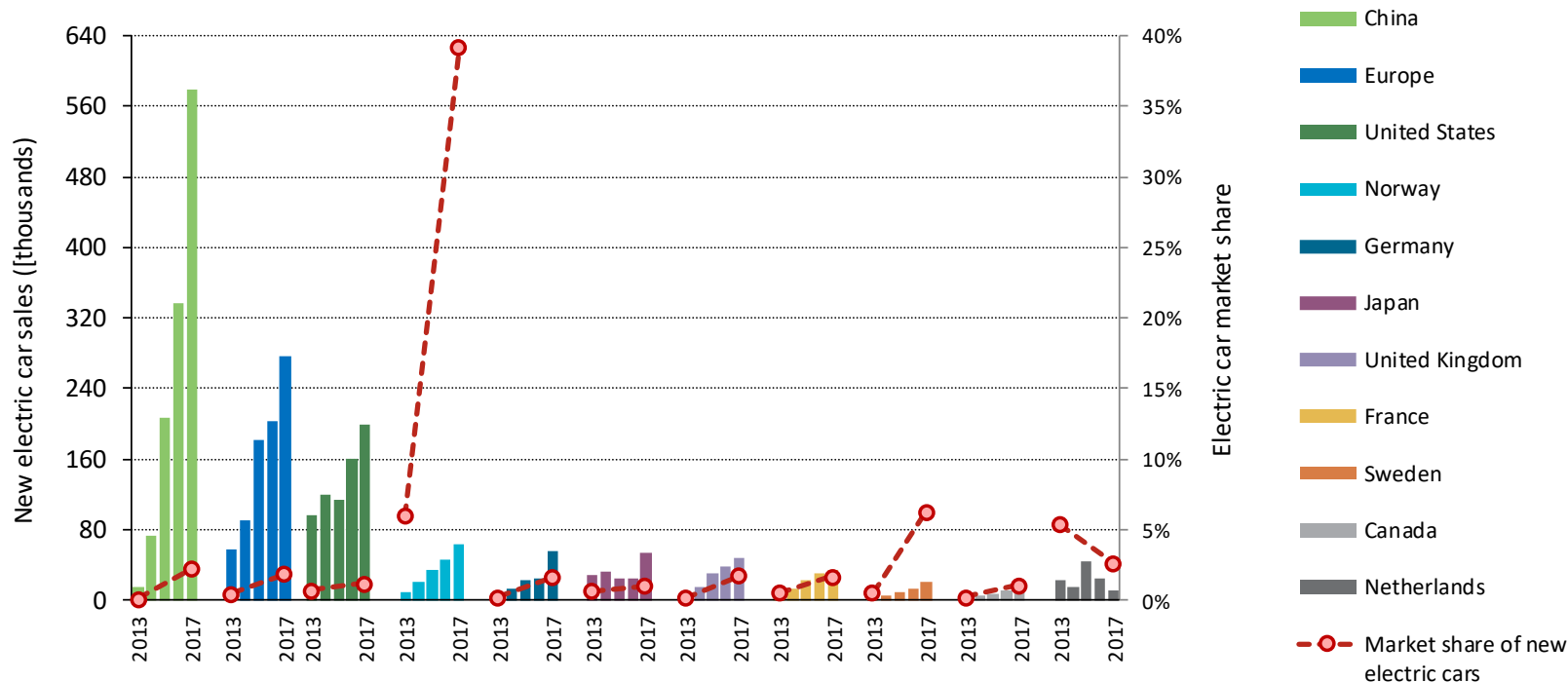


The number of electric cars on the road continues to grow



The electric car stock exceeded 3 million in 2017
However, electric cars still only represent 0.3% of the global car fleet

Electric car sales are on the rise in all major car markets



China is the largest electric car market globally, followed by Europe and the US
Norway is the global leader in terms of market share, with 40% in 2017

Electric mobility is not limited to cars



Electric 2-wheelers: major phenomenon in China, where there are 250 million in the rolling stock and 30 million sales per year

Low Speed Electric Vehicles: estimated at 4 million units in China (sales above 1 million). Not favoured by policy support but by cost and practicality (small size, no driving license/registration required)

Buses: 360 000 in China. Close to 90 000 sales in 2017. Stimulated by policy support.

Growing interest in C40 cities (better economics: not only local air quality or climate-driven phenomenon)

EV uptake is still largely driven by the policy environment

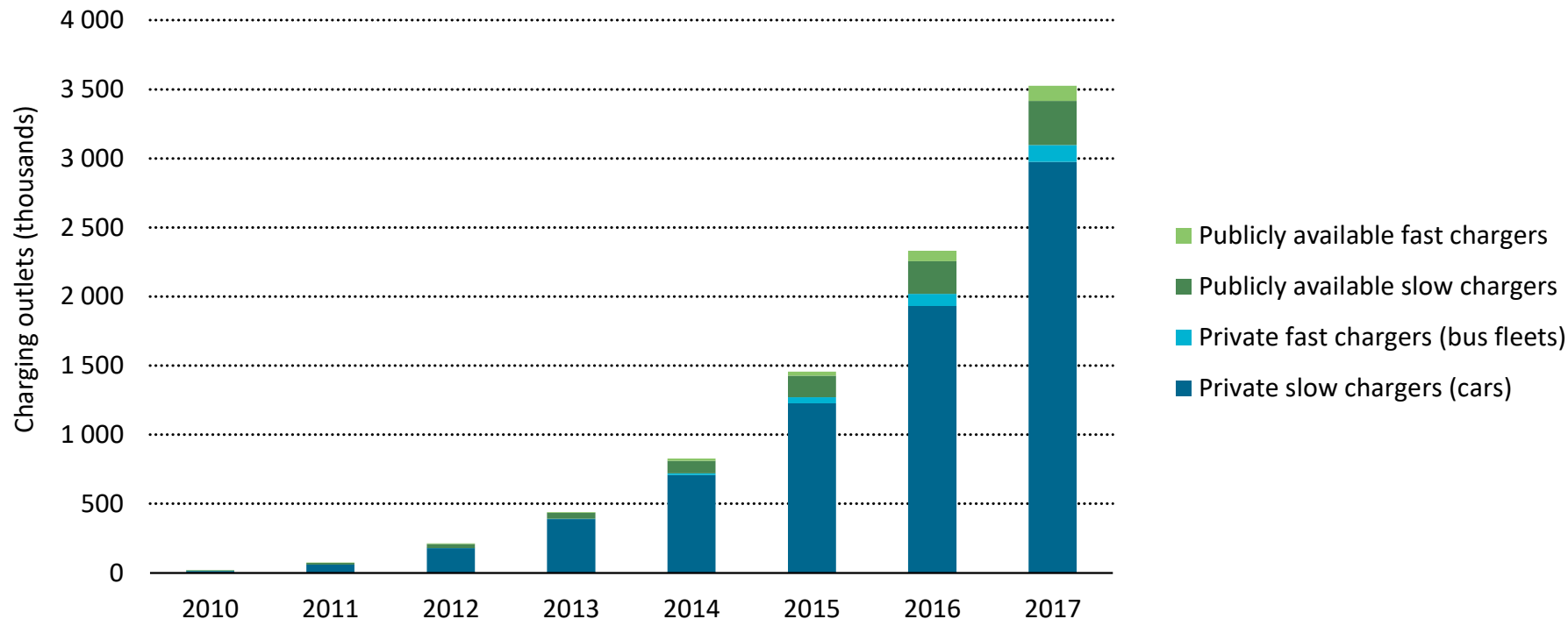
Key instruments deployed by local & national governments for supporting EV deployment:

- financial incentives to facilitate EV purchase and reduce usage cost (e.g. offering free parking)
- public procurement (taxis, buses)
- financial incentives and direct investment for the deployment of chargers
- regulatory instruments, such as fuel economy standards and restrictions on the circulation of vehicles based on their tailpipe emissions performance

Minimum range requirements and credits per electric vehicle under China's NEV credit system

Vehicle type	BEV	PHEV	FCEV
Minimum electric range (km)	100	50	300
Range of NEV credits per vehicle	1-6	1-2	2-5

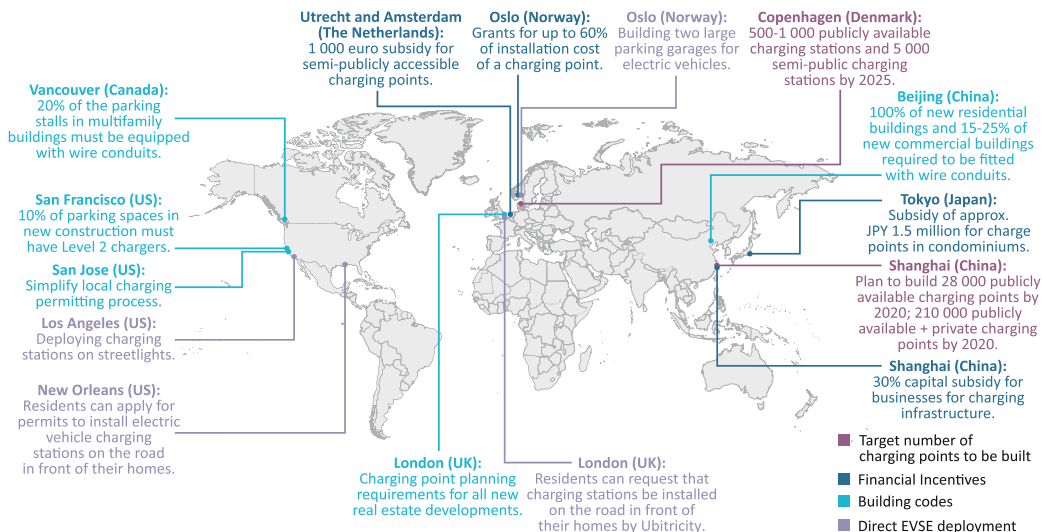
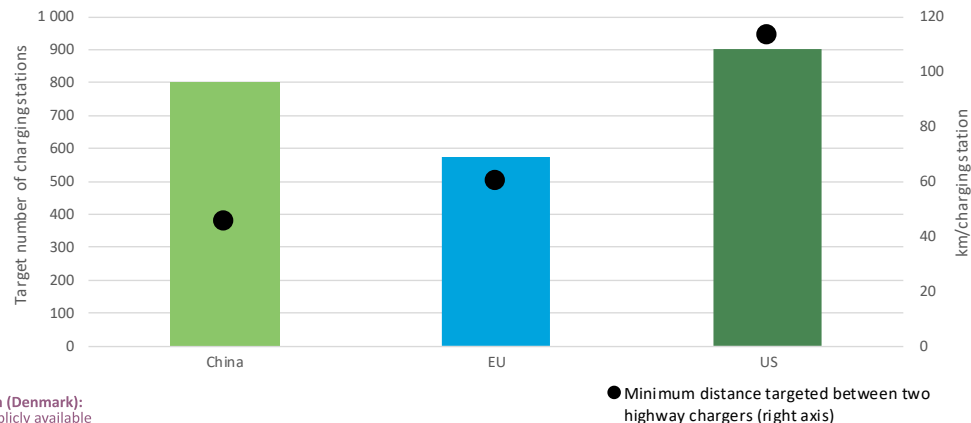
Charger deployment accompanies EV uptake



EV owners charge mostly at home or at work: private chargers far exceed publicly accessible ones
Publicly accessible chargers important to ensure EV market expansion, fast chargers essential for buses

Charger deployment also currently supported by policy

Major markets such as China, the European Union and the United States clearly have ramped up their ambition to install fast charging facilities along highways

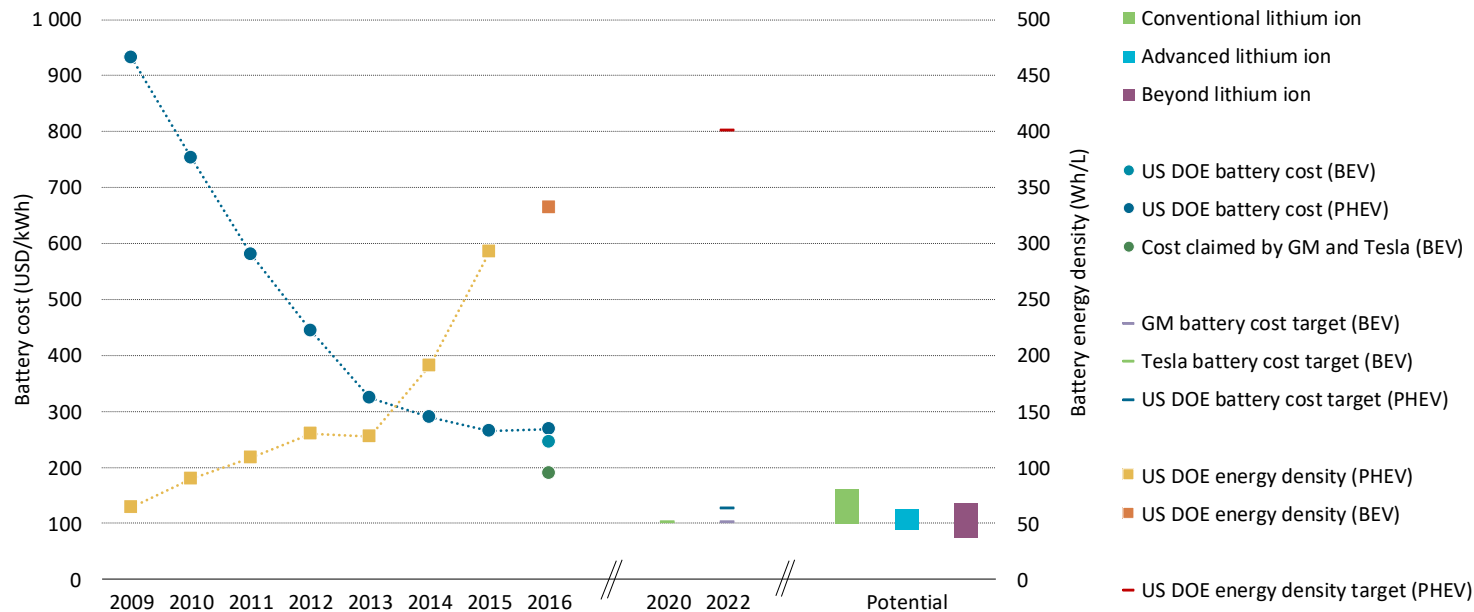


Cities are using a variety of measures to support charger deployment

Four main categories: targets, financial incentives, regulatory requirements (building codes) and direct deployment of chargers

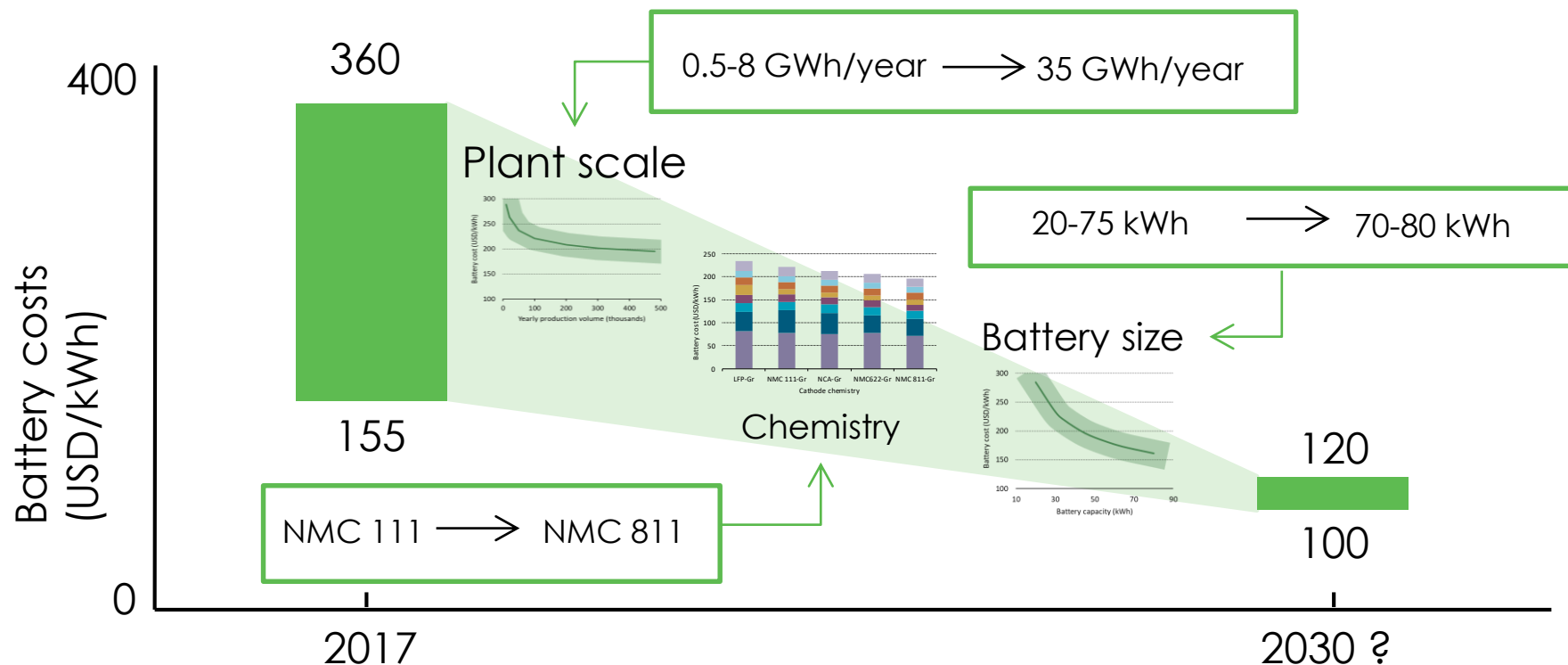
Battery costs and range as key factors for the success of e-mobility

Evolution of battery energy density and cost, 2009-16, and future prospects



Battery costs and energy density progresses are expected to keep delivering positive outcomes. This will further help lowering adoption barriers.

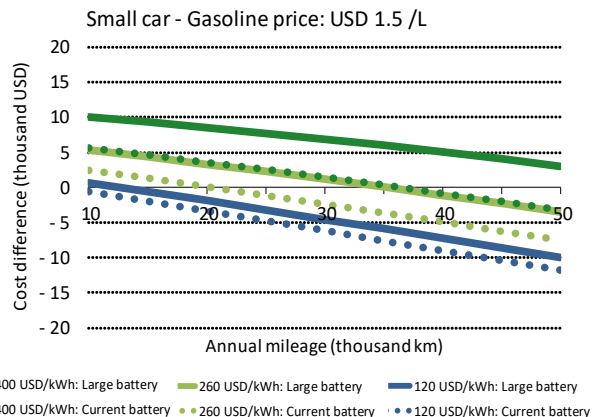
Lithium-ion batteries: further cost reductions within reach...



The combined effect of manufacturing scale up, improved chemistry and increased battery size explain how battery cost can decline significantly in the next 10 to 15 years

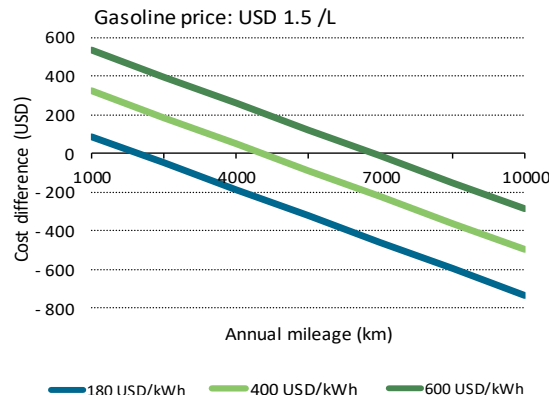
Implications for the cost competitiveness of EVs

LDVs - BEV



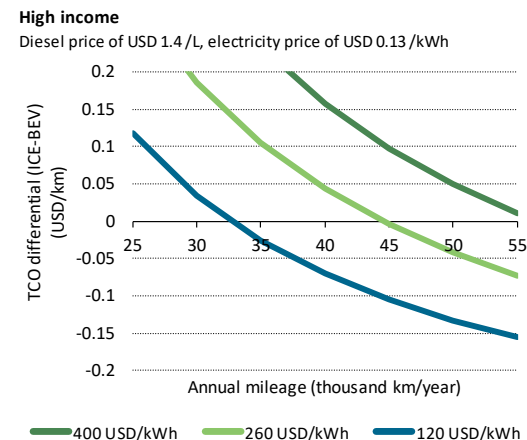
BEVs are most competitive in markets with **high fuel taxes** and at **high mileage**. At a USD 120/kWh battery price and with EU gasoline prices, BEVs are competitive even at low mileage.

2-wheelers



The economic case for electric two-wheelers is strong: in countries with **high fuel taxes** electric two-wheelers **are already cost competitive** with gasoline models.

Buses



Electric buses travelling 40 000-50 000 km/year are cost competitive in regions with **high diesel taxation** regimes if battery prices are below USD 260/kWh.

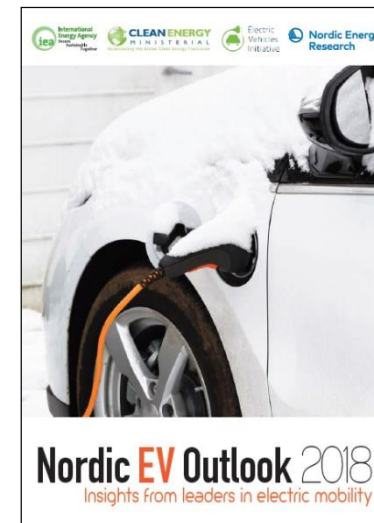
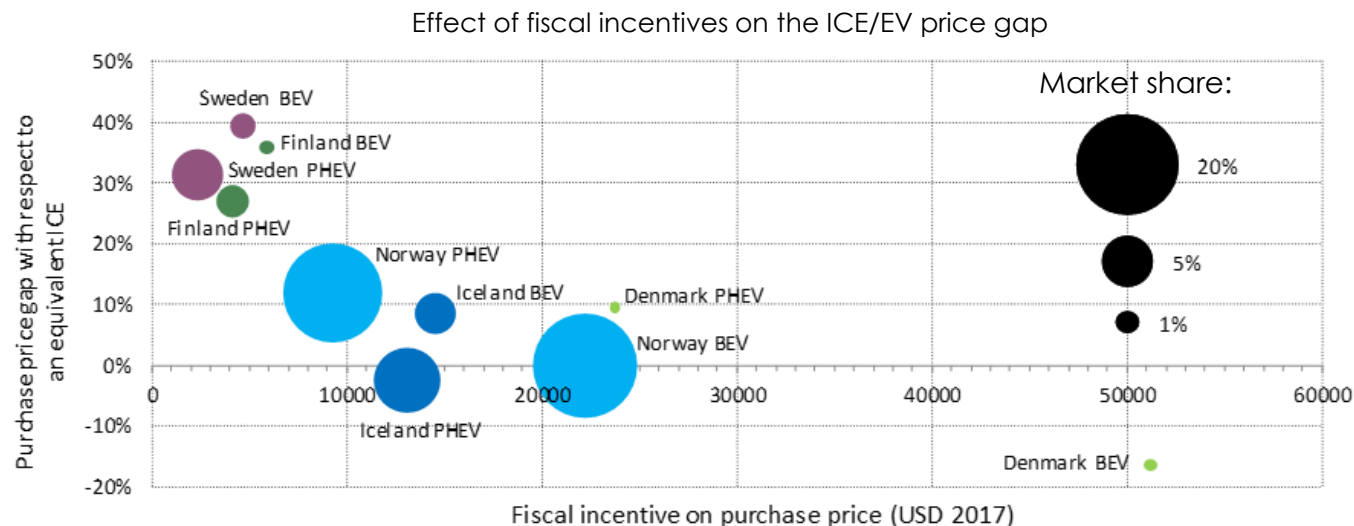
Electric car sales are correlated to changes in EV policies (1/2)

BEV and PHEV changes in incentives in a selection of countries, 2016

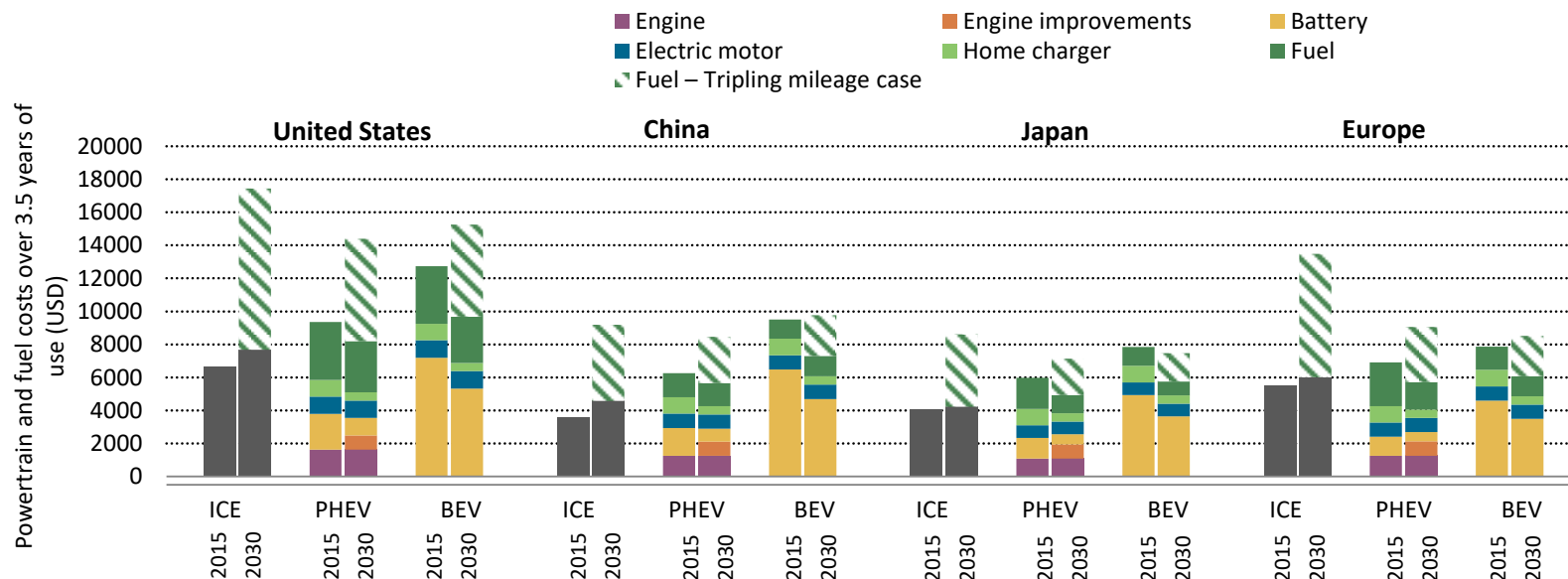
Country	2015 vs. 2016 policy developments		2015 vs. 2016 sales growth		2016 sales	
	BEV	PHEV	BEV	PHEV	BEV	PHEV
China	~		75%	30%	257 000	79 000
United States	~		22%	70%	86 731	72 885
Norway	~	↗	6%	164%	29 520	20 660
United Kingdom	~		4%	42%	10 509	27 403
France	~		26%	36%	21 758	7 749
Japan	~		48%	-34%	15 461	9 390
Germany	~		-6%	20%	11 322	13 290
Netherlands	~	↘	47%	-50%	3 737	20 740
Sweden	~	↘	0%	86%	2 951	10 464
Canada	~		19%	147%	5 220	6 360
Denmark	↘		-71%	-49%	1 218	182
South Korea	~		75%	-40%	5 099	164

Changes in electric car incentives, especially for vehicle purchase, can have an immediate and sizeable impact on electric car sales and steer the market towards either BEV or PHEV preference.

- **Strong policies** have driven this growth :
 - **reducing the purchase price** of EVs has emerged as the main factor enabling adoption
 - Lack of **continuity** in policy support has been identified as a major risk (example of Denmark)

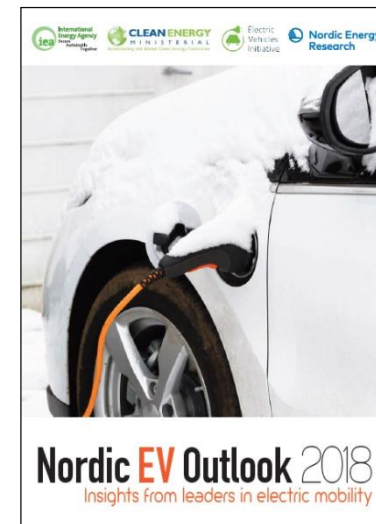
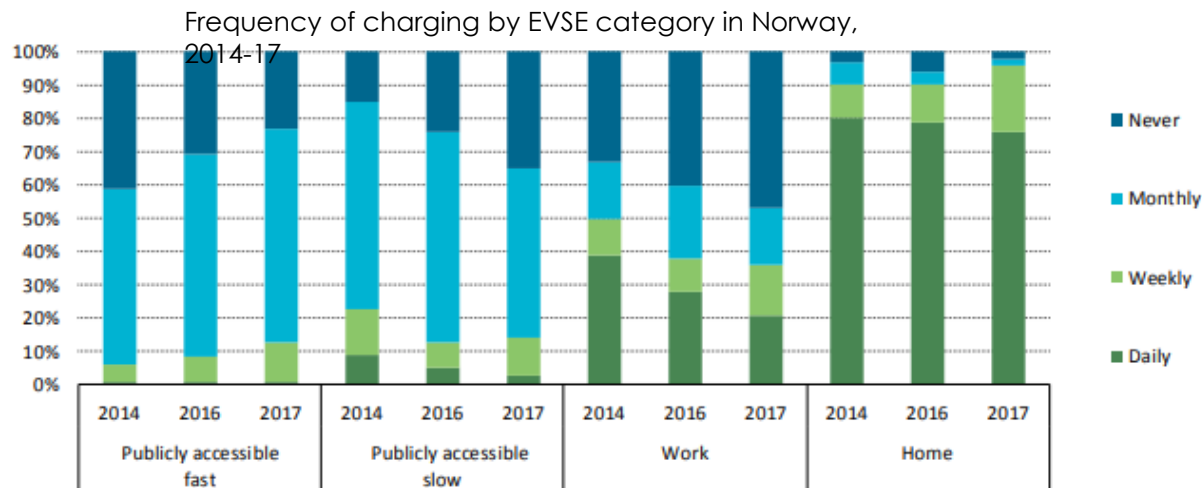


Comparative cost of passenger car technologies by country/region in the 2DS, 2015 and 2030



Achieving cost-competitiveness over the next decade will require policy instruments to allow market scale-up, reflect the cost of externalities of ICEs, and encourage synergies with new mobility models.

- **Charging infrastructure** has been implemented alongside EV deployment (2017: 1 publicly accessible charger/16 EVs):
 - **Home charging** is the most widely used by consumers
 - **More charging options** will need to be offered as the market grows. Many players are entering the EVSE market and business models are being tested
 - Delayed charging will need to be implemented to **avoid local grid disruptions** or costly and avoidable grid upgrades



E-mobility is also gaining ground in non-car modes; China leads the way



Electric 2-wheelers: > 200 million, mainly in China.

In other countries: ~200 000 in India, ~30 000 in the Netherlands, ~1 000 in the UK

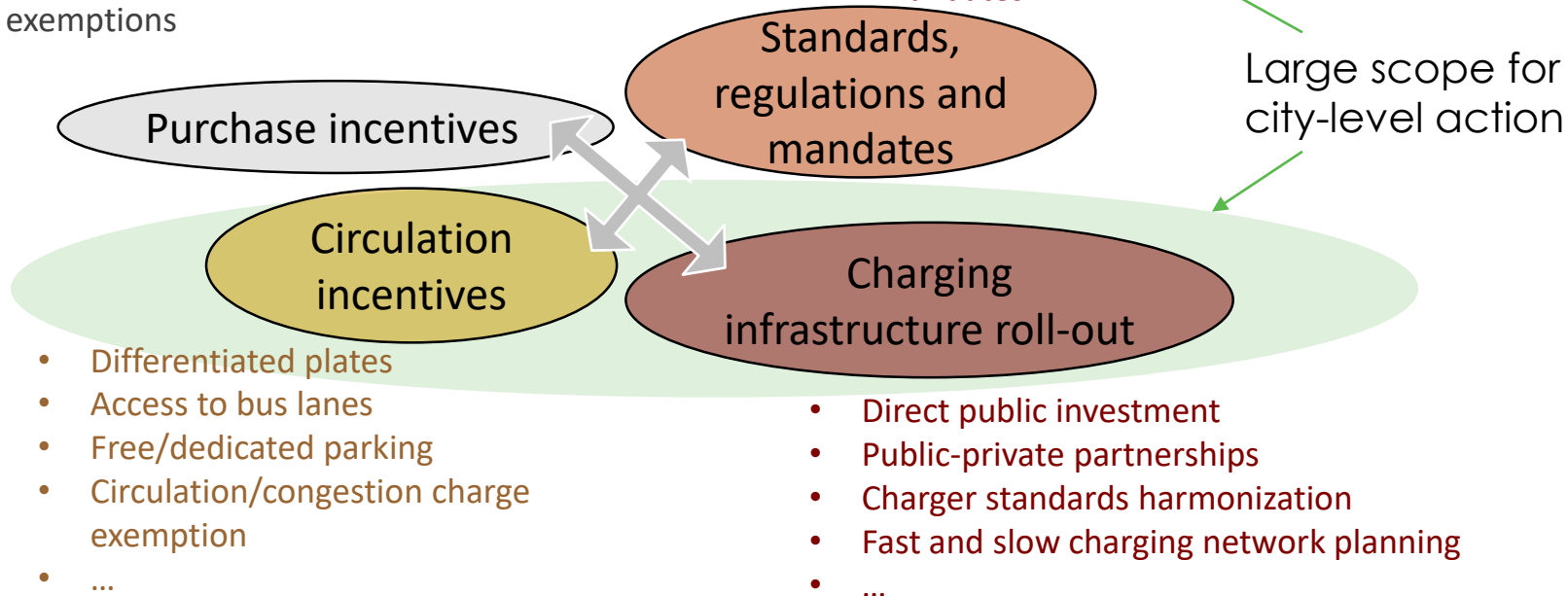
Low-Speed Electric Vehicles: ~4 million in China

Electric buses: 350 000 in China.

In Europe: deployment stage and ambitious procurement plans

- CO₂-based, technology-based differentiated taxation and rebates
- Feebates
- VAT exemptions
- ...

- Fuel economy standards
- Fuel taxes
- Public fleets, taxi fleets initiatives
- ZEV mandates

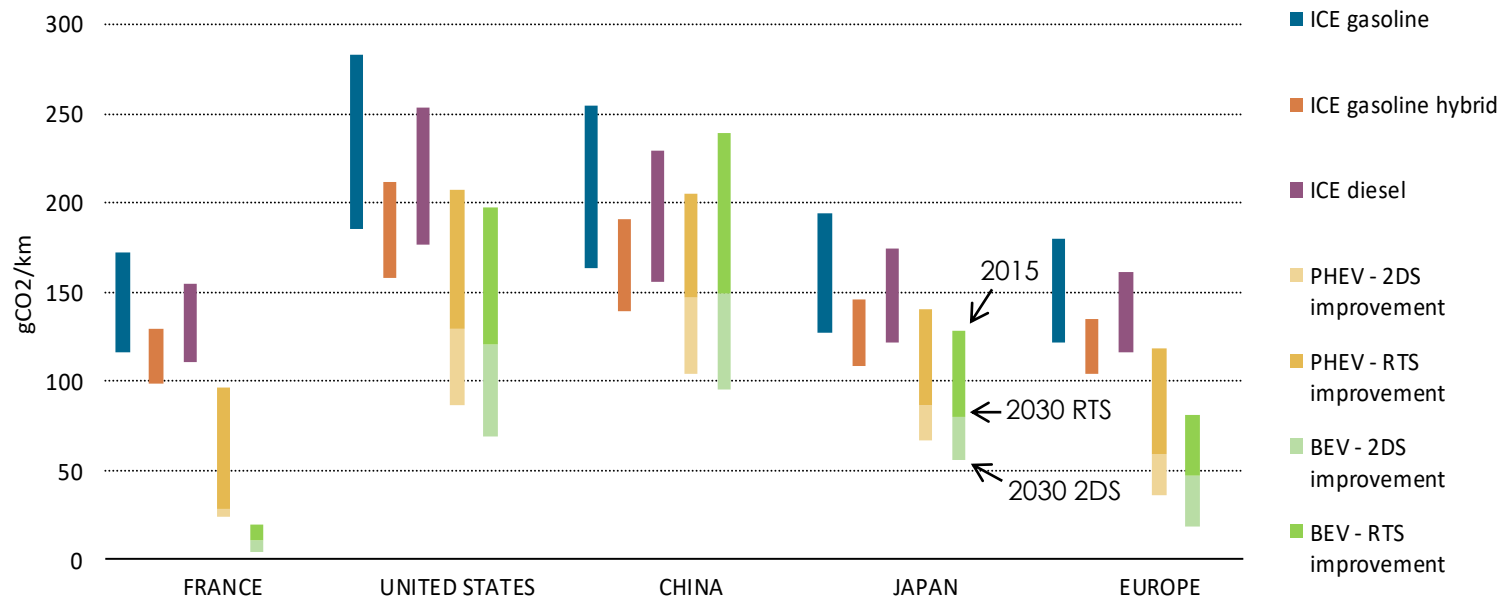


Close monitoring of the effect of EV support policies are paramount to avoid adverse effects

EVs benefit the environment and are essential to CO₂ emissions reduction

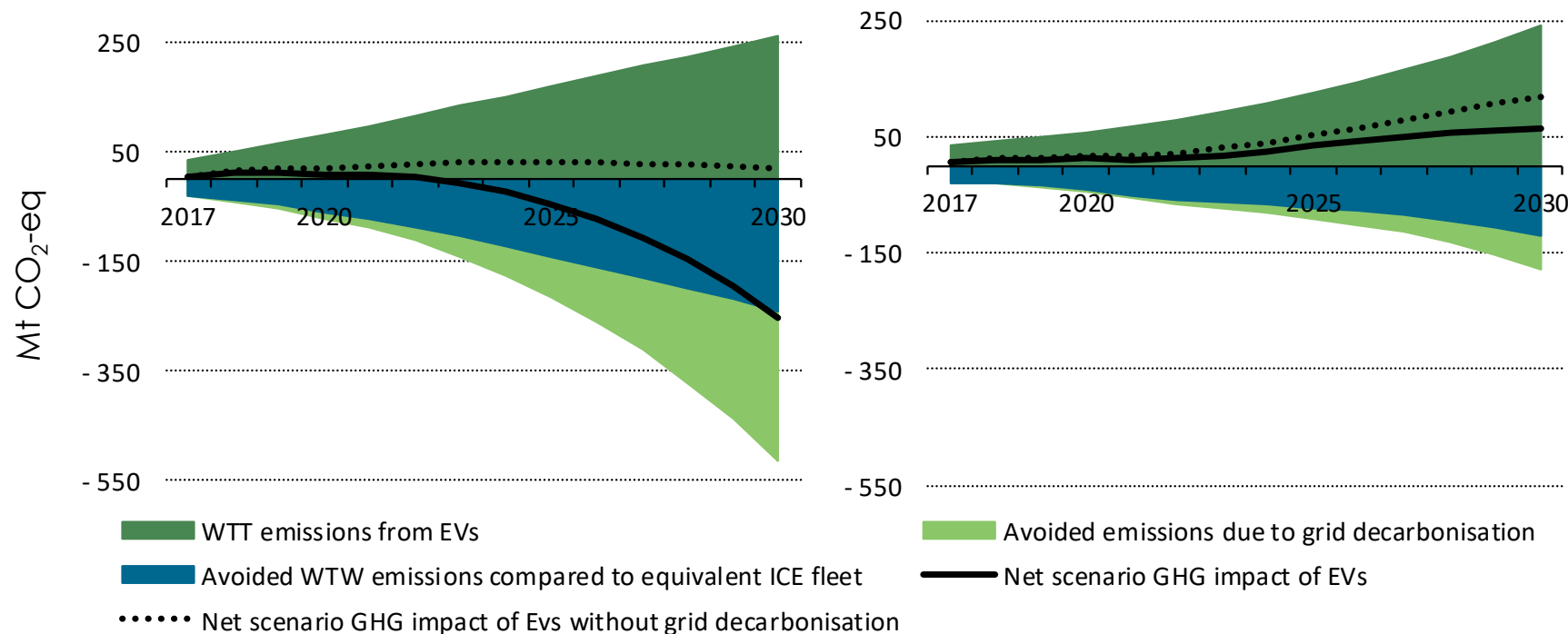


On-road WTW CO₂ emissions for various technologies by country/region, RTS and 2DS, 2015 to 2030



If coupled to low-carbon power, the high energy efficiency of EVs offers prospects for substantial CO₂ emissions reductions. This complements their air quality, energy security and noise reduction benefits.

Vehicle Use Cycle GHG emissions



By 2030, WTW GHG emissions associated with the use of EVs are lower than those of equivalent ICE vehicles at a global scale, even if electricity generation does not decarbonise from current levels.

Policies favouring the transition to electric mobility



CARBON
PRICING OF
FUELS



PUBLIC
PROCUREMENT



BRIDGING THE
PRICE GAP



FUEL ECONOMY
STANDARDS



LOCAL ACCESS
REGULATIONS



ROAD PRICING



PRIVATE &
PUBLIC EVSE
ROLLOUT



DEMAND-DRIVEN &
BUSINESS-DRIVEN
EVSE



SUCCESSFUL GRID
INTEGRATION



MATERIAL DEMAND
MANAGEMENT



SECOND LIFE, END-
OF-LIFE AND
RECYCLING





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- New Energy Vehicle (NEV) credits mandate
 - Target of the NEV credit mandate is 10% of the passenger car market in 2019, and 12% in 2020
- Vehicle Subsidy Program: subsidies for the purchase of electric cars, dependent on three characteristics: the vehicle range (in km), energy efficiency (in kWh/100km) and battery pack energy density (in Wh/kg)
- Electric bus sales in China also promoted primarily by subsidies
 - Started in 2009 by the central government, supplemented by support from local authorities (pilot cities) and progressively reduced over time
 - Policy update in 2017 to prevent fraud: overall subsidy reduced and converted into operational subsidies to target the support scheme to transit operators of electric buses
- China is considering a national ban on ICE cars running on fossil fuels





- Update of the CO₂ emissions standards for new cars and LCVs (to 2030)
 - Inclusion of an incentive scheme aiming to stimulate the uptake of zero- and low-emission vehicles
 - The incentive scheme reduces (by up to 5%) the overall CO₂ target for manufacturers that exceed the 2025 (15%) and 2030 (30%) low- and zero-emission vehicle market share thresholds (shares calculated using weights)
 - No penalty for non-compliance of low-or zero emission targets
- France, Ireland, the Netherlands, Slovenia, Sweden, UK (+ Norway) pledged to end sales of ICEVs by 2030 to 2040
- Selected examples of policies on zero emission buses:
 - Public procurement (Clean Vehicles Directive)
 - Netherlands: aims for all emissions-free bus sales by 2025 & all-electric stock by 2030
 - C40 fossil-fuel-free streets declaration: only electric buses would added to the municipal fleets of Barcelona, Copenhagen, London, Milan, Oxford and Paris (plus others globally)
- EU roadmap: aim to reduce its GHG emissions by 80% in 2050 compared with 1990 levels
 - Emissions from transport could be reduced to more than 60% below 1990 levels by 2050



- Dynamic situation:
 - FAME: incentive scheme that reduces the upfront purchase price of hybrid and electric vehicles (launched in 2015)
 - April 2017: vision aiming to have an all-electric vehicle fleet by 2030
 - September 2017: Tata Motors won 1st public procurement EV tender by EESL
 - December 2017: SIAM white paper proposing a pathway towards all new vehicle sales being all electric by 2047 and 100% of intra-city public transport as all electric by 2030
 - February 2018: Ministry of Heavy Industries and Public Enterprises stated that it had not set any target for electric cars for 2030 and referred back to FAME scheme for EV policy
 - February 2018: launch of the National E-Mobility Programme by the Ministry of Power. Focusing on creating the charging infrastructure and a policy framework so that by 2030 more than 30% of vehicles in India are electric
- Greater coordination needed, but positive signs for EVs

- Federal level revision of fuel economy standards announced in April 2018 Details of new standards still unknown
- California (granted a waiver by EPA to regulate CO₂ emissions) vowed to stick with the stricter rules
 - A number of other States followed California on this
- ZEV mandate also increased in ambition in California and other States
 - 1.5 million ZEVs and 15% of effective sales by 2025, 3.3 million in 8 States combined (California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, Vermont)
 - Target of 5 million ZEVs by 2030 in California
- There is a risk of a double standard in the US market
 - More stringent rules for cars sold in California and the States that follow its lead
 - Weaker rules for the rest of the States





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