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Is the European automotive industry ready for the global electric vehicle revolution?

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- The automotive sector is highly important for the EU. It ranks among the most important sectors in terms of value added, R&D, and exports in Europe.

- The automotive sector is currently undergoing a number of radical transformations that will create both opportunities & challenges for the EU automotive industry.

  - Electrification, autonomous driving, sharing and connected cars.

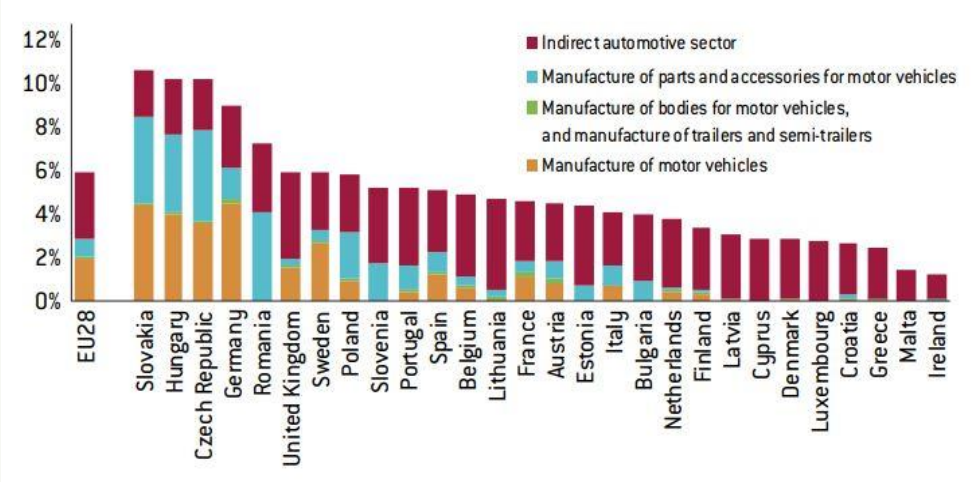
- We look into one of these transformations: electrification of vehicles.

- In particular, we examine the current state of the EU automotive sector in order to assess if it is well-positioned to respond to the (potential) electric vehicle revolution.

The automotive sector in the European economy

The automotive sector is important for the EU economy

- The automotive sector accounts for about 6% of EU value added.
  (> than pharmaceutical and machinery equipment manufacturing sectors)
- In some EU countries, the automotive sector is even more important:
  BIG4 (>8%): GER, SK, HU, CZ.
- The indirect sector (e.g. sales & maintenance) accounts for over half of all automotive value added in the EU.
- Indirect sector is more labour-intensive and accounts for greatest share of employment.
- Manufacture of vehicles and parts more capital-intensive and is concentrated in the BIG4.
- Vehicles account for 9% of EU exports. Vehicles account for >10% of exports from BIG4 and SLO, ES, UK, and SWE.

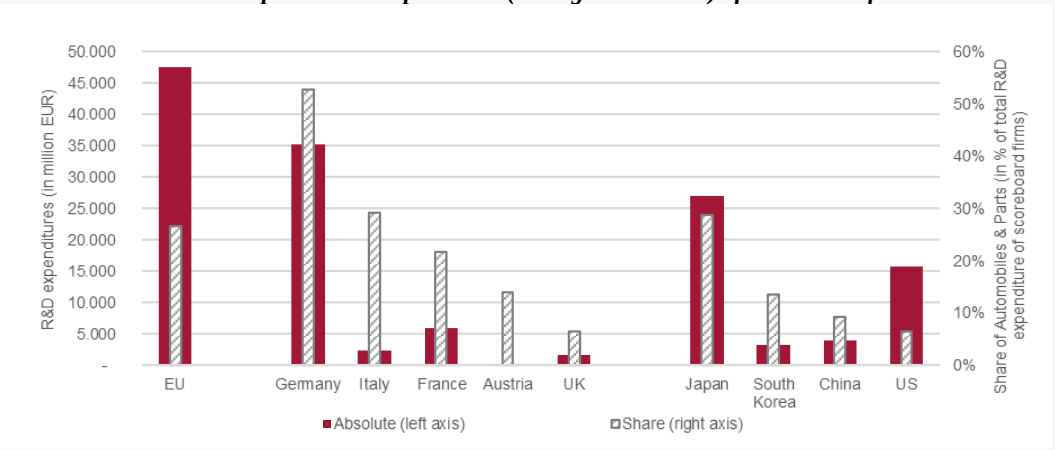


Share of the automotive sector in total value added

The automotive sector is important in the European R&D landscape.

- The European companies of the R&D scoreboard from the automotive sector account for 25% of all R&D spending by European scoreboard firms.
- EU automotive firms hold a dominant position in R&D (followed by Japan)

Automotive and parts R&D expenditure (average 2013-2016) of scoreboard firms



Source: Bruegel based on R&D Scoreboard 2013-2016 and Scoreboard 2014.
Note: The R&D data are firm-level, obtained from WORLD - 2500 companies.

Ranking of top automotive R&D spending companies

Rank 2015			Share in Sector R&D	Share in Sector Sales	Cum R&D
1	VOLKSWAGEN	Germany	12,62%	8,49%	13%
2	TOYOTA MOTOR	Japan	7,46%	8,62%	20%
3	GENERAL MOTORS	USA	6,39%	5,57%	26%
4	DAIMLER	Germany	6,05%	5,95%	33%
5	FORD MOTOR	USA	5,71%	5,47%	38%
6	HONDA MOTOR	Japan	5,09%	4,43%	43%
7	ROBERT BOSCH	Germany	4,82%	2,81%	48%
8	BMW	Germany	4,79%	3,67%	53%
9	FIAT CHRYSLER AUTOMOBILES	Italy	3,81%	4,40%	57%
10	NISSAN MOTOR	Japan	3,76%	3,70%	61%
32	TESLA	USA	0,59%	0,15%	
38	GREAT WALL MOTORS	China	0,36%	0,41%	
46	GUANGHZOU MOTORS	China	0,25%	0,17%	

Source: Bruegel based on R&D Scoreboard 2015.

The Electric Vehicles (EVs) trend:

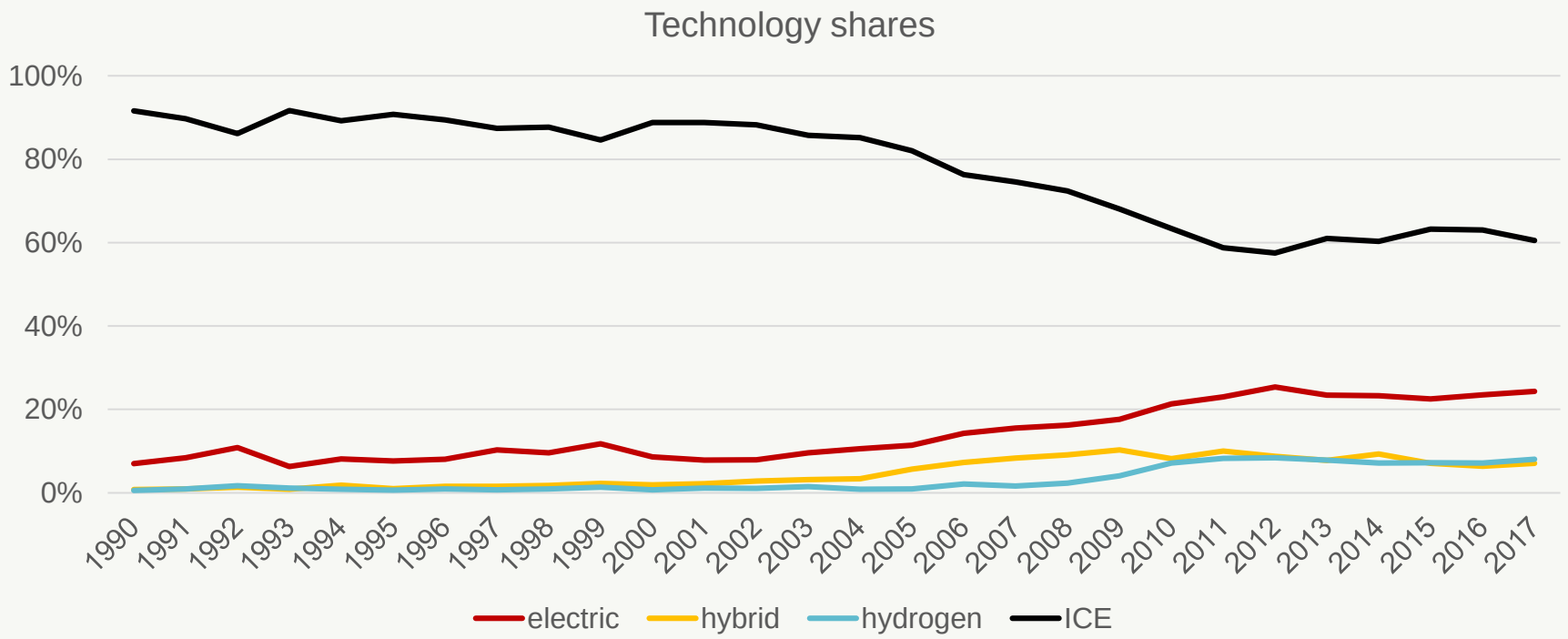
How real?
How disruptive?

The trend towards electronic vehicles (EVs) is real

- The current trend towards EVs stems from:
  - Clean energy and climate change concerns have led to CO2 emission reduction targets and support for zero emission vehicles and carbon taxing.
  - Technology improvements reducing the costs to produce and use EVs, particularly in battery technology.
- The growth of EVs is expected to proliferate in the future.
  - More governments are increasing their support for clean emission vehicles.
  - Technology and manufacturing costs to produce EVs and their batteries are likely to continue to fall as production expands.

EV technology development kicked off

- Patenting for power train technologies, which was dominated by the ICE technology, has started to shift towards cleaner power train technologies, of which the EV technology has become the most important one.



Source: EPO Patstat, April 2018 edition.

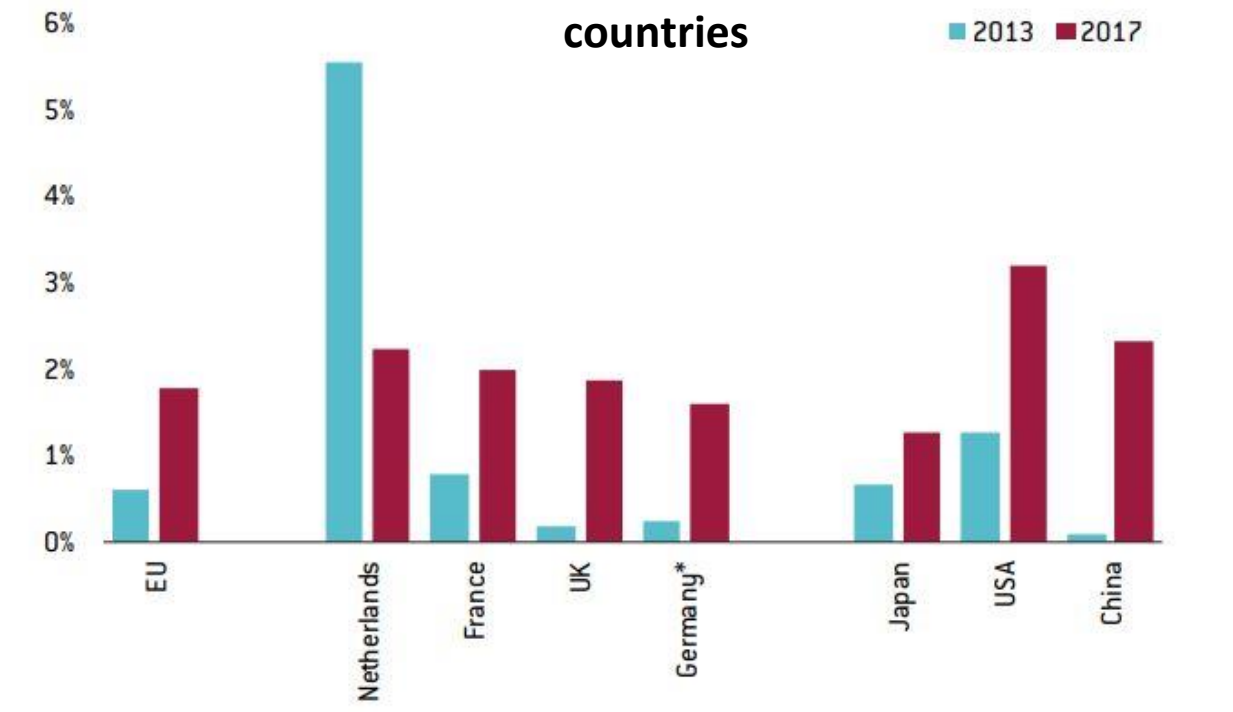
Note: We count all patents filed under the Patent Cooperation Treaty (PCT) in all possible patent offices worldwide. With this practise, we only capture "high-quality" patents and avoid a double counting of patents. Using only PCT patents, we miss out local patenting trends but ensure comparability between the different jurisdictions.

Note: Patents are classified according to four different power train technologies. We rely on the classification of Aghion et al. (2016) that divides power train into electric motor technologies, hybrid motor technologies, hydrogen motor technologies, and internal combustion engine (ICE) technologies. Classification is done via the International Patent Classification (IPC) code system. The patent codes used for the classification can be found in the annex.

Global demand for EVs has kicked off

- The global EV market remains small, but is growing.
- Only one country in world, Norway, has a high share of EV registrations on total registrations. All other major countries, or country groups such as the EU, exhibited shares well below five percent in 2017.
- The EU has the third largest share of EV registrations (15%) in 2017 behind China (48%) and the US (16%).

EV registration as a share of total passenger car registrations, selected countries

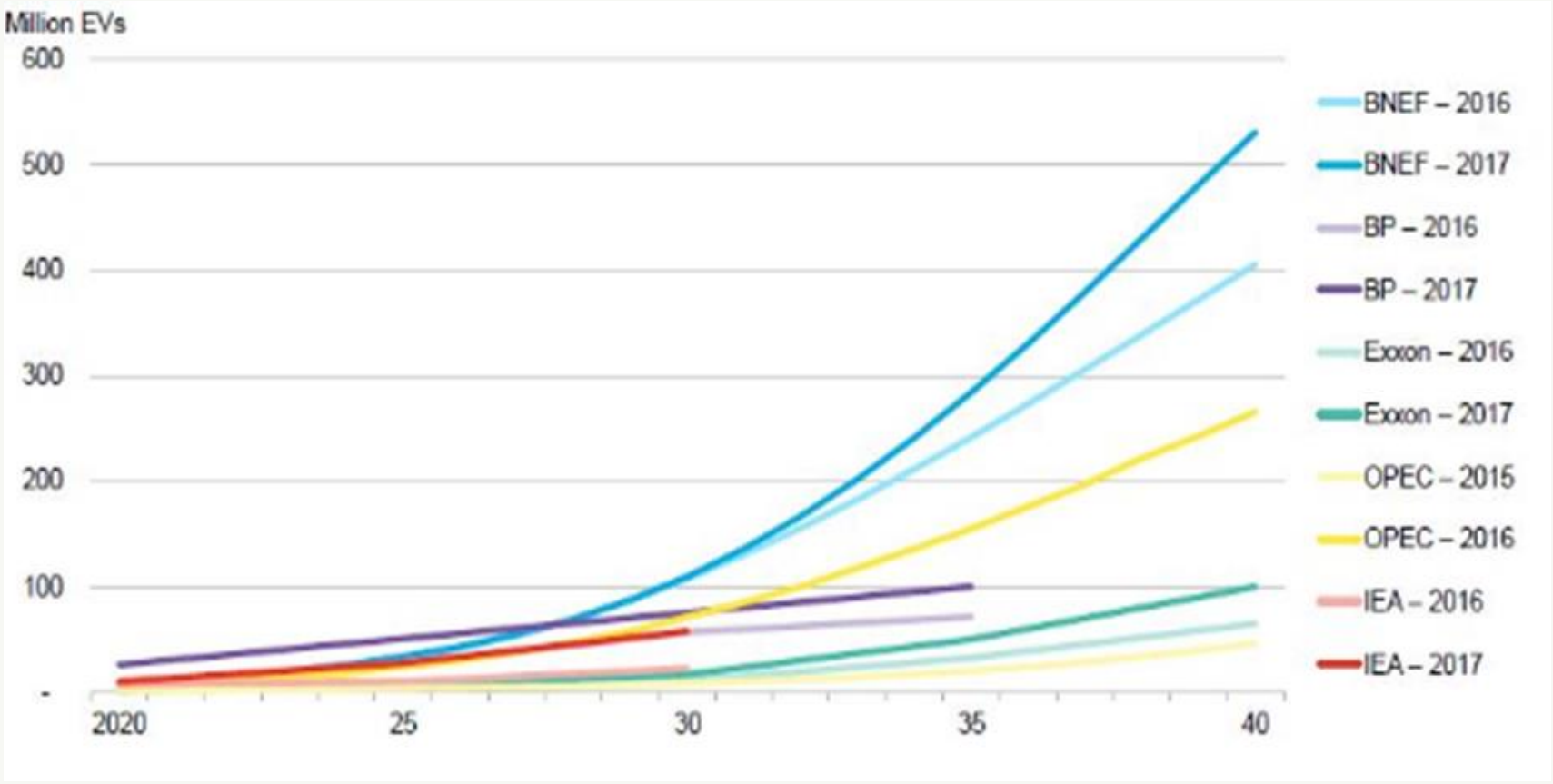


Source: Bruegel based on national sources.

The deployment of EVs is expected to proliferate in the future.

- BNEF (2017) anticipates more than 500 million EVs globally by 2040 – a significant upward adjustment compared to BNEF's prior forecast in 2016.

Global EV deployment forecasts

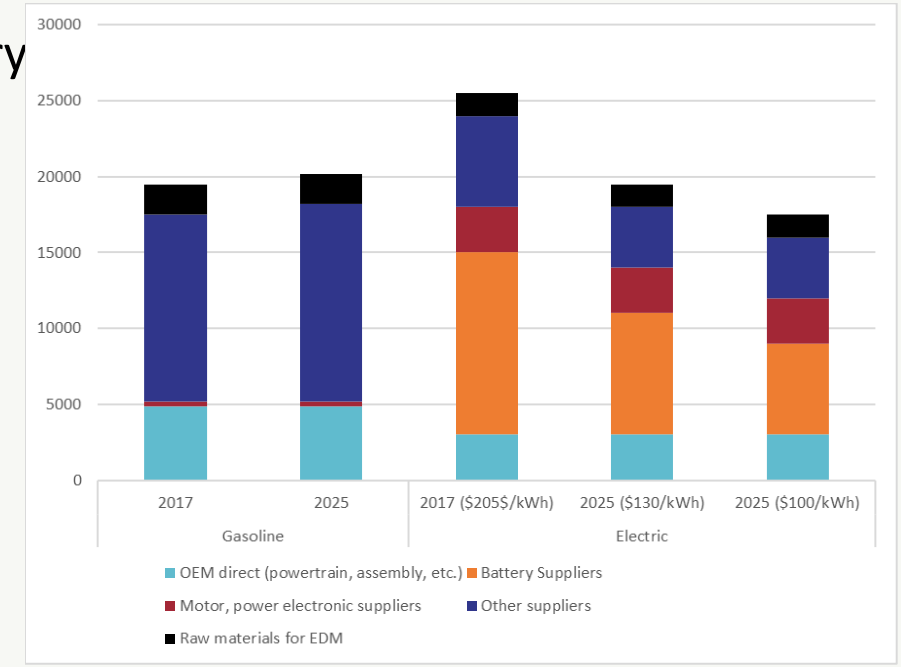


Source: Bloomberg New Energy Finance.

The trend towards EVs will impact current ICE supply chains.

- Reduced mechanical complexity of EVs will reduce manufacturing costs and the number of jobs available in the automotive sector.
- EVs require less lifetime maintenance than ICE vehicles which could diminish after-sale revenues for manufacturers.
- Opportunity for new suppliers to emerge and capture value through taking advantage of economies of scale.
- A critical EV component is the battery

Breakdown of the manufacturing cost of ICE and electric vehicles ($)



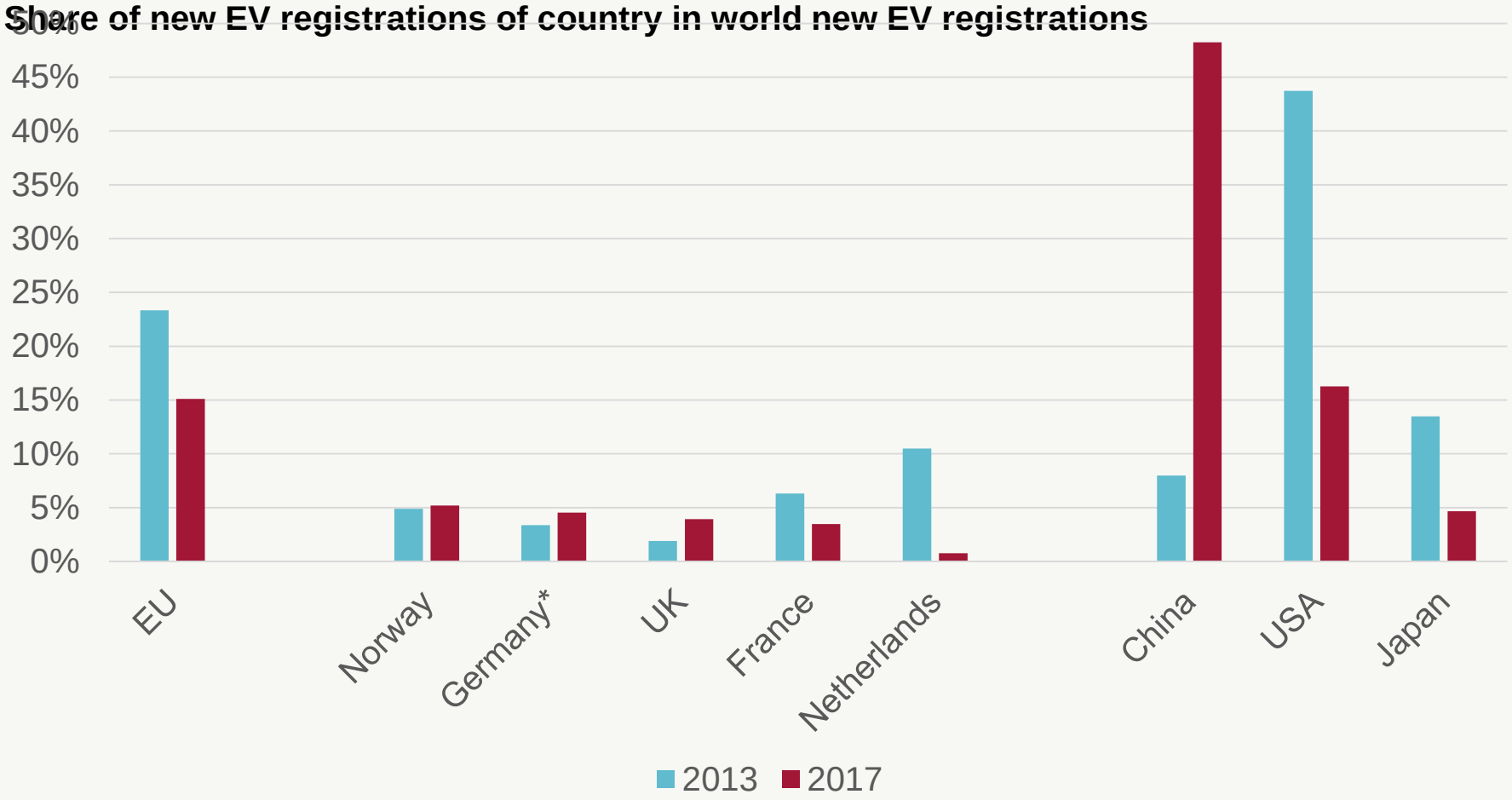
Source: UBS (2017).

EU's position in EVs

Demand for EVs
Manufacturing of EVs
Technology development of EVs

Europe as a market for EVs

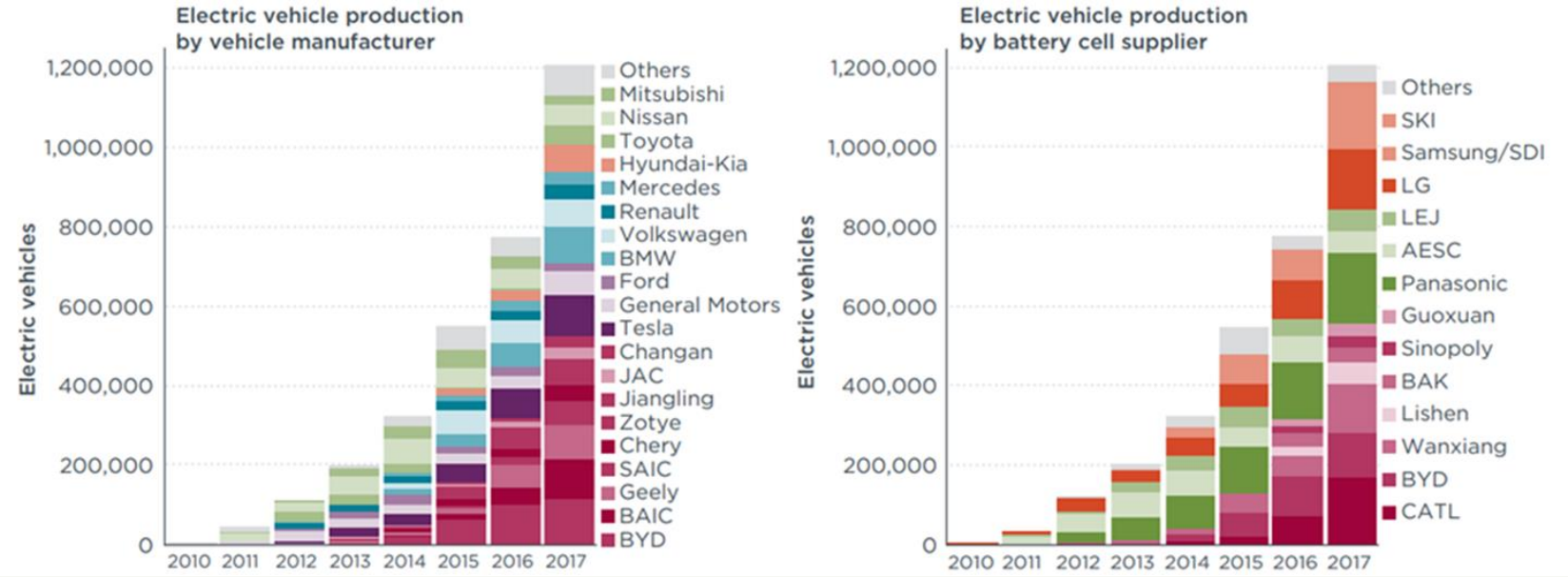
- EU and the US dominated the worldwide EV market in 2013, but were then surpassed by China: 48% of worldwide registered EV registered in 2017 were in China.



Source: Bruegel based on national sources.

The EU and the global manufacturing of EVs

- China has quickly risen as global leader in EV manufacturing.
  - Japanese and US companies were early movers, but did not develop over time (excluding Tesla).
  - European companies entered late, but are catching up, especially Germany.
- In EV battery manufacturing, China also leads, followed by first movers Japan and Korea. The EU is not present.

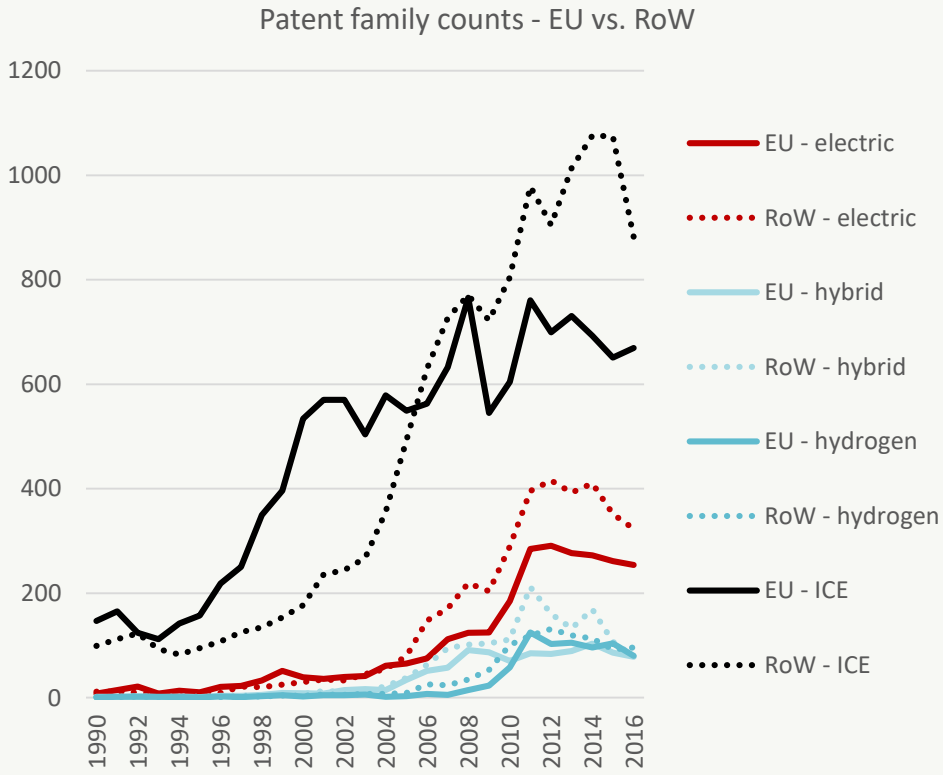


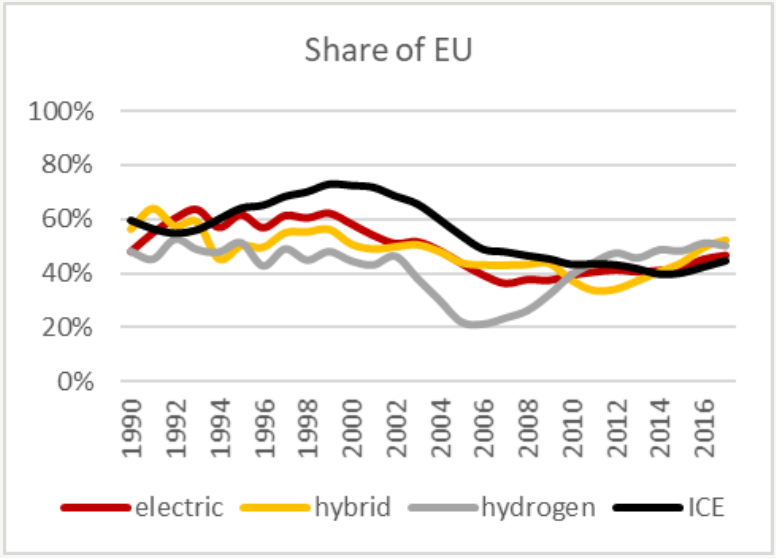
Source: International Council on Clean Transport (2018).

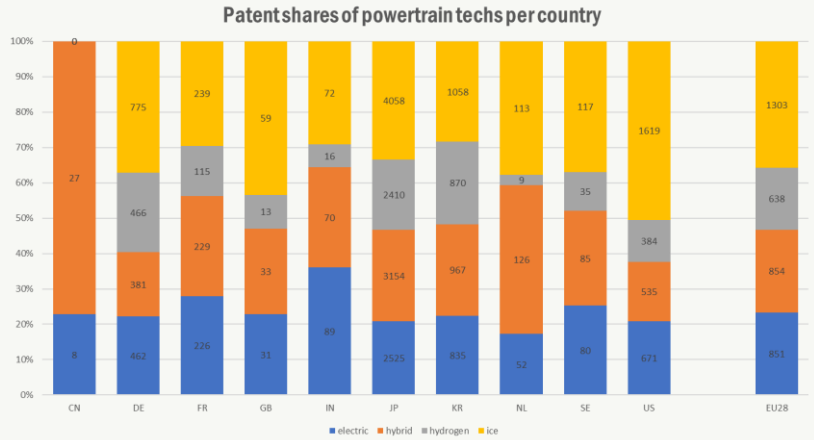
The EU and EV technology development

- While EV patenting started to take off in the RoW, the EU was not yet following. In the late nineties and the early 2000s it was still mostly patenting in ICE technologies. But since 2008, EU has been gradually catching up on EV patenting and slightly increasing its share. By now, it has an almost equal weight in each power train technology.

Patenting EU vs. RoW in major power train technologies







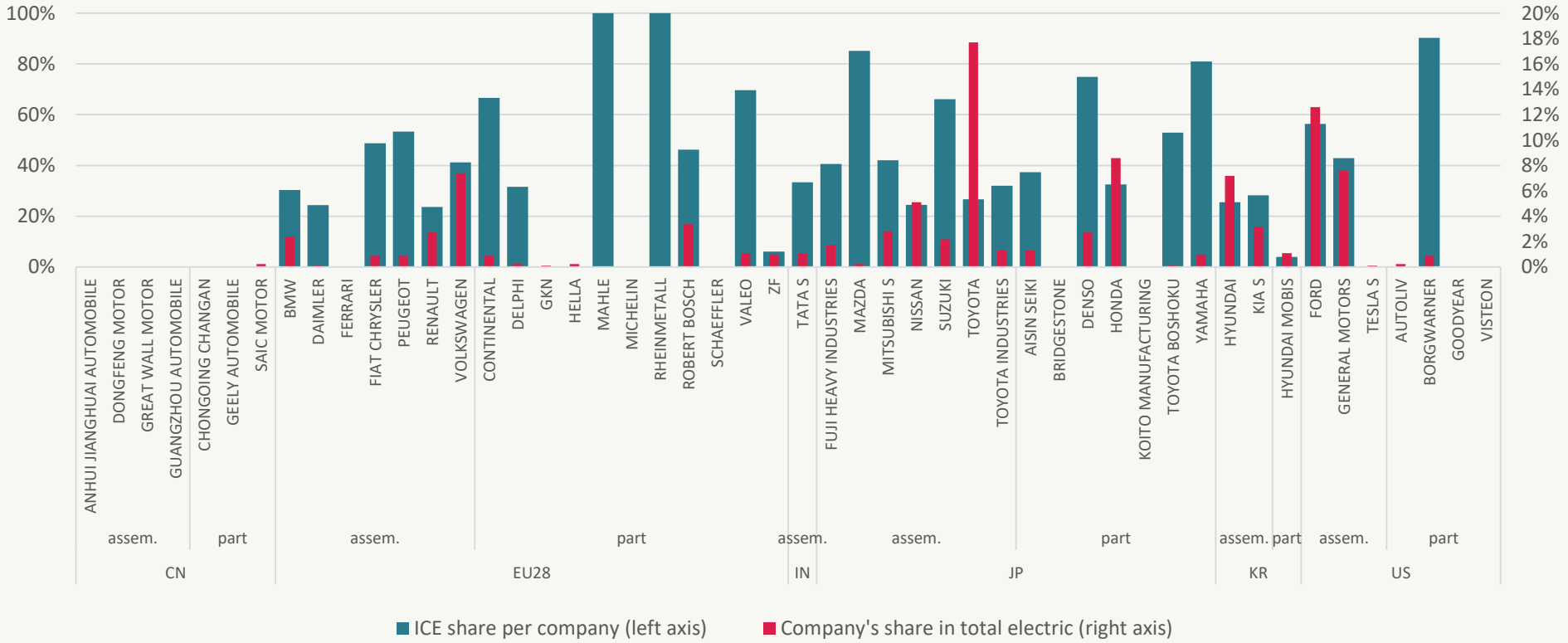
Source: EPO Patstat, April 2018 edition.

EU automotive firms and EV technology development

- Exposure to ICE very idiosyncratic: especially a few car parts companies patent only in ICE technologies

- The big car assemblers (VW, Toyota, Ford, GM) exhibit largest shares in electric technologies patents

Patenting structure of the top-50 automotive companies (2012-14, R&D Scoreboard)



Source: JRC Scoreboard 2016

Note: Car sector as defined by the scoreboard; number shows patent families; *ICE share per company (left axis)* shows ICE patents in total power train patents per company; Company's share in total electric (right axis) shows company's share of its electric power train patents in all electric power train patents of the top-50 automotive companies.

Conclusions and policy recommendations

Europe can still be in the global EV race...

- European car (parts) manufacturers are strong global players
- European car sector is still leading in terms of R&D expenditures,
- European car companies show considerable patent activity in new engine technologies - Mostly German

BUT :

- EU companies still do not patent a lot in new technologies: considerable technology development still dedicated to ICE technologies
- European car sector is not first mover in EV, catching up, but not (yet) leading;
- A few car (parts) companies are highly exposed to ICE technologies;
- Limited battery manufacturing capacity
- Limited growth in demand for EVs

To face global EV revolution, EU has to move into higher gear ☺

A more ambitous integrated EU policy approach

- The proper framework conditions should be in place to warrant more ambitious investment in EV by car companies.
- Best practice examples of EV policies from Norway and China illustrate that piecemeal interventions will not work.
- What is needed is a broad policy framework, combining a multitude of demand and supply-side instruments in an ambitious long-term clean transport policy mix.

- Stimulating demand
  - Subsidies, taxation and public procurement favouring clean (incl EV) rather than dirty technologies.
- Stimulating supply
  - Public R&D support for the next generation of clean technologies, including support for investment in the latest technologies and support for the conversion of dirty technologies into clean.
  - Standards and regulation setting supporting clean technologies including EV
  - Bolster infrastructure deployment: a non-exhaustive list includes urban planning, public transport, charging stations and improving access.

1) Targeting EU R&D funds to trigger frontier clean technologies

- With over EUR 50 billion annually invested in R&D by the European automotive industry, we do not believe that any pubic R&D funding can make a substantial difference.
- However, the EU can improve its transport research and innovation funding by carefully allocating money to targeted areas.
    - Transport-related research and innovation funding should notably focus on early-phase technologies, such as solid-state batteries.

2) Rethinking transport taxation

- Taxation is a key policy tool to foster road transport decarbonisation.
- Different taxes apply throughout the transport system, from the initial purchase of a vehicle, to ownership taxes and usage taxes. These taxes can be used to influence user decisions and automotive industry strategies.
- European countries still have very different transport taxation regimes. For example, only ten countries consider CO2 in the composition of their vehicle registration taxes.
- A harmonization of mobility taxation throughout Europe could lead to more certainty for business thus increasing the incentives to invest in production in Europe.
- The EU should thus promote a new discussion among EU countries on the future of transport taxation, as is being done in the field of digital taxation.

3) Cleaning-up cars: stricter emission standards

- In 2018, the EU agreed to reduce carbon emissions from new cars by 37.5% by 2030 compared with 2021. However, this is not sufficient to ensure decarbonisation of European transport by 2050.

- Stricter emissions standards will pressure the automotive industry to become a global player in clean vehicles.

4) EU support for member states' transition towards clean transport

- An 'EU Clean Transport Fund' could be established to provide funding to countries and cities committed to transport decarbonization.
- Regions/Cities could bid for EU money to support different clean technology projects.
  - For instance, projects supporting the deployment of alternative fuels infrastructure or to support the retraining of workers to enable them to switch from dirty to clean technology production.

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Thank you for your attention !

Policy Contribution can be downloaded at:

http://bruegel.org/2018/12/is-the-european-automotive-industry-ready-for-the-global-electric-vehicle-revolution/

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