Q&A

PwCStrategy& Transition Impact Study 2020-2040

ABOUT THE STUDY

1 – What's at stake?

The climate crisis is one of the greatest challenges facing mankind. Greenhouse gas emissions related to road transport must decrease by 90% by 2050 to reach Green Deal objectives. Rapid electrification is a must, but how we get there requires careful consideration.

The Fit-for-55 package proposed by the European Commission in July 2021, outlines a pathway to 100% CO2 emission reductions for all new cars and vans by 2035 compared to 2021. As emissions are currently measured at the tailpipe only, the current proposal would lead to a de facto ban on the Internal Combustion Engine (ICE), leaving auto manufacturers (OEMs) no other choice than going electric. Much is at stake for workers in EU factories if production shifts to electrification only.

The PWC Strategy& study finds that automotive suppliers alone employ around 600,000 workers whose work depend on the internal combustion engine. The production of battery electric vehicles will create new employment opportunities, but overall is less labour intensive. The livelihoods that depend on those jobs need to be taken into consideration. It is therefore critical that we assess what different policy approaches would mean for employment and the realisation of climate targets.

2 – What are the objective of the study?

The study aims to understand the impact of three different market scenarios on value-add and employment among automotive suppliers across Europe from 2020-2040. Further, the study looks at what the three scenarios would mean for climate targets. The three scenarios are as follows:

Mixed technology – projects a 50% tailpipe CO2 reduction by 2030 compared to the 2020 95g NEDC (5 percentage points less than the current CO2 proposal). This scenario assumes a role for renewable fuels[1] to achieve net-zero CO2 reductions with a significant market share of hybrid technologies. It also assumes incentives for Batter Electric Vehicles (BEV) purchases.

EV-only – projects a 60% tailpipe CO2 reductions by 2030 (5 percentage points higher than the current CO2 proposal), and a 100% CO2 reduction by 2035 – de facto banning the ICE. This scenarios assumes a marginal role for renewable fuels, with a role only for full hybrid electric vehicles (FHEV). It also assumes incentives for both BEVs and charging infrastructure.

Radical – projects a 100% tailpipe CO2 reduction already in 2030, which is significantly more stringent than the current CO2 proposal. This scenario assumes highly restrictive EURO 7 emissions standards, excluding mild hybrid electric vehicles (MHEVs) and assumes incentives for BEV purchases and recharging infrastructure.

All three scenarios assume accelerated electrification to meet climate goals, with a high market share for electric vehicles[2] by 2030 of more than 50%, almost 80%, and close to 100%, respectively.

[1] Sustainable and advanced biofuels, hydrogen, synthetic fuels (eFuels), recycled carbon fuels
[2] Battery electric vehicles, plug-in hybrid electric vehicles and full hybrid electric vehicles

3 – Which countries are covered by the study?

The study covers the EU27 Member states, EFTA countries (Iceland, Liechtenstein, Norway, and Switzerland) and the UK. Additionally, seven countries were analysed in detail: the Czech Republic, France, Italy, Germany, Poland, Romania, and Spain, which cover ~74% of the automotive production.

4 – What methodology was used?

Data was gathered through an explorative survey and 199 returned questionnaires (mostly compiled by companies at plant level). Survey results were validated with 33 expert interviews and three workshops. Data from national and European trade associations as well as internal expertise from PWC Strategy& further supports the impact assessment. The forecast model is built on a country specific automation grade and the minimum production volumes required to keep a plant open, both derived through the surveys and expert interviews. Production volumes by year based on the three different regulatory and market scenarios and country specific indicators are used to forecast when production in a certain country will be scaled down and which countries will attract most investment in new powertrain technologies. The model is further refined with Eurostat data on employment, value-add, labour costs, energy costs and the C)2 footprint of the energy mix.

5 – What sets this study apart from other studies?

This is a first of its kind study that weighs different market scenarios to assess powertrain employment and value-add impact of electrification across the EU and individual members states along the automotive supply chain.

Earlier studies into the employment impact of electrification have either assumed a slower uptake of electrification than currently foreseen or focused on vehicle manufacturers rather than automotive suppliers. While automakers have greater capacity to divest or insource activities to compensate for a loss of activity in the powertrain domain, automotive suppliers can react with much less agility, as they are bound by long-term contracts with vehicle manufacturers.

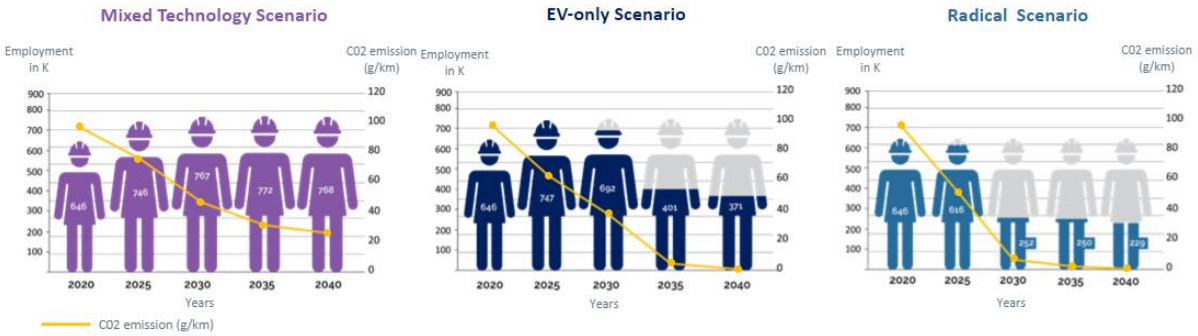
In addition to global and well capitalised industry leaders, the sector of automotive suppliers consists of hundreds of specialised companies and SMEs with less access to capital to invest in the transformation of their business models. Automotive suppliers directly employ 1.7 million people against the 1.2 million people employed by vehicle manufacturers, highlighting the need for a supplier specific assessment. It is important to note that this study does not include greater employment related job risks in vehicle manufacturing or car use related employment in workshops, distribution, and gas stations (3.2 million people across the EU).

6 – Does the study consider job creation in the battery supply chain in Europe?

All scenarios and calculations have been made on the assumption that there will be a *full battery value chain based in Europe*, from processing of raw materials to the final battery assembly. The battery, which accounts for 70% of the electric powertrain value-add, is indispensable for the projected employment gains in Europe. Based on the current public debate, political push and company announcements, this assumption appears fair but uncertainties, particularly regarding timing, remain. It is unclear when investments will happen and in what time frame in relation to expected job losses. Another obstacle includes local sourcing of critical minerals needed for battery cell production. Finally, it is important to note that battery powertrain related job gains do not compensate 1:1 for jobs lost in ICE production. Several of these activities may be undertaken by different companies, in different

regions, and requiring different skill sets. A mixed technology approach would help to mitigate the risks and create a more manageable transition.

7 – What is the powertrain employment forecast for all three scenarios?



Mixed technology – Overall powertrain employment will be on a constant rise, peaking at ~768k in 2040. Loss of only 4k jobs from 2035-2040

EV-only – Overall powertrain employment will fall by 275k by 2040. Loss of 291k jobs from 2030-2035.

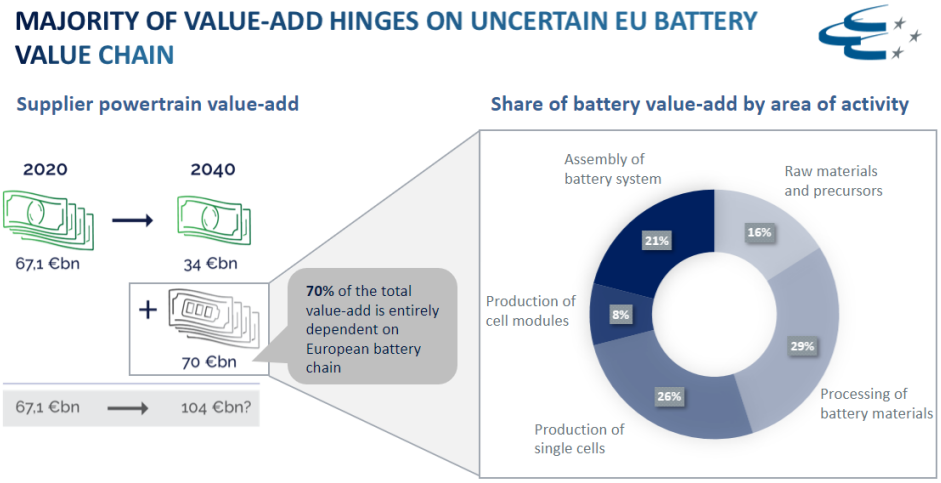
Radical – Overall powertrain employment will be on a constant decrease to 2040. From 2025-2030 ICE employment will significantly decrease driving the overall loss of 364k jobs.

8 – Does the mixed technology approach reach climate neutrality in 2050?

The scenario projects a 50% CO2 reduction by 2030, 5 percentage points less than the European Commission Fit-for-55 proposal. The reduction is attained with a 20g offset of renewable fuels, making it possible to meet the CO2 target with a 28% CO2 reduction from electrified powertrains and the other 22% from sustainable renewable fuels. Beyond 2030, additional volumes of sustainable renewable fuels, complemented by rapid electrification, can make road transport carbon-neutral. Technology is not the enemy, but rather fossil fuels. All technologies, whether ICEs or BEVs or hydrogen combustion vehicles, should run on green energy. Technology openness allows all available solutions to play their role, and to deliver a just transition.

9 – How will the transformation impact industry value-add?

Currently, 75% of the finished vehicle's value-add comes from suppliers. The majority (70%) of value-add in the EV-only scenario will shift to battery cell production under the assumption of a what is still an uncertain European battery value chain.



OTHER QUESTIONS

10 – Are there enough volumes of sustainable renewable fuels available for the road transport sector? Shouldn't they be rather used for the maritime or aviation sector?

Additional demand will create a long-term, stable market for renewable fuels. The rising demand of several billion litres of renewable fuels annually, triggered by a voluntary crediting scheme for OEMs, would lead to establishing a secure and long-term stable market for fuel suppliers. Only then will fuel suppliers see the necessary business case to invest in more renewable energy plants as well as the production plants for renewable fuels. An in-depth analysis conducted by Imperial College London Consultants, commissioned by CONCAWE, concluded in 2021 for instance that there is sufficient sustainable biomass to meet demand to facilitate use of sustainable fuels in light duty road transport. This study considers imports and the use of biomass for other purposes such as industrial production. Another study, conducted by the Institut der Deutschen Wirtschaft, highlighted the contribution that synthetic fuels (i.e., green hydrogen) produced in sunlight rich regions such as North Africa and the Middle East could play to help lower CO2 emissions of existing vehicle fleets.

This demand of renewable fuels by OEMs, who can use these renewable fuel credits to fulfil their CO2 fleet targets, can already now be estimated to amount to up to 25 billion litres by 2030 for new passenger cars, while the introduction of the CO2 emission standards for new vans will likely spike the demand for renewable fuels even more.

11 - Are all the global regions going this way?

From a global perspective, different approaches are being pursued to decarbonise road transport. While there is support for EVs, no major global car markets are opting for technology bans. That's the case in the United States, where the Federal government is pushing to scale up the sale of EVs[3] and charging infrastructure[4], without however making commitments to ban ICEs vehicles.

To decarbonize passenger vehicles, China is betting on a multi-technology approach with an increasing market penetration of New Energy Vehicles (NEVs), including battery electric vehicles (BEVs) and plug in hybrids (PHEVs)[5], with the aim that, by 2035, BEVs become the mainstream of new vehicle sales and FCEVs start to be commercialised. No bans on ICEs though. Similarly, India has also ambitious plans to electrify road transport, but has not indicated concrete initiatives to ban ICE technology for passenger vehicles, as recently stated by the government Road Transport and Highways Minister Nitin Gadkari.

Such an approach was reflected at the recent COP26, where the EV-only approach lacked global consensus at the COP26. With the aim of reaching as many signatories as possible from governments, cities, OEMs, business fleet owners and operators as well as financial institutions, the Glasgow's declaration on "Zero Emission" Cars and Vans failed to get the endorsement of main mobility-technology States and Industry players. Signing onto the declaration means endorsing an EV-only approach that would have considerable social impacts, without ensuring an efficient and effective transition to reaching climate goals, leaving behind a wide range of green technologies and available resources, such as existing infrastructure.

Where electric mobility is the best and most economical solution it will succeed. The business case is growing fast, especially where there are incentives and charging points in place. But where

[3] FACT SHEET: President Biden Announces Steps to Drive American Leadership Forward on Clean Cars and Trucks
[4] President Biden's Bipartisan Infrastructure Law
[5] China's New Energy Vehicle Industrial Development Plan for 2021 to 2035

affordability and charging infrastructure are not a given, there should be room for alternatives. The world needs both sustainable renewable fuels and electrification to reach the climate objectives.

Germany has publicly communicated the impossibility of joining the COP 26 declaration, in defence of the role that renewable fuels can play adapting the current vehicles fleet and supporting the use of the internal combustion engine running on green energy. France, Spain, Italy or the UK have also not signed the declaration. International manufacturing economies such as China, Japan and the United States also did not sign the pledge. As for industry representatives, the declaration has also not been endorsed by the world's biggest car manufacturers – Toyota, Volkswagen, Stellantis and Hyundai.

12 - What is the difference between Tank-to-Wheel (TtW), Well-to-Tank (WtT) and Well-to Wheel (WtW)

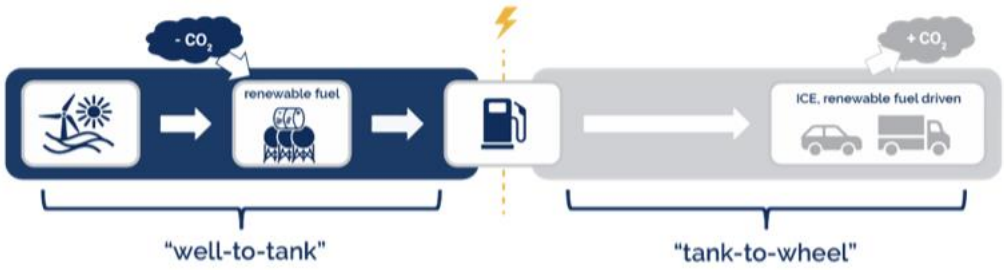
Tank-to-Wheel = considers tailpipe emissions only

Well-to-Tank = only considers emissions from the production and distribution of fuel/electricity used to power a vehicle

Well-to-Wheel = considers the emissions from both of the above life-cycle phases of a vehicle (WtT + TtW)

The EU introduced its first CO2 regulations more than a decade ago to regulate the amount of carbon dioxide emitted from passenger cars and vans. Currently, the regulation aims to cut CO2 tailpipe emissions from newly registered cars to 95g/km[6] in 2020 and to 80g/km in 2025. These standards are proposed to be tightened even further for 2030 and 2035 in order to reduce transport related emissions to meet the EU's overall carbon emissions of 55% by 2030.

The issue with tailpipe measurement (or TtW) is that it only assesses emissions from the vehicle's exhaust, ignoring emissions related to the production of vehicles or the fuels they use, including how electricity is generated. As not all electric vehicles run on renewable energy, the term "zero emission" is misleading. To incentivise technologies with the lowest overall carbon footprint, emissions from vehicles should ideally be regulated on life-cycle basis, with a Well-to-Wheel (WtW) approach as a first step, which considers the production and distribution of the fuel/electricity used to power a vehicle (Well-to-Tank).



Emission reductions on the fuels/energy production side should be recognised when determining compliance with CO2 standards, for example through the introduction of a voluntary crediting mechanism[6], which enables an additional option for automakers to fulfill the fleet-wide targets with additional volumes of renewable fuels.

Technology openness gives industry the needed time to transition, while mitigating the social disruption often coupled with abrupt change, without compromising on climate. A planned and

[6] Crediting System - Crediting System (crediting-system-for-renewable-fuels.eu)

thoughtful transition consisting of a mixed technology approach keeps options open to adjust to new developments, be they technological breakthroughs, geopolitical events, or availability of resources, and at the same time, presents significant value creation opportunities in the automotive industry, one of Europe's biggest industrial assets.