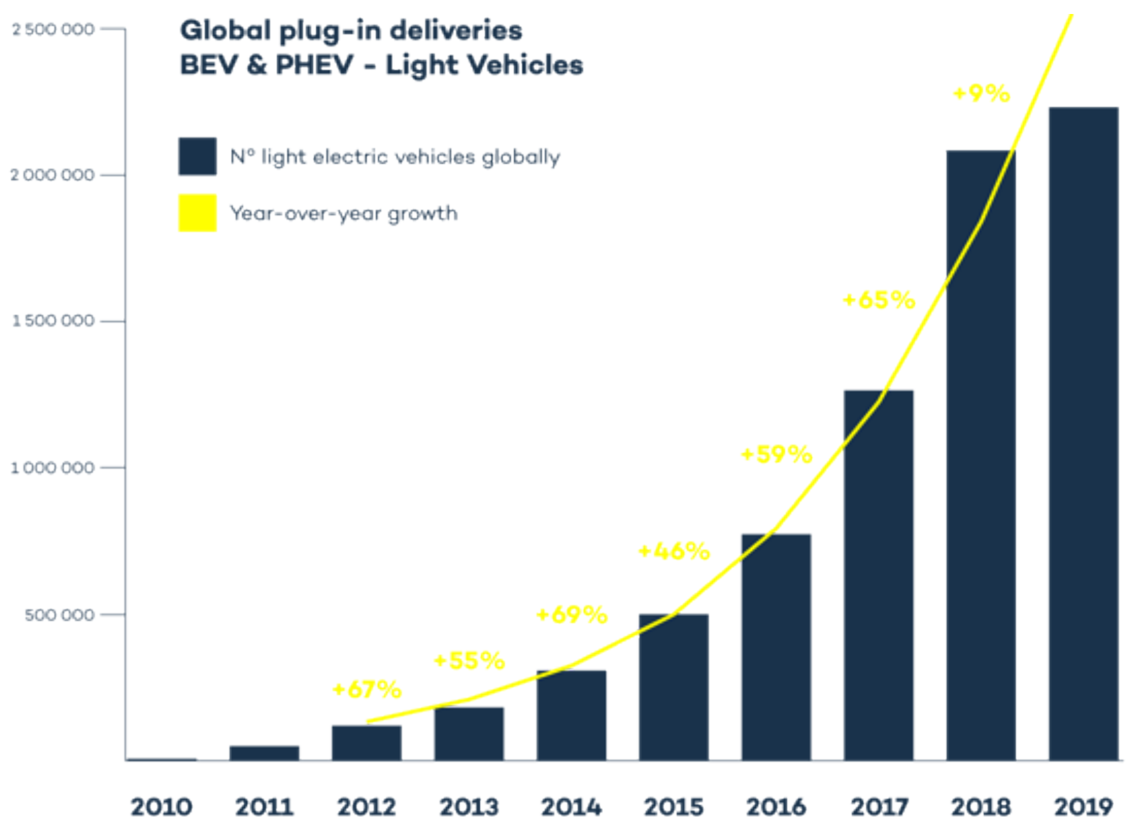
ΦΟΡΕΧΑΣΤΣ: Eς ΜΑΡΚΕΤ ΒΨ 2030

There were almost 4.8 million battery electric vehicles in use globally in 2019 with 9% higher than in 2018. This is a clear deviation from the growth rates of the previous 6 years, which were between 46% and 69%. The reasons for this shift are due to the decrease in sales in the second half of 2019 in the two largest markets, China and the USA.

Amid COVID-19, the outlook for 2020 global EV sales becomes more difficult. The preliminary EV sales data for January and February is very positive in Europe, encouraging in the USA, but dismal in China, where the total vehicle market was down 80% in February. US EV market sales is projected to rise to 6.9 million units by 2025.
The number of EVs on U.S. roads is projected to reach 18.7 million in 2030, up from 1 million at the end of 2018. This is about 7% of the 259 million vehicles (cars and light trucks) expected to be on U.S. roads in 2030.

While the direction is right, it's good to keep in mind that as of 2019, only 2.5% of the world's passenger vehicles run on electricity. This would suggest that we still have a long road ahead until we can declare electrification a reality. The following scenarios are intended to provide the outlook assumptions of EV developments



Σχεναριο 1: Τηε μοστ ρεαλιστιχ

A baseline scenario

Most consumers are reluctant to switch to EVs, as long as the total cost of ownership is higher and drive ranges are lower.

Input parameters regarding cost, energy use and oil price are all estimated as realistically as possible. Government incentives for EVs are assumed to continue roughly as currently in place. A number countries provide significant subsidies or tax exemptions, others do not.

ICEV fuel efficiency improves are in line with the CO2, real-life improvements are expected to remain somewhat lower than the test cycle improvements required by the regulation. After 2020, it is assumed that ICE efficiency improves with 5% every 5 years. Most consumers are reluctant to switch to EVs, as long as the total cost of ownership is higher and drive ranges are lower.

Assumption:

- only the ‘innovators’ will be interested, as long as the TCO of the EVs is higher than that of comparable ICEVs. This group of users represents about 5% of the car buyers. This group is, however, still price sensitive, which is modelled using a price elasticity. Is distinguish between urban innovators that are mainly interested in FEVs and EREVs, and non-urban innovators that are mainly interested in PHEVs and EREVs.

The reasoning behind this is that the 'real life' emissions of cars could be less strong than the reductions during type approval. The rest of the consumers will only start buying EVs once their TCO can compete with that of ICEVs. They will also be price sensitive: the larger the cost benefit, the larger the market share.

Production capacity and charging opportunities will be limited at first, and increase over time. It is assumed that it will take until 2025 before production capacity and charging can be fully developed and do not provide limitations on market uptake. Energy prices (diesel, petrol and electricity) are assumed to develop in line with the regulated price trends. EVs replace ICEVs, the number of vehicle sold and their annual mileage will be the same as in the baseline.

Regarding the charging profiles is assumed that part of the vehicles will be charged ‘smartly’ between 2018 and 2022. All EVs will be able to apply smart charging from 2023 onwards, resulting in a relatively high share of charging during night times. The reasoning behind this development is that it will take some time to develop a common smart charging methodology, but as the number of EVs increases, the benefits of charging management/smart charging and therefore the need to implement and use this technology will increase.

Gas-fired dispatch composes the greatest share of the additional generation needed. Specifically, by 2030, it provides nearly 70 worth of additional output. Similarly to the capacity mix, increases in coal and wind generation are also observed. However, the contribution of coal to the overall generation mix decreases by over 25% between 2025 and 2030. Other renewable generation types (hydro, solar and biomass) are largely unaffected by the growth in electricity demand ensuing from EV deployments.

Σχεναριο 2: ΧΟΝΣΕΡςΑΤΙςΕ ΠΡΟΓΡΕΣΣ

A potentially realistic progression of EV

In this scenario there is **relatively limited technological progress**. Costs of batteries reduce less fast than anticipated in Scenario 1. Successful further development of ICEVs, leading to significant CO2 efficiency improvements at reasonable cost. Fuel efficiency of ICEVs is expected to reduce in line with the CO2 and cars regulation. Between 2020 and 2030, efficiency is assumed to increase further, by 10% every 5 years. Government incentives for EVs reduce of time, insufficient to compensate the higher total cost of ownership compared to ICEVs. Consumer interest remains limited to a relatively small market (innovators and some niche markets). TCO of FEVs remains high compared to ICEVs, resulting in a low market uptake. Batteries remain expensive, oil price and electricity price as in baseline scenario, governments provide some subsidies and tax exemptions in many countries, but not enough to achieve competitive TCO.

PHEVs will successfully enter the market, but their electric range remains limited and consumer interest as well, due to limited charging possibilities. EREVs will not enter the market, as they will remain expensive and offer little advantage over other types of vehicles. Energy prices are assumed to develop in line with the regulated price trends.

The charging profiles will be mainly unmanaged untill 2030, in line with the unmanaged profile described in the previous section. As the number of EVs remains limited, the need for smart charging is limited and few efforts are made to encourage smart charging.

Coal capacity competes with gas for the additional generation needs caused by EV, as the technologies' reliable availability better fits the demand peaks brought on by unmanaged EV charging.

Eς Σχεναριο 3: ΟΠΤΙΜΙΣΤΙΧ/ΑΜΒΙΤΙΟΥΣ

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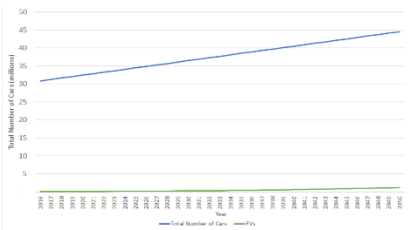
This scenario is the most optimistic one, from the EV development perspective. The story line is as follows: **R&D leads to a rapid decrease of battery cost and increase of battery lifetime.**

TCO of medium-size PHEVs becomes almost competitive with ICEVs in part of the urban transport, and in non-urban transport. The share of electric driving with PHEVs increases compared to the baseline, as their electric range increases. In parallel, FEVs become competitive in the small vehicle segment and urban transport. After 2020, their market share also increases in the medium-size vehicles sales as the ranges of FEVs increase and cost decrease. In the larger vehicle market and non-urban vehicle use, PHEV and EREVs gain quite rapid market share from 2020 onwards, as their TCO also gets competitive. The driving range of EREVs also increases over time. From 2025 onwards, fast charging will be offered in the majority of countries, practically removing all range anxiety and range limitations. Government incentives for EVs are high at first in some countries and will be rapidly reduced as costs go down. ICE development (regarding fuel efficiency and cost) and energy costs are assumed to be the same as in Scenario 1.

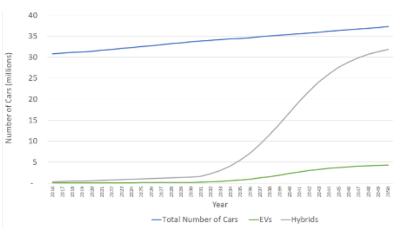
Regarding the charging profiles, we assume that charging will be mainly unmanaged before 2022 and that after a transition period, smart charging will become more common in the years from 2023 onwards, as the number of EVs increases and the benefits of charging management/smart charging increase.

The fuel types contributing most to the increases are natural gas, coal and wind. However, while natural gas increases its share of the generation mix from 50% to 57% between 2025 and 2030, coal decreases to 27% from 37%.

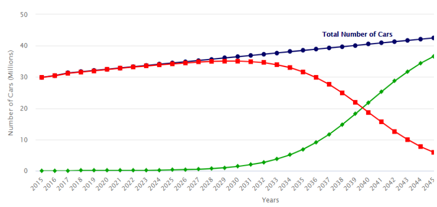
Scenario 1



Scenario 2



Scenario 3



Though EV market growth has been considerable, challenges remain. These include vehicle availability, consumer awareness, charging infrastructure, and threats from competing alternative fuels or fuel efficiency solutions, just to name a few.

These challenges and threats are eroding with the natural cycle of technological development and concerted efforts by stakeholders (governments, automakers, and energy providers) to move the market toward lower emissions transportation, specifically electrification.

TCO *total cost of ownership*

ICEV *Internal combustion engine*

PHEV plug in electric vehicle
EREV extended range electric vehicle