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# Market penetration of xEV in Switzerland: proposal for a more aggressive scenario

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## Executive Summary

The market evolution of plug-in cars in Switzerland suggested the elaboration of a more aggressive scenario, in comparisons with those done by other authors, to match the increase of the market penetration of the xEVs and the evolution of the offer. The new scenario forecasts that the market penetration of the xEV cars (% of the new registrations) will increase, starting from about 12% in 2020, up to 60% in 2025 and more than 90% in 2030. These results come from a comparative analysis with other European markets and are driven by the following: the acceptance of the Swiss market in this decade (despite of the lack of nationwide subsidies), the cost reduction of xEVs in the next 10 years, the increase of the offer of xEVs in terms of both number of OEMs and number of models, the growth of public charging infrastructure.

## 1 Need of a new scenario

The Swiss Government and other organizations have issued in the last years scenarios showing the market penetration of plug-in passenger cars (xEV) in Switzerland, [2], [3], [4], [5]. Comparing the forecast with the real market data [1], the oldest scenarios, like [2], estimated a lower market penetration growth than the one experienced in the last years (Figure 1). But, according to the authors, even the newest scenarios ([3], [4]) are showing a slower growth than the potential of Switzerland.

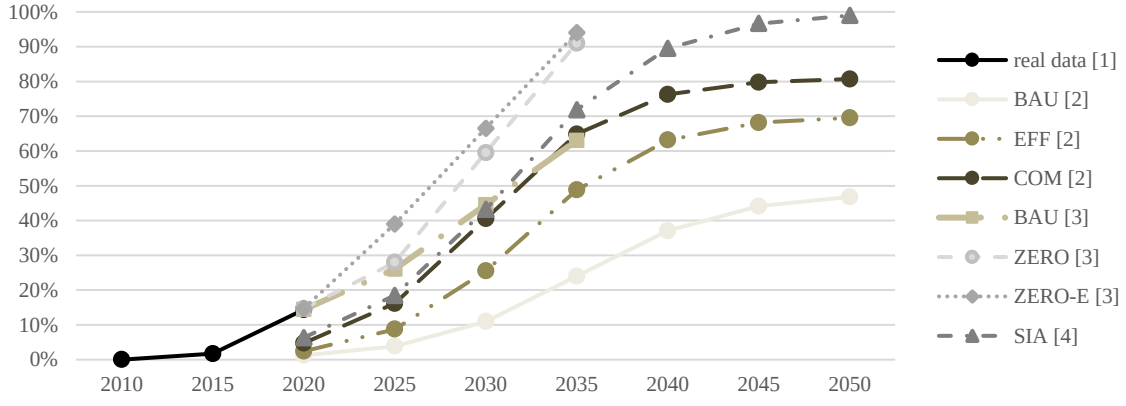


Figure 1: comparison new registrations scenarios of xEVs in Switzerland

The comparison of the market penetration (Figure 2) in Switzerland and other countries, suggests that the Swiss market acceptance is particularly high, despite of the lack of nationwide subsidies or other economic incentives.

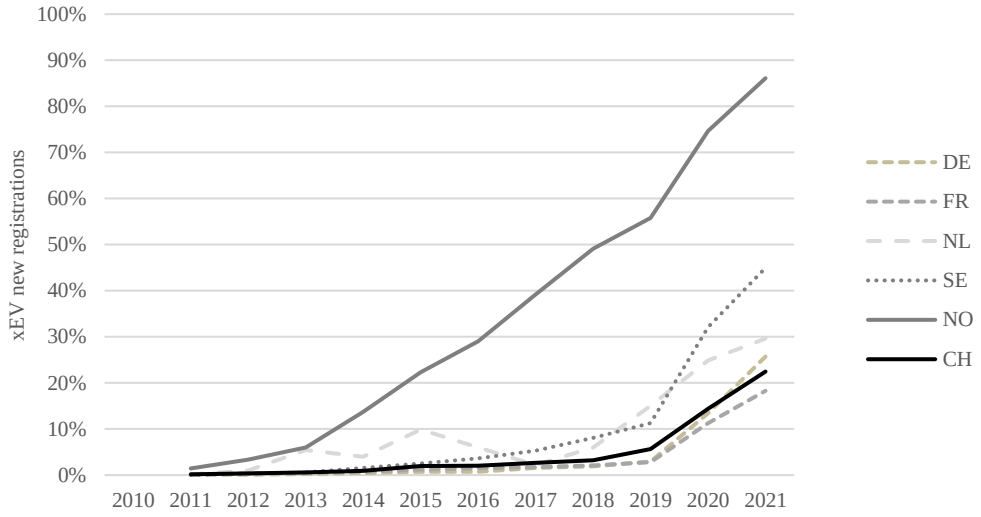


Figure 2: percentage of new registrations of xEVs in Switzerland and in other selected countries [5]

This fact, with the expected removal of the remaining market hurdles, has pushed Swiss e-Mobility (the national association for the electromobility) to work together with Protoscar to develop a more aggressive scenario, because Switzerland is not yet ready for the imminent market ramp-up of electromobility. In particular, the starting position is very poor due to the limited access to private charging stations. Over 70% of the population does not have its own garage. The urgent need for measures that are necessary for the upcoming market development has not yet been recognized by the decision-makers. The present scenario is therefore intended to raise awareness.

# 2 Driving factors

A more aggressive scenario is driven by several factors that are related to the offer and demand of xEVs and the improvement of the boundary conditions. Fines for $CO_2$ emissions, upfront cost reduction, increase of the xEV models on the market, increase of awareness of the potential customers are the main factors on the offer and demand sides, while the development of the public charging infrastructure and a possible more active policy at national level, are the main factors on boundary conditions side.

## 2.1 Fines for the $CO_2$ emissions

Switzerland has adopted a system that applies fines related to the $CO_2$ emissions of the cars which are registered for the first time in Switzerland [6]. The mechanism follows the same principles of the one adopted by EU and fines have been already charged to the importers. On 2020 the total amount of fines was 132 MCHF or 556 CHF per each vehicle [7], with an increase of 42% compared to 2019. Therefore, the efforts of the importers to sell xEVs will increase year after year. This will have a positive impact on the demand side, because the dealers will be more engaged in selling xEVs and the massive advertising campaigns they are already doing to push xEVs, will increase the awareness of the potential clients about xEV technology.

## 2.2 Upfront cost reduction and competitive TCO

Many analysts agrees that up to 2025 the gap between ICE and BEV will decrease [8], [9] and in the period 2025 – 2030 the price parity between ICE cars and BEV will be achieved [11], driven mainly by the battery cost reduction. One of the main purchase barriers will be then removed.

At the same time the Total Cost of Ownership (TCO) of BEVs will become more and more competitive. Today a comparison between a BEV and an entry level ICE car belonging to the same market segment, is still favorable to ICE, when the mileage is low. Already at 5’000 km/year the TCO of the entry level of a VW Golf and VW ID3 is the same (1,34 CHF/km) but at 10’000 km/year the latter is much lower (0,75 vs 0,79 CHF/km) [12]. Even if TCO is very sensitive to the fuel price, nevertheless TCO is getting more and more competitive.

## 2.3 Increase of xEV models

In the next 2 or 3 years the xEV offer will cover, with tenth of models [8], all the market segments. In the next 10 years, most OEMs are planning to achieve 50% or even more of the sales to be xEVs. It means that the end customers will find the same huge offers of brand, models, versions, they are used to in the ICE segment [10]. The limited choices of the market will not be an issue anymore, so another market barrier will be removed.

## 2.4 Development of charging infrastructure

Public charging infrastructure is growing fast. According [13], at the end of 2021 6'606 public accessible charging stations have been already installed in 3'163 sites and the growth trend is continuing (+25% charging stations in the last 12 months). It is already quite likely that people not yet driving electric vehicles notice that charging stations are a common sight both in the cities and along the highways. Analyzing the plug power, 18% supply more than 42 kW: these fast-charging opportunities can convince people, who have not yet decided to embrace the e-mobility, that BEVs are no more a city car but they can cover all the individual mobility needs. The further development of charging infrastructure, increasing the confidence in the technology, will fade away another barrier. In contrast to the private charging network, Switzerland has an excellent public charging network. This is especially true between the conurbations, which are mostly close to each other due to density of the inhabited area between Jura and Alpes. The so-called range anxiety is less distinct in Switzerland than elsewhere, allowing for a more aggressive scenario.

## 2.5 Increase of awareness

The acceptance of e-mobility by most of the Swiss population is already a fact. The acceptance, which is highest in the upper social class, is spreading to the other classes as well [14]. At the end of 2020 the number of people considering likely or much likely the purchase of an xEV in the next years has increased up to the 56% (+ 14% compared to 2019) and those excluding a purchase of a xEV at all were 16% (-24%) [15]. The acceptance is already moving from the pioneer and early adopter to the early majority segment of customers, but the combined effects of all the driving factors will increase the speed to reach all the consumer segments. As emphasized in the analysis [14], the knowledge transfer from people already experiencing e-mobility to people starting to be interested in it, plays a crucial role. However, the bigger the number of xEV users the faster the knowledge transfer and then the acceptance.

# 3 Scenario construction

## 3.1 Assumptions

From the analysis of the driving factors, the following assumptions have been introduced:

- Switzerland will continue to be very receptive to electric vehicles, thanks to the increase of the awareness and knowledge of the technology.
- Up to 2025, the electric vehicles will be adopted by the market segment of the early majority, where the environmental concern alone is not enough to choose an EV, but it has to be supported by at least a lower upfront cost.
- Starting from 2025, the price parity will convince the market segments of the late majority to switch to electric vehicles and finally the laggards will be slowly forced to give up the ICE cars, both because finally they will be familiar with EV technology and for the lack of alternatives.
- In 2035, 100% of new registered cars will be xEV.

These assumptions suggest an "S" shape curve, which can model the growth from 2010 up today, the increase of growth rate between 2020 up to 2030, and finally a slow-down corresponding to the phase where the electric vehicles are adopted by the "laggards".

## 3.2 Scenario curve

The scenario gives the percentage of new registrations of xEVs. The points of the curve between 2020 to 2035 have been defined considering that:

- in 2020 Switzerland achieved the same market penetration of Norway with 5 years of delay.
- There are no reasons why Switzerland should not be able to replicate the market growth of Norway in the period 2015 – 2020, because all the driving factors are even better than in the

past 5 years. Norway could of course rely on upfront cost parity between BEV and ICE, nevertheless Switzerland has shown good market results (Figure 2) and price parity is very close (see 2.2).

Basically, the scenario curve represents the growth rate which Norway is experiencing, heading to a 100% market penetration on 2030 latest, but with a delay of few years. The method for curve construction is outlined in Figure 3.

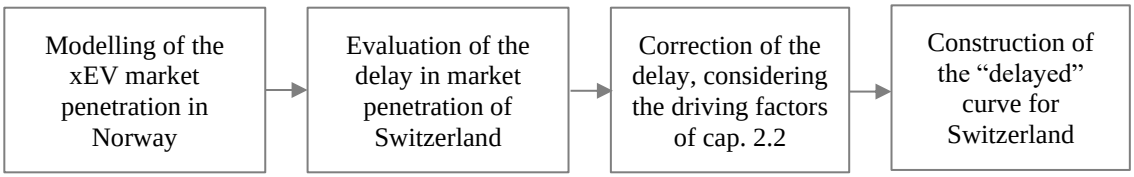


Figure 3: method for the scenario curve construction

The delay (around 5.5 years), has not been corrected because it has been evaluated that on one side today in Switzerland there are more favorable driving conditions than in Norway 5 years ago (§ 2), on the other side there are factors which potentially could contrast those conditions, as mentioned at the end of the § 1.

The Figure 4 shows the curve and the Table 1 the numerical values.

Figure 3: proposed new scenario, compared with [3] and [4]

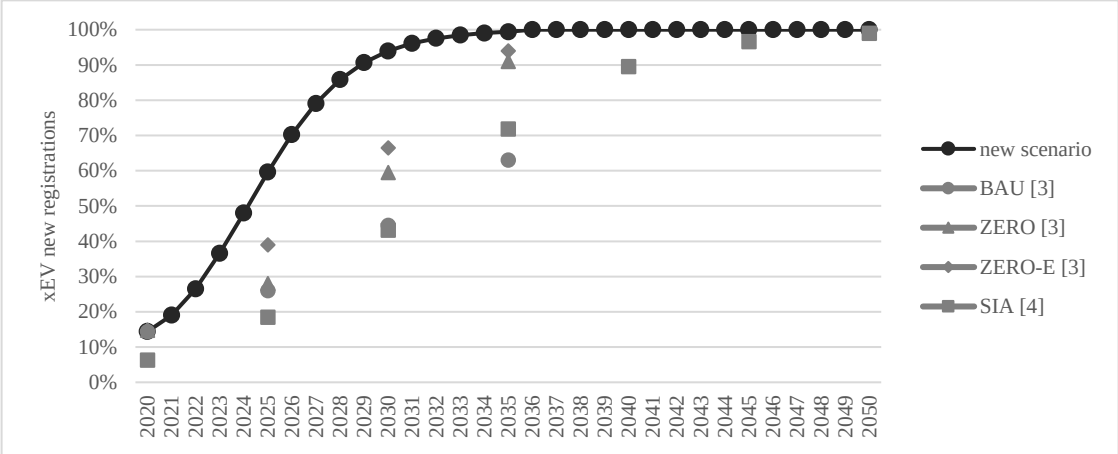


Figure 4: proposed new scenario, compared with [3] and [4]

| Year | xEV market penetration (% of new registrations) |
|---|---|
| 2020 | 14.4 |
| 2025 | 60 |
| 2030 | 94 |
| 2035 | 100 |

Table 1: proposed scenario

Some scenarios, like "ZERO" and "ZERO-E" [3] head to 100% not later than the proposed scenario, but the path to 100% is closer to a linear growth than the "Norway-like" growth. In author's opinion, that growth have to be taken as the benchmark for a scenario aiming to reach the goal explained in § 1.

## 3.3 Split BEV / PHEV

The main assumption is that xEVs are made by BEVs and PHEVs and that in 2030 all the xEVs will be BEVs because:

- PHEVs are only a temporary solution, introduced by the OEMs to decrease the $CO_2$ emissions of the whole fleet.

- As pointed out by some analysis [16], PHEV are not providing environmental benefits, because in real life conditions the use in charge depletion mode is less than the theoretical one (i.e. the one used for the measurement of the emissions according the normative. Once there will be more awareness about this issue, the subsidies for these vehicles will be no more given, accelerating their phasing-out.
- The price parity BEV/ICE, which should be achieved in the period 2025 - 2030, together the increase of charging infrastructure, will remove all the motivations which could lead the customers to prefer PHEVs than BEVs.
- It will make no sense for OEMs to continue to put two technologies in a car, with increasing production costs and complexity, considering the decrease of battery costs.
- Some OEMs (e.g. VW and Audi) have already announced that they mean to cease the development of combustion engines: as a consequence also PHEVs will not be developed anymore in the future.
- The decision of some countries to ban ICE cars, is another indicator about how temporary PHEV technology is.

The Figure 5 shows the assumed new registration of BEVs and PHEVs.

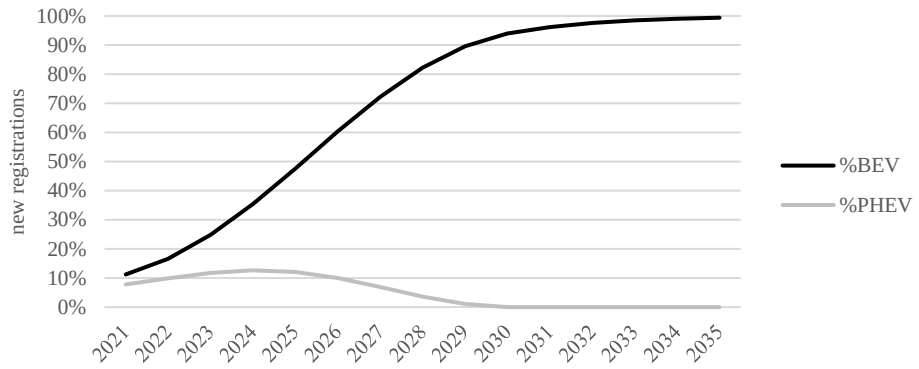


Figure 5: split of new registrations into BEVs and PHEVs

## 3.4 Impact of the scenario on the fleet composition

A simplified analysis has been carried out with the goal to understand the impact of the proposed scenario on the whole car fleet of Switzerland. The new registrations are assumed to be a constant value of the fleet, according to the statistics [17] and the evolution of the fleet is assumed to follow the same trend of [18], but with some adaptations to match the fleet in 2020 with the forecast. The evolution of the xEV fleet, is shown in Figure 6. At the end of the analyzed period, the xEV fleet reaches the 60% of the total fleet, with BEVs representing the 95% of xEV fleet, because of the assumption about the share BEV/PHEV of the new registrations.

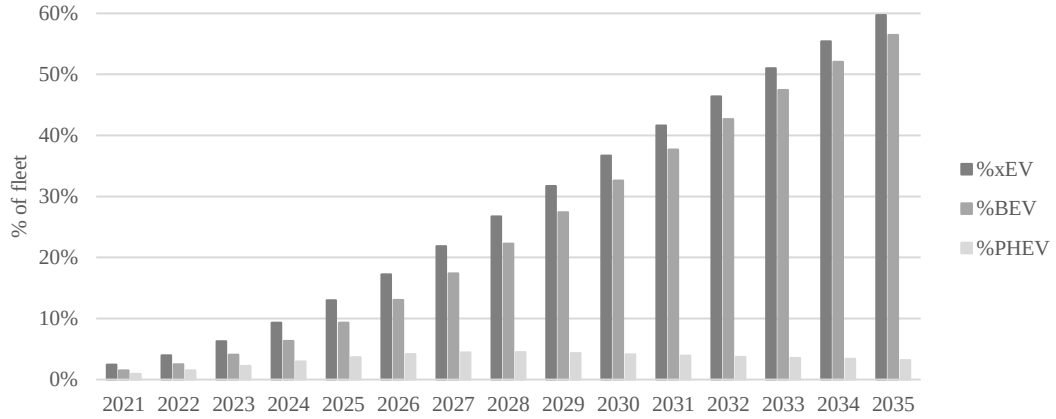


Figure 6: evolution of the xEV passenger car fleet as % of the whole fleet

### 3.5 Examples of method application

The method described in § 3.2 has been applied to the other countries compared to Switzerland in Figure 2 , modelling their scenarios starting from 2021. This is simply an exercise, showing "what if" a country would follow the same growth trend of Norway, without any correction to consider the specific driving factors of each country and their evolution in the next years (see Figure 3). Replying the growth rate of Norway, these countries could achieve a 100% xEV new registrations in the period 2030 – 2035.

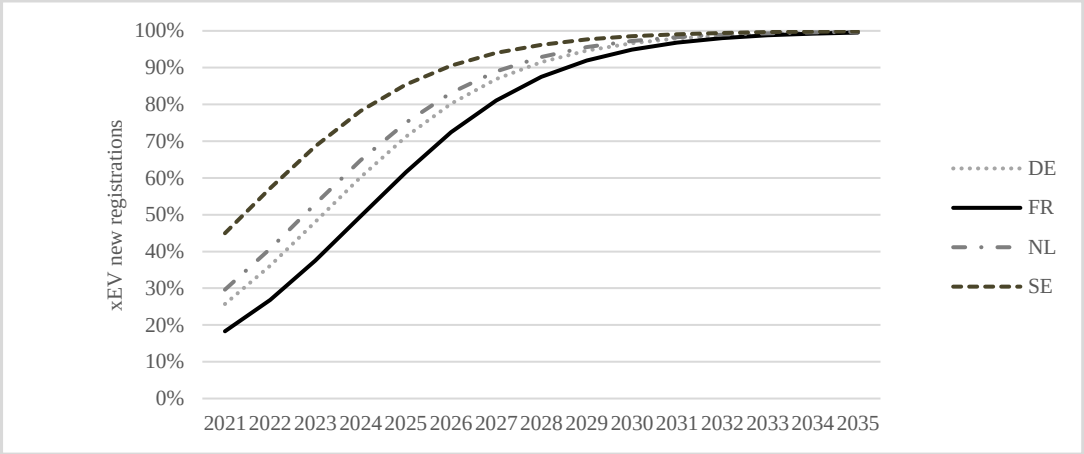


Figure 7: example of application of the method presented in this paper to other countries.

## 4 Conclusions

The authors recommend the e-mobility stakeholders in Switzerland to adopt this or any other more aggressive scenario than those presented in Figure 1, because real market data and the evolution of the driving factors, suggest that the xEV market in Switzerland has the potential to get a 100% market penetration in the period 2030 - 2035. The xEV market penetration [13] at the end of 2021 (22,4%) and in Q1 2022 (25.5%) provides a clear indication for the adoption of more aggressive scenarios (the forecast of the scenario here presented was 19% in 2021 and 26.5% in 2022). The presented scenario is still aligned with the new market data, but in general it will be regularly updated for a better alignment both with the market data and the evolution of driving factors.

The method used for Switzerland could be applied to any country, upon an analysis of the driving factors and an estimation of their impact, i.e. if their evolution will set up conditions suggesting an electrification speed either similar or slower/faster than the one experienced by Norway.

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# Presenter Biography

Giorgio Gabba obtained a master's degree in Aeronautical Engineering from Politecnico di Milano. He has always worked in the e-mobility field. On 1999 he joined Protoscar SA as project manager and senior researcher/analyst. Current activities focus on charging infrastructure analysis (quantification of charging infrastructure, definition of the sites, planning, deployment plans and recommendations), WTW assessment, fleet analysis.

Krispin Romang is Director of the national association for electric mobility Swiss eMobility and Head of Policy at the TCS Mobility Academy. He represents the industry's interests in various bodies and committees and is a secretary of the parliamentary group for electromobility. Krispin has over a decade of experience in the field of individual mobility and electrification of propulsion. He previously worked in the security, IT and banking sectors. Krispin is a business economist and lives with his family in Bern.