

What if all cars were electric?

July 27 2015, by Anne-Muriel Brouet



Credit: Alain Herzog/EPFL

A century ago, Switzerland decided to electrify its railways. Out went coal, coal pollution and energy dependency. Today, what about switching all our cars over to electricity? The air would be cleaner, but what would be the impact on electricity demand, employment and tax income? This is the topic of Cihan Cavdarli's Master Thesis in Energy Management.

His first [conclusion](#): if all cars in Switzerland were electric, total [electricity demand](#) would rise by 19-24% depending on the scenario. Should this make us think twice? Not at all, if we look at the bigger picture. To measure the impact of the widespread use of [electric vehicles](#), Cihan took many other factors into account – economic, environmental, technological and tax-related. "The positive impact of switching to electricity generally outweighs the negative impact, apart from some extreme cases," said Cihan.

Anticipating the country's phasing out of nuclear power, Cihan looked at two scenarios. One assumes a high carbon footprint, with [nuclear energy](#) replaced by gas. The other boasts a low carbon footprint, with renewable energies stepping into the nuclear breach. "This latter scenario is the best fit for [electric cars](#)," added Cihan.

He based his work on the scenarios drawn up by the research institute Prognose. He also used the [Swiss-Energyscope calculator](#), developed by the Energy Center, to estimate marginal electricity generation - in other words, the source of the additional kWh to power electric cars for each scenario.

Cihan took into account primary energy consumption (before transformation, storage and transport) for both internal-combustion and electric vehicles. Under the assumption that energy efficiency will improve, the consumption of primary energy by electric vehicles will decrease. Depending on the scenario, this decrease is expected to be 16-23% by 2035. So that evens things out.

The environment also stands to gain. Private vehicles currently account for 25% of CO₂ emissions. In the best case this figure would fall to 5% (with a second life for batteries); in the worst case, 10%. In addition, even if only a third of vehicles were electric, nitrogen oxide emissions would be cut in half.

A tax on electrical vehicles?

When it comes to the impact on tax revenues, things get a little more complicated: taxes on fossil fuels currently account for 8% of Switzerland's tax income. "Tax revenues will go down unless the tax on mineral oils is shifted to electric vehicles," said Cihan. But the tax impact would be reduced. This is because internal-combustion engines are becoming increasingly efficient, which means that fuel consumption

is on the decline. And the country will save money on fuel imports. The savings will be even higher since the energy will come from locally produced renewable energies.

In view of their price tag, electric vehicles are not yet economical. But by 2020 they should cost the same as gas-powered ones. As long as the government doesn't tax electric vehicles – and oil prices don't rise to \$180 a barrel.

Provided by Ecole Polytechnique Federale de Lausanne

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