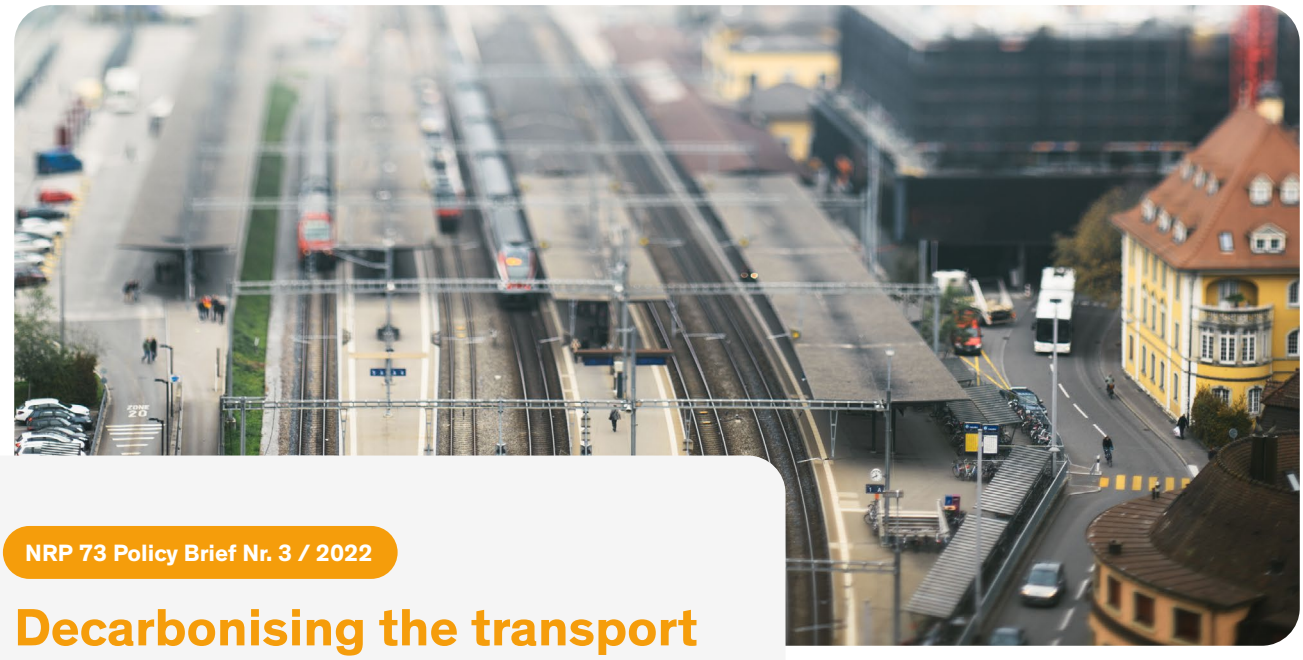

NRP 73 Policy Brief Nr. 3 / 2022

Decarbonising the transport sector

Policy implications

— The optimal strategy for decarbonising passenger transport in Switzerland consists of a "push-and-pull" mixture of measures. Market-based instruments are needed to encourage low-emission technologies (CO_2 levy), promote operational efficiency (occupancy) and public transport use and ban new fossil-fuelled cars. Although market-based instruments are effective and necessary, they are not sufficient in themselves.

— Focusing solely on the changeover from fossil-fuelled to battery electric vehicles will only result in further growth in vehicle numbers, while traffic volume and energy demand will increase, meaning that huge quantities of electricity will have to be imported from abroad.

— Achieving net zero by 2050 is ambitious but possible. Rapid action is required: although emissions will decline without additional measures, Switzerland will fall short of its climate goals by a significant margin.

— The necessary structural transformation will create opportunities for econonomic sectors closely associated with transport and energy production, as well as for their suppliers. This applies particularly to the renewable energy and battery recycling segments as well as to suppliers for the electrical vehicle industry.

— With the process of decarbonising transport underway, linking economic sectors and policy areas of transport and energy will become increasingly important. The electricity for large-scale electrification must be obtained from renewable sources which, ideally, will be located in Switzerland. Decarbonising transport therefore requires simultaneous and continued expansion of renewable energy production in Switzerland.

Swiss National Science Foundation

Passenger transport in Switzerland can be fully decarbonised by 2050 with no detriment to the economy.

It is possible to decarbonise passenger transport by 2050 and derive economic benefits from doing so. Three lines of action were analysed:

1 Electrifying cars

2 Shifting motorised private transport to public transport

3 Increasing car occupancy rates

Each line of action will individually yield reductions of 25 to 50 percent by 2050, but individually they are not sufficient to decarbonise transport. **Combining all three lines of action examined will achieve 80 percent decarbonisation by 2050**. There is a serious risk that, even in combination with the two other lines of action, electrical vehicle adoption – of itself the most effective line of action – will take place too slowly without further measures. To ensure successful decarbonisation by 2050, it is essential to **ban new fossil-fuelled cars from 2030**. This will also provide **planning and investment certainty** for economic operators in mobility-associated sectors and opportunities to establish competitive new areas of industry. Our research shows that **rapid and tangible measures to decarbonise** transport and establish production capacity for renewable energy are essential if Switzerland is to achieve its goal of decarbonising transport (achieving net zero) by 2050.

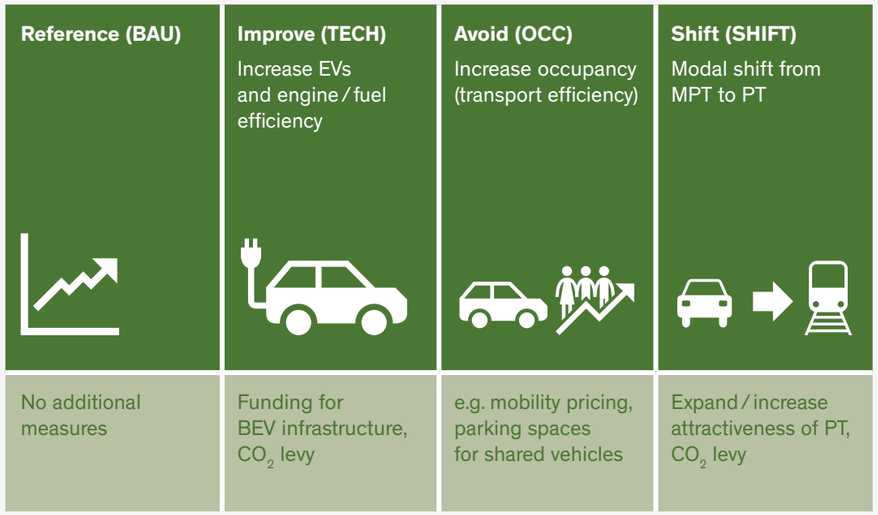

Figure 1 – Three action lines for decarbonising passenger transport
BEV: Battery electric vehicles

What is meant by...

Electric vehicles, electrification: When talking about the changeover from fossil-fuelled to electrically powered vehicles, we are referring to full battery electric vehicles, not hybrid vehicles.

CO_2 levy: TECH and SHIFT assume that a mileage-dependent levy is charged to fund battery electric vehicle (BEV) infrastructure and public transport.

Welfare: We base our assessment of economic effects not only on GDP, but also on welfare, comprising GDP and leisure time benefits.

Research and results

Climate change is still progressing and the risk of extreme weather events is increasing. In 2021, therefore, the Federal Council set itself the goal of decarbonising Switzerland by 2050. The transport sector accounted for 40 % of CO_2 emissions in 2018 and is therefore an important player in Swiss efforts to achieve net zero. As yet, the transport sector has virtually no decarbonisation instruments for passenger transport apart from fleet limits and obliging fuel importers to compensate emissions. The new CO_2 Act, which would have provided such instruments, was rejected in a first referendum. Given the goals to which the government has committed, there is a huge need for action. As part of the NRP 73 project "Decarbonisation of the transport sector", we used a model to analyse various lines of action that could be used to decarbonise passenger transport and the impacts they would have. Our analysis was based on scientific model calculations and incorporated the knowledge of experts close to the market.

The three main lines of action for decarbonisation were compared

We analysed the economic impact of three fundamental lines of action (key scenarios) for reducing the CO_2 emitted by traffic:

1 Improve (TECH)

Improving fuel / engine efficiency and vehicle efficiency towards low-carbon and zero-carbon technologies. This centres on the electrification of passenger transport (penetration of battery electric vehicles).

2 Avoid (OCC)

Increase transport efficiency with increased car occupancy rates.

3 Shift (SHIFT)

Modal shift from private to public transport.

We used a literature review and discussions with experts to determine what maximum realistic potential for reducing CO_2 each line of action has. Then we defined in broad terms the instrument set that could be used to achieve these. Analysing the transport-related and economic impact required a model framework that linked the economy as a whole to a differentiated transport system. We therefore adopted a multi-model approach consisting of a dynamic computable general equilibrium (CGE) model, a model of Switzerland's car fleet and a model of vehicle type choice. In our model, households have the choice of using growing income to consume more, save more or demand more leisure time (i.e. work less). The model shows the effects of decarbonisation on the economy as whole and on society in terms of gross domestic product (GDP) and welfare (GDP plus leisure time benefits). We first modelled a key scenario for each line of action, then compared the results between the three key scenarios and with the reference trend (BAU). This analysis excludes air traffic and the impact of digitalisation on mobility.

BAU: Reference
SHIFT: Shift from MPT to PT
OCC: Increase car occupancy rates
TECH: Increased electrification of cars
OPT 1: Combination of SHIFT / OCC / TECH
OPT 2: OPT 1 plus ban on new fossil-fuelled cars

Discussion

It is possible to decarbonise passenger transport and derive economic benefits by 2050.

Without further action, traffic emissions will decline in the period up to 2050 solely as a result of ongoing technical progress and the growing adoption of electric vehicles. However, Switzerland will fail to achieve the Federal Council's climate targets by a significant margin. No single line of action will be sufficient in itself to decarbonise passenger transport by 2050. Having analysed the models of economic effects, we therefore used a model to test combinations of the three lines of action capable of achieving the goal of decarbonisation while producing the best possible economic effects (optimal scenario OPT1). The main results of this optimisation step in the scenario analysis show clearly (see Figure 2):

— It is possible to decarbonise transport and derive economic benefits (GDP, welfare). Furthermore, external costs will fall as a result of the transport decarbonisation strategy, decreasing the cost and effort of adapting to climate change (assuming that other countries contribute too).

— Viewed in isolation, the technical (TECH) line of action of electrifying vehicles has the greatest potential for reducing emissions, but will not be able to deliver the decarbonisation the Federal Council is aiming for by 2050 and also involves increased energy imports. Additional efforts to improve efficiency (OCC) and bring about a modal shift (SHIFT) are therefore needed. Decarbonising transport will require a combination of the three lines of action in their entirety.

— While an optimal combination of the three lines of action will reduce CO_2 emissions by 80 %, it will not lead to full decarbonisation of transport in Switzerland (OPT 1).

— Under all the scenarios investigated, transport services in Switzerland are cheaper (more efficient) to produce than in the reference trend. Over time, the households have to spend less money on the passenger transport mobility services they need than in the reference trend. They can then spend the money saved to increase consumption of other goods or use it via additional leisure time (lower labour supply, lower income). Both result in greater overall economic welfare.

— Instead of imported fuels such as oil or gas, battery electric vehicles require electricity. The more of this additional demand for electricity (from renewable sources, otherwise there is no reduction in CO_2 emissions) can be covered by domestic production, the more the existing expenditure on imports can be channelled into domestic value creation.

CO_2 emissions 2050

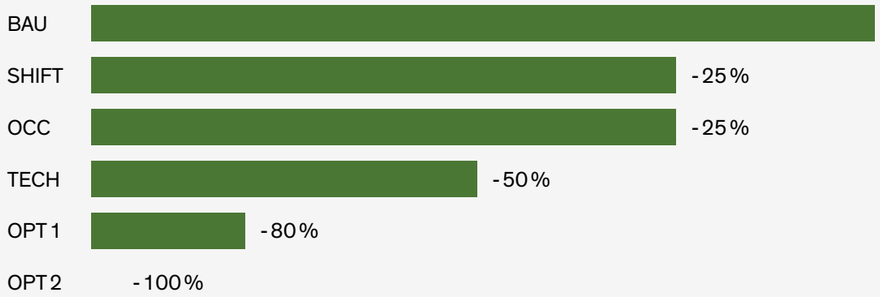

Figure 2 – CO_2 emissions in passenger transport 2050 (key and optimal scenarios compared to the reference scenario)

Decarbonising transport will require a combination of all three action lines.

The model-based analyses show that this will require a set of market-driven and non-market-driven measures.

To ensure that the most significant action line in terms of emissions – promoting battery electric vehicles – produces results faster and targets are safely met by 2050, a ban on registrations of new fossil-fuelled vehicles (combustion engine ban, optimal scenario OPT 2) will be required. This will provide planning and investment certainty for vehicle production and sales as well as investment certainty for other mobility-associated sectors. If the three action lines are combined and supported by a ban on combustion-engine vehicles (between 2030 and 2035), it will be possible to achieve the goal of decarbonising passenger transport by 2050 in an economically efficient way.

Conclusions

It is possible to decarbonise passenger transport in Switzerland by 2050 and obtain economic benefits if the appropriate push-and-pull mixture of measures is implemented in time. The results show that there is no need for a political discussion of which of the three action lines – a) electric instead of fossil-fuelled vehicles, b) modal shift to public transport, c) increasing occupancy rates – will result in the decarbonisation of transport, since it is clear that a combination of the full potential of all three is required. Although the three action lines in combination will reduce CO_2 emissions from passenger transport by 80 % by 2050, they will still not be able to deliver the full decarbonisation targeted. From an economic perspective, the ideal strategy that will lead to full decarbonisation of passenger transport by 2050 is a combination of accelerated technical progress, market-based instruments – to promote and fund low-emission technologies – and a ban on registrations of new fossil-fuelled vehicles. To ensure that decarbonising transport yields economic benefits, it will be necessary to partly replace current imports of vehicles and fossil fuels by domestic value creation. This means that a substantial proportion of the additional electricity that will be required to decarbonise passenger transport should be produced in Switzerland.

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About NRP 73

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The National Research Programme “Sustainable Economy” (NRP 73) was launched by the federal council with a global budget of CHF 20 million for five years of research starting mid-2017. It funded 29 research projects in different thematic areas such as Circular Economy, Finance, Building & Construction, Cities & Mobility, Forestry, Agriculture & Food, Supply chain, Sustainable Behaviour and Governance. NRP 73 aims at generating scientific knowledge about a sustainable economy that uses natural resources sparingly, creates welfare and increases the competitiveness of the Swiss economy.

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