Institute of Transport Economics
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ENGLISH Summary

Effects of changing electric vehicle incentives

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We look at implemented and potential future changes in tax rates for electric cars, and how they affect direct greenhouse gas emissions from passenger vehicles in Oslo towards 2030. The assessments are made based on a combination of existing research, new counterfactual simulations with the BIG model and new econometric analyses. The results show that tax changes that make it less profitable to own and use an electric car will mean that emissions in Oslo will not decrease as quickly as previously assumed. The changes that have the most impact are full toll rates and full value added tax for electric cars. As the analyzes are based on historical data and the electric car market is developing rapidly, there is considerable uncertainty in the estimates.

In relation to Oslo municpality's work on reducing greenhouse gas emissions, a reference scenario has been prepared for greenhouse gas emissions in Oslo up to 2030. Road traffic is the largest source of greenhouse gas emissions in Oslo, and assumptions related to road traffic emissions may have a major impact on the reference scenario. In this project, we investigate how changes in electric car incentives and other policy instruments affect the phasing-in of electric cars and greenhouse gas emissions from passenger cars in Oslo. We are looking at both implemented and proposed changes. The study is limited to passenger cars and direct emissions from driving within Oslo. This work will form a basis for assessing whether the reference scenario for greenhouse gas emissions should be updated.

We investigate the following effects:

- Effects of already implemented tax changes:
  - Removal of VAT exemption for electric cars for the amount over NOK 500,000
  - Introduction of a weight component in the registration tax for passenger cars
  - Introduction of full re-registration fee for electric cars
- Effects of proposed tax changes:
  - Increased tolls for electric cars in the toll ring in Oslo: (a) an increase from 50 to 70 per cent of the normal rate for electric cars and (b) removal of differentiation between electricity and fossil fuel, i.e., 100 per cent of the normal rate
  - Introduction of a kilometer dependent road use tax for electric cars, in addition to road tolls
  - Removal of the VAT exemption for electric cars
- Effects of increased CO_2 tax on fuel

In our analyses, we take into account that changes in various policy instruments may have an effect both on the choice between electric cars and exhaust cars, and on overall car ownership and driving. However, it is only the change in driving with exhaust cars that has an impact on emissions.

The statistics show that the market penetration of electric cars in Oslo is happening rapidly. From 2019 to 2022 alone, the electric car share of new car sales has doubled, from 38 per cent to 76 per cent. When we look at cars owned by residents of Oslo, the proportion of electric cars and driving with electric cars increases approximately in tandem. The development in the proportion of electric cars in the toll rings in Oslo is fairly similar. Looking at sales data at the car model level shows that the weight and price of new electric cars has increased over time. The increase should be seen in conjunction with the fact that there have been more new electric car models in the larger segment with long range, and that car buyers to a greater extent choose these larger cars. The development in total traffic is relatively flat.

There is no single model that can calculate the effects of all the relevant changes in policy instruments on electric car sales, driving and greenhouse gas emissions. We therefore assess the magnitudes of the various effects based on available empirical data combined with selected new analyses. We have analysed changes to purchase taxes using the BIG model and the effect of tolls for electric cars on the working trip using individual register data. The effects have been calculated on the basis of what we believe to be the best available knowledge base, but there will obviously be uncertainty as to how the policies will actually affect emissions. Most importantly, all analyses will necessarily be based on historical data. This is problematic in a market where developments in both technology and market shares are happening as rapidly as the electric car market in Norway.

Our calculations show that implemented and proposed changes in electric car benefits that make it less profitable to own and use an electric car compared to exhaust cars will, in isolation, result in an increase in direct greenhouse gas emissions from passenger cars in Oslo up to 2030. The emissions will continue to fall, but the decline will be somewhat slower than if these changes had not been made. Figure S.1 illustrates how each individual measure will affect greenhouse gas emissions year by year, relative to the baseline scenario. For the increase in CO_2 tax on fuel, we have considered the case where the rates are doubled (corresponding to a ten per cent increase in the consumer price). For road use tax for electric cars, we have based our work on NOK 0.29 per kilometre – this is in addition to the current toll rates. To make it easier to compare the effects, it is assumed that all individual measures will be introduced from 2023 onwards.

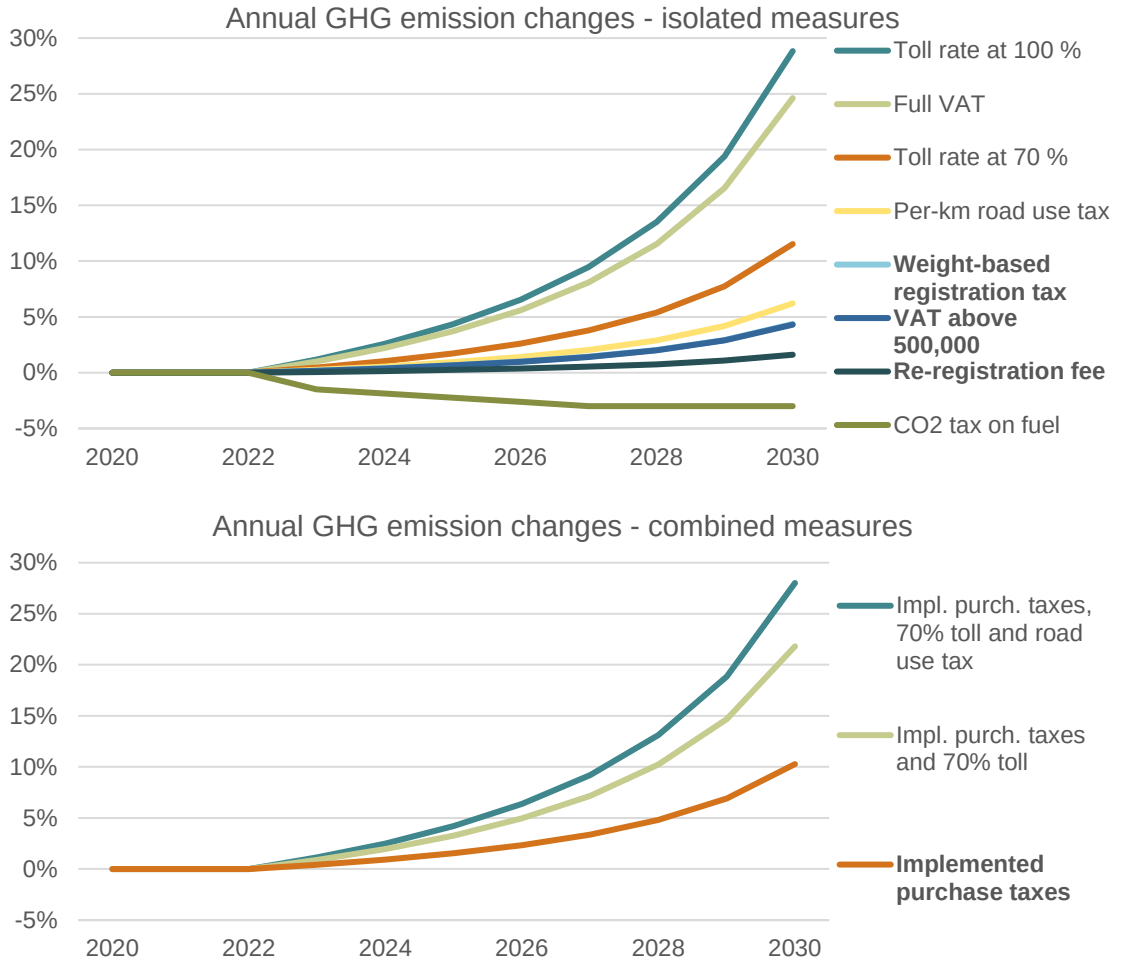

Figure S.1: Effects of various measures. Annual changes in greenhouse gas emission levels relative to the reference scenario. Bold: already implemented measures.

The tax instruments that in isolation would have the highest impact on greenhouse gas emissions are full VAT on new electric cars and full tariff for electric cars in the toll cordon. The calculations indicate that full VAT would have increased emissions in 2030 by about 25 per cent, and the full toll rate would have increased emissions by almost 29 per cent. These emission increases stem from more people opting out of electric cars since they become more expensive to buy and/or own. Although total driving is declining somewhat, many households will choose an internal combustion engine car instead of the electric car.

In addition to assessing the effect of various policy instruments, we have also looked at the overall effect of selected packages of policy instruments. These are also shown in the figure.

- The already introduced purchase taxes (VAT on amounts above NOK 500,000, introduction of a one-off registration tax with weight component and a re-registration tax for electric cars) are not included in the reference scenario. The calculations indicate that these taxes increase 2030 emissions by slightly more than 10 percent relative to what the reference scenario implies.
- If the electric car tariff in the toll cordon in 2023 had increased to 70 per cent of the normal tariff, and the aforementioned purchase taxes still apply, emissions relative to the reference scenario would increase by almost 22 per cent in 2030.

- Furthermore, a road use tax for electric cars of NOK 0.29 per kilometre, in addition to introduced purchase taxes and a 70 per cent toll rate, would have led to an emission increase of 28 per cent in 2030 relative to the reference scenario.

When looking at the relative change in emissions over time, it is important to bear in mind that greenhouse gas emissions in the reference scenario are significantly higher in 2020 than in 2030. This is why the relative effect in previous years is small compared to the relative effect in later years. Figure S.2 attempts to illustrate the magnitude of this, by showing what each individual fee has to say for the *level* of annual emissions towards 2030. Note that it is the emission level in the reference scenario plus each individual measure in isolation that is shown, and the baseline scenario will understate the emissions because purchase taxes already introduced are not included. Therefore, Figure S.2 should not be interpreted as a forecast of we think emission levels will be.

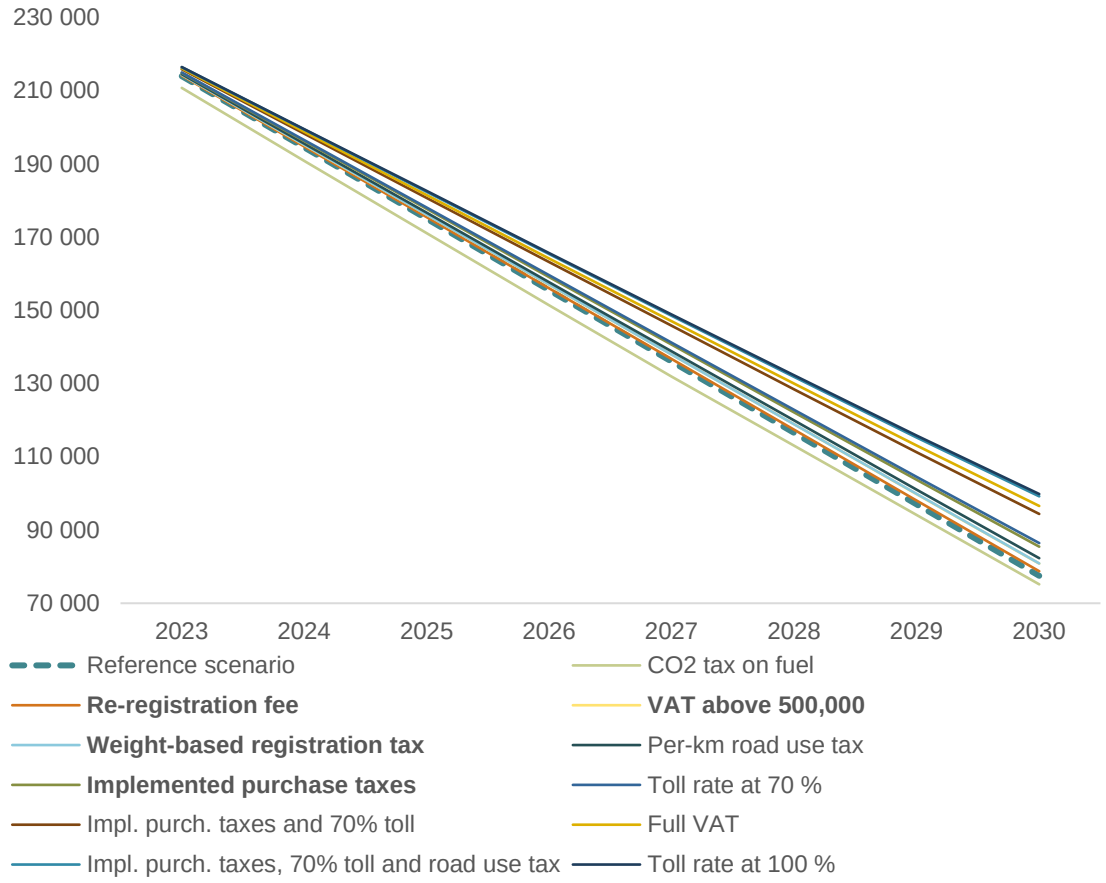

Figure S.2: Tonnes of CO_2 from passenger transport per year, given various measures. Bold: Already implemented measures. Note: The figure does not give a forecast of future greenhouse gas emission levels but illustrates isolated effects of singular policies relative to the reference scenario.

The figure illustrates the annual difference in emission levels for each policy change. The dotted line constitutes the reference scenario, and all emission changes are relative to this. Because of the scale, it is difficult to clearly see the difference between each line, but the order and relative distance between the lines is the same as in Figure S.1. The figure illustrates that despite significant changes in 2030 emissions, these differences are small compared to 2020 levels. In the baseline scenario, emissions are assumed to fall from about 270,000 tonnes per year in 2020 to about 77,500 tonnes per year in 2030. By comparison, our calculations give emissions of up to 100,000 tonnes in 2030.

The City of Oslo's climate target is a 95 per cent reduction in direct greenhouse gas emissions in 2030 compared with the 2009 level. To illustrate the direct impact of these policy instruments on the climate target, we also show the reduction that the 2030 emission figures from the previous figure represent relative to the emissions in 2009.

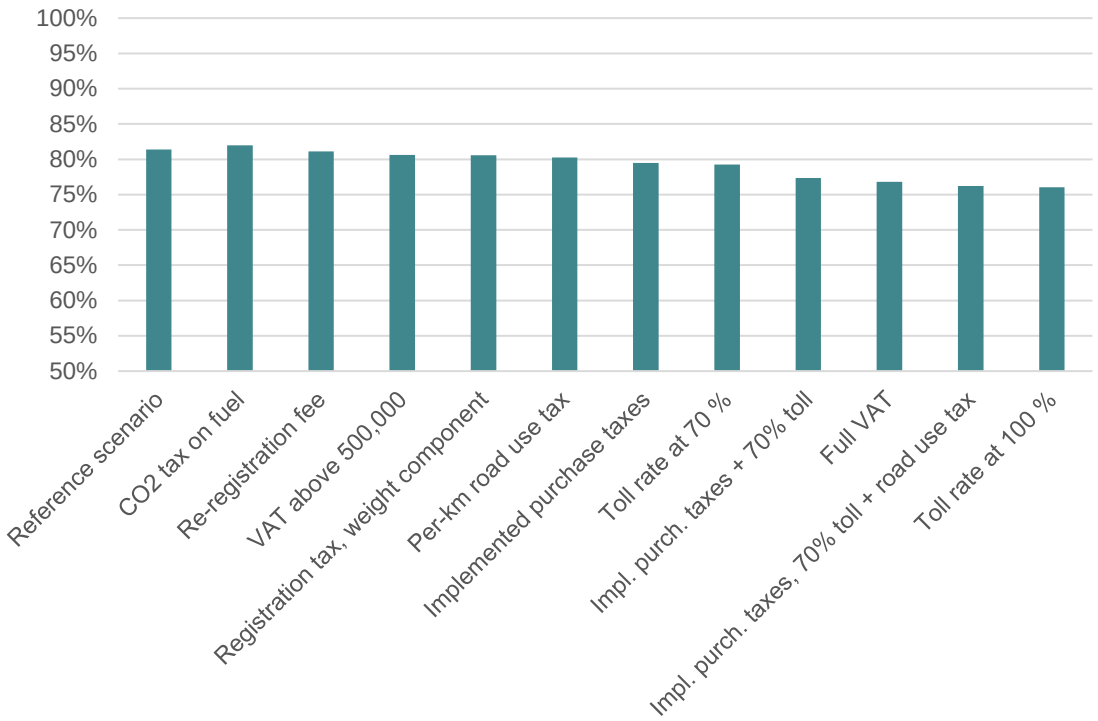

Figure S.3: Percentage reduction in greenhouse gas emission levels in 2030 compared to 2009-levels. Note: The figure does not give a forecast of future greenhouse gas emission levels but illustrates isolated effects of singular policies relative to the reference scenario.

Figure S.3 illustrates that even in the reference scenario, the emission cuts are not large enough to reach the climate target of a 95 per cent reduction (for passenger transport by road in isolation). The greenhouse gas emissions assumed by the reference scenario constitutes a decrease of 81.4 per cent compared with 2009 levels. According to our calculations, the already introduced purchase taxes for electric cars will reduce this further, to around 79.5 per cent. If the toll rate for electric cars had increased to 70 per cent of the normal tariff in 2023, the emissions reduction would be 77.4 per cent. A road use tax for electric cars on top of this would reduce the emission reduction to 76.2 percent, with an emission level close to 100,000 tonnes of CO2 in 2030.

There is considerable uncertainty in these results. Some of the analyses are based on data that are a few years old, which means that we do not fully take into account the current supply of and demand for different car models. For all taxes that affect the price of new cars, we have used the BIG model, which is estimated on 2019 data. We have made discretionary adjustments to the calculations to better reflect the current vehicle fleet where we believe there is a basis for this. This applies in particular to VAT over NOK 500,000 and the one-off registration tax weight component for electric cars, since the cars sold today are typically more expensive and heavier than in 2019. In many cases, however, it is unclear whether market changes from the time of calculation until today (or even until 2030) will reduce or amplify the estimated effects.

It is also worth mentioning that passenger transport is the source of emissions from the transport sector with the greatest uncertainty in the reference scenario itself. According to the documentation of the reference scenario, the uncertainty can be expressed as a lower and an upper limit for emissions in 2030 of 28,091 tonnes and 137,540 tonnes, respectively, with a mean value of 77,500 tonnes. Although our calculations indicate that policy instruments have a substantial effect on the emission level, none of the policy changes we have considered imply emission levels that are close to the upper limit of the uncertainty interval of the reference scenario.

In this report, we have only looked at the effect these policies will have on greenhouse gas emission levels. Changes in policy instruments that make it more expensive to own or use electric cars will also result in a reduction in overall car ownership and car use. There will therefore to some extent be a trade-off between cutting greenhouse gas emissions from car use and reducing car traffic in general.