Institute of Transport Economics
Norwegian Centre for Transport Research

ENGLISH Summary

Monitoring CO_2 emissions on Norwegian roads

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Commissioned by the Norwegian Public Roads Administration, the Institute of Transport Economics (TØI) has developed a statistical monitor to account for the monthly variations in CO_2 emissions in Norwegian road transportation. A simple spreadsheet is used to convert the monthly sales of fossil and biogenic fuel into tons of carbon dioxide emitted by vehicles traveling on Norwegian roads.

The monthly sales of fuel for road transportation in Norway are shown in Fig E.1.

One notes a pronounced seasonal variation in the fuel sales. Gasoline sales peak every year in July, on account, undoubtedly, of private citizens' vacationing. Diesel sales, on the other hand, usually peak in October, when freight vehicles are at their busiest (Fig. E.2).

Since 2009, Norwegian fuel providers have been obliged to sell a certain share of biofuel. Most providers comply with the obligation by blending biodiesel or bioethanol into the diesel or gasoline sold. In addition, small amounts of pure biodiesel are sold separately.

Since 2001, gasoline sales have been declining, in response to the shrinking stock of gasoline driven cars (Fig. E.3). Diesel sales were, however, increasing until 2016 (Fig. E.2). Since then, overall fuel sales have followed a declining trend, on account of the steadily rising share of battery and hybrid electric passenger cars (Fig. E.3). A temporary drop in the fuel sales occurred in 2020 and 2021, due to reduced mobility and freight during the corona virus pandemic.

Carbon dioxide emissions in road transportation are proportional to the fuel consumption. We apply a rate of 2.32 kg CO_2 per liter of fossil gasoline and 2.66 kg CO_2 per liter of fossil diesel. Biofuel is assumed to be climate neutral, in line with convention. The use of electricity, too, is assumed to be emission free, since all important power plants in the European Economic Area (EEA) are encompassed by the European Union's Emissions Trading System (EU ETS).

With these assumptions, we convert fuel sales into carbon dioxide emissions, giving rise to the pictures shown in Figs. E.4 through E.6.

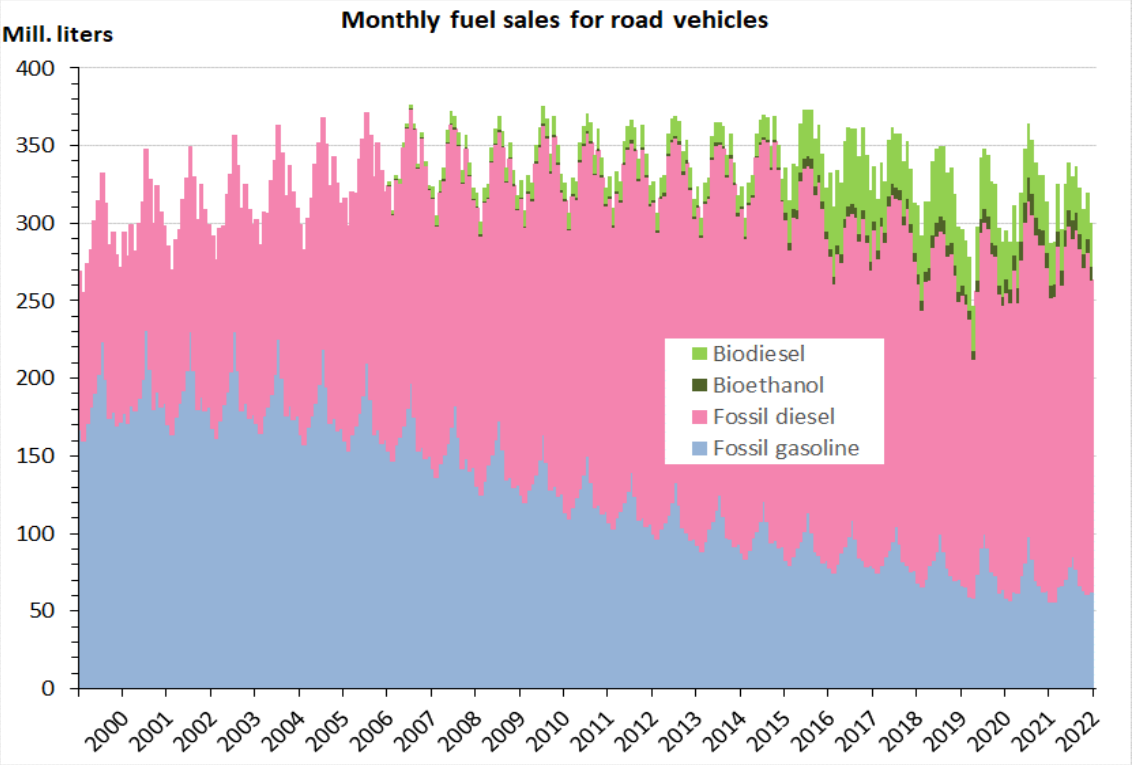

Figure E.1: Monthly sales of fuel for road transportation in Norway 2000–2022.

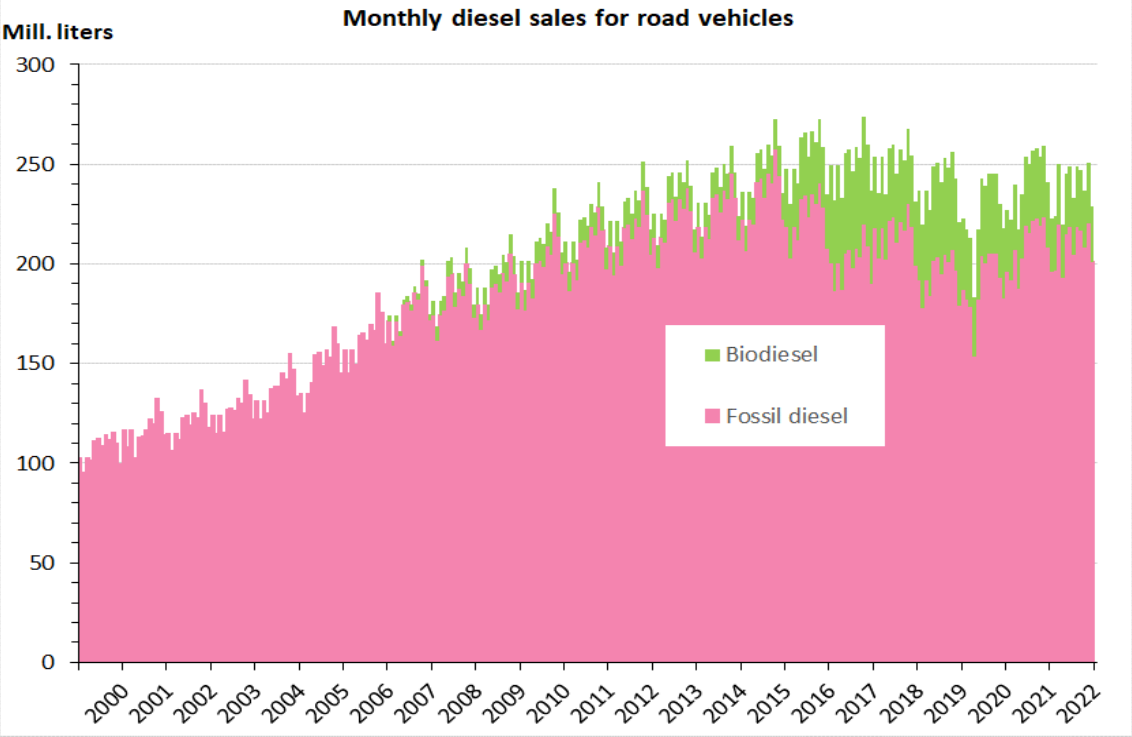

Figure E.2: Monthly sales of diesel for road transportation in Norway 2000–2022.

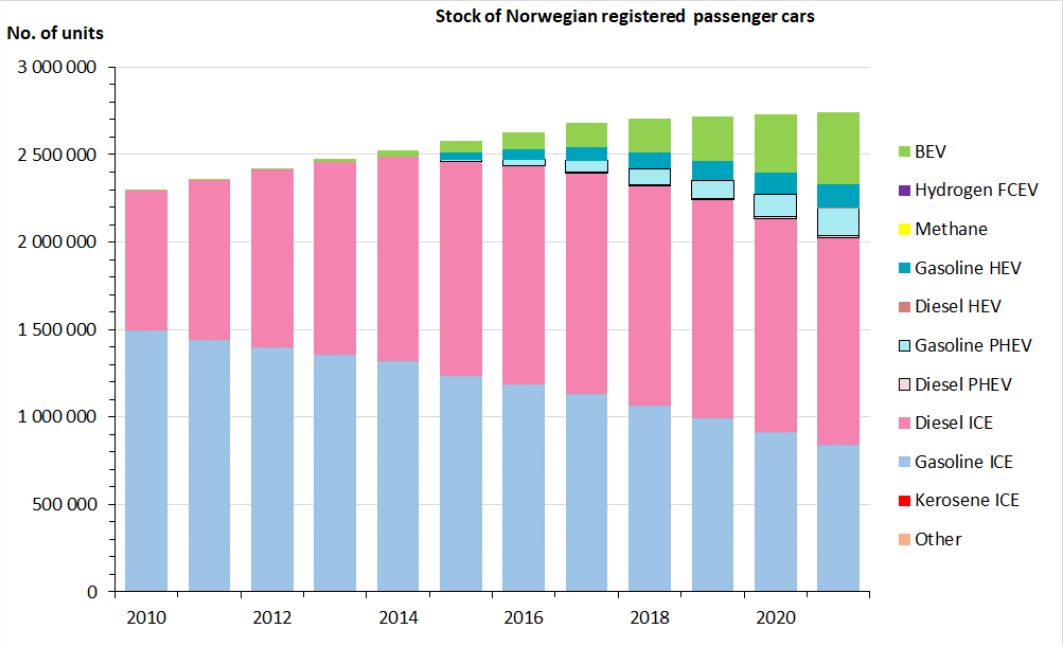

Figure E.3: Stock of Norwegian registered passenger cars at year-end 2010-2021, by type of powertrain. BEV = battery electric vehicle, FCEV = fuel cell electric vehicle, (P)HEV = (plug-in) hybrid electric vehicle, ICE = internal combustion engine.

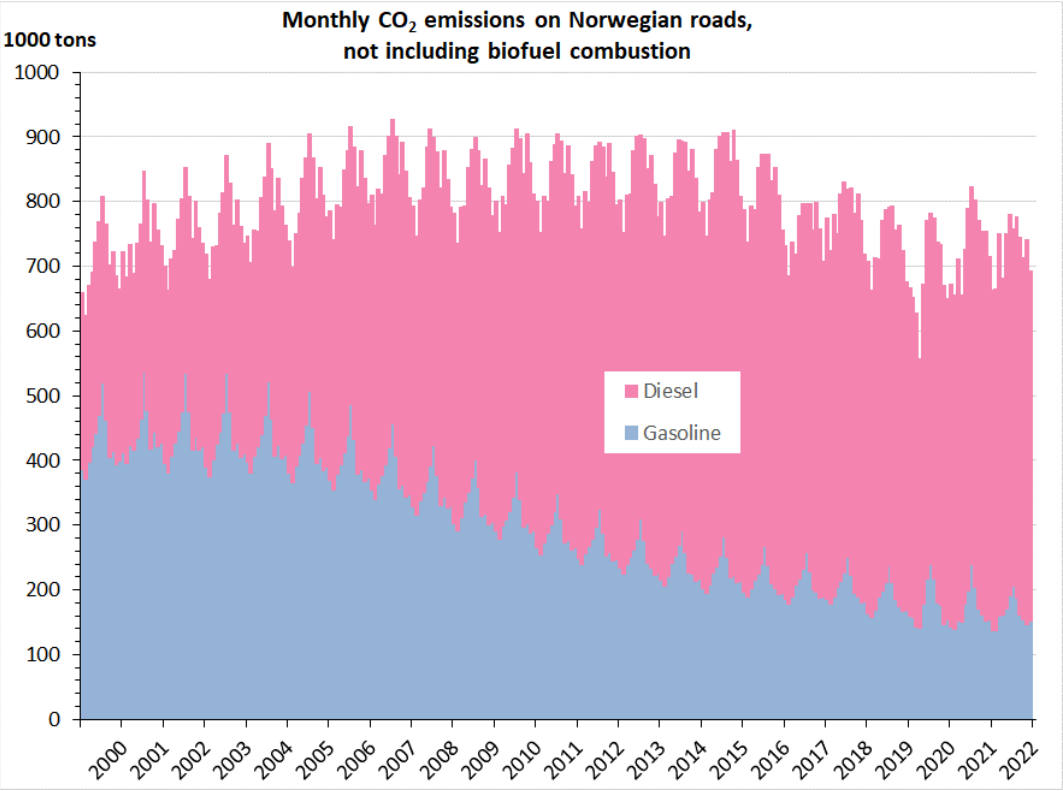

Figure E.4: Calculated monthly CO_2 emissions in Norwegian transportation in 2000–2022.

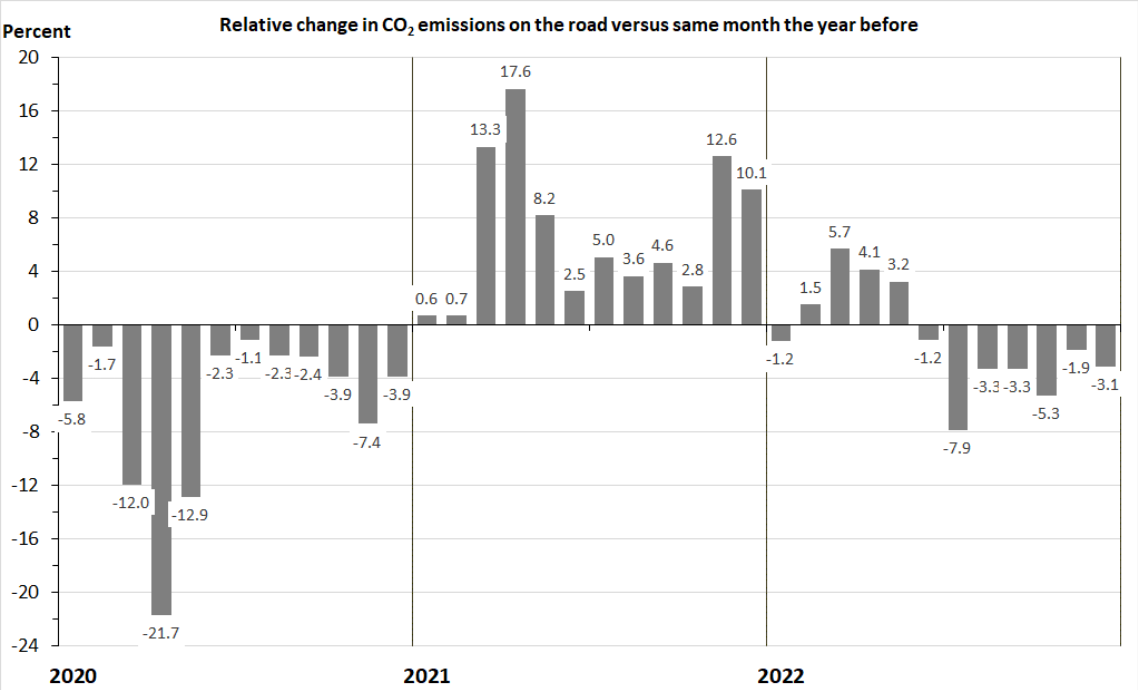

Figure E.5: Relative change in monthly CO_2 emissions on Norwegian roads 2020–2022, compared to the same month of the preceding year.

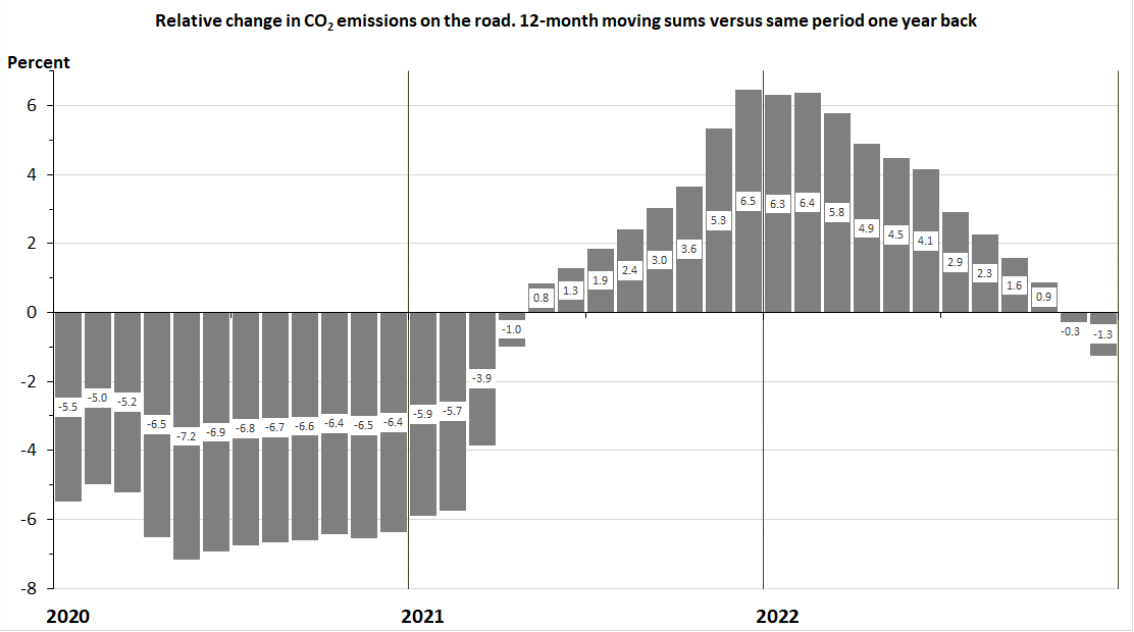

Figure E.6: Relative change in 12-month moving sum of CO_2 emissions on Norwegian roads 2020–2022, compared to same period one year earlier.

The enhanced substitution of biofuel for fossil fuel has given rise to greenhouse gas (GHG) emission cuts in the road sector since 2015 (Fig. E.4). In later years, the gradual substitution of battery and hybrid electric powertrains for internal combustion engines has played a role, too.

In Fig. E.5, we show monthly variations in CO_2 emissions in road transportation, when compared to the same month of the preceding year. The drastic fall in emissions during the first year of the pandemic (2020) was counterbalanced, more or less, by positive growth rates in 2021. Growth rates continued to be positive in February through May of 2022, but became negative in the second half-year.

Monthly growth rates are subject to haphazard variation. We therefore prefer to report 12-month moving averages or sums, as in Fig. E.6. Here, the December figure represents the entire calendar year. One notes than in 2022, CO_2 emissions on the road were 1.3 percent lower than in 2021, which, in turn, exhibited 6.5 percent higher emissions than in 2020, but slightly lower emissions than in 2019.

As compared to crude monthly growth rates, the advantages of 12-month moving sums and averages are threefold. (i) Seasonal variations are neutralized. (ii) Trends stand out more clearly and visibly. And (iii) figures become comparable to just about any previous or future 12-month period or calendar year of reference.

In Fig. E.7, we exploit these opportunities to construct indices relative to two alternative reference years: 1990 and 2005.

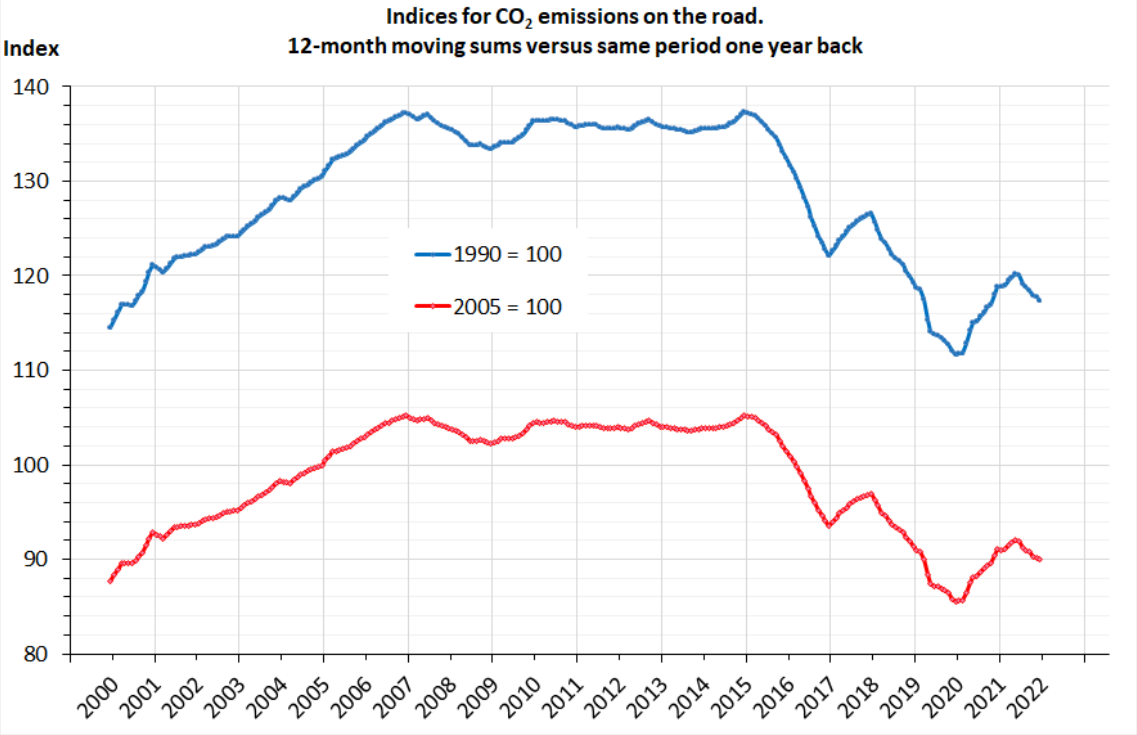

Figure E.7: Indices for carbon dioxide emissions in Norwegian road transportation, based on 12-month moving sums, relative to 1990 or 2005 levels.

One notes that in 2022, CO_2 emissions on Norwegian roads were 17 percent higher than in 1990, but 10 percent lower than in 2005 – the reference year of the European Union's Effort Sharing Regulation for the non-ETS sector.