Modelling Energy Policies in Passenger Car Transport – A Case Study of Austria

(7) Transport

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Motivation and main question

The EU has aimed to reduce CO_2 emissions by about 55% compared to the emissions in 1990 until 2030. The transport sector is responsible for 30% of overall CO_2 emissions in Austria. Thereof 72% is road transportation. Despite the Corona Pandemic, the transport sector caused 21.4 million tons CO_2 in 2020. Compared to 1990, there is an increase of 7.6 million tons of CO_2. The core objective of this work is the derivation of least-cost policy strategies for policymakers to achieve a significant reduction of CO_2-emissions in passenger car transport. The focus is on a switch towards alternative fuels and electric vehicles. The impact of monetary, technical and legal transport policies on the national level will be modelled until 2050. Possible strategies could be increased registration taxes, the implementation of a CO_2 tax, CO_2 regulations or standards on the maximum energy consumption of passenger cars.

Methods of approach

In a first step, historical data regarding the number of vehicles, energy prices, fuel intensity, energy consumption and currently implemented policies for 2000-2020 will be analysed. Then, this data will be implemented in a Business-As-Usual-Scenario (BAU) until 2050. Finally, possible policy scenarios will be modelled to estimate the impact of different policies. The tool developed in the scope of this work is based on a tool developed in the research project „ALTER-MOTIVE“ [1] (project duration 2008-2011).

The methods of approach are as follows (see Figure 1): The CO_2 emissions CO_2 are calculated by using specific CO_2 factors f_{CO2_SP} and the energy consumption E. E is affected by the fuel intensity FI and the vehicle km driven *vkm*. The fuel intensity of the newly registered cars FI_{new} can be regulated by standards. Moreover, E is affected by the vehicle kilometres driven *vkm*. On the one side, the *vkm* is affected by the vehicle stock V_{stock} and the vehicles registered every year V_{new}. The investment costs for the newly registered vehicles IC_{new} can be regulated through subsidies or registration taxes τ_{REG}. At least the *vkm* is affected by the service price of the cars PS_{stock}, which also contains the fuel price P_F. There is a tax on fuel τ_F. But the introduction of a CO_2 based tax CO_{2tax} can be effective too.

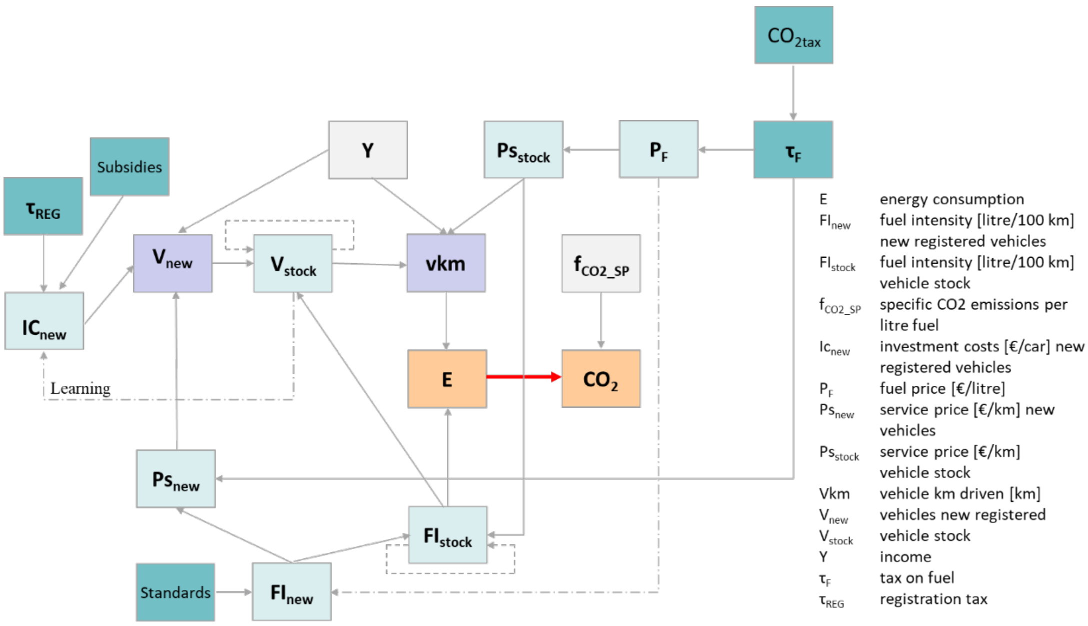

Figure 1 - Methods of approach

The following assumptions were made for the first exemplary policy scenario:

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- CO_2 tax: 0.254[EUR/kgCO2/year]; Fuel tax increase: 0.05[EUR/kgCO2/year];
- Registration tax: +20%/year (petrol, diesel, CNG/LPG, flex fuel); + 10%/year (hybrid);
- Subsidy increase +15%/year (BEV, FCV) +5%/year (hybrid (exempted diesel-hybrid)); no subsidy increase necessary from 2025;

Results and conclusions

Figure 1 shows the amount of CO_2 in a BAU-scenario in Austria from 2000 to 2050. If current policies are not changed, CO_2-emissions from road transport would only be slightly reduced. Figure 3 shows the CO_2-emissions in a policy-scenario until 2050. The results indicate that expanding existing policies and implementing new policies are necessary to achieve CO_2 neutrality in the long term.
The assumptions for the policy scenario are opinions to reach the EU goals. There is no “one size fits all” strategy. All of the policies have advantages and disadvantages. No policy or measure has the capability to reduce energy consumption and CO_2 emissions alone; therefore, it is necessary to force a broad, customizable portfolio of policies.
What we have already seen, however, is that drastic steps are needed to reach the EU targets. The energy efficiency of the vehicles must be improved, 'but above all energy consumption must be reduced.

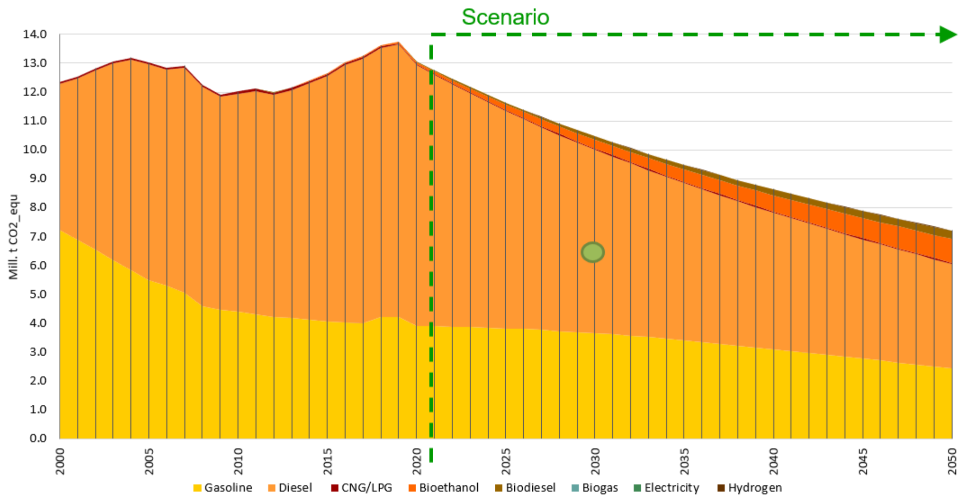

Figure 2: AT - BAU: CO_2-emissions

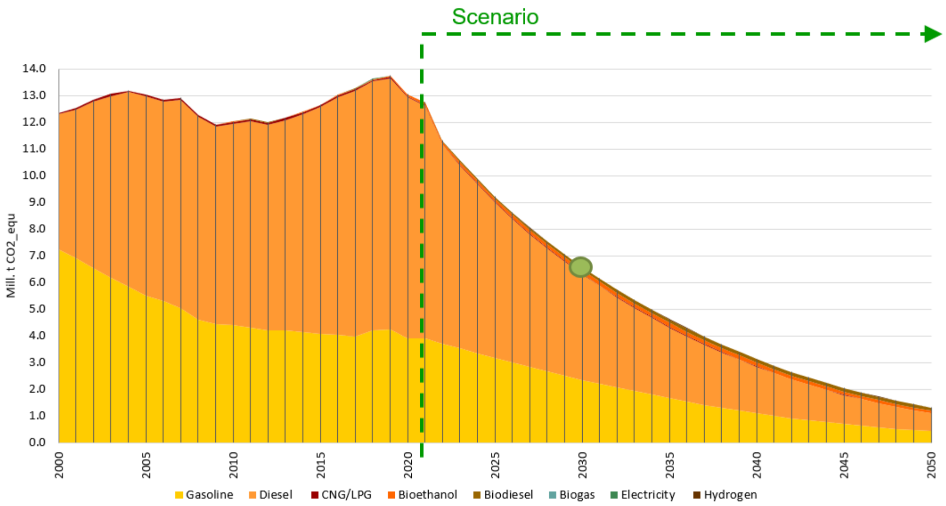

Figure 3 - AT - Policy: CO_2-emissions

Literatur

[1] Ajanovic A., et al.; 2009. Country review report. www.ALTER-MOTIVE.org Available online: (accessed on 18 June 2021).