Road transport decarbonization – policies to promote electric vehicles

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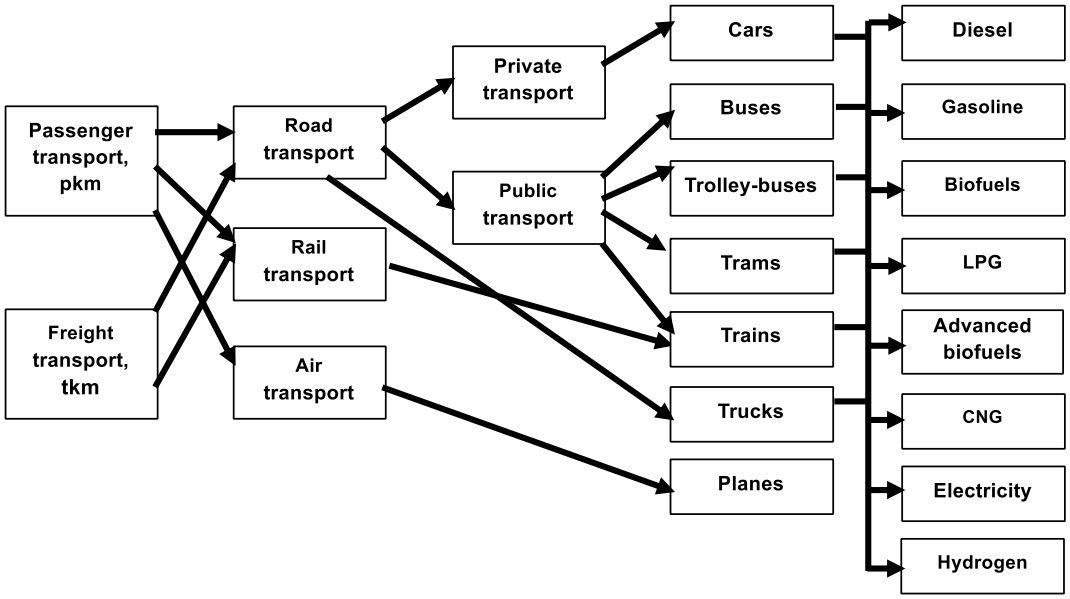
Extended Abstract: An ambitious targets to reduce greenhouse gas (GHG) emissions by 40% (below level in year 1990) and increase renewable energy share to 32% in 2030 have been set by the European Union. In December 2019, by introducing European Green Deal, the emission reduction target was raised even more – to 50% below 1990 level, but with emphasis on doing it in responsible and sustainable way (European Commission, 2019a).

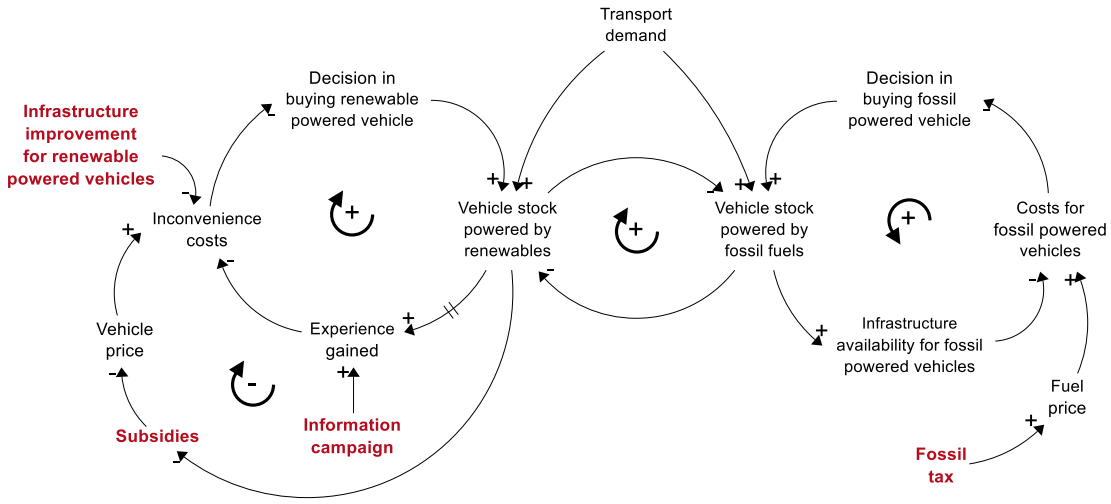
However, transport sector is lacking in transition towards carbon neutrality. Renewable energy target for 2020, under Directive 2009/28/EC (European Parliament, 2009), was set at 10% from total transport energy consumption, however a lot of European countries had problems to reach the target. 2030 target under newest renewable energy Directive 2018/2001 (European Parliament, 2018) was set at 14%, which is less ambitious than total renewable energy and GHG emission reduction targets. It clearly points at how deep the lock-in of fossil technologies in the transport sector is, and how difficult it is to adopt the new technologies. Share of renewable energy in transport sector of Latvia was only 2.56% in year 2017 and 4.73% in year 2018 (Eurostat, 2020).

This paper shows the application of system dynamics to model the transport sector, and demonstrates the case of Latvia. Aim of the paper is to determine the policies necessary to reach the renewable energy target of transport sector in Latvia. Main focus is on the road transport, especially electric vehicles.

Transport demand can be split in two categories – transportation of cargo, and transportation of people. Figure below shows the general elements and their connections in the modeled system. Demand can be covered by the means of road, rail, air and maritime transport, but based on insignificant domestic demand for air and maritime transport, they are not covered in this research. Model covers eight types of fuel – diesel, gasoline, liquefied petroleum gas (LPG) and compressed natural gas (CNG), which covers the most popular fossil fuels in Latvia, and biofuels (1st generation biodiesel and bioethanol, used in diesel and gasoline blends), advanced biofuels (2nd and 3rd generation biofuels produced from feedstock in accordance with Annex IX under Directive 2018/2001 (European Parliament, 2018)), electricity and hydrogen which covers the existing and promising renewable fuels.



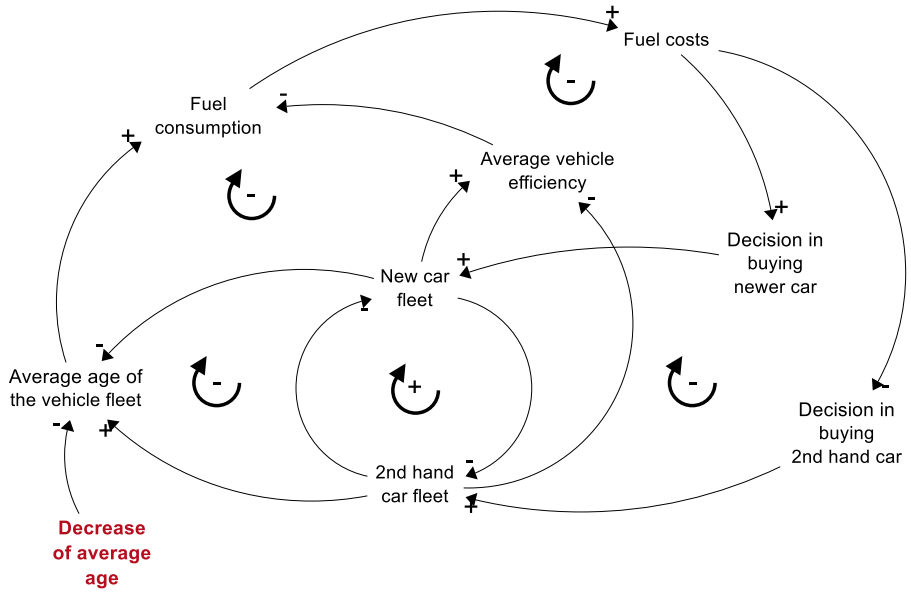
Main causal loops of the model, as well as the policies adopted are demonstrated in the following figures. Renewable and fossil technologies compete with each other, therefore, the more one is used, the less there is a demand for the other. The advantage of the fossil vehicles is the well-developed infrastructure, and fairly low fuel and vehicle price. To overcome these barriers, there are different policies that can be adopted – development of infrastructure necessary for renewable vehicles, subsidies or grants for new car purchase, information campaign on the benefits of renewable vehicles, and about available support, as well as increase of fossil fuel price by imposing new fossil taxes, or increasing already existing taxes.



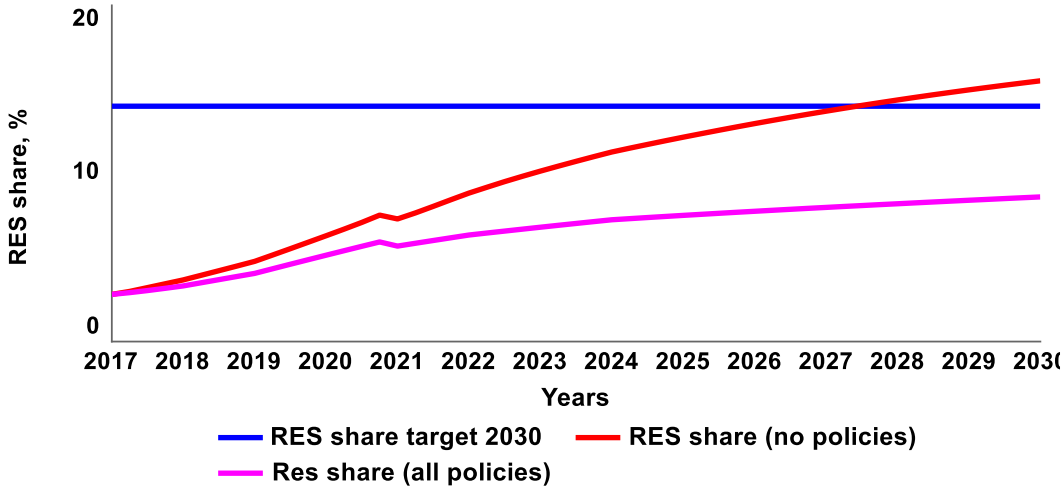
Model also considers the possibility to purchase not only new cars, but also 2nd hand cars. In Latvia 2nd hand car sales are higher than new car sales due to relatively low income for large part of the population, therefore, to increase the total efficiency of the vehicle fleet, and also indirectly promote the renewable vehicles, it is necessary to decrease the average age of the vehicle fleet. It can be done by imposing additional costs, when registering old vehicle purchase, or by different means.

Model structure also includes the switch between different transport modes – from private to public (and vice versa) and from road to rail, but there are no additional policies considered to promote the switch between the modes, to increase the system efficiency and decrease the total

energy consumption, therefore no significant change in transport modes is observed. Emphasis in this paper is more on the switching between different fuel types, and promoting the scrapping of older vehicles, to replace them with newer ones within the mode, to promote the switch to renewables.



Modelling results shows that the current development trend is insufficient to reach the renewable energy target, therefore business-as-usual approach cannot be used, when deciding on transport sector development pathways. Highest impact from policies on renewable energy share in transport sector comes from infrastructure development for renewable vehicles, while only slightly lower result comes from subsidy policy. Other policies, including fossil tax policy, shows improvement in relation to base scenario, however, by their own, they are insufficient to reach renewable energy target of 14% in transport sector. None of the policies are sufficient on their own, and best result can be obtained by combining them all together.



The developed model proved to be an efficient tool to analyze the transport sector and it helped to determine the impact of different policies on transport sector development, and in achieving the renewable energy target. Next modeling steps should include the development of mode shifts and respective policies to promote them, therefore, promoting not only renewable energy, but also energy efficiency in transport sector. It is relevant, because European Union have set the target not only for renewables, but also for energy efficiency.

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