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Analysing the modal shift to rail potential within the long-distance passenger travel market in Germany

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Abstract

The German Federal Government has defined ambitious climate protection targets. This also entails considerable efforts in the transport sector, which accounts for significant greenhouse gas emissions and final energy consumption. Beside the daily/short-distance travel, also long-distance mobility (more than 100 kilometers) has to be considered for reducing greenhouse gas emissions and final energy consumption. This part of the passenger transport market is of great importance, since it causes a large proportion of passenger-distance in Germany. The predominate proportion of long-distance passenger rail transport services is operated by electrified trains. Therefore, the railway system is predestined to become an important and promising component of a sustainable transport system.

We present results of a recently finished study, carried out by the authors on behalf of the German Federal Ministry of Transport and Digital Infrastructure (BMVI). The goal was to investigate impacts of selected steps to increase the attractiveness of long-distance passenger rail transport system in Germany in order to support a modal shift to rail. We evaluate their success by modelling travel demand, CO2 emissions and final energy consumption in the long-distance-transport sector in the year 2030.

This paper gives insights into the study, its chosen approach and main findings. It starts with results from a literature review to identify and structure possible and reasonable measures. In particular, concepts and alternative approaches from other European countries are of great importance. Building on this, three different scenarios are introduced. The first scenario includes only measures reducing travel times, which are realizable by exploiting train speed potentials. The second scenario is defined by reduced fares, applying a reduction of taxes and duties on a level comparable to other European countries. The last scenario is a combination of the first two ones.

The impact on modal shift for the relevant market is determined by a nationwide long-distance passenger transport model. The model is differentiated by four means and six trip purposes. 412 traffic analysis zones represent origins and destinations within Germany. Following the discussion of results of modelling travel demand, decreases in CO2 emissions and final energy consumption are shown. Finally, recommendations for actions are introduced and discussed.

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1. Introduction

The German Federal Government has set ambitious climate protection targets. The goal is a reduction of greenhouse gas emissions of 80-95% of the 1990 values by 2050. Alongside, a reduction of the final energy consumption is needed. It is widely acknowledged, that the transport sector will have to be considered in this process, as it amounts for about 18% of total CO_2 emissions and its final energy consumption is directly linked to this magnitude of emissions.

In recent years, several measures have been taken to make the use of energy in the transport system more sustainable. These measures focused on new technologies and on dissemination of alternative means of transport. Many of these strategies address everyday mobility. Especially in the urban context, numerous measures are suggested by local planning authorities. Research accompanied these projects in various studies.

In addition to everyday mobility, long-distance mobility has to be considered in order to reduce greenhouse gas emissions and final energy consumption. This segment of the passenger transport market is of great importance, as it constitutes more than 30% of transport performance in Germany. In this segment, rail transport can offer a fast and environmentally-friendly means of transport, as most of long-distance passenger rail transport is operated by electrified trains. Therefore, the railway system is well suited to become an important component of a sustainable transport system.

This paper reports on the results of a recently finished study carried out by the authors on behalf of the German Federal Ministry of Transport and Digital Infrastructure (BMVI). The goal of the study was to investigate the impact of selected measures to encourage the use of rail transport for long-distance trips, herein defined as trips within Germany longer than 100 kilometres on modal shift, CO_2 emissions and final energy consumption in the transport sector. Their effects are quantified under the application of three alternative scenarios.

The paper gives insights into the study, the chosen approach and main findings. It starts with results from a literature review to identify relevant measures that could increase the attractiveness of the long-distance rail transport system. A brief insight into the German long-distance railway market is given afterwards. On the basis of these findings, three different scenarios are developed to identify and evaluate possible measures to support a modal shift to rail in the long-distance travel market.

The quantification of the impacts of these scenarios on long-distance modal shift, CO_2 emissions and final energy consumption is based on a travel demand model and the TREMOD framework. After an introduction to these models, changes in travel demand, CO_2 emissions and final energy consumption are shown. Finally, recommendations for actions are introduced and discussed.

2. Main Barriers to the attractiveness of rail travel

The German railway network offers convenient and fast connections for most relations between the economic centres of the country. However, many passengers use other modes for long-distance travel. Comprehensive work on barriers to passenger rail use has been recently carried out by Blainey and Hickston (2012). They grouped manifold reasons why customers prefer other means of transport over rail travel into three dimensions. According to their research, there is a set of hard barriers, soft barriers and complementary barriers. We follow these dimensions, as all three of them require different actions to address their respective negative effect.

Hard barriers are such aspects that are relatively straightforward to measure or estimate. They affect all passengers basically the same, although they might be valued differently by different individuals. The most important hard factors are travel time and travel costs, which we will shortly discuss.