

ETC 2020 Conference Abstract
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Projecting global land-based transportation up to 2100

Global population has seen rapid growth in the 20th and the beginning of the 21st centuries, starting from 1.6 billion people in 1900 to reach over 7 billion in 2015. By 2050 world population is expected to reach more than 9 billion people. Country and individual wealth also increased substantially in the past decades. While forecasts for population and economic growth are available, sound projections on the development of global land-based transportation are rare and difficult to obtain. That is why we have developed an approach to derive a country by country projection of land-based transport up to the year 2100. It is built on the car-based mobility (motorization) as a starting point. Besides population and economic growth, additional qualitative factors are taken into account.

Growing individual mobility has accompanied economic and social development and will be an essential prerequisite for growth in developing economies. However, negative effects of individual mobility are also apparent, including increased energy consumption, air pollution, greenhouse gas emissions, the use of space and the increased injuries and death through traffic accidents. It is thus a crucial effort to project the pathways of individual mobility on a country by country level in order to assess its implications and to draft appropriate policy decisions.

By analyzing historic data of developed countries, a correlation between wealth creation, expressed as gross domestic product (GDP) per capita and motorization can be observed. The development follows an S-shape curve, reaching saturation levels at approximately 40000 US\$_{2011PPP}. Together with global population growth and the increase in personal wealth, mobility demand will increase similarly. It is not a question whether mobility will increase, but where such increase will take place, which modal shares can be expected and what levels of motorization may be reached in individual countries.

Our projection of global country by country land-based transport is based on statistical data, from which Gompertz functions of saturation levels of vehicle ownership are created. As far as possible, country-specific saturation levels are derived, while for other countries a grouping of data was used to estimate regional saturation levels. Furthermore, we included other country-specific or regionally-specific qualifying factors to modulate the saturation figures. Available data enabled us to include the factors for "active population", "spatial characteristics" and "car infrastructure" in our analysis. Two projections, with and without the consideration of those factors are derived. With the aid of additional statistical data we derived vehicle kilometer travelled (VKT), passenger kilometer travelled (PKT) and the mode share of 2-wheelers and public transport by bus and rail.

In order to align our projections with climate research, we have based our projections on population and economic forecasts derived in the context of the Intergovernmental Panel on Climate Change (IPCC). Particularly, we have based our "reference case" on the "middle of the road" scenario, developed in the context of the Shared Socio-Economic Pathways (SSP) in preparation for the Sixth Assessment report by the IPCC.

Based on preliminary analysis, we expect land-based passenger transport demand to grow by a factor of 2.4 between 2015 and 2050 and between 3.3 and 3.5 by 2100, with and without considering qualitative factors. While cars take a share of 52 % (with) to 63 % (without qualifying

factors) in total PKT, rail transport is taking 21 % or only 10 % and 2-wheelers 10 % to 7 % respectively. Integrating the qualitative factors, rail passenger kilometer between 2015 and 2100 will grow nearly 8-fold compared to 4-fold without qualifying factors. The number of passenger cars will grow from approximately 1 billion in 2015 to between 3.4 and 4.4 billion vehicles in 2100. In addition to the global figures, figures for selected countries are presented in the paper.

The projection of the country by country land-based transport demand provides a valuable base for further analyzing opportunities and challenges, stemming from expected growth and development. Those may include greenhouse gas analysis, transport market analysis and technology pathway analysis.

Short abstract:
208 words

Projection of global country by country land-based transport until 2100
Based on saturation levels of vehicle ownership and qualifying factors
Passenger cars, 2-wheelers and public transport by bus and rail are projected