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Potentials for reducing greenhouse gas emissions by inducing modal shift in European long-distance passenger travel

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Abstract: *Long-distance person transport contributes significantly to the GHG-emissions of all person transport. The EU aims for reducing the emissions by inducing a significant modal shift to the train, raising its market share to at least 50% on medium distances in 2050. This implies that the current share has to be multiplied by four. The paper examines the impact of significant modal shifts on the GHG emissions of long-distance transport by Europeans. The impact is estimated for three scenarios, a) no modal shift (trend), b) doubling train use, and c) larger shifts that give the targeted 50% market share. The basic assumption is that the probability of a modal shift to the train is higher when the appropriateness of the train compared to the currently used mode is better. Therefore, different modal shifts are assumed for different segments of the long-distance travel market, indicating different standards of the train mode compared to the best performing alternative. In the segment where the train currently is inferior, no shift is assumed. The main result is that the potential for reducing emissions in long-distance travelling is limited. It is unlikely that reductions larger than 20% can be achieved. The main reason is that the segment where the train is inferior includes the majority of the mileage and emissions of long-distance travel. Moreover, it is the fastest growing segment. If a reference is made to only the segments where the train is competitive, the possible reductions are significantly larger.*

Keywords*:* “GHG emissions”, “modal shift”, “long-distance travel”, “Europe”.

1. Introduction

Climate change is considered as a threat for the quality of living. The EU and other countries agreed to limit global warming to below 2% (EC, 2011, UNFCCC, 2015). This objective requires a drastic reduction of greenhouse gas emissions up to 80-95% below the 1990 level. The aim is to achieve this reduction by 2050. In some sectors, achieving a large reduction is simpler than in other sectors. In the transport sector a lower reduction of at least 60% is targeted, compared to the 1990 level. When compared to 2008, the reduction should be at least 70%. Since then, energy use for transport in Europe decreased somewhat, thanks to the economic recession (Faberi et al., 2015), but this decrease will not reflect the long-term trend.
It is expected that this immense reduction cannot be fully achieved by making vehicles more resource-efficient and using cleaner fuels. Moreover, curbing mobility is not an option for the EU (EC, 2011). The policy is to induce a shift to larger energy-efficient vehicles that carry combined volumes of freight or passengers. This means in the case of freight transport a shift from road to rail or water, and in the case of passenger transport a shift from car to the collective modes bus or train. The airplane is also a large vehicle for collective transportation but it is significantly less resource-efficient than bus or train (IEA, 2014).
Concentrating on passenger transportation, the trend is an increase of the environmental burden. In the Western European countries, the increase can be fully explained by an increase

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in long-distance travelling. While the volume of short-distance travelling is stable, long-distance travelling is growing rapidly, particularly travelling by the energy-inefficient airplane (Frick and Grimm, 2014, Van Goeverden et al., 2016). The EU aims at a large shift in inter urban transport to rail. In 2050 the train should have a market share of over 50% in medium-distance transport (EC, 2011). This is a very ambitious target, considering that the current share is just a fraction. Defining medium distance as 100-1000 km, we estimate a train share of 14%, using the data that will be described later in the paper.

This target rises the questions how such a large modal shift can be achieved and which bottlenecks in the current railway network have to be solved in order to provide the capacity needed for the enlarged demand. These questions regard the feasibility and the cost of the policy. Another relevant question is to what extent the GHG-emissions of long-distance passenger transport will be reduced when the targeted modal shift to the train would be achieved. This question regards the benefits of the policy. The paper discusses the latter question: what are the benefits of a large modal shift to the train in terms of reduced GHG-emissions of long-distance passenger transport?

The analysis includes an estimation of the current travel volumes and emissions of the long-distance modes and a prediction of the volumes and emissions in 2050 in three scenarios. Section 2 explains the method for estimating the impact of the modal shift on the travel volumes. Section 3 discusses the data and other input are used for assessing the travel volumes and the emissions. Section 4 presents the travel volumes and emissions in the case of autonomous development. The potential of modal shifts is discussed in Section 5 and summarized in the concluding Section 6.

2. Some principles for the estimation of the travel volumes

The GHG-emissions connected with long-distance travel are estimated for 2017 and predicted for 2050. The development between 2017 and 2050 depends on the trends in travel volumes by mode and the reduction in the modal emission factors (emission per person km). This section discusses some principles for the calculation of the travel volumes.

The predictions of the impact of a modal shift on travel volumes start from the assumption that the probability of a modal shift to the train is not equal for all non-train journeys. This means that the impact of a significantly enlarged train share on the emissions cannot simply be calculated by randomly assuming a shift to the train for a (sufficient) number of long-distance journeys. We assume that a shift to the train is more likely to happen when the appropriateness of the train compared to the currently used mode is better. Modal shift policy will then be relatively effective for journeys where the train is a good alternative. The potential for reducing emissions by inducing a modal shift to the train depends on the relative contribution to the emissions of journey segments where the train is a good or poor alternative.

The estimation of the impact of the modal shift on travel volumes is performed for a number of market segments with a homogeneous standard of the train mode. We assume the segments that are defined by Van Goeverden et al (2019). They broke down the long-distance travel market into the next five segments:

1: The standard of the train is inferior to at least one alternative,
2: The standard of the train is poor compared to the best performing alternative,
3: The standard of the train is roughly comparable to the best performing alternative,
4: The standard of the train is better than the best performing alternative,
5: The standard of the train is superior to all alternatives.

The definition of the segments is based on travel distance, type of origin and destination locations, the need to cross an important sea barrier, car availability, and number of persons travelling together. Table 1 shows how the five segments are derived from these variables.

Crossing the defined categories of the variables produces a large number of elementary segments with journeys where the train has a certain standard. The standards are indicated by a number: 1 is inferior, 2 is poor, 3 is common, 4 is good, and 5 is superior. Clustering of the elementary segments with the same standard produces the five defined segments.

Table 1 : Elementary segments with standards of the train; source: Van Goeverden et al (2019)

			Car available				**No car available**			
	Number of travellers		**One**	**Two**	**3-14**	**≥15**	**One**	**Two**	**3-14**	**≥15**
Distance	**Origin**	**Destination**								
100-200 km	Core city[1]	Core city[1]	4	4	3	3	5	5	5	3
		Suburb	3	3	3	3	5	5	5	3
		Rural	3	3	2	2	5	5	5	2
	Suburb	Core city	4	3	3	3	5	5	5	3
		Suburb	3	3	3	3	5	5	5	3
		Rural	3	2	2	2	5	5	5	2
	Rural	Core city	4	3	3	2	5	5	5	2
		Suburb	3	3	2	2	5	5	5	2
		Rural	3	2	2	2	5	5	5	2
	Sea barrier >20 km		3	3	3	3	5	5	5	3
200-1200 km	Core city	Core city	4	4	4	3	4	4	4	3
		Suburb	4	3	3	3	3	3	3	3
		Rural	3	3	2	2	3	3	3	2
	Suburb	Core city	4	4	3	3	3	3	3	3
		Suburb	4	3	3	3	3	3	3	3
		Rural	3	3	2	2	3	3	3	2
	Rural	Core city	4	4	3	3	3	3	3	3
		Suburb	3	3	3	3	3	3	3	3
		Rural	3	2	2	2	3	3	3	2
	Sea barrier >20 km		3	3	3	3	3	3	3	3
1200-2000 km	No sea barrier >20 km		3	3	3	3	3	3	3	3
	Sea barrier >20 km		2	2	2	2	2	2	2	2
>2000 km	All		1	1	1	1	1	1	1	1

1: city >200.000 inhabitants

The segment definition includes an upper limit of 2000 km for the train market; the standard of the train is assumed inferior for longer trips. The upper limit would be enlarged if an overnight high-speed train network would be introduced, as is proposed by the UIC (2013). The distance range served by night trains is larger than that for day trains because of the more efficient time use, moving when being asleep. An overnight high-speed train network would increase the upper limit of distances where the train is competitive to ca 3000 km. The analyses in the paper will be done for two classifications of the travel market, one with an upper limit of 2000 km (no overnight high-speed train service), the other with a limit of 3000 km (with an overnight high-speed train service).

The predictions for 2050 are made for three scenarios (with each two variants: without or with an overnight high-speed train network). One scenario assumes no policy on modal shift and is indicated as Trend scenario or Scenario T. The second scenario assumes a powerful policy that doubles the train market share but still fails to achieve the targeted 50%. This scenario is indicated as Doubling train use scenario or Scenario S1. The third scenario assumes an even stronger policy that succeeds in achieving the targeted 50% market share of the train. This is indicated as Major shift scenario or Scenario S2. The differences in the outcomes for S1 or S2 compared with T represent the impacts of the modal shift.

The analysis focusses on the impacts of a modal shift and ignores other changes in travel behaviour that might result from policies that make the train more competitive, like changes in destination choice. The latter can both counteract and enhance the direct modal shift impacts on the GHG emissions.

3. Data and assumptions for the predictions

The analyses include the prediction of travel volumes and CO_2 emissions in 2050 for the different scenarios. These need data about the current travel volumes and emission factors, and assumptions about the predictions for 2050. The 'current' volumes regard 2017, the most recent year for which statistics are available at the time of writing the paper. This section discusses the data and assumptions behind the estimates for 2017 and the predictions for 2050 in the case of autonomous development (Trend scenario).

3.1 Travel volumes

Volumes in 2017

The major source are the databases of the DATELINE project (2001). DATELINE was a survey on long-distance travelling by EU residents, carried out in 2001 and 2002 in the 5th Framework Programme of the EU. The survey covered all 15 EU-countries at that time and Switzerland. Several studies found that daytrips and journeys on relatively short distances (<400 km) were largely underreported by DATELINE respondents (Hautzinger et al., 2005; Kuhnimhof et al., 2009). In order to correct for this, expansion factors were developed (Van Goeverden et al., 2016) that are used in addition to the original data for assessing travel volumes.

The DATELINE-data give volumes for 2001. A more recent European-wide survey on long-distance travelling is not available. We estimated volumes for 2017 by updating the DATELINE data. The update was based on figures on per capita mobility and on population. Mobility trends were derived from statistics on the trends in tourism and patronage of long-distance travel modes. Airplane statistics were derived from Eurostat (1), train statistics from Amadeus (2017), and statistics on modal use by tourists from Eurostat (2). The statistics show that, per capita, air travel increased significantly, bus patronage decreased, trips by train increased marginally while the kilometres travelled with this mode had a weak opposite trend (indicating a concentration on relatively short distances), and the usage of the car was stable. Factors for updating the 2001 figures were produced by mode, country of residence, journey type (domestic, international within Europe, intercontinental), distance class, and trip purpose. The analysis of the paper is limited to travel by the residents of 9 Western European countries surveyed in the DATELINE project; these are the countries where the DATELINE-survey was conducted on household level. In the other surveyed countries, with the survey on person level, essential information is missing (viz. the number of travellers in a journey, one of the most influencing variables for modal choice and used for the definition of the segments). The 9 countries included are: Austria, Flanders, Germany, Ireland, Italy, Luxemburg, the Netherlands, Sweden, and the United Kingdom. Most of the Mediterranean countries are excluded, including those where the bus is the dominant public transport mode for long-distance trips. The included countries will not be fully representative for Europe, but will represent Western Europe fairly well.

Predictions for 2050

Journey volumes in 2050 (Trend scenario) are predicted by extrapolating the observed trends per capita between 2001 and 2017, with a number of exceptions. The negative trends for the bus and the train for longer distances (> 700 km crow-fly) are assumed not to be continued; a stable number of journeys per capita is assumed. Liberalization of the long-distance bus market might stop the negative trend in bus travel, and the for decades ongoing discontinuation of train services on the longer distances might be finalized with the recent discontinuation of the night train services in Germany and France. In the case of the fast growing air and cruise ship modes, the observed annual growth between 2001 and 2017 is assumed to continue to 2030 and then to be halved between 2030 and 2050. The so predicted reduced growth of air travel is in line with predictions of the EC (2016).

In the case an overnight high-speed train network would be introduced, some additional assumptions have to be made for the predicted volumes by train in the distance range served by this network (1300-3000 km). The introduction of the network will affect the standard of long-distance train services and, as a result, modal choice. The DATELINE data demonstrate that the 2001 market share of the train for international journeys on typical overnight conventional train distances (1000-1400 km) was between 4% and 8%. Because in this distance range still trips by day trains will contribute somewhat to this share, we assume for international connections shifts of 5% from the airplane for the distances where the overnight high-speed trains are most competitive (1500-2000 km) and somewhat smaller shifts on other distances in the range of 1300-3000 km. For the small number of domestic connections in this distance range, we assume impacts that are three times larger, considering that the probability that the train is chosen is for a domestic journey about three times that for an international journey, controlled for journey distance and a large number of other variables (Van Goeverden and Van Arem, 2010). Only shifts from the airplane are assumed, because the airplane is for these large distances by far the most important competitor of the overnight trains.

Obviously, predicting trends in travel volume in such a large period is highly uncertain. We estimated margins of the predicted values by analysing two alternative trends. One regards a relatively small growth of journey numbers, assuming that the growth will be just half of the initially predicted growth under the condition that the number of journeys in 2025 will be at least 10% lower than the predicted number. This means in the concrete, that the growth of the fast growing international air transport and cruising will be halved, and that the other modes with an expected rather stable development will have 10% less journeys. The second alternative trend assumes a relatively large growth. The assumed growth is for fast growing modes 50% higher than the expected growth, and for the other modes (expected growth <10%) 10% more journeys than initially predicted. The margins are country-specific; they depend on the observed growth for residents of a country between 2001 and 2017.

3.2 Emission factors

Emissions in 2017

The main sources for the emission figures in 2017 are Knörr and Hüttermann (2016) and Otten et al (2014). Figures for vessels are missing in these studies. Figures for ferries are derived from Carbon Independent (2009), carbon emissions of sea cruises are based on Howitt et al. (2010). In this paper, we use GHG-emission figures that are expressed in CO_2 equivalents. These include the emissions of other greenhouse gasses. The radiative forcing impact of these gasses is particularly high in the high atmosphere, implying that the CO_2 equivalents are for the air mode significantly higher than the CO_2 emissions.

Predictions for 2050

Figures for 2050 are derived from predictions by the EC (2016) on the developments in the energy efficiency by mode and the carbon intensity of both the energy demand by the transport system and the production of electricity. The predicted increase in the energy efficiency between 2017 and 2050 ranges from 10% for shipping to 50% for air travel. The predicted decrease of the carbon intensity is 5% for the transport energy demand in general, and 70% for the production of electricity. The latter implies a very large reduction of CO_2 emissions by electric modes, which are particularly the train (almost all long-distance train services are electric hauled) and a small but increasing part of the road modes.

In order to cope with uncertainty connected with predictions so far ahead, we assume margins around the 2050 figures that reflect either a 50% lower or a 50% higher decrease.
Table 2 lists the calculated figures for 2017 and 2050 with the 2050 margins between brackets.

Table 2 : GHG emission factors expressed in CO_2 equivalents per person km by mode

Mode	Type of journey	2017	2050
Car	Holiday, other private	106	68 (48-87)
	Business, commuting	191	122 (87-156)
Bus, coach		33	27 (24-30)
Train		20	5 (1-13)
Autotrain		80	21 (2-50)
Airplane	< 1000 km	306	192 (135-249)
	1000-3000 km	210	132 (93-171)
	≥ 3000 km	190	119 (84-155)
Ferry, footpassenger		100	87 (81-94)
Ferry with car		350	306 (284-328)
River cruise		200	175 (162-187)
Sea cruise		350	306 (284-328)
Other		135	115 (105-125)

4. Travel and emission volumes in the case of autonomous development

Table 3 presents the estimated (2017) and predicted (2050) travel and GHG emission volumes for each segment with a certain standard of the train; the travel volumes are both in terms of journey numbers and mileage. The volumes regard the long-distance journeys of the residents of the 9 countries reported in Section 3.1. Journeys are defined as round trips. Figures for 2050 include both the cases without and with introduction of an overnight high-speed train network (with upper distance limits of 2000 km and 3000 km respectively for a competitive train standard). Travel volumes are indicated for 2001 as well, because these are used for assessment of the trend.
The table includes the volumes of the journeys by train. The journey numbers by train regard the journeys where the train is the main mode, mileage and emissions by train regard the trip stages where the train is used, either as the main mode or as an access/egress mode. In the segment where the train is inferior, most of the estimated kilometres and emissions by train relate to access/egress trips.
The upper and lower margins for the 2050 figures have about the same size for most volume figures and are indicated as one margin which is a rounded figure between the two margins. The exceptions are the train emission figures where the upper margins are substantially higher; then both margins are indicated. The emission margins indicate the situation of either low travel growth combined with large decrease of all emission factors, or high travel growth combined with small decrease of all emission factors. Because two extremes are combined, the emission margins are relatively large.

Table 3 : Long-distance travel and emission volumes by defined segment

Year	**2001**		**2017**		**2050 (trend)**			
Distance limit	**2000 km**		**2000 km**		**2000 km**		**3000 km**	
Indicator, train standard	**All modes**	**Train**	**All modes**	**Train**	**All modes**	**Train**	**All modes**	**Train**
Journeys (million)	1657	201	1830	228	2325 (±500)	296 (±60)	2325 (±500)	304 (±60)
Train inferior	4%	0%	5%	0%	9%	0%	5%	0%
Train poor	36%	11%	35%	10%	32%	10%	34%	11%
Train common	40%	36%	39%	36%	38%	35%	39%	35%
Train good	18%	41%	18%	41%	17%	41%	17%	40%
Train superior	3%	13%	3%	13%	3%	14%	3%	13%
Kilometres (billion)	1836	120	2420	132	4319 (±1050)	177 (±35)	4320 (±1050)	215 (±45)
Train inferior	40%	2%	47%	2%	57%	4%	45%	2%
Train poor	23%	13%	19%	13%	15%	13%	22%	20%
Train common	26%	39%	23%	38%	20%	38%	25%	41%
Train good	11%	39%	9%	39%	7%	37%	7%	31%
Train superior	1%	7%	1%	8%	1%	8%	1%	7%
Emissions (million ton CO_2 equivalents)			401	2,7	498 (±250)	0,9 (01-2,6)	494 (±250)	1,1 (0,1-3,2)
Train inferior			55%	2%	63%	4%	49%	2%
Train poor			15%	13%	12%	13%	20%	20%
Train common			21%	38%	18%	38%	24%	41%
Train good			8%	39%	6%	37%	6%	31%
Train superior			0%	8%	0%	8%	0%	6%

The table shows that most journeys belong to the segments with a poor or common train quality. However, the majority of the kilometres are made for journeys in the segment with an inferior train quality, and an even larger share of the emissions is produced by journeys in this segment. Moreover, it is the fastest growing segment. The shares of the segments where the train is good or superior are small and decreasing. Another observation is that the emissions are expected to increase despite assumed reductions in the emission factors. Only if the growth of long-distance travelling is significantly smaller than expected and/or the reduction in emission factors is significantly larger than expected, a decrease of emissions can be achieved.

5. Potentials for GHG reduction by modal shifts to the train

In this section the potential for GHG reduction by modal shift is estimated for the two scenarios that assume a strongly increased market share of the train in 2050. The first step is to predict the travel volumes by mode in the two scenarios. The prediction is performed for each of the five segments with certain standards of the train mode. It is assumed that in the segment where the train is inferior no modal shift can be achieved; this means that the travel volume (and emission) in this segment is unchanged compared to the Trend scenario. In Scenario S1 (doubling train use) the train market share of the train doubles in each of the four other segments. The increase of train patronage is the result of shifts to the train from all other modes assuming that the propensity that a traveller will shift to the train in a certain segment is equal for each mode. The result is an overall increase of the train market share to 30% in medium-distance transport (100-1000 km). In Scenario S2 (major shift) where the impact has to result in the targeted train share of at least 50% on medium distances, multiplying the train share by 3-4 in each segment is not possible because the share would exceed 100% in some segments. The scenario assumes shifts of a defined proportion of the non-train journeys to the train which is higher for the segments where the competitiveness of the train is higher and is equal for the different modes. The assumed proportion of shifted journeys is 25% for the segment where the train quality is poor, 50% for the common segment (where the train quality is comparable to that of the best performing alternative), 75% for the segment where the train quality is good, and 100% for the segment where the train is superior. These shifts result in an overall train market share of 53% in medium-distance transport. The scenarios are visualized in Figure 1. The figure regards the situation of no overnight high-speed train network.

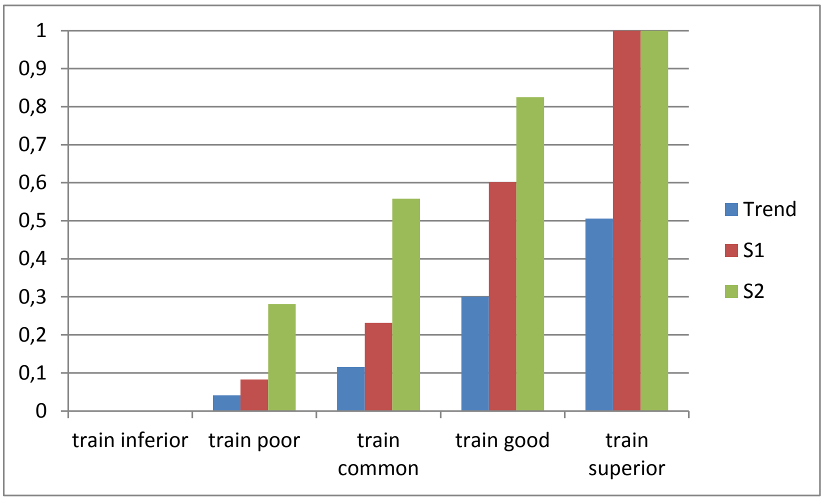

Figure 1 : Predicted train market shares by segment in the Trend scenario and the two scenarios-with-modal shift; S1: Doubling train use, S2: Major shift to the train

Figure 2 shows the impact of the modal shifts on the mileage by travel mode, again for the case without an overnight high-speed train network. In the case the train share is 100% (S1 and S2 in the superior segment), still some kilometres are travelled with other modes; these regard the access modes to the train.

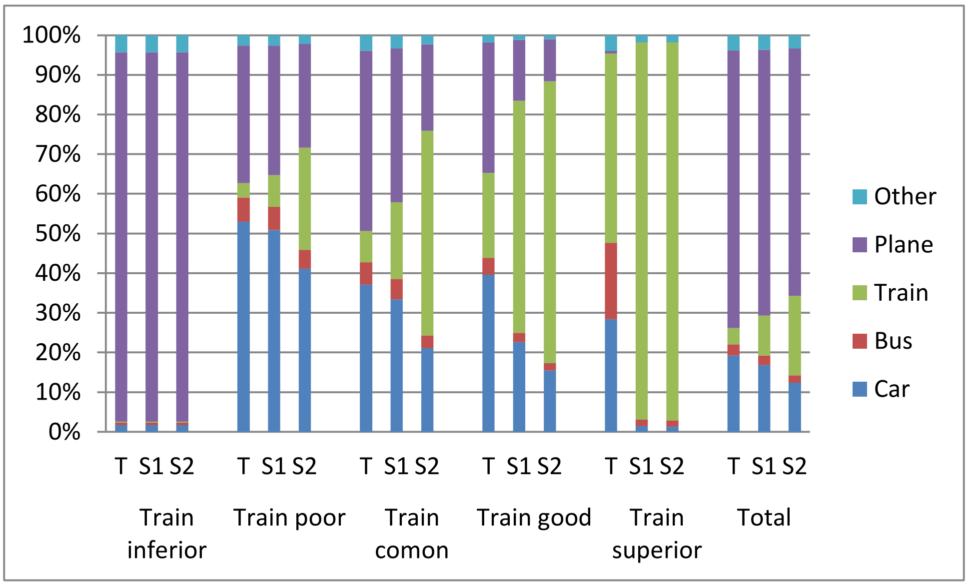

Figure 2 : Modal splits (mileage) in 2050 by train segment and scenario

The impacts on the mileage by train are naturally large. The total impact is more than doubling in S1 and more than quadrupling in S2. In S2 the train is the second most important mode, but still far behind the always dominant airplane.

Table 4 shows the predicted increase or decrease of the GHG emissions between 2017 and 2050 and the impact of the modal shifts to the train (comparing S1 and S2 to the Trend scenario). The latter are the key result of this paper. Results are presented for both all long-distance journeys and the journeys in the four segments where the standard of the train is not inferior and the train is more or less competitive (indicated as train-sensitive segments). These include all journeys <2000 km or <3000 km, depending on the assumption with respect to an overnight high-speed train network. Comparison for the train-sensitive segments is not useful in the case the segment definitions differ, that is comparing 2017 with 2050 assuming an overnight high-speed train network. The predicted developments between 2017 and 2050 are highly uncertain; the uncertainty is indicated by margins below the predicted figures. The margins assume either a significantly lower travel growth combined with a significantly larger decrease of emission factors than predicted, or a significantly higher travel growth combined with a significantly smaller decrease of emission factors. These uncertainties do not apply when comparing the 2050 figures (S1 or S2 to Trend).

Table 4 : Impacts of trends and modal shifts on the GHG emissions by long-distance travelling in 2050

		Compared to 2017		**Compared to Trend**	
Scenario (2050)	**Upper distance limit train-sensitive segments**	**All LD travel**	**Train-sensitive segments**	**All LD travel**	**Train-sensitive segments**
Trend	2000 km	+24% (-34% / +99%)	+1% (-45% / +60%)		
	3000 km	+23% (-34% / +98%)			
Doubling train use (S1)	2000 km	+17% (-38% / +88%)	-15% (-54% / +35%)	-6%	-16%
	3000 km	+15% (-39% / +85%)		-7%	-13%
Major shift to the train (S2)	2000 km	+5% (-44% / +71%)	-41% (-68% / -3%)	-15%	-41%
	3000 km	-1% (-48% / +60%)		-20%	-39%

The emissions will likely increase between 2017 and 2050. The increase is the balance of higher travel demand (partly explained by population growth) and lower emission factors of the transport modes. The predicted increase is 24%. In the modal shift scenarios, the shift to the relatively energy-efficient train lowers the increase, but in both scenarios still an increase is predicted. Only in the case an overnight high-speed train network would be introduced, a very small decrease (-1%) is predicted for the Major shift scenario. However, as result of the uncertainty of the developments in travelling and emission factors, in all cases a decrease or much higher increase can happen. Focussing on the train-sensitive segments, the results are quite different. There is hardly no increase predicted (+1%), while the modal shifts would affect a significant decrease which is particularly large in the Major shift scenario.

The potential of the modal shifts, expressed by the relative reduction in the 2050 emissions of long-distance travel, is limited. Doubling train use would reduce the difference only by 6% compared to the trend, or by 7% if a high-speed overnight train network is introduced. The larger modal shifts in the Major shift scenario induce significant larger but still limited reductions of 15% and 20% respectively. The rather small potential can be explained by the large share of emissions produced for the journeys in the segment where the train is inferior and no modal shift is assumed. Focussing on the train-sensitive segments, the potential is larger, 13-16% in S1 and 39-41% in S2. Particularly, the decrease effected in the Major shift scenario that meets the 50% train share target is substantial.

6. Conclusions

Long-distance person transport contributes significantly to the GHG-emissions of all person transport. Moreover, the emissions are increasing and are predicted to be ca 25% higher in

2050 than in 2017. The emissions can be reduced by modal shifts to energy-efficient modes (bus and train) and the policy of the EU is directed at strengthening the position of the train. The analysis of the paper demonstrates that the potentials for reducing the GHG-emissions of long-distance travel by inducing modal shifts are limited. The reduction will likely not exceed 20% and could only in the case of very strong efforts in improving the European train system just offset the predicted trend. The main reason is that the majority of the emissions is produced by journeys where the system characteristics of the train make this mode inferior to other modes, particularly the airplane. Referring to only the market segments where the train is more or less competitive, the reductions are significantly larger.

If we assume that the 70% reduction target of the emissions for transport (EC, 2011) is valid for long-distance travelling as well, the conclusion is that inducing a major shift to the train is by far insufficient to meet this target for this travel segment. In order to bring about larger reductions in the GHG emissions by long-distance travelling, policies that aim to induce a modal shift should be accompanied by policies that are directed at changes in destination choice. Then the EU should give up the principle that curbing mobility is no option. If a significant part of the intercontinental travellers by air could be persuaded to select the destination in the own continent, the emissions will be reduced significantly. Apart from a reduction as result of shorter distances, an additional reduction will be achieved because journeys shift from the segment where the train is inferior to train-sensitive segments which will affect modal shifts in favour of the train.

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