CHALMERS

The role of night trains in the future of long distance travels

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HIGHLIGHTS

- The European Green Deal imposes a reduction of transport emissions by 2050 by up to 90% of 1990 levels.
- The long-distance travel market is dominated by air travel, whose industry contributes to around 3.8% of total CO_2 emissions in the EU.
- A case study has been conducted in Sweden to investigate the potential of international and domestic night trains as an alternative to flights. The potential travel demand shift and the reduction of associated emissions were investigated.
- The analysis shows propensity for a much higher usage of night trains in the future as the result of a set of measures, including the adoption of an easy booking system and the completion of the Scan-Med corridor. Reduction of the number of night train transfers and in price difference with flights might further increase night trains demand.
- Policies in support of night trains have the potential to further reduce long distance travel related emissions, safeguard the public acceptance of existing EU climate policies that will lead to more expensive flights and enhance connectivity between individuals and companies in different EU countries.

POLICY CONTEXT

The European Green Deal is one of the European Commission's priorities aiming to make Europe the first climate neutral continent by 2050[i]. The achievement of the goal implies radical changes for long distance travels. In this landscape, the importance of taking action has been highlighted. Direct CO_2 emissions from the sector accounted for 3.8% of total EU emissions just before the COVID-19 pandemic[ii], with a significant increase when non-CO_2 effects are considered[iii].

Fit-for-55 is an ambitious policy package that involves the aviation sector through the strengthening of the EU emission trading system as well as the RefuelEU policy with increasing quotas for sustainable aviation fuels[iv]. These policies will deliver major emission reductions from air travel by adopting alternative fuels, such as advanced biofuels and electrofuels, and all-electric aircrafts. Such changes will likely lead to significantly higher air travel fares. The aviation industry's carbon footprint can be mitigated not just through technological advancements but also by modifying travel habits such as switching to closer destinations or to greener transport modes, with train travel representing the most environmentally friendly option [1,2].

The potential of night trains

Nowadays, for long distance travels, the airplane is the most attractive mode in terms of travel time and price, with its attractiveness increasing with trip distance. Yet, trains can play a role as an alternative mode and have received great policy interest in the recent years.

In 2021, the EU announced the "European year of rail" that promoted several initiatives to raise awareness about the green transition and to foster and support the interest of the European citizens in more sustainable ways of travelling, including a special EU train[v] crossing over 100 cities in 26 countries. The strategic importance of the railway transport was reinforced by the Europe's Rail Joint Undertaking (EU-Rail) established by Council Regulation (EU) 2021/2085 of 19 November 2021. Its aim is to deliver, via an integrated system approach, a high capacity, flexible, multi-modal and reliable integrated European railway network by eliminating barriers to interoperability and providing solutions for full integration.

In 2022, the Directorate General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) published the Transition Pathway for Tourism[vi], a document indicating different measures in support of a green and digital transition of the tourism sectors. The document includes a specific measure referring to the improvement of the appeal of railways for visitors, supported by a legislative initiative aiming at boosting a smart and sustainable TEN-T network with long-distance, night and cross-border passenger rail services[vii]. In the same year, as part of the "European year of youth" 2022, the EU proposed a series of initiatives to boost rail transport options for young people to travel throughout Europe by rail at more affordable prices.

The potential of trains as an alternative to flights depends on the trip distance. High-speed day trains can compete with flights on ranges up to about 1000 km. For longer ranges, night trains is likely necessary for making railway an attractive alternative to flights, especially in countries at the periphery of Europe, such as the Iberic peninsula, or Scandinavia. Regarding the actual usage, so far night trains have faced difficulties to grow beyond a niche market due to a series of limitations, including high operating costs, lack of interoperability of different track gauges, rail voltages, signalling systems as well as insufficient network capacity, absence of a unified ticketing and booking system, the lack of travellers' rights for arrival guarantee and a persistent prioritization of national connections by railway operators [3].

The overcoming of some limitations might exploit the potential of night trains demand and further reduce the long-distance travel related CO2 emissions.

THE SWEDISH CASE

A case study to investigate the potential of night trains to replace flights has been conducted in Sweden, which has been considered as an interesting case study for three reasons. First, the geographical location in the periphery of Europe and the absence of high-speed train

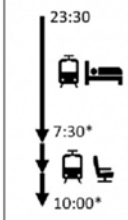
make day train an inconvenient option for long distance travels within, from and to Sweden. Second, the opening of the new tunnel, the Fehmarn Belt fixed link, between Denmark and Germany by 2029, as a key project of Scan-Med Corridor[viii] will reduce travel times by train from Sweden to the rest of the EU. Third, the "flight shame" and the "staying on the ground movements", discouraging people from flying due to the high carbon emissions, have received widespread social support across the Swedish population even before the popularity of the Friday for future climate strikes.

In this case study, different scenarios of travel demand and associated carbon footprints have been estimated until 2050. Insights from two specific studies, conducted by the Chalmers University of Technology in Sweden, are presented in this policy brief. The first study investigates leisure travellers' willingness to switch from flights to night trains in response to a set of innovations and measures [5]. The second study estimates the carbon footprint associated to different scenarios [6].

Night trains demand

Demand for night train until 2050 were estimated using historical trends, changes in population, and changes in preferences in response to a set of potential innovations. Historical trends are retrieved from the Swedish national travel survey and the Swedish survey on incoming tourists, changes in population are obtained from Statistic Sweden, while preferences for night trains are estimated through a Stated Preference experiment (Figure 1) collected through a survey conducted to a representative sample of the Swedish population [5].

Figure 1 – Stated preference experiment

	Night train	Flight
		
Comfort level	High (new train)	
Number of changes	2 changes	
Total travel time	10:30 hours	5:15 hours
Price (per adult)	1 500 kr	1 000 kr

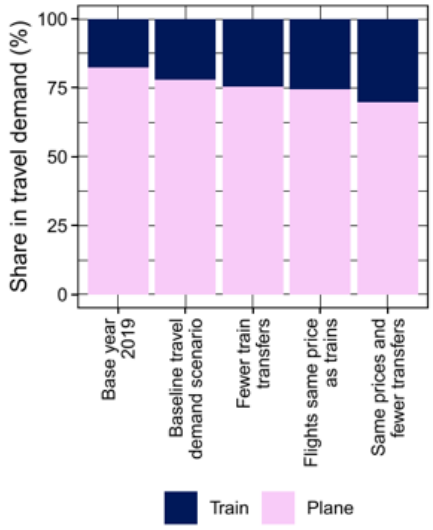
Respondents of the survey were asked to select their favourite option between flight and night train along a set of choice tasks with randomized destinations and trip characteristics, such as comfort level, number of transfers, total travel time, and price. This method allowed to estimate respondents' sensitivity to changes in trip characteristics, and the importance of each factor. In this way, it became possible to simulate changes in travel demand through e.g. reduction of price, or the increase in comfort level. The analysis shows that price, travel time and number of changes are the most important factors for long distance travel mode choice.

Source: Curtale et al. (2023)

Different scenarios of travel demand were estimated from and to the NUTS3 (or NUTS2, according to most granular available data) regions reachable by train, based on an improved booking system, and simulated changes in ticket price and the number of connections. The scenarios also included the reduction of travel time from 2029 onwards due to the new FBFL tunnel.

In all scenarios, an increase in travel demand of night trains and flights combined until 2050 is expected. In the baseline scenario, around 20% of combined train and flight demand would travel by train. In the most optimistic scenario (i.e. fewer train transfers and similar price for night trains and flights), the train share could rise up to 30% (Figure 2). The increase in train shares is expected to be modest for destinations over 2,000 km, but would reach over 50% in some mid-range destinations below 1,000 km, such as the Stockholm-Berlin one [5].

Figure 2 – Estimated travel demand

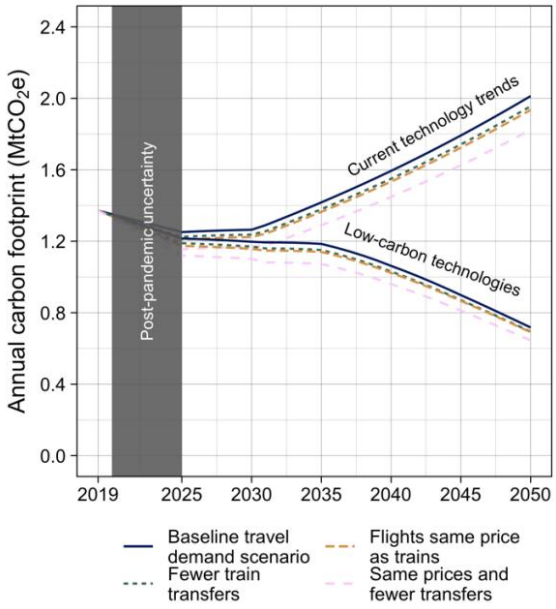


Source: Morfeldt et al. (2023)

Carbon footprint

The carbon footprint associated with projected travel demand has been estimated in the second Chalmers's study [6] using an attributional prospective lifecycle assessment framework. The carbon footprint is estimated in carbon dioxide equivalents over a 100-year time horizon (GWP-100), including emissions of greenhouse gases as well as the non-CO_2 effects of emissions at high altitudes. The carbon footprint is estimated for the 8 scenarios resulting from the combination of 4 travel demand scenarios ("baseline", "fewer train transfers", "same price for flights and night trains", "fewer train transfers AND same price for flights and night trains"), and 2 alternatives for technology adoption based on the scenarios by the International Energy Agency: "stated policies" (current technology trend) and "sustainable development" (low-carbon technologies) [4,6]. Figure 3 illustrates the projections of carbon footprint associated with the 8 scenarios.

Figure 3 – Projections of carbon footprint



Source: Morfeldt et al. (2023)

The results show that the switch from planes to night trains could reduce the cumulative carbon footprint until 2050 up to 7–9% compared to the baseline travel demand scenario. However, none of the modelled changes would lead to carbon footprint reductions in absolute terms if the energy and transport systems continue to develop in line with current technology trends. The results indicate that the impact on the carbon footprints of the low-carbon technologies pathway would be significantly larger than that of the mode shifts.

POLICY RECOMMENDATIONS

To reach the goal of the Green Deal, changes in aviation technology are crucial. Tools such as the EU ETS and RefuelEU can achieve these objectives. However, they will also result in an increase in air ticket prices, potentially limiting citizens' travel opportunities.. Therefore, complementary solutions should be promoted, such as incentives for changes in destination choice or transport mode.

The biggest reduction of carbon footprint could be achieved by changes in destination choice. Policies aiming at incentivising destinations within Europe instead of extra-EU and overseas would be beneficial in this direction.

A change in transport mode could be supported through policies in favour of night trains, which have the potential to contribute to 1) achieving further reduction of CO_2 emissions, 2) safeguarding the public acceptance for existing EU climate policies by supporting the availability of alternatives to upcoming more expensive flights, and 3) to enhance connectivity between individuals and companies in different EU countries.

Until now, night trains have struggled to expand beyond a niche market. A case study in Sweden revealed an untapped potential for night train demand if some of these challenges were addressed. Concretely, the case study highlights a positive impact on night train demand due to: 1) an easy booking system, 2) the reduction of travel time by night train in response to the opening of the new FBFL tunnel and fewer transfers, 3) the reduction of night train price.

To get over the limitations faced by night trains in the last decades, a recent report from the European Commission proposed a set of actions to overcome obstacles of 1) infrastructure charges, 2) capacity and capacity allocation, 3) rolling stock, 4) ticketing and rights for connecting passengers, 5) creating cross-border PSOs, 6) data collection, reporting and monitoring [7].

Among those, the evidence of the presented case studies highlights the importance of EU Regulation 2021/782 on rail passengers' rights and obligations, and the adoption of measures to reduce the night train tickets price.

One obvious option which still hasn't been done I all EU member states is to remove VAT from international train (as it is already done for air tickets)[ix]. Anotheroption to reduce the ticket prices could be to reduce track access charges for passenger trains during the night. There is an ongoing experiment in Belgium where it recently has been decided that night train operators will be fully exempted from paying track access charges and energy costs in the coming two years[x]. In addition, the adoption of Public Service Obligation (PSO) models to cross-border night trains which cannot be delivered commercially may improve financeability and ensuring a service of general interest [7]. This kind of solution, promising but complex, is quite delicate and should be carefully planned as it could lead to unfair competition, as it has been questioned in the recent example of the Stockholm-Hamburg night train.[xi]

Finally, the completion of the European Transport Corridors by 2030 and of the wider TEN-T network by 2050 will provide a faster, safer, and more competitive railway infrastructure. This will further improve the night trains offer, making night trains a concrete additional tool towards the green transition.

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