



Building a Paris Agreement Compatible (PAC) energy scenario

CAN Europe/EEB technical summary of key elements

June 2020



1.5 Transport

Key assumptions

Due to efficiency considerations and given the decreasing cost of renewable electricity and battery storage, in transport, fuel switching to direct electrification has been prioritised. Therefore:

- For private cars, the PAC scenario assumes a fully electrified fleet by 2040¹. Road freight will also be covered in priority by electrification (either through batteries, highways with overhead catenary lines or switch to rail), then by renewable hydrogen for heavy duty.²
- Shipping will be covered by electricity for short-distance, a mix of electricity and renewable hydrogen for mid-distance (intra-EU), and a mix of renewable hydrogen and ammonia for long-distance.³
- Aviation will be mostly covered by liquid synthetic fuels and marginally by second-generation biofuels⁴, until the progressive development of electric aircrafts post-2040.

Evolution of energy demand

In general, transport activity (i.e. the product of passengers or tons of freight*distance) will slightly increase, with annual activity growth rate ranging from 0.52% in cars to 1.67% in freight. However, the growth in travel demand will be more than compensated by efficiency gains through electrification, technical improvements, modal shift and behavioural changes. These gains will cut energy demand in half between 2015 and 2040. For private cars, this would lead to over 20% reduction in car use and a 10% increase in the number of passengers per vehicle by 2040 compared to the baseline. For aviation, most of demand reduction will stem from price incentives (with a €150/t carbon price by 2040), leading to an overall reduction in energy demand by around 26% in 2040 compared to baseline. Regarding the impact of modal shift, the PAC scenario assumes doublings⁵ rail freight between 2015 and 2040⁶, and a 12% shift⁷ from car to bus, train, walk and bicycle combined.

Integration of members' and experts' feedback

Most of the members' and experts' feedback has been questioning transport activity growth and limited modal shifts. Considering these remarks, the PAC scenario has been updated to reflect behavioral changes, by applying a moderation of activity between 2020 and 2040. The PAC scenario also reflects circular economy principles, by reducing freight activity post-2040, and technological progress, by including the uptake of electric aircraft to gradually replace liquid biofuels post-2040. Since empirical evidence confirms the link between gross domestic product (GDP) growth and transport demands⁸, the PAC scenario kept a moderate growth in transport activity to remain consistent with other sectors.

Sensitivities and limitations

¹ Transport and Environment: Roadmap to decarbonising European cars, November 2018.

² Transport and Environment: Roadmap to climate-friendly land freight and buses in Europe, June 2017.

³ Ammonia has a higher energy density than hydrogen and therefore allows for longer distances. Transport and Environment: Roadmap to decarbonising European shipping, November 2018.

⁴ Transport and Environment: Roadmap to decarbonising European aviation, October 2018.

⁵ In tons of freight*km, from around 400 billion to around 800 billion.

⁶ Transport and Environment: Roadmap to climate-friendly land freight and buses in Europe, June 2017.

⁷ In passenger*km.

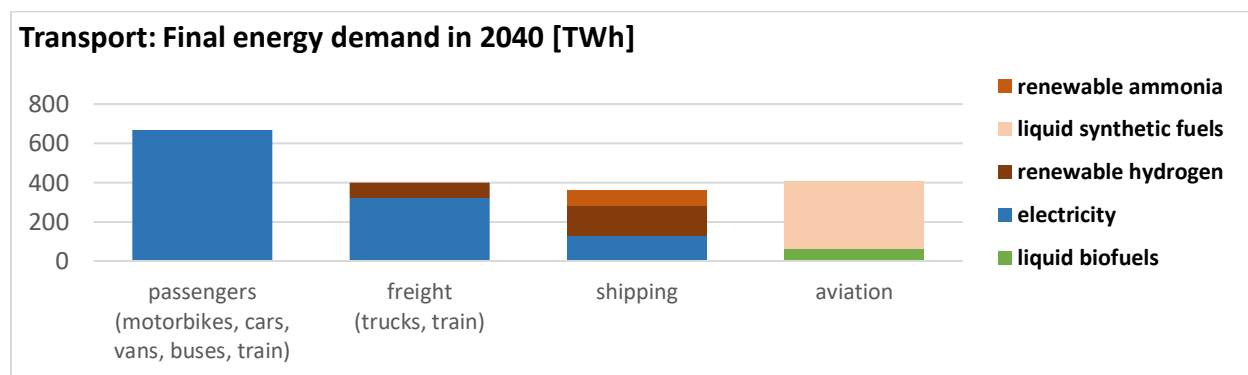
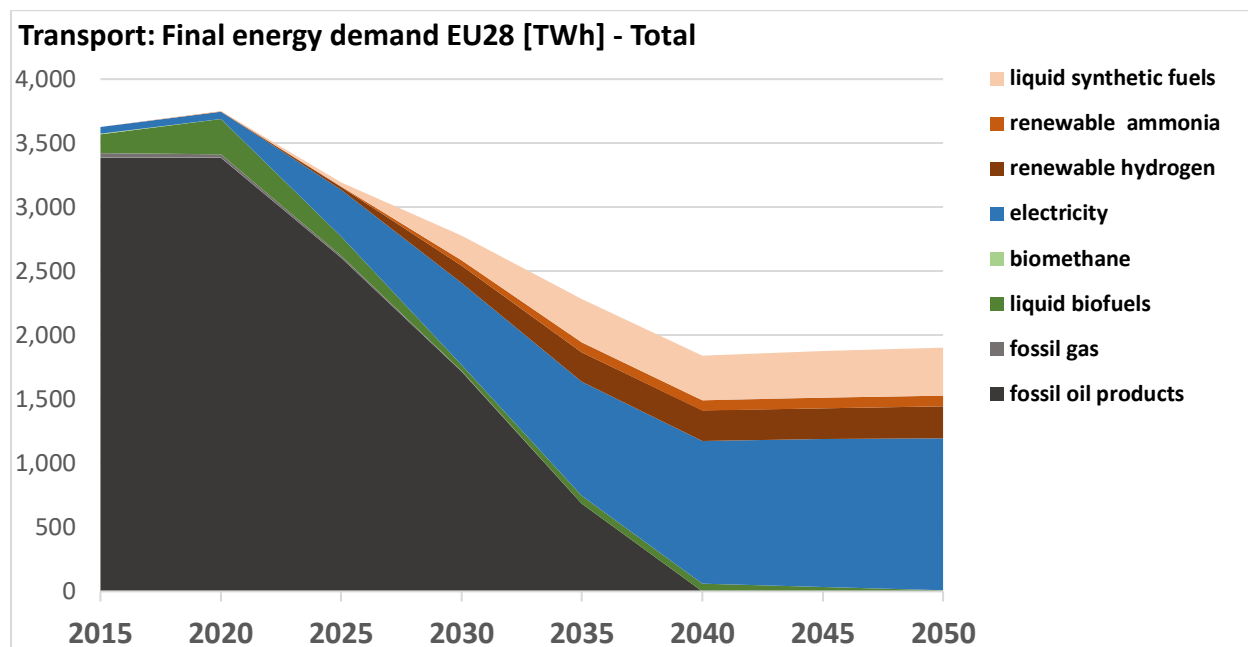
⁸ CAN Europe/EEB: Summaries of PAC scenario workshops and General Assemblies workshops.

⁹ OECD: Decoupling the environmental impacts of transport from economic growth, December 2016.

Reaching net zero emissions by 2040 could be challenging for the transport sector, meaning vehicles with internal combustion engine (ICE) sold after 2020 will need to have a shorter lifetime in order to reach a fossil-free fleet by 2040. Also, the high pace of electrification requires particular attention in sustainable battery and electricity supply to remain Paris Agreement compatible.¹⁰

Key results

- Transport will move from a 90% fossil-based to a 100% renewable energy mix in the next 20 years.
- Biofuels demand will be halved by 2040, moved to second-generation and strictly dedicated to aviation.
- Direct use of electricity will represent around two thirds of the transport fuel mix.



¹⁰ Dominish, E., Florin, N. and Teske, S.: Responsible minerals sourcing for renewable energy, April 2019. The PAC scenario does not include a detailed assessment of the raw material needs for ramping up renewable generation capacities and EV batteries production. Research shows that besides increased responsible sourcing, demand for metals in a 100% renewable energy scenario can be satisfied through higher recycling rates and material efficiency. If supply chains are managed appropriately, social and environmental harms can be avoided and further expansion of unsustainable practices such as deep sea mining are not necessary.