The effect of digitalization on the energy consumption of the EU passenger transport

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Dresden, 12th April 2019

Outline

1. Introduction
2. Methodology
3. Results
4. Conclusions and further research

1. Introduction – Research objective

Digital technologies may allow new mobility paradigms in cities, with disruptive solutions including:

- Mobility as a Service
- Sharing Mobility
- Autonomous Vehicles

Other drivers include mobility demand, vehicles' efficiency, load factors, users' behavior, decarbonization targets, etc.

The aim of this work is to define possible future scenarios to **evaluate the potential effects of digitalization trends** on the **energy consumption of passenger transport** in the European Union.

1. Introduction – Existing models

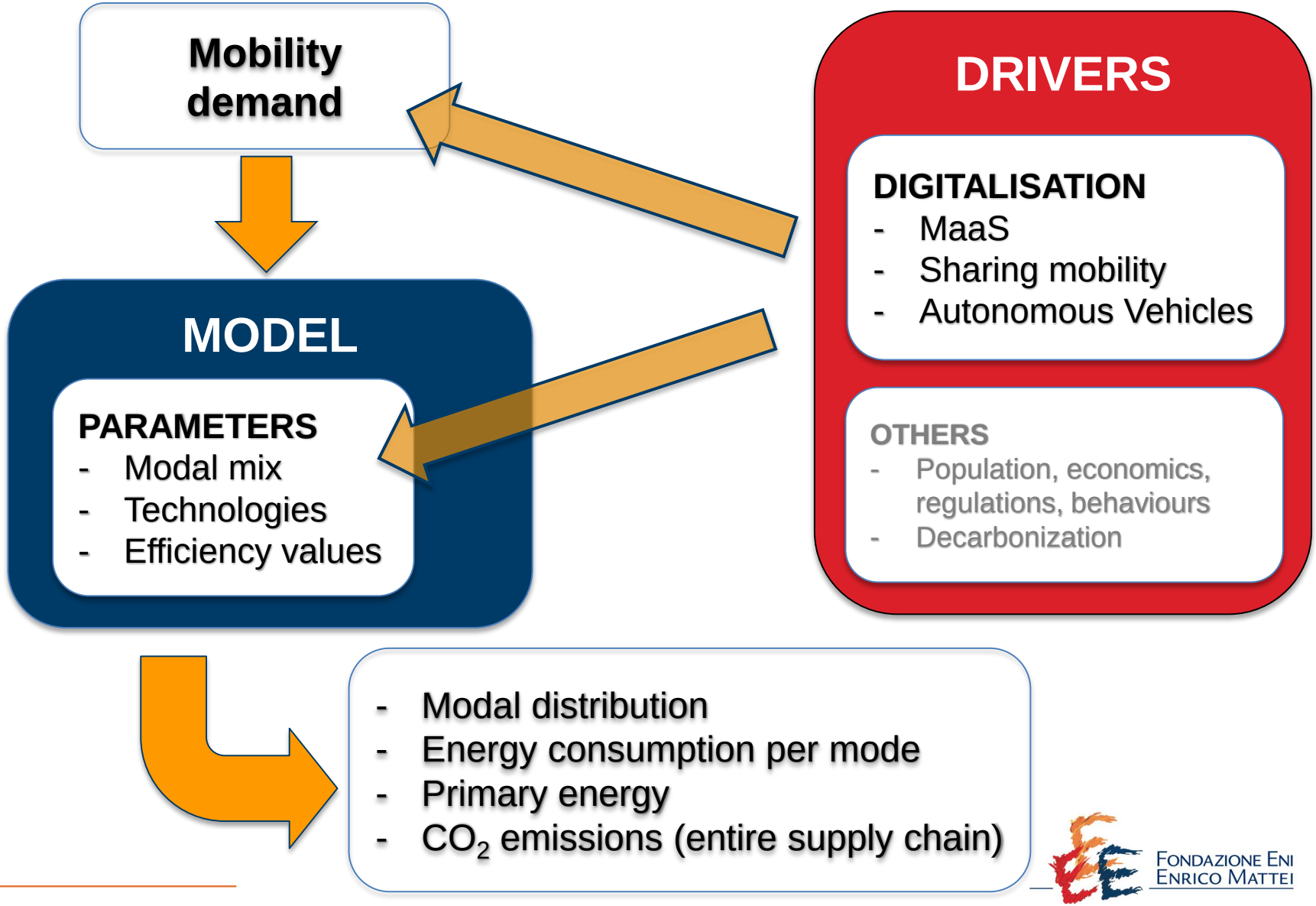
Different global transportation models are available (including MoMo, MESSAGE, GCAM, Roadmap, etc.) with the aim of estimating the energy consumption and environmental impact of the transport sector.

Existing models are generally **more complex**, they are **seldom open source**, and often transport is included into a wider modelling of the entire energy system.

No specific application to analyze the effect of digital technologies has been found in the literature so far.

→ Development of a dedicated simplified **top-down model** to analyze the potential effects of digitalization in the transport system.

2. Methodology – Model definition

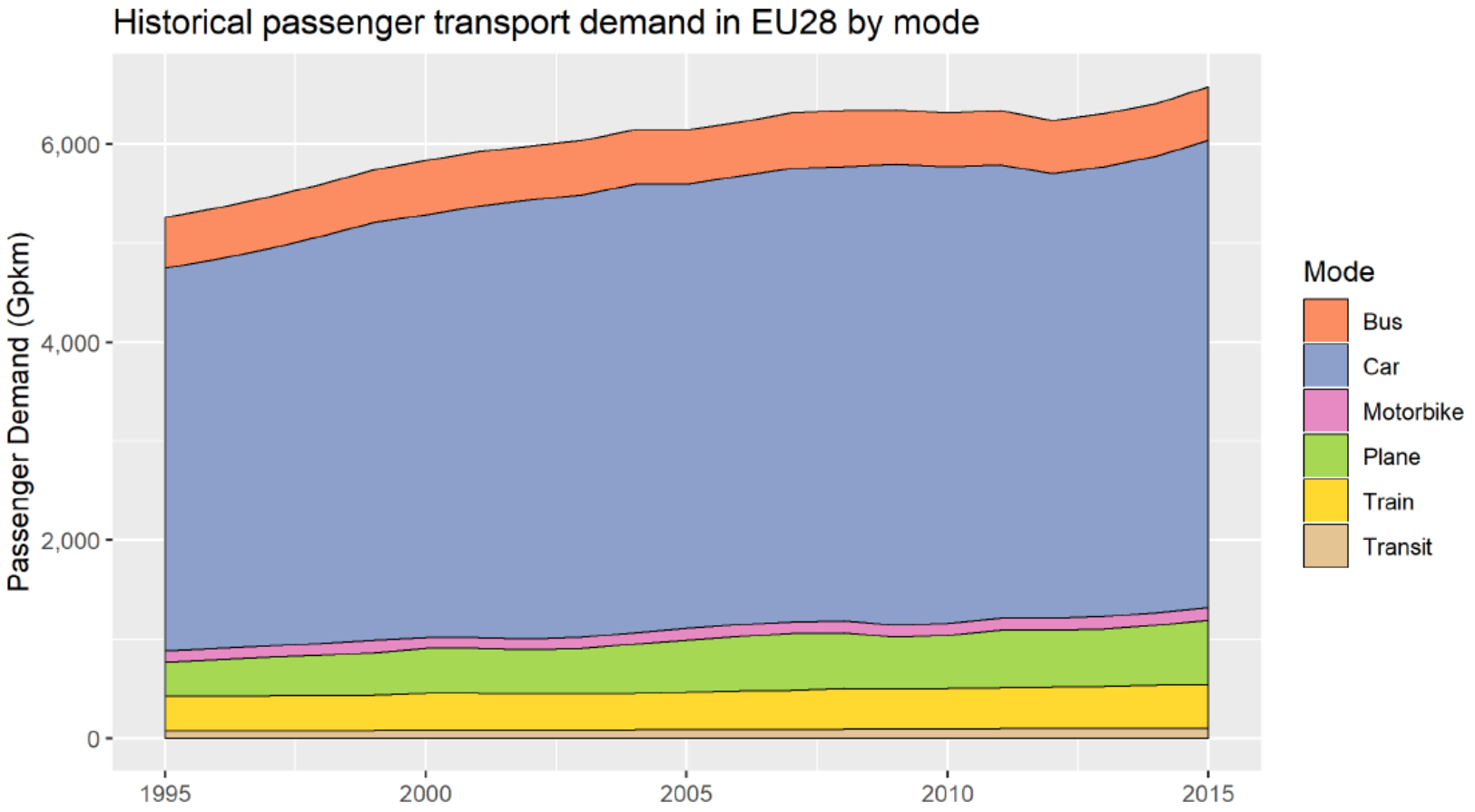


2. Methodology – Data sources

Main data sources used in this work:

- **Mobility demand and modal shares**: EU, Eurostat.
- **Technological shares** for each mode: author's elaboration from different sources (ICCT, ACEA, Eurostat, etc.)
- Technological **parameters**: author's elaboration from different sources (MIT, etc.)
- **Primary energy and emission factors**: literature values from research papers.
- Electricity **generation mix**: Eurostat, ENTSOE.

2. Methodology – Historical modal share



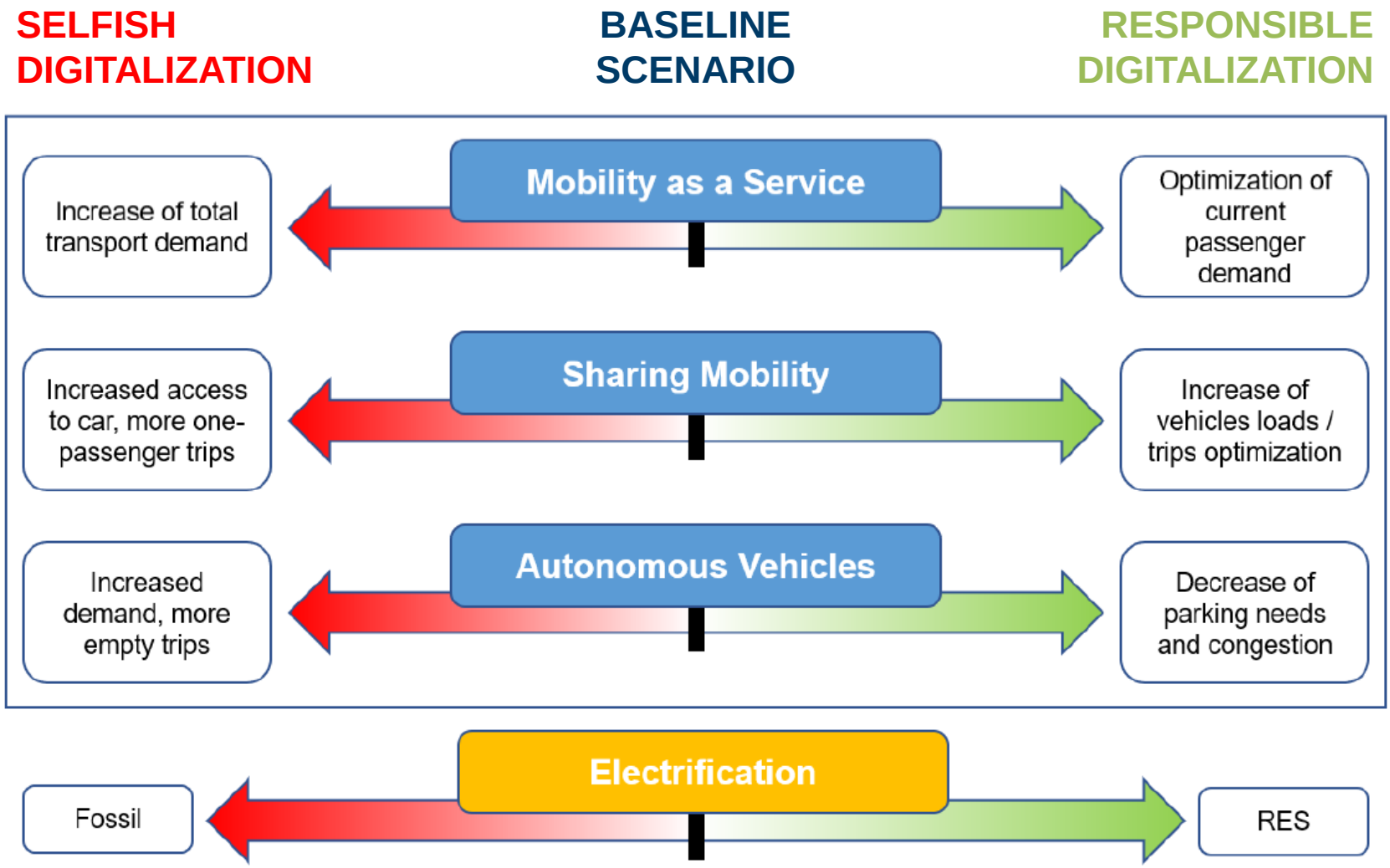
Source: Author's elaboration on EU data (2017)

2. Methodology – Hypotheses for baseline scenario

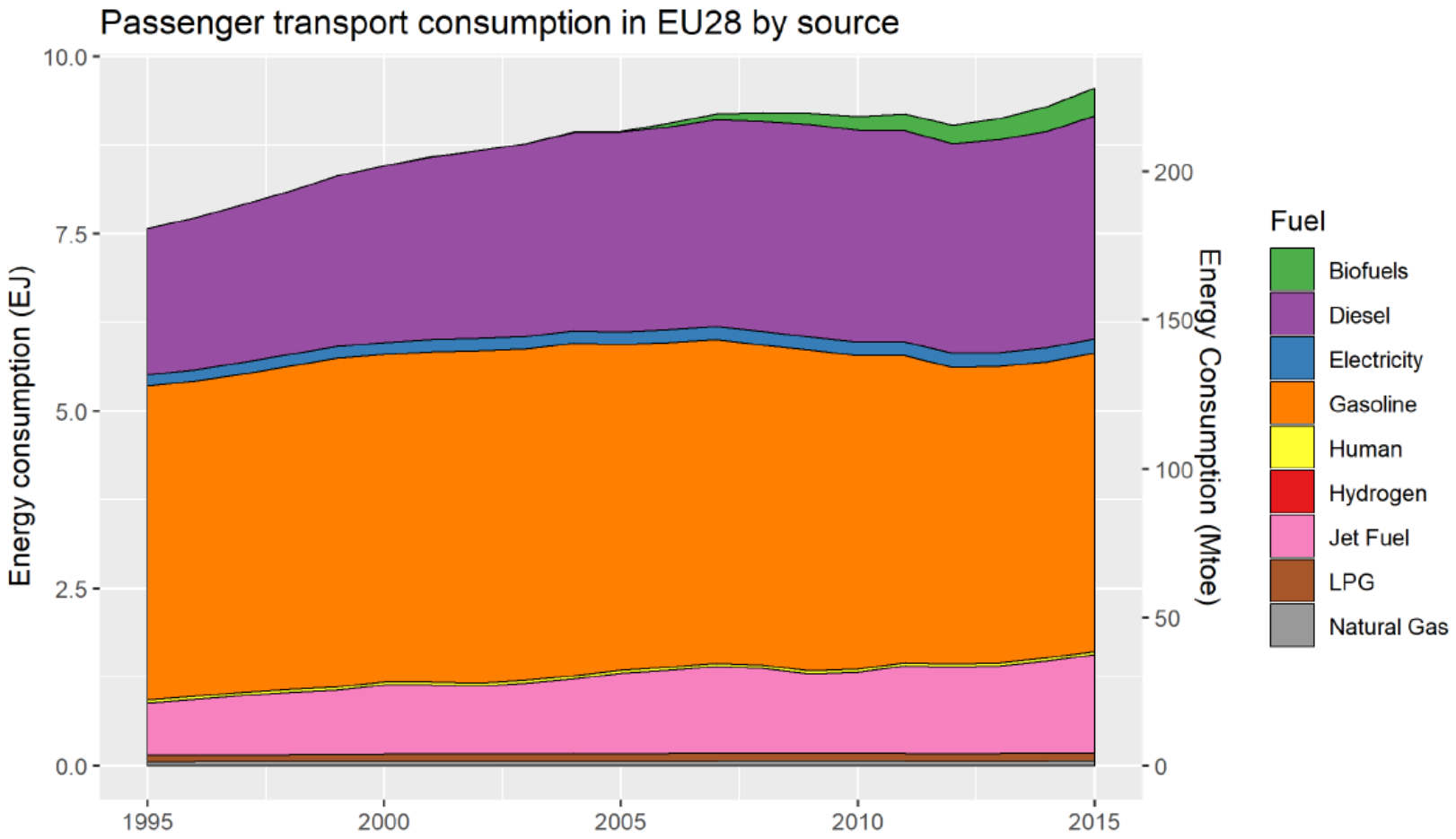
Future evolution:

- Increase of **total mobility demand** based on average historical trends and expected population evolution.
- Evolution of **modal shares** based on literature studies (increase in public transport and active modes in cities, rise in aviation, etc.).
- **Technology shares** based on a comparison of trends from various literature studies (that remain constant across scenarios).
- Expected increase in light-duty vehicles **energy efficiency** based on literature studies, author's hypotheses for other modes.
- Electricity mix evolution based on future estimation for EU power sector.

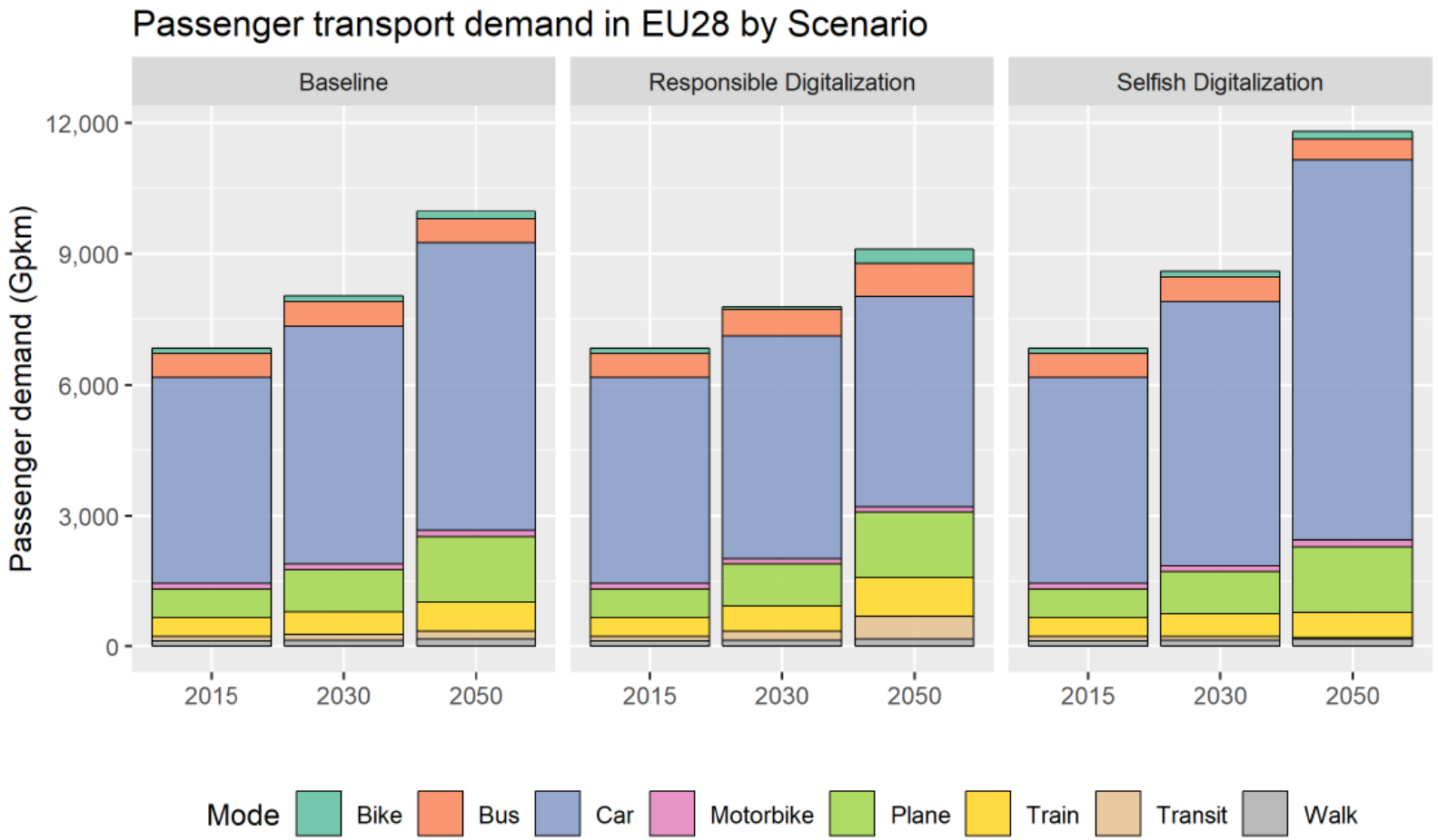
2. Methodology - Scenarios



3. Results – Historical trend of energy consumption



3. Results – Effects on passenger demand



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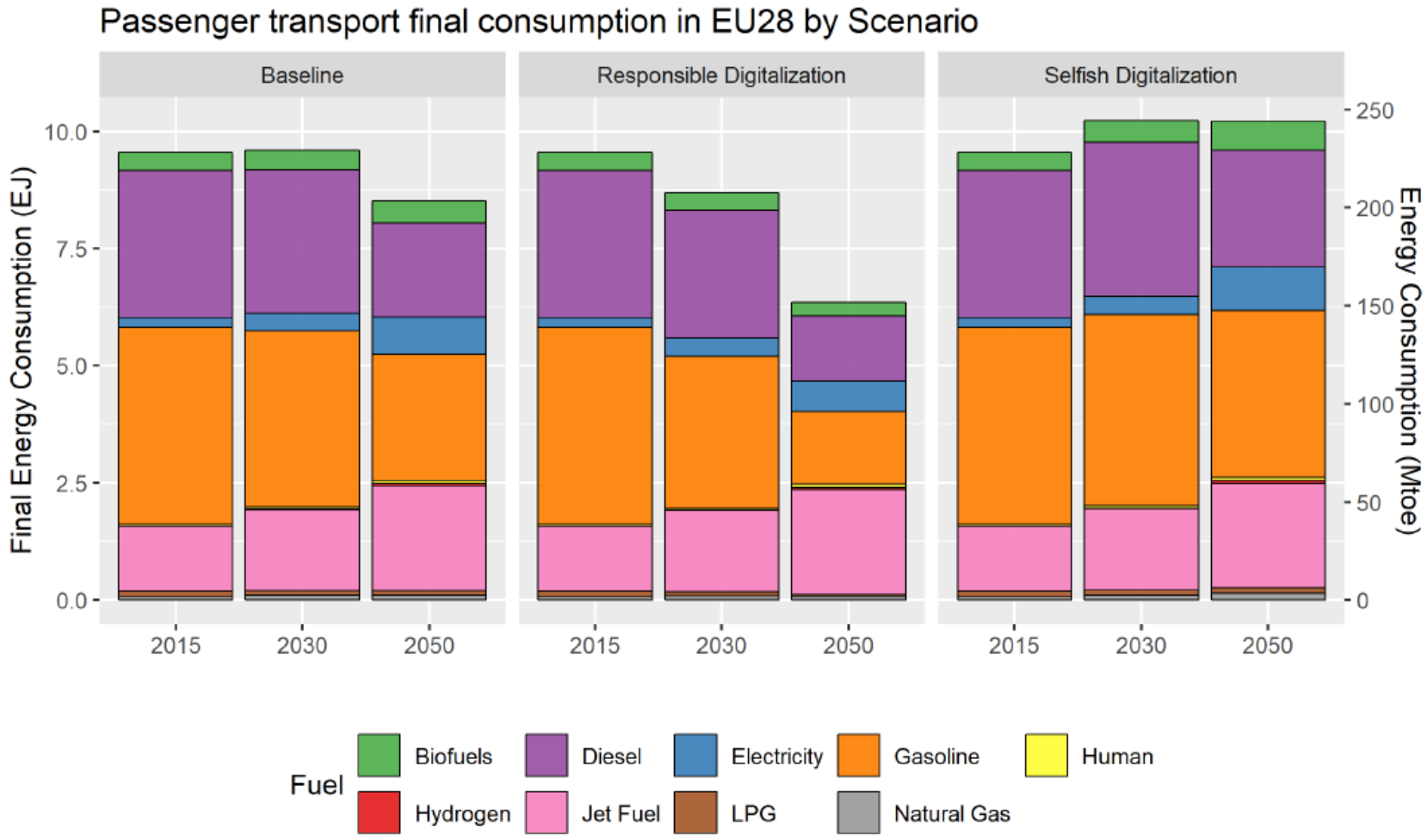
3. Results – Effects on energy consumption



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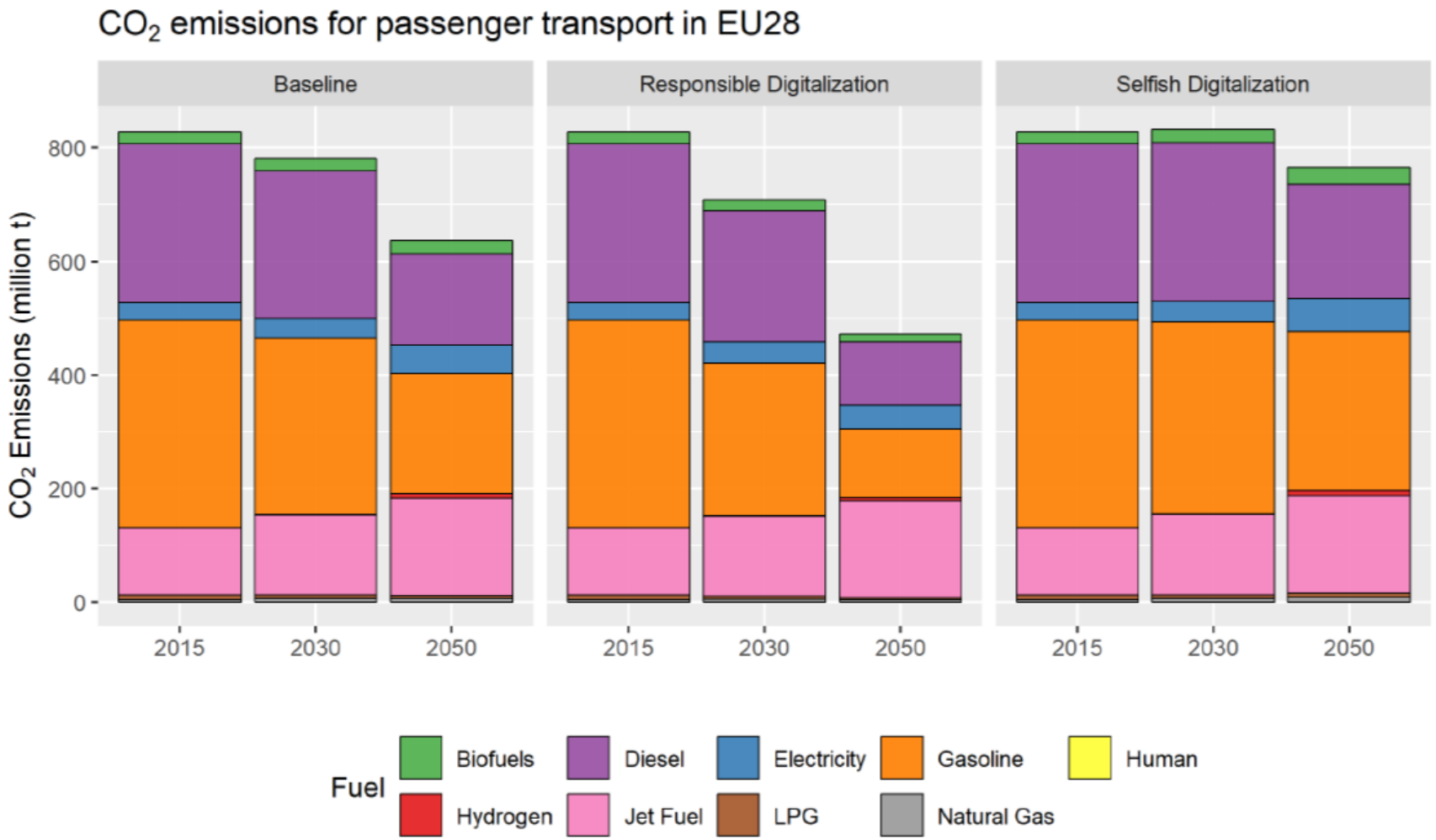
3. Results – Effects on CO_2 emissions



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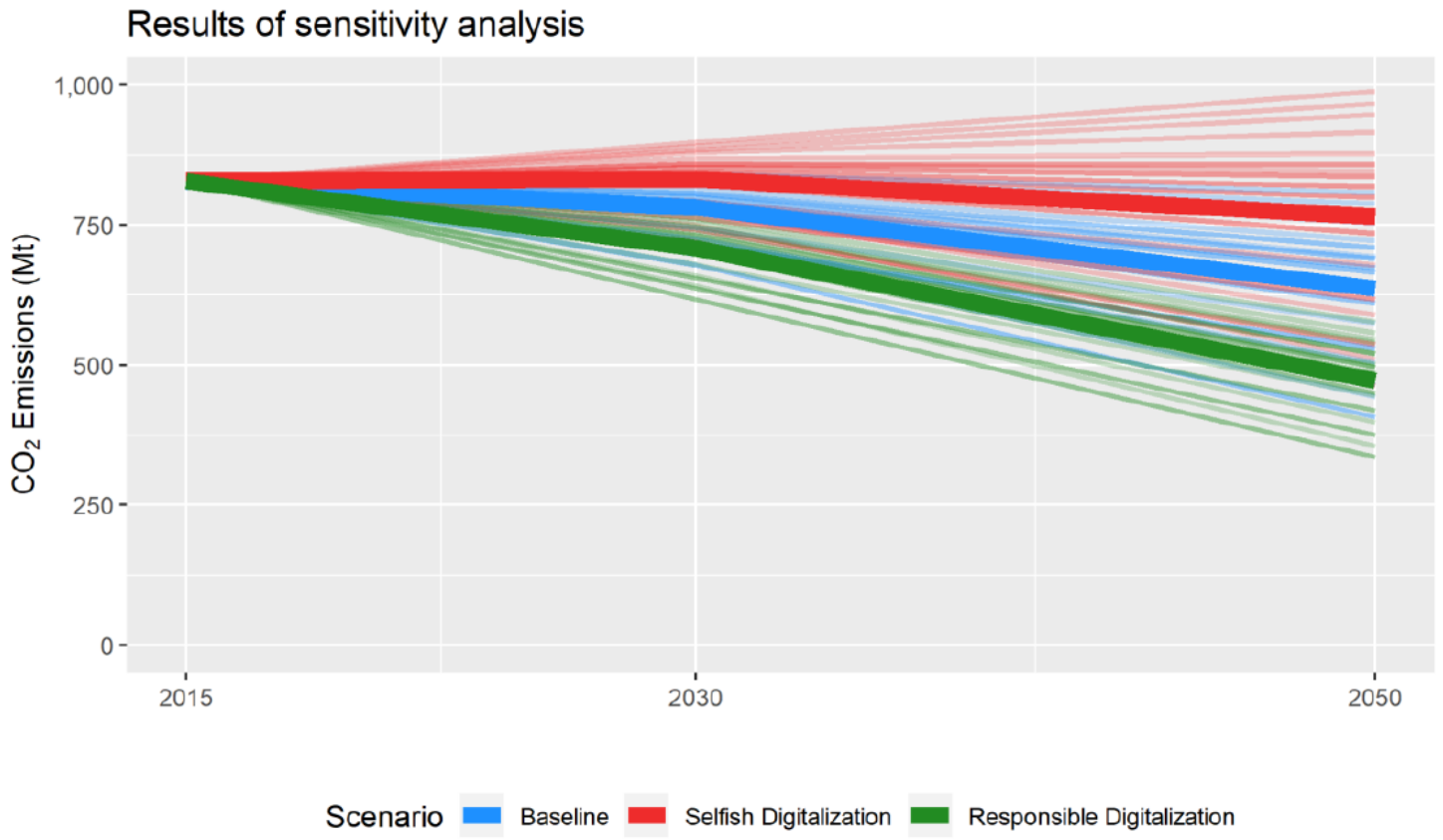
3. Results – Sensitivity analysis

Other parameters that affect the scenario results: **electricity mix**, penetration of **EVs** (in light-duty vehicles), vehicle **efficiency** trends.



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4. Conclusions

- **Digital technologies** may have a significant impact on passenger transport, especially in cities. Further research is needed to study all the aspects that are involved.
- Digitalization could lead to **opposite effects** when considering energy consumption and CO_2 emissions. Thus, proper **policy measures** are needed to limit or mitigate negative effects.
- **Other drivers** have a strong importance in the final results, including vehicles **energy efficiency**, **EVs** penetration as well as the actual **power mix**.

4. Further research

Further applications of this model will include:

- Inclusion of the **freight transport** into the model, due to its expected increasing importance in future trends.
- Better definition of the demand, based on a more detailed description of additional aspects (e.g. including **urban vs motorway** demand).
- Applications to **some EU countries**, to highlight the differences of national historical trends and future mobility targets.
- Specific comparison of **alternative decarbonization options** to evaluate the synergies with digitalization.

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Thank you for your attention!

Any question and/or feedback?

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