Capacity Area B2 Topic 3.1 Milestone 1

Working version of STEM model with the non-car fleet

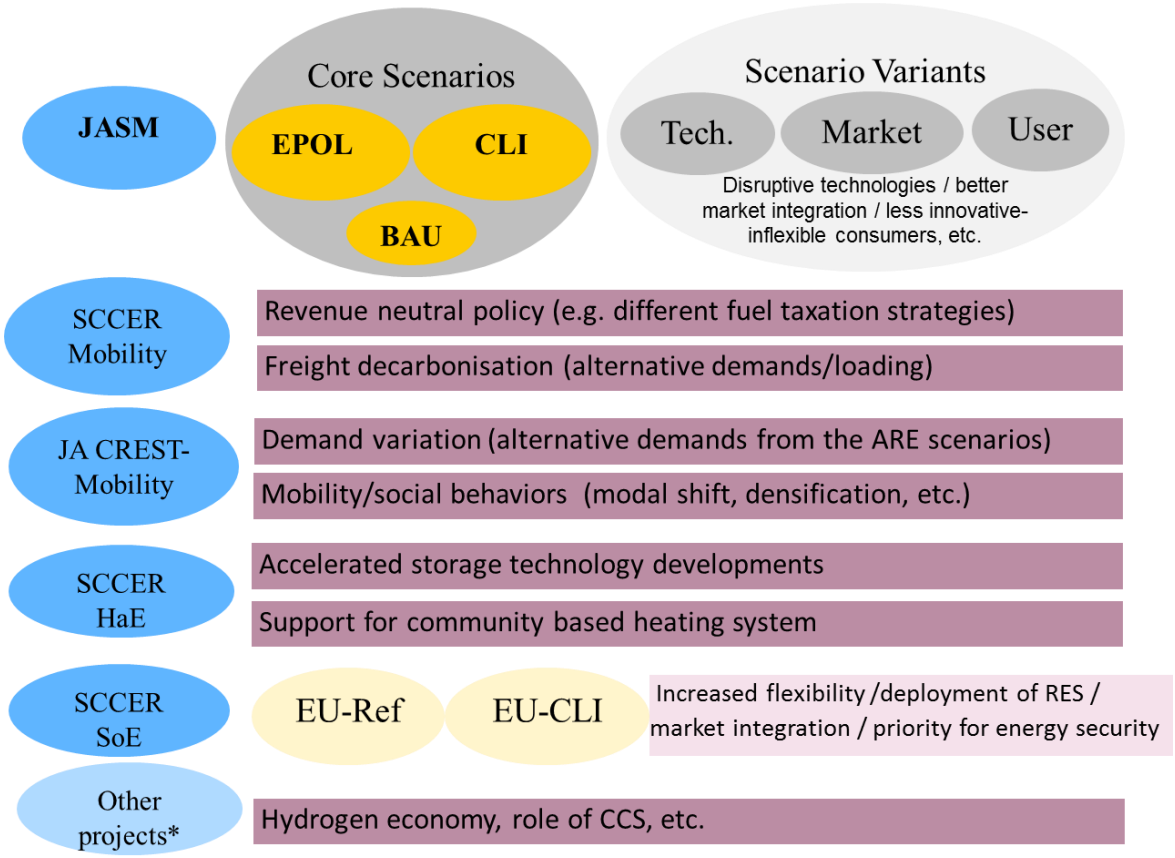
Over the last four years, the Swiss TIMES Energy system Model (STEM) has been extensively developed. Within SCCER Mobility, the transportation module of STEM has been enhanced. In particular, the representation of non-car fleet (buses, two wheelers and trucks) has been updated and strongly expanded. The mobility demands have been extended by including new demand categories for trams/trolley buses. The model is now calibrated to 2015 energy balance and vehicle stocks in all demand categories (i.e. cars, rail, buses, trucks, etc.). In the recalibration of the transport module, we also extensively used the 2015 Swiss travel survey data (Mikrozensus zum Verkehrsverhalten) to implement mobility usage profiles.

The scenario analysis for SCCER Mobility will also substantially benefit from other related projects (and vice versa). For example, we have amalgamated the model developments and updates from SCCER Joint Activity "Scenarios & Modelling" (JASM). For example, the electricity supply module of STEM has been further developed in terms of technology cost, resource potential, etc. These developments are crucial for e-mobility in the transport module. In the updated version of STEM, e-mobility is modelled with fine details, thus facilitating the control of battery charging time as well as potential replacement of car battery within the lifetime of cars. The aforementioned model developments are well documented in a supplementary model report (Kannan et al., 2019).

Within the scope of JA CREST Mobility, we have implemented TIMES elastic variant for the private mobility demands. In the earlier STEM version, mobility demands (vkm and tkm) are inelastic, i.e. fixed; and exogenously defined demands must be supplied independently of the cost. With the newly implemented elastic variant, the mobility demand becomes elastic. For a given policy, the demand can asymmetrically change (increase or decrease) depending on price elasticity. We have also compiled mobility price elasticities through a literature review. These developments on STEM elastic variant are described in the updated STEM documentation (Kannan et al., 2019).

In recent months, we began to implement various relevant model developments from our past and ongoing projects into the STEM model. The aim of this consolidation is to benefit from many parallel model developments at PSI, which ultimately enable us to update and maintain one model. The consolidation as such showed to be a major challenge. We nearly reached the limits of model capability due to high data compilation times and extensive requirements on computational resources. This necessitated use of new computational hardware. We are pursuing applications of the consolidated STEM within SCCER Mobility and other SCCER projects with our involvement, i.e. JASM, JA CREST-Mobility, SCCER Supply of Electricity and SCCER Storage.

Though we use the same STEM model, the focus of the scenario analysis is specific to each project. The figure shows an overarching scenario matrix proposed under the various SCCER projects. The foci of scenario analyses within SCCER mobility is on mobility specific questions. For example, we analyze a tax/revenue neutral policy for the transportation sector and different decarbonization strategies for freight transportation (e.g. demand variation, loading levels, etc.). At the same time, the core scenarios offer mobility related insights in a broader context. Thus, with the current scenario set-up, we will benefit from various relevant projects.



Overarching scenario matrix for application of STEM model for SCCER and other projects.

References:

Kannan, R., Panos, E., Kober, T., Luh, S. (2019) A supplementary documentation to the Swiss TIMES Energy System Model (STEM): Updates on transportation module and development of STEM elastic variant, PSI.

Panos, E., K. Ramachandran, Kober, T. (2019) Definition of scenarios and general model assumptions, PSI.