Extending a Swiss energy system model with heterogeneous mobility consumer groups

**Highlights:**
- The Swiss TIMES energy system model applies a cost-optimization approach, which has limitations for representing passenger transportation.
- Cost-optimization approach shall be enriched with behavioral realism to identify critical target groups for tailored decarbonization policies.
- The single homogeneous representative of all consumers is replaced with heterogeneous consumer groups, differing in mobility-relevant socio-demographics.
- Each group is attributed with a set of techno- and socio-economic characteristics to reflect their mobility behavior/decisions.
- The work conducted so far provides insights on the size of each consumer group and their driving patterns.

**1 Introduction**

The Swiss TIMES Energy Systems Model (STEM) generates potential future pathways (2050+) for the whole energy system of Switzerland.

- Cost-optimization model
- Technology-rich bottom-up approach with detailed techno-economic technology definition

**Shortcomings in STEM passenger transport:**
- Real-world transportation dynamics are strongly driven by consumer behavior, while cost minimization plays a minor role.
- Limited representation of consumer behavior in STEM, due to the underlying pure cost-optimization approach.
- For transportation, the cost-optimization approach should be enriched with behavioral realism.

**2 Overcoming the limited mobility behavior representation**

- **Aims**
  1. Heterogeneous consumer groups replace the current homogeneous mean representative consumer.
  2. Behavioral attributes for each consumer group characterize differing mobility preferences.

- **Expected benefits:**
  - Enriching cost optimization approach with behavioral aspects leads to improved representation of decisions for mobility investments and technology use.
  - Tailored policy measures for targeted consumer groups can be identified and evaluated for decarbonizing transportation.
  - This enables to find pathways leading to effective decarbonization with minimum perceived negative influence for the overall society.

**3 Current state: one homogeneous representative of all consumers**

Swiss population is represented by one mean representative decision-agent [2]:

- This consumer will always select the most cost-efficient mobility option, within given boundary conditions.
- No consideration of differing...
  - ...socio-economic situations
  - ...mobility demands
  - ...car preferences

**4 Improved methodology: heterogeneous consumer groups**

**5 Techno- and socio-economics represent behavioral attributes**

- **Consumer group characteristics**
  - Number of cars
  - Travel money budget
  - Travel time budget
  - Access to small/big cars
  - Modal switch elasticities
  - Modal switch: Car owner

- **Main challenges:**
  - Future mobility behaviors are unknown. Reasonable assumptions are necessary.
  - Calibrating the model
  - Validating model outcomes

**References**


**Partners**

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