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# Agent Based Micro-Simulation of PHEVs

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# Two part of Presentation

- Overview of MATSim
- Current work: A framework to investigate PHEVs (based on MATSim).

# Some requirements of PHEV research community

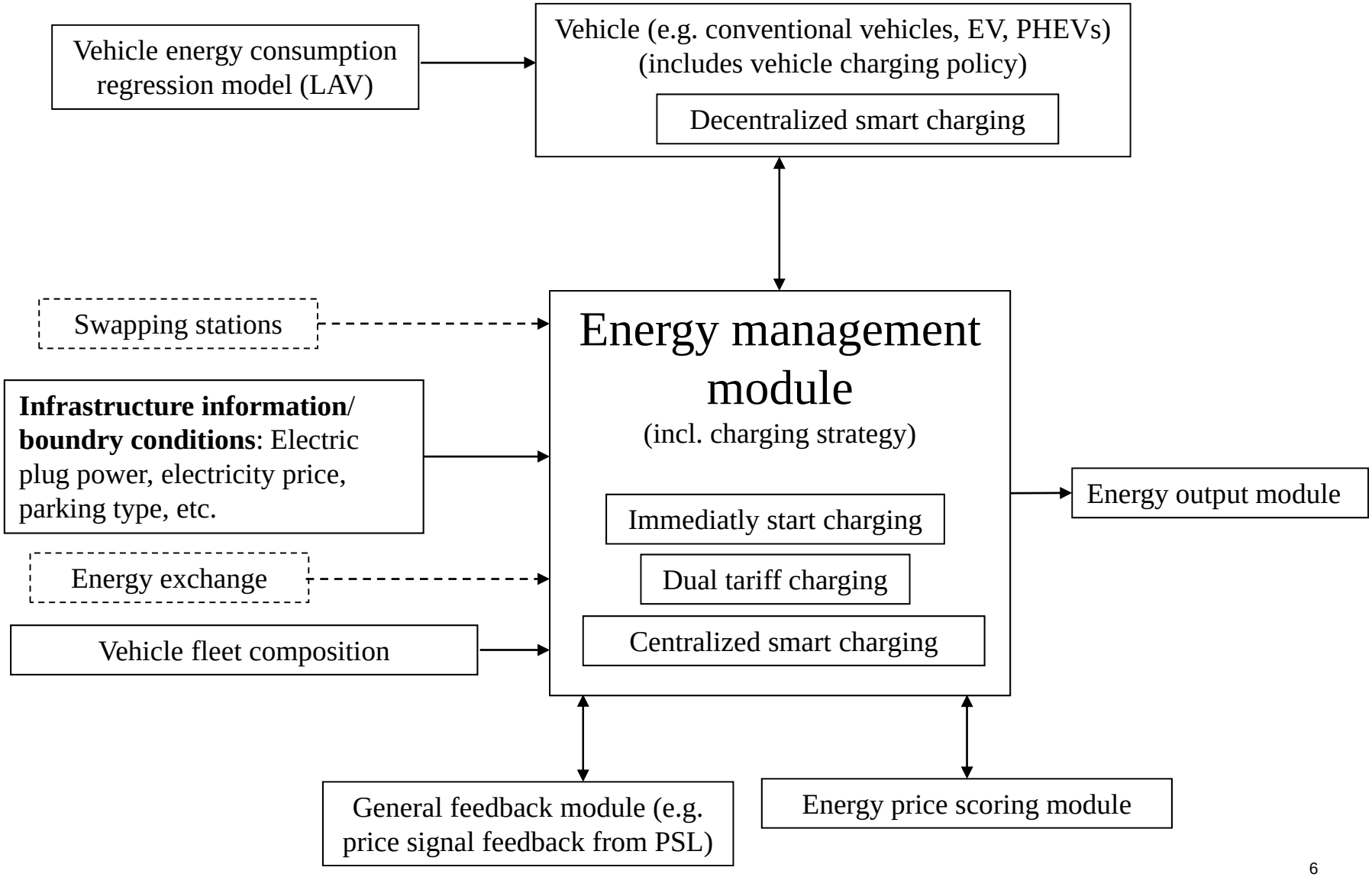
- **Electricity demand** changing in terms of location and time of day
  - charging power/speed can vary between locations
  - Influence/bottlenecks in lower voltage grid?
- Need to distinguish electric vehicles and PHEV
  - PHEVs more flexible due to gasoline tank
- Vehicles with batteries could potentially supply the grid (V2G, V2H)
  - What is the role of battery size in terms of V2G and emissions
- Ability to incorporate individual agent's preferences
  - E.g. parking price, distance, income, location
- Government policy (e.g. Parking advantage for electric vehicles, street tolls)
- Fleet modelling: Emissions analysis (e.g. green house gase emissions after change of a policy)

# Some requirements of PHEV research community

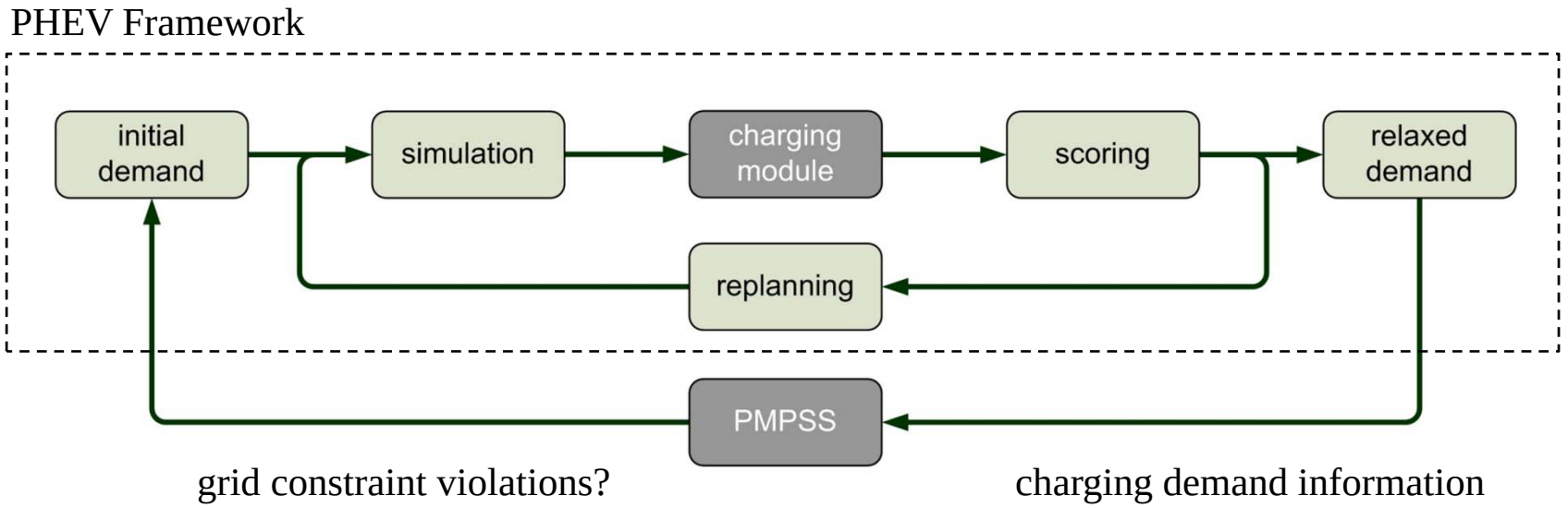
- **Charging Schemes**
  - Decision by agents (manually)
  - Decisions by electric grid (e.g. smart grid)
  - Decisions by on board computer of cars (automatically)
    - E.g. based on current state of charge, distance to next destination(s), charging price (changing over the day), parking duration, max unchargable state
- Energy Exchange (buying and selling electricity)
- Analyzing black outs (focusing on detailed analysis instead of on rough numbers)
- ...

=> **The proposed PHEV framework helps answering such questions.** Many of these features have already been implemented.

# PHEV Framework Overview (Core Modules)

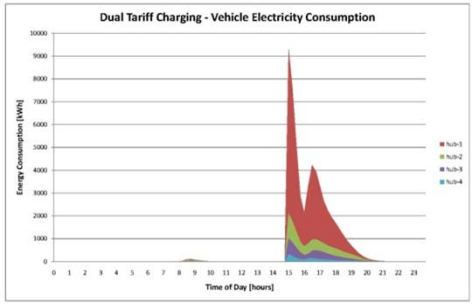


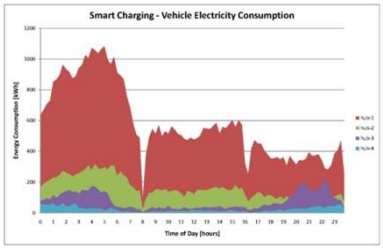
# Plugging-in Feedback Module into PHEV Framework

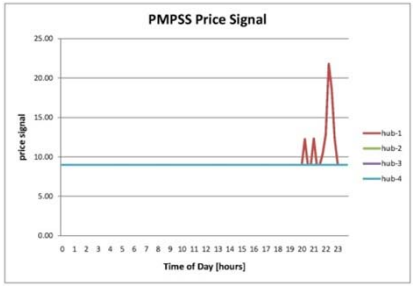


# Joint Experiments

- Test experiments conducted in October 2009
  - Matthias Galus will present later
- At the moment we are working on setting up a scenario for the city of Zürich



# Work in Progress and Future Work

- Decentralized smart charging
- V2G
- Integration of general energy source/storage concept (e.g. solar panels)
- Energy exchange
- Swapping stations

# Questions?