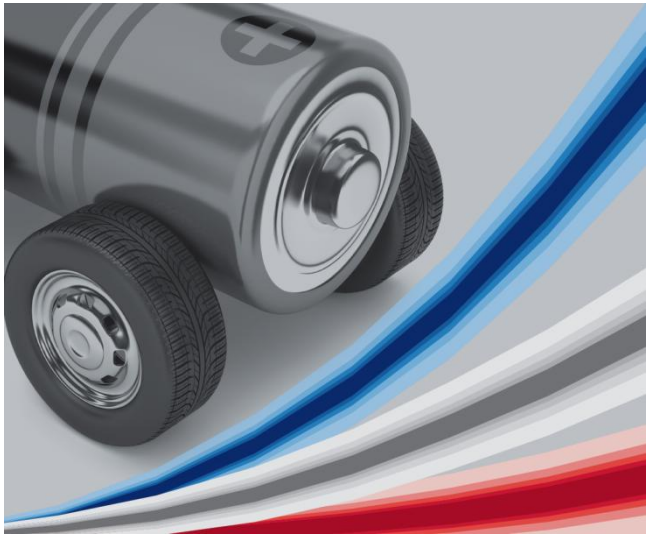
Electric vehicles - Potentials for increasing system flexibility

Future trends and modelling aspects

Tobias Boßmann

Fraunhofer Institute for Systems and Innovation Research ISI



Berlin, 21 September 2015

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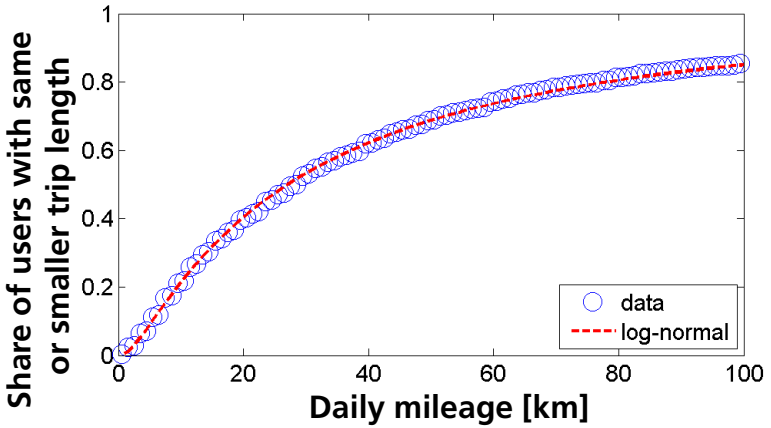
Some quick facts about (electric) vehicles 1/2

- **Daily mileage** is short:
  - 80% of the trips are inferior to 60 km
  - Only few trips (8%) are longer than 130 km

Source: Mobilitätspanel, Fraunhofer ISI



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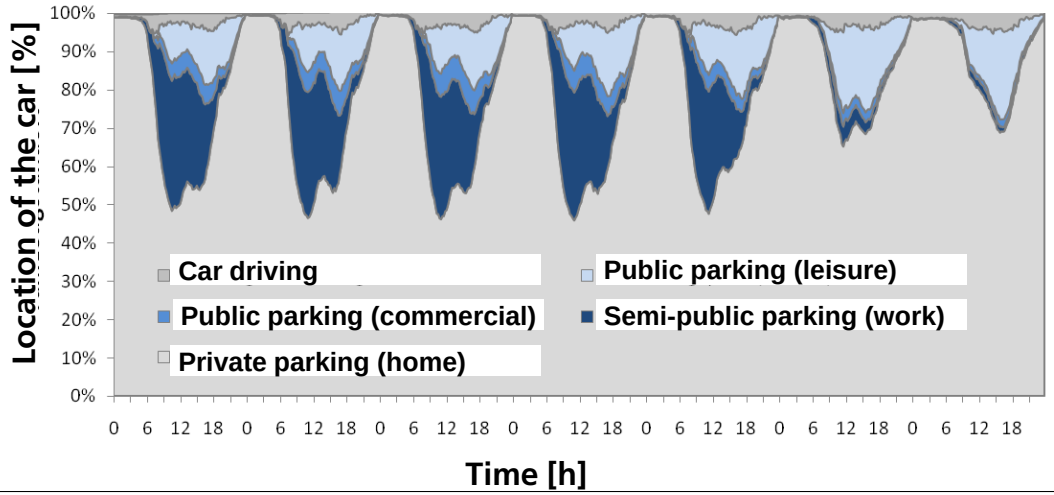
- Average duration of **parking**
  - 95% of the time cars are parked – primarily at home or at work
- **Electric vehicles are suitable for most trips and could be charged at home**



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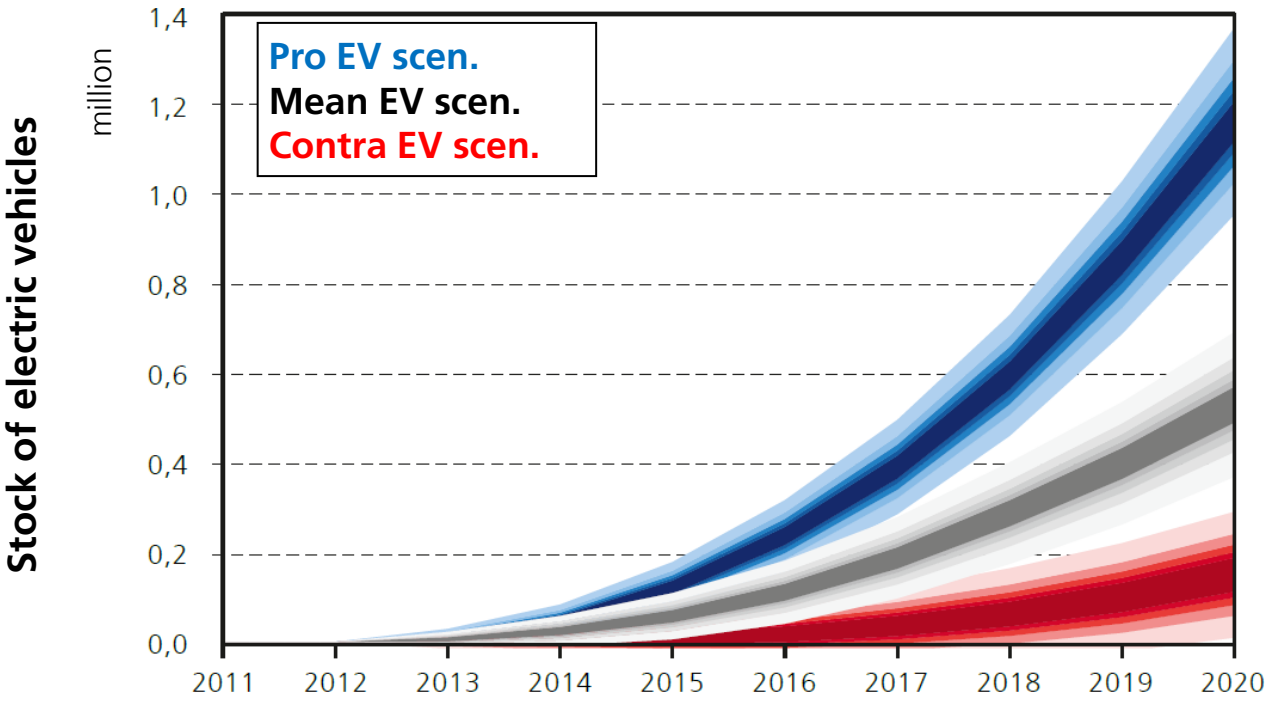
Potential dissemination of electric vehicles in Germany (insights from *ALADIN*)



- TCO-based decision, considering fuel and electricity prices, costs for infrastructure, limited availability of electric car models, willingness to pay
- **Dissemination of electric vehicles very sensitive to framework conditions**

Source: Plötz, Gnann, Kühn, Wietschel (2013): *Markthochlaufszenarien für Elektrofahrzeuge.*

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Some quick facts about (electric) vehicles 2/2

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  - 95% of the time cars are parked – primarily at home or at work
- **Electric vehicles are suitable for most trips and could be charged at home**
- Assuming **1 million electric vehicles**
  - At annual mileage of 14,300 km (German average) and 16 kWh/100km = 2.3 TWh/a => **0.5% of annual German electricity demand**
  - Storage of 10 kWh = 10 GWh **≈ the major German pump storage plant**
  - **Battery charging** at 3.7 kW = 3.7 GW **≈ 2.4% of installed capacity** (155 GW in 2009) Source: BDEW, Fraunhofer ISI
- **Large fleet provides some storage but requires a lot of installed capacity**

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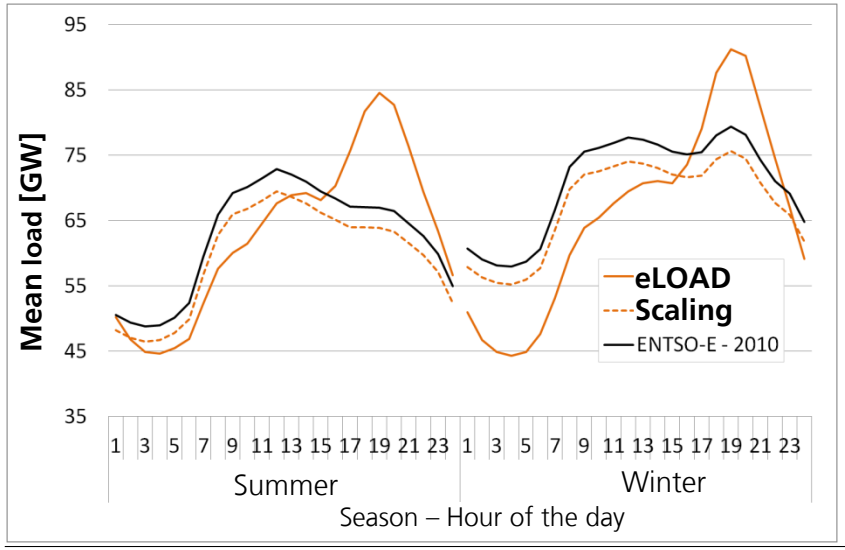
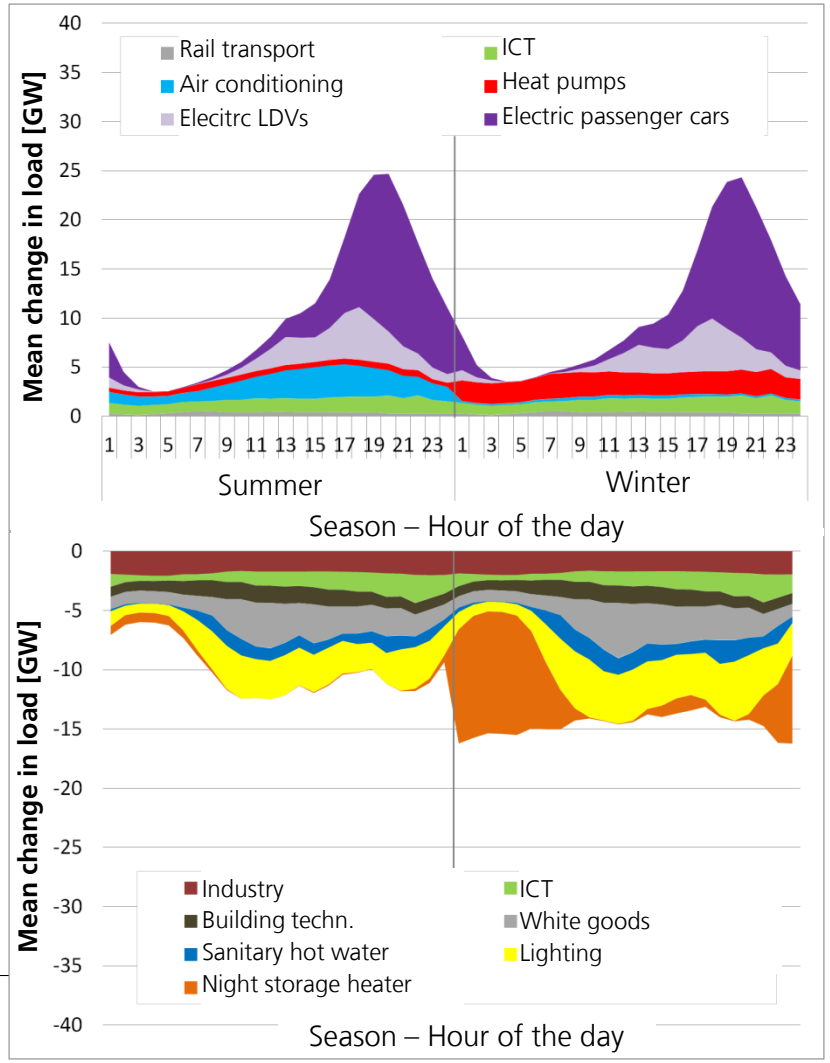
Long-term impacts of electric vehicles on the electricity system (insights from *eLOAD*) - 1/2

- Calculations performed with **eLOAD model**
- Assumptions on electric vehicles for 2050
  - 25m electric vehicles
  - Charging after the last journey

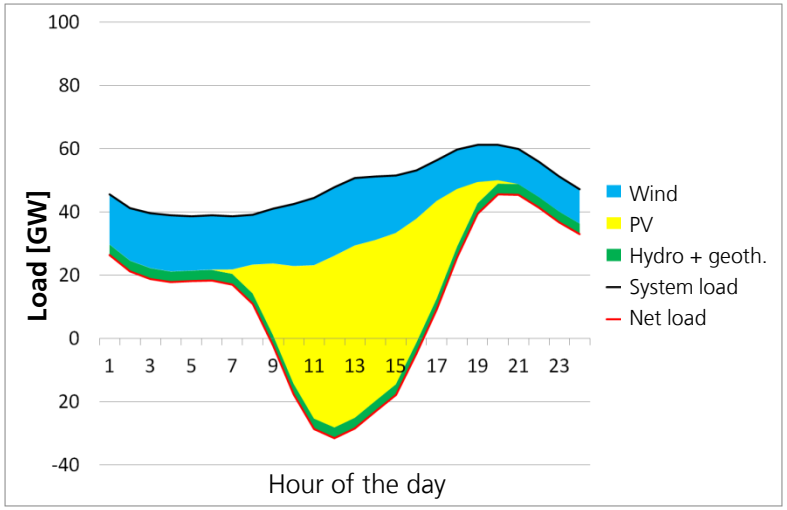
⇨ +18 GW evening peak load

⇨ **Risk of substantial increase in peak load**





Long-term impacts of electric vehicles on the electricity system (insights from *eLOAD*) - 2/2



Summer Sunday 2050

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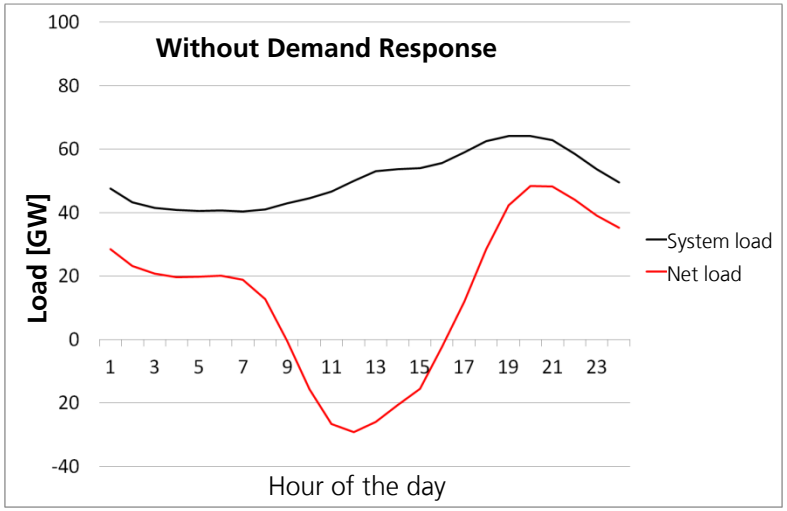
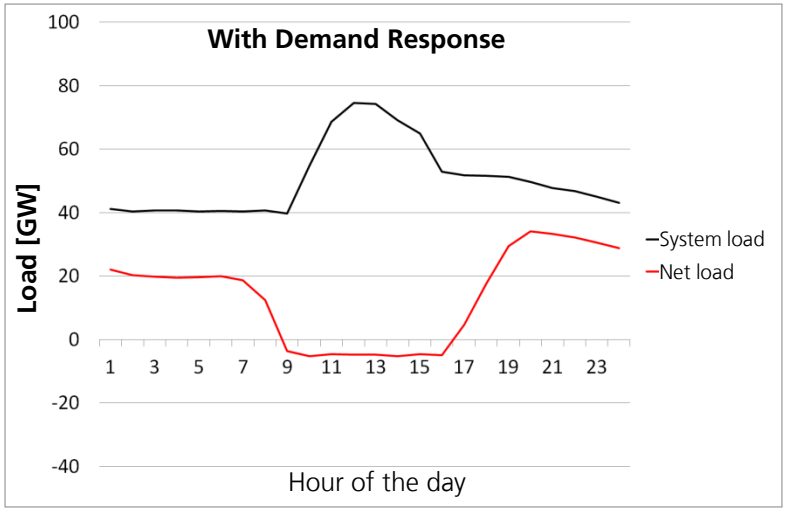
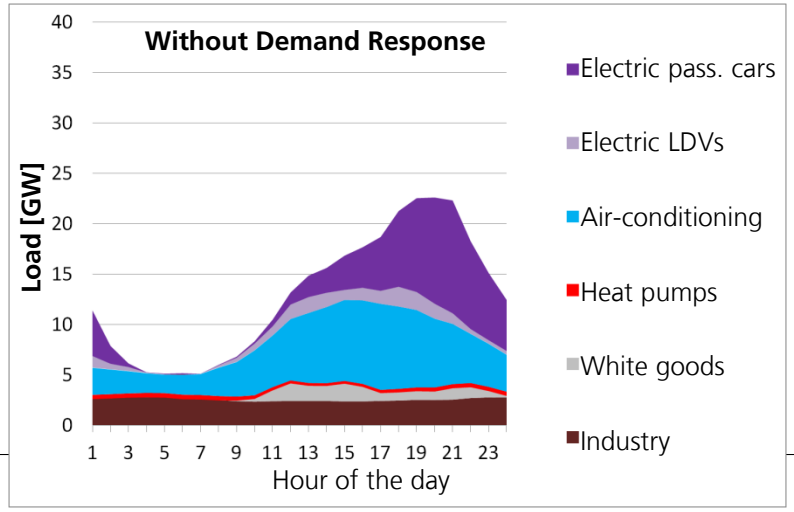
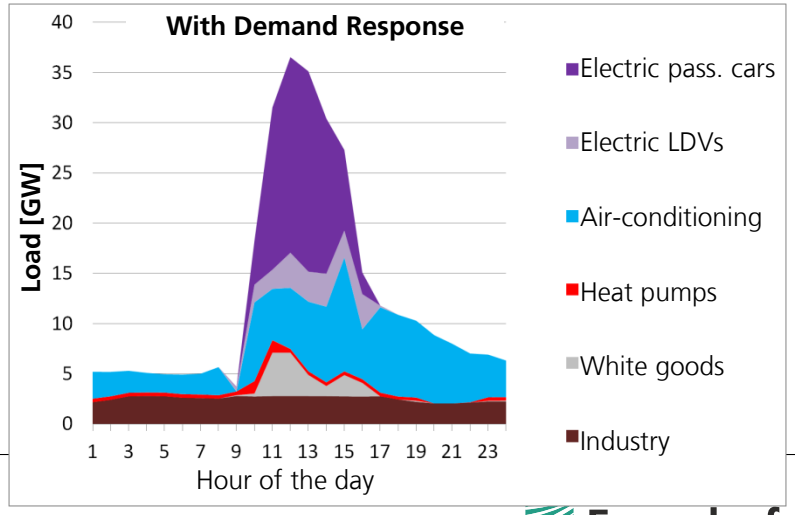
Long-term impacts of electric vehicles on the electricity system (insights from *eLOAD*) - 2/2









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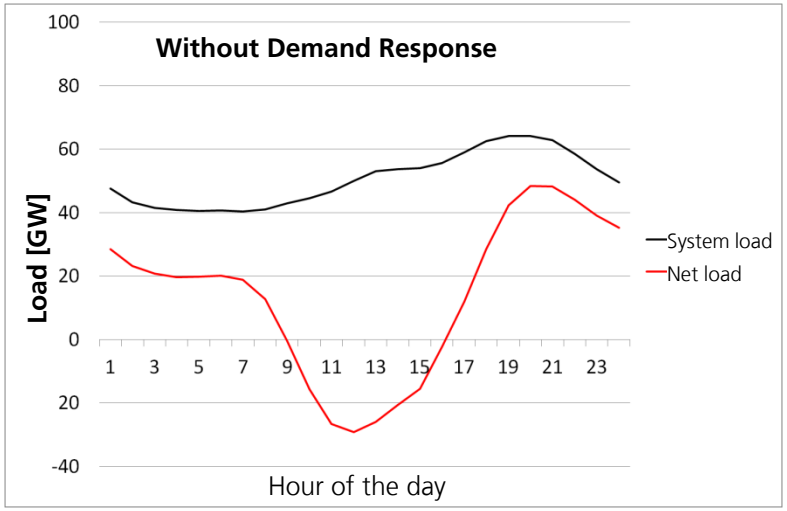
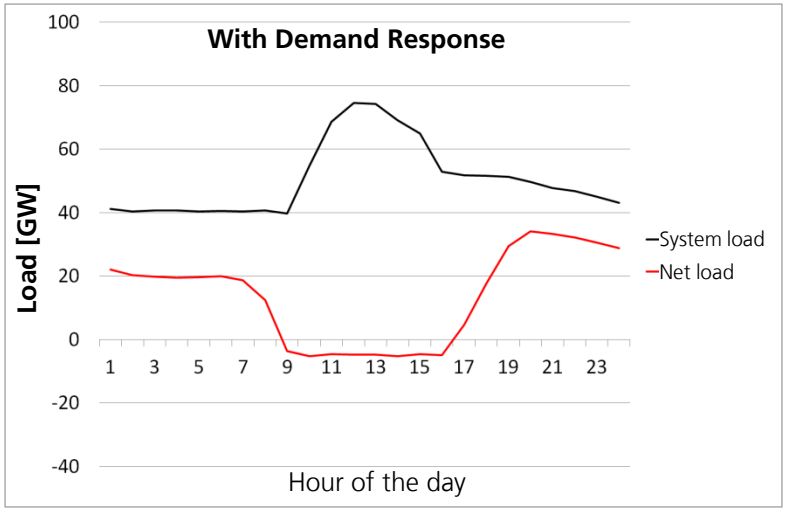
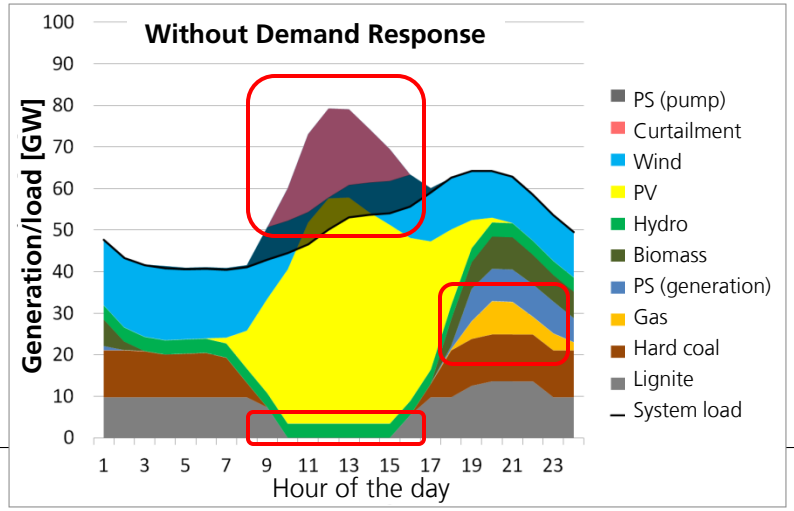
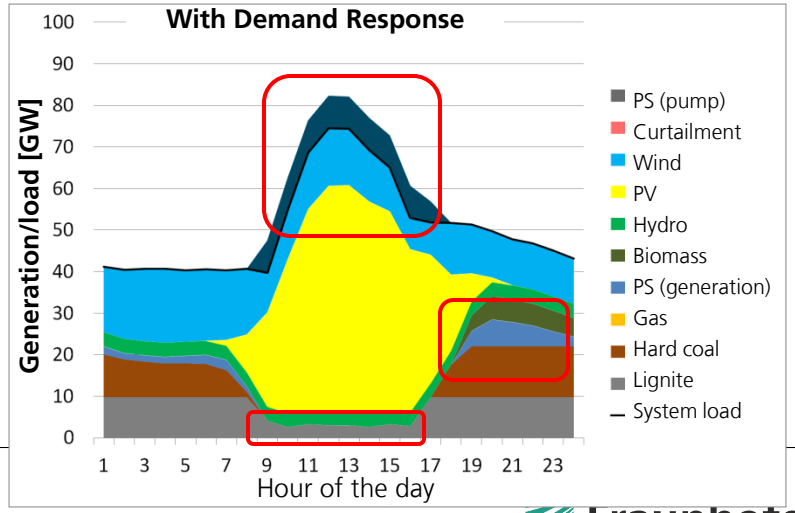
Long-term impacts of electric vehicles on the electricity system (insights from *eLOAD*) - 2/2









Summary

Insights from the models on the future impacts of e-mobility on electricity systems

- **Diffusion** of electric vehicles is uncertain and subject to the **framework conditions**
- Significant **dissemination** of electric vehicles **=** substantial increase in electricity **demand**
- Lack of overarching **charging strategy** challenges the electricity system (**peak load**)
- In the long run: e-mobility = large **DR potential** => capable for RES integration
- **Scheduling** charging electric vehicles at hours of high RES generation challenges the **grid**

Requirements for further e-mobility and energy system modelling

- Cost-efficiency of **DR programmes** to incentivize system compatible charging
- Impacts of **fast charging** on grid stability
- Electrification of road **freight transport**
- **Interaction** of flexibility options (DR, grids, storage…) and other policies

Potential fields of future political action

- Introduce **time varying electricity** rates
- Develop harmonized **charging strategies** and business concepts

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Thank you for your kind attention!

Dr. Tobias Boßmann
Fraunhofer ISI
tobias.bossmann@isi.fraunhofer.de
+49-721-68 09 257

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