IEEE ISGT PES

G4V – grid-for-vehicles

Impact and opportunities of the mass-market introduction of EV on future grids

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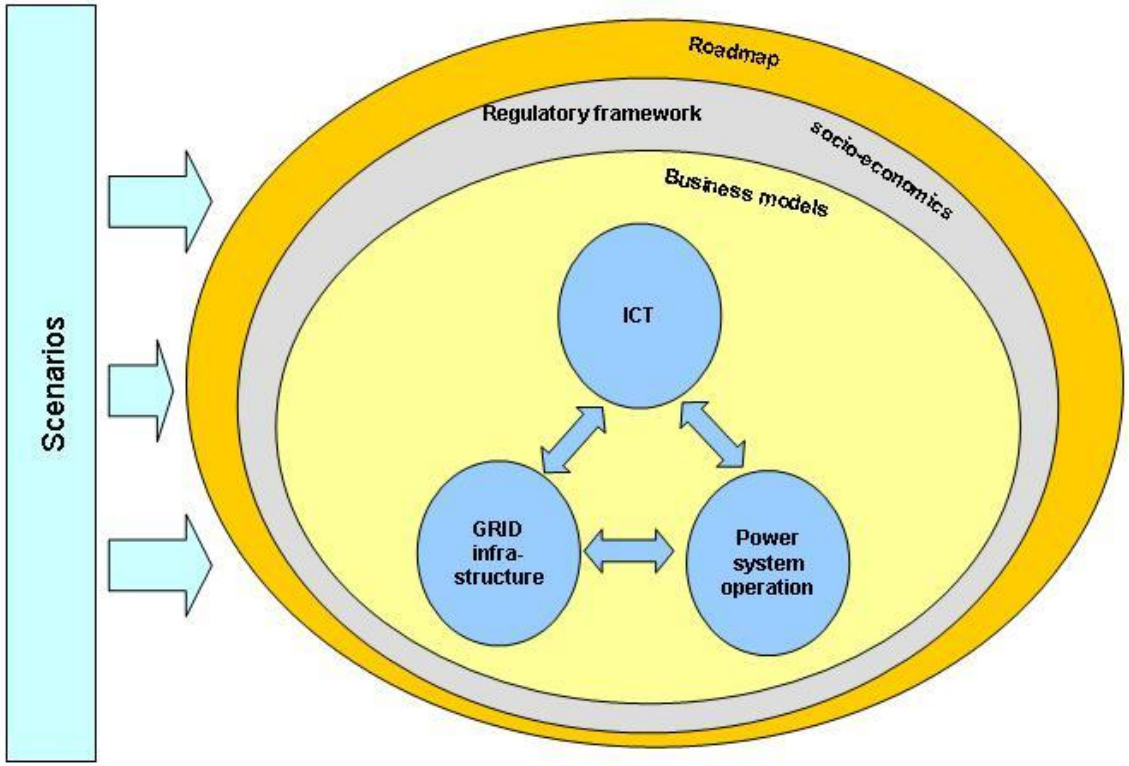
Overview – the G4V-project
Project duration: Jan 2010 – June 2011

time-horizon: 2030

Key – Question:
What needs to be started **now** in order to enable a mass market of EV?

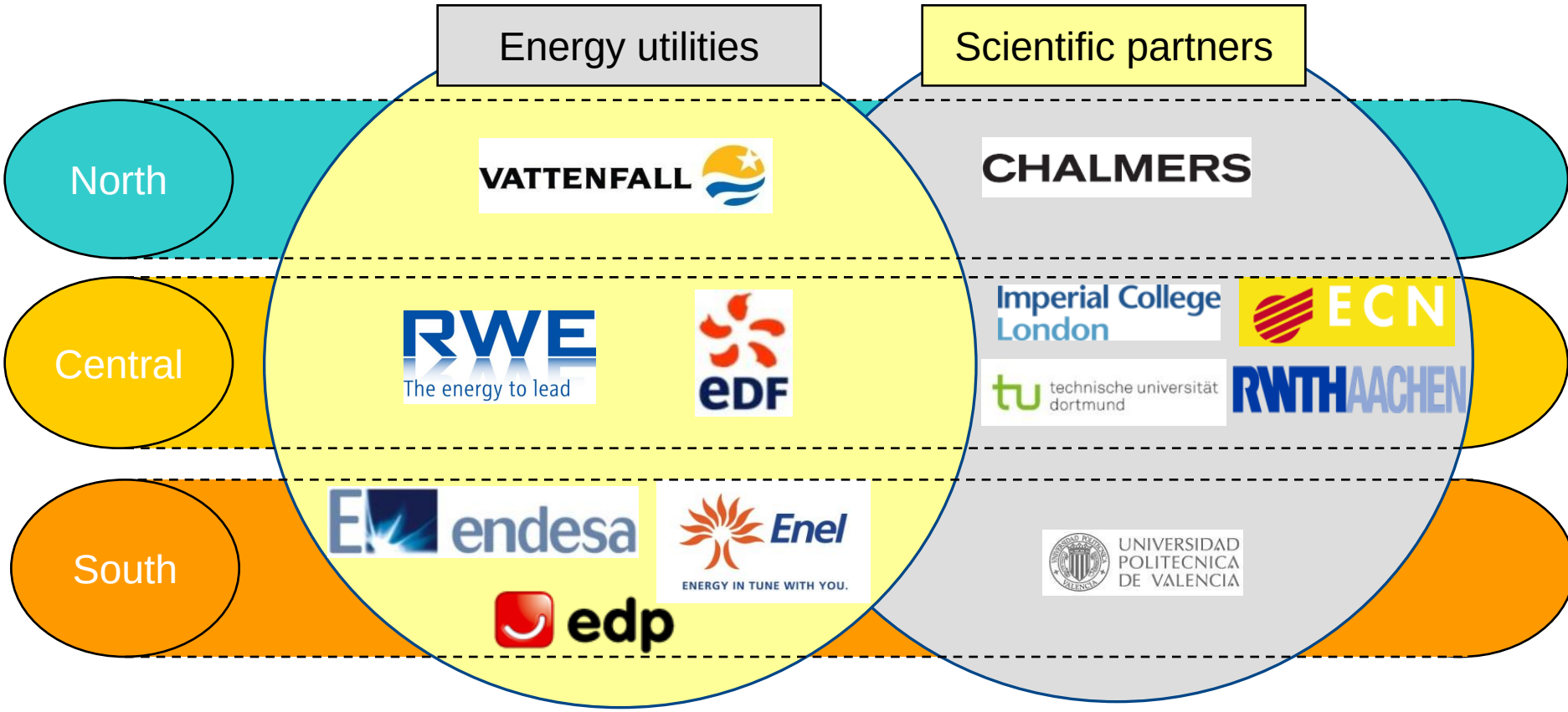


- technical issues
- legal framework
- business model
- customer convenience
- environmental aspects

Recommendations

The G4V consortium

12 partners from eight countries



Influencing Parameters

- market penetration (subsidies ?)
- regional distribution
- temporal distribution
- directionality (uni/bi)
- kind of vehicle (BEV/PHEV)
- kind of battery (Li-Ion?)
- battery capacity (1kWh - 35kWh, usable percentage ?)
- battery exchangeability (yes/no)
- energy demand (approx. 6kWh/d, log-normal distribution)
- connection power (3.7kW - 40kW)
- market access regulation
- …TO BE CONTINUED…

Definition of Szenario-worlds

How could the development in the European electricity sector look like?

Business as usual

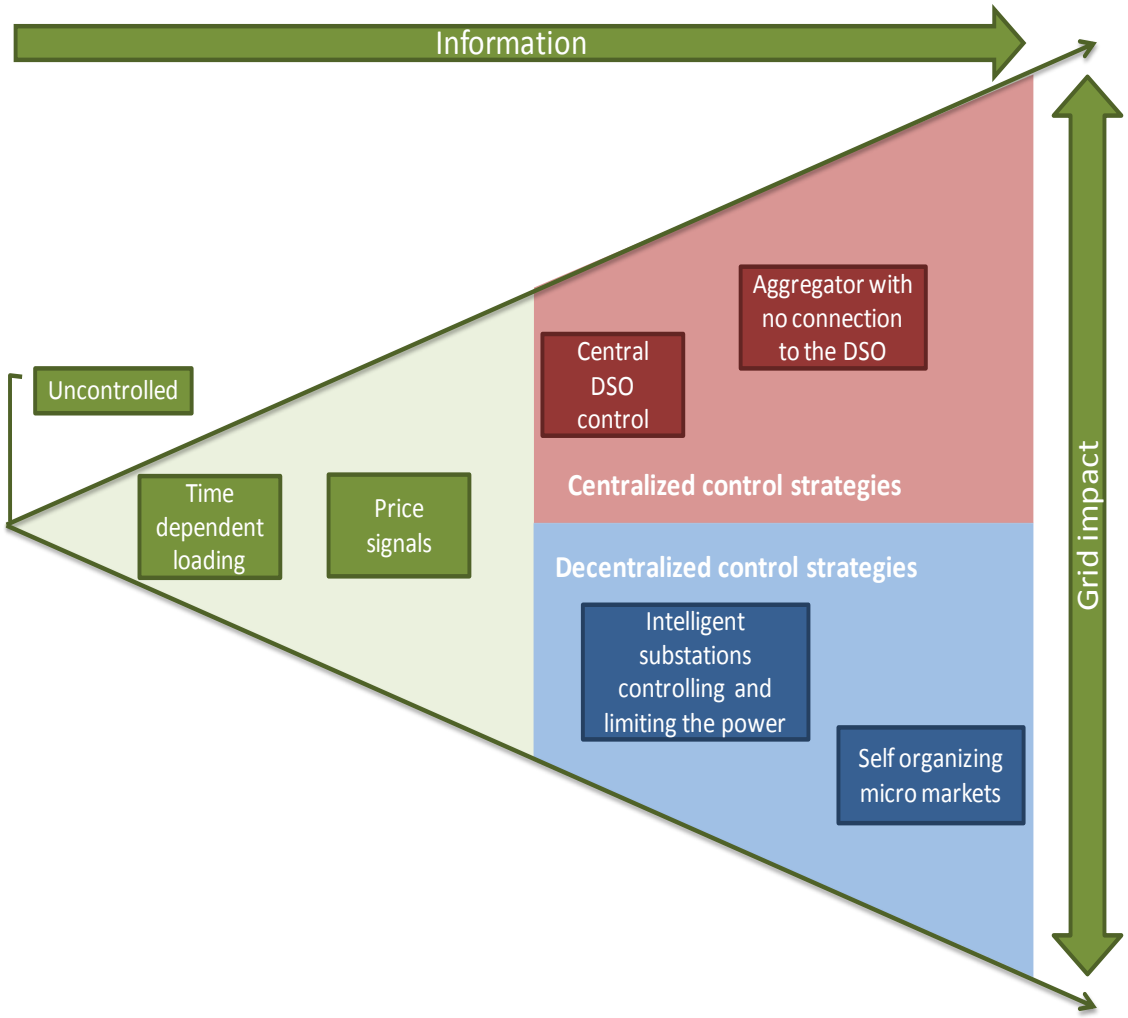
Main differences:

- regulatory framework
- charging control strategies
- grid infrastructure
- services

„EV – optimal“

Reasonable innovations

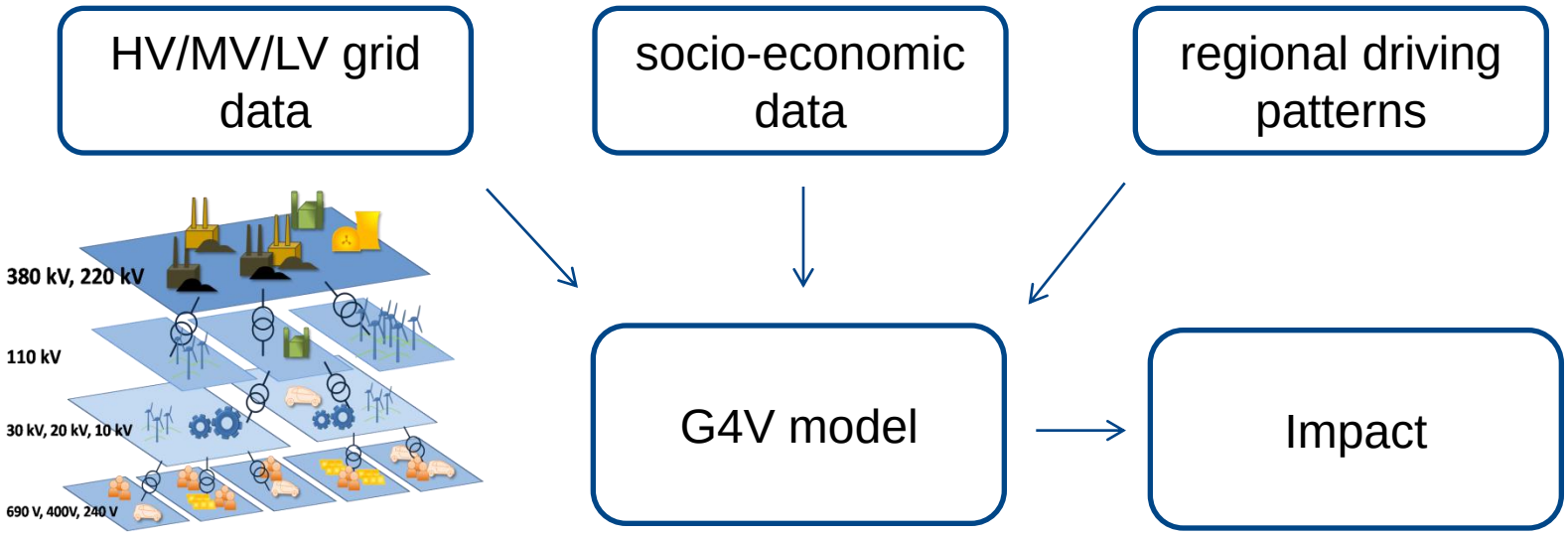
Overview about Control strategies



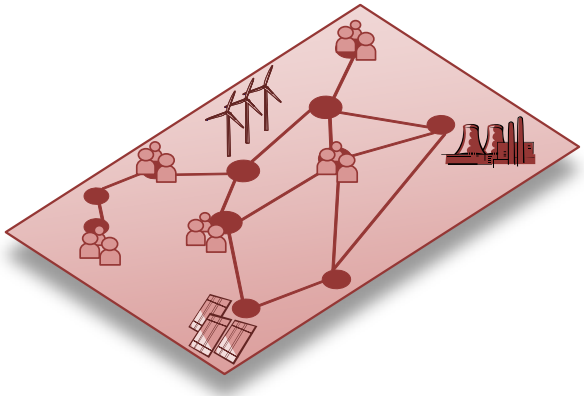
- Main objectives:
  - Integration Renewables
  - LV-grid – congestion management
  - Exploitation of EV's flexibilities

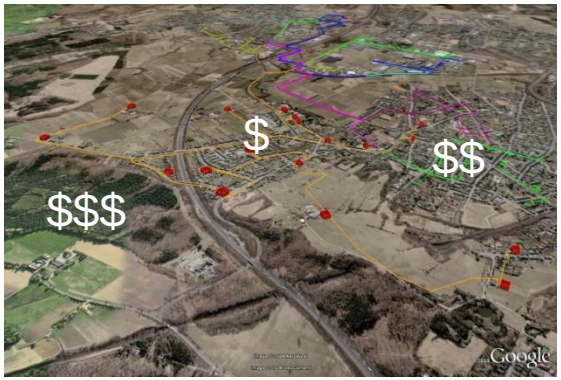
„G4V Impact Assessment Approach“

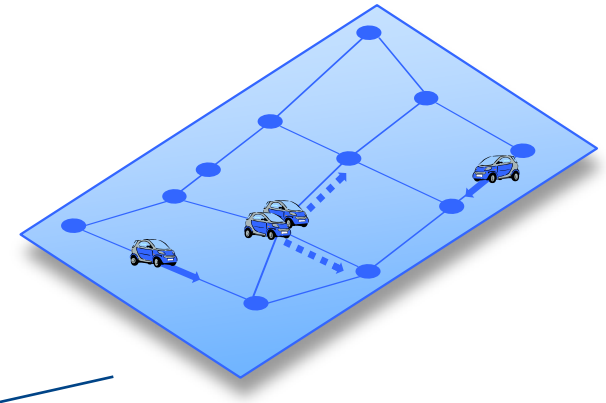
- **agent based**
- **geographically referenced**
- **high time resolution (15min)**
- **long duration (2010-2030+)**

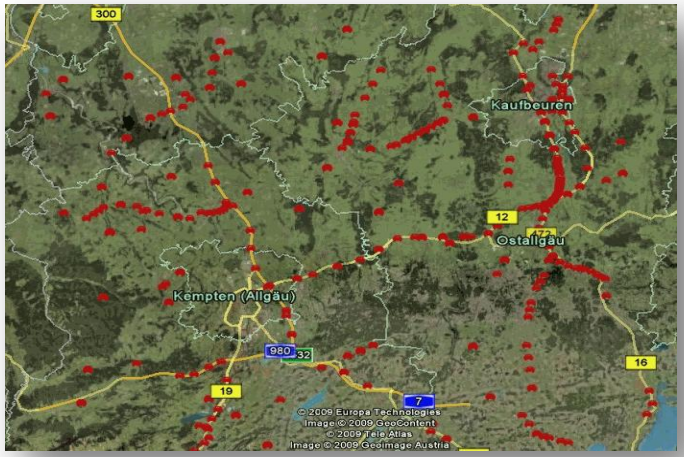


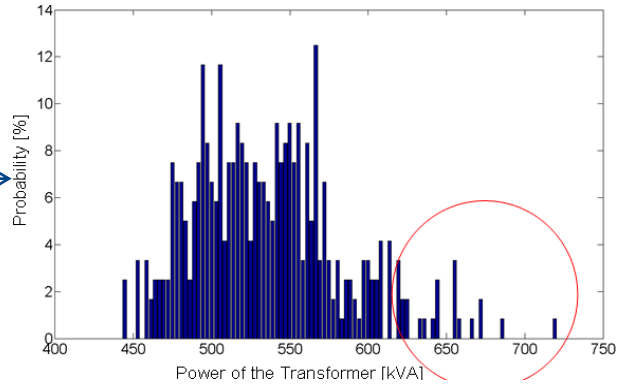
„G4V Impact Assessment Approach“

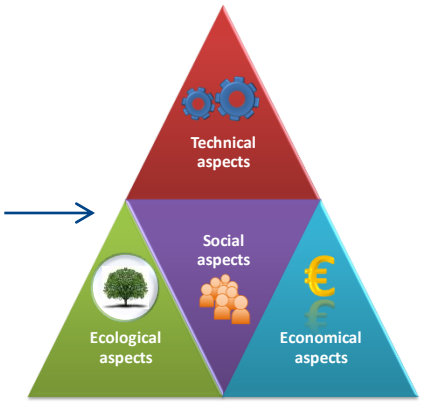








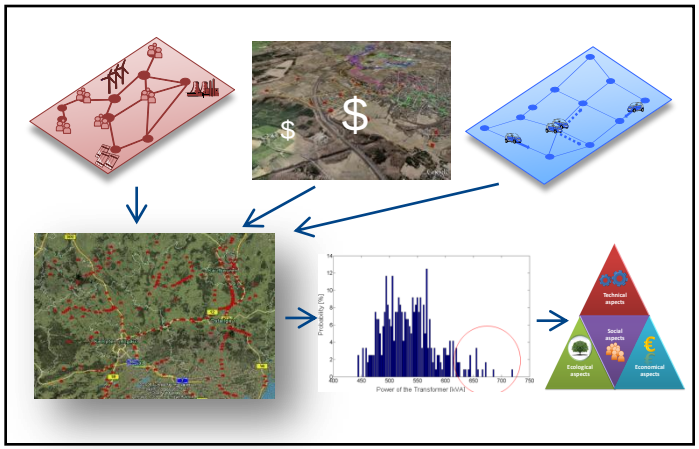




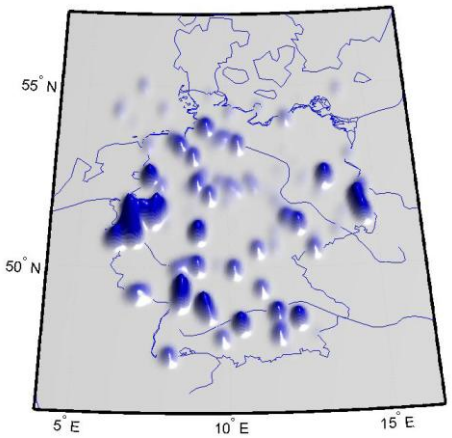
„EU-27 Impact Assessment“

North,South,
Central Europe

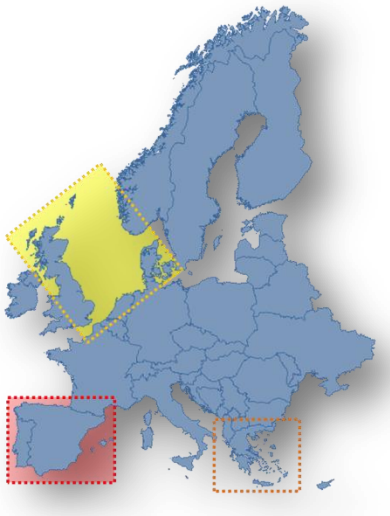
Urban, Rural,
Suburban



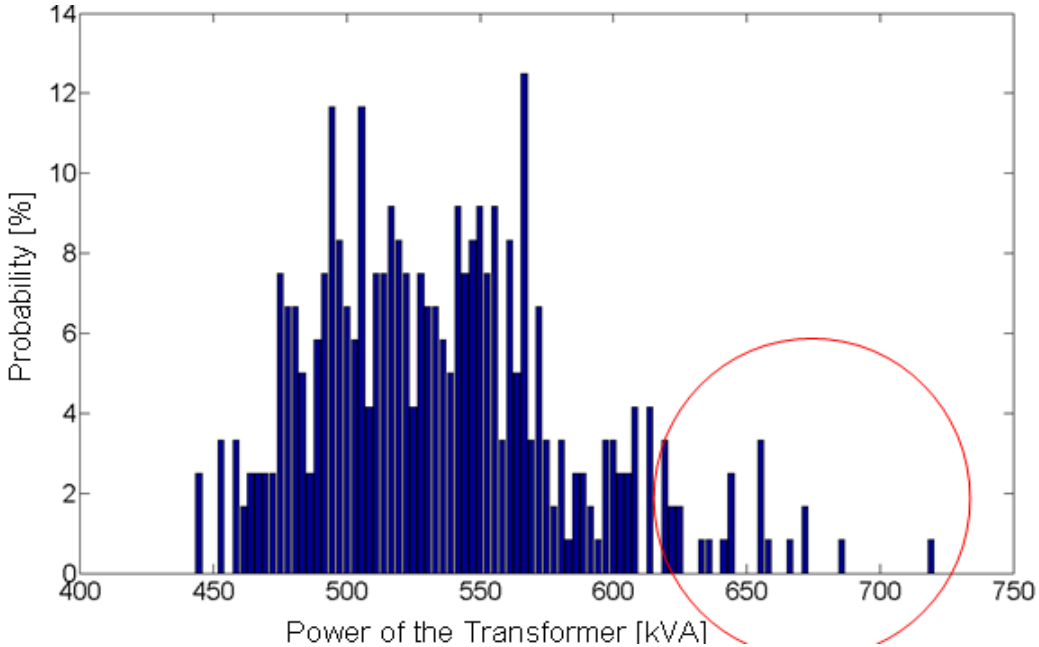
Extrapolation of
local results to
national level



Extrapolation to
EU-27 impacts



Exemplary results - Probabilistic load flow



Specs:

- suburban grid: 630kVA transformer
- 250 households
- Energy consumption 2000-4000kWh/a
- Radial distribution grid
- Battery capacity 35 kWh
- Penetration rate: 12,5%

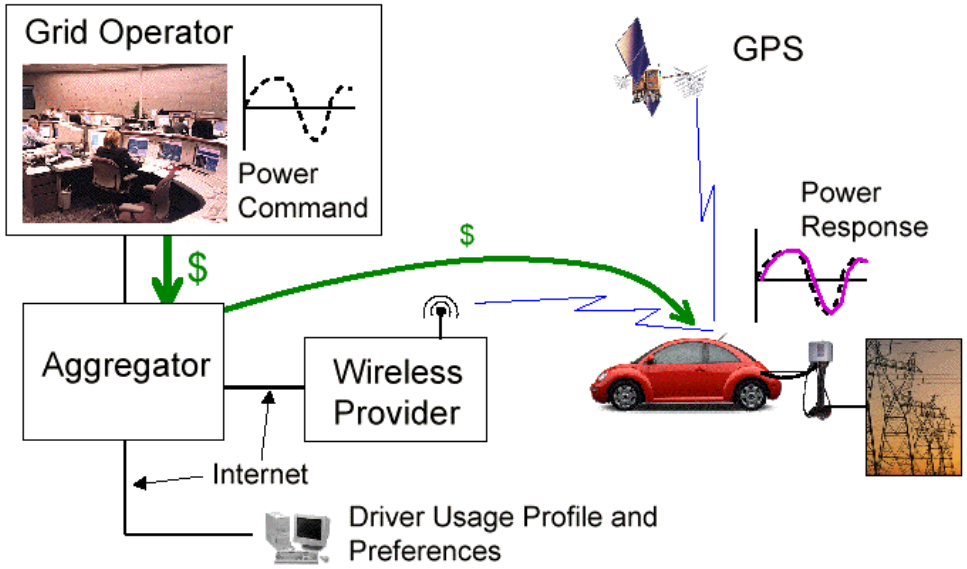
- only a few transformer overloads
- ➢ Necessary to include a safety margin (probability of occurrence) into grid assessment

V2G for Aggregation

V2G → **using „plug-in“-capable electric vehicles as a massively distributed storage for grid services such as balancing power**

Aggregation

- technical requirements (ICT, Charger, …)
- load flow calculations and impact on grid-levels (LV, MV, HV)
  → interdependencies!
- business case (reserve power market)



Frequency control: V2G vs generators?
→ Comparison needs to be elaborated!

E-mobility and the Smart Grid – A WIN-WIN

E-mobility and the Smart Grid a WIN-WIN for

- grid-operators
- retailers
- manufacturers
- costumers
- …

Thank you!

more information?

please visit: **www.g4v.eu**

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