G4V™ Grid for Vehicles

SEVENTH FRAMEWORK PROGRAMME

Session I –
Assumptions and Basic Scenarios

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The G4V Reference Scenario: Conservative, Pragmatic and Advanced World

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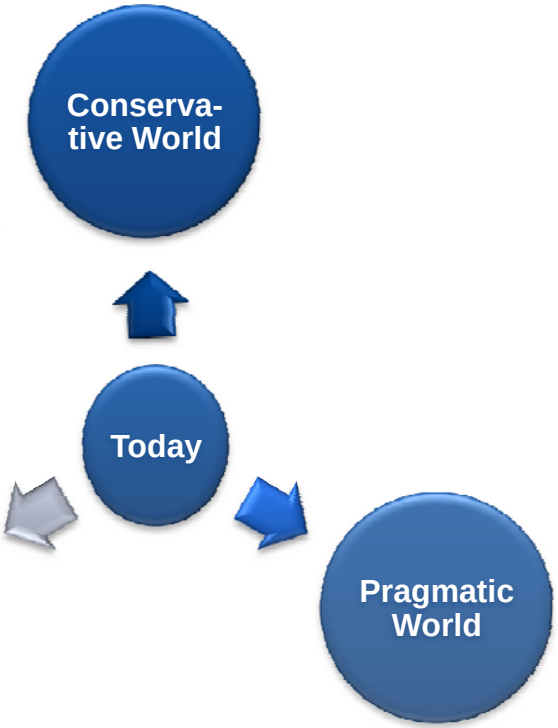
Objective

- Development of **different scenarios** for the assessment of the impacts of EV and provision of fundamentals for the whole project
- **Common understanding** of the scenarios within the project
- Mapping of future developments in the energy and automotive sector as a **framework for electric vehicles in 2030** and in mass market of electric vehicles

Methodology

- The future is uncertain → Capture all possible developments in the future
- Discussion with all partners about an approach for the development of scenarios and a common framework



→ ***Development of three independent worlds***

- EV penetration rates between 0-100% are analyzed in each world
- The scenario worlds sets **the framework for the simulations within the G4V** project
- All relevant conditions for setting a framework have to be defined in the scenarios worlds

Main differences between the scenario worlds

	Conservative World	Pragmatic World	Advanced World
Charging control	No	Yes, simple charging control	Yes, complex charging control
Prices	As today	Dynamic tariffs	No limitation
Regulation	Conservative	Some liberalization	Optimal situation for EVs
Services	Unidirectional, no services	Unidirectional, all services can be provided	Bidirectional, all services can be provided
Grid infrastructure	Conventional development	Smart grids	Advanced smart grids, virtual power plant etc.
ICT	As today	Innovative	Advanced
Stakeholders	Traditional stakeholders	Traditional stakeholders with new roles	New stakeholders

The conservative world

Conditions as today

Idea of the conservative world

- Business as usual approach
- Impact of EVs in the near future
- Reference scenario for the other worlds

Description of the conservative world

- No major changes in the energy system or regulatory framework
- Conservative development as today

Possible interpretation of results in other WPs

- Impact of an integration of EVs on a grid situation similar to todays condition

The pragmatic world

Reasonable changes and adaptions

Idea of the pragmatic world

- A likely world in the near future with reasonable changes and adaptions
- Assessment of the possible impact of some changes in the energy system

Description of the pragmatic world

- Some changes in the regulatory framework
- Unidirectional V2G services can be provided
- New business models and grid concepts such as smart grids
- Not every innovation is integrated into the grids.

Possible interpretation of results in other WPs

- Impact of an integration of EVs in the next 10 years
- Answers the questions what can be achieved with few system changes in the near future

The advanced world

A world with all possibilities

Idea of the advanced world

- A world in the distant future including all energy systems innovations
- The possibility to show the full potential of EV in the grids

Description of the advanced world

- All useful innovations are integrated in the electricity systems
- Bidirectional Vehicle2Grid services are possible
- Major changes in the regulatory framework
- Advanced smart grids

Possible interpretation of results in other WPs

- Maximum integration possibility of EVs into the grids
- Analysis of the technical potential of EVs

Overview about the worlds and varied parameters

	Conservative World	Pragmatic World	Advanced World
Charging control	**No**	**Yes, simple charging control**	**Yes, complex charging control**
Prices	As today	Dynamic tariffs	No limitation
Regulation	Conservative	Some liberalization	Optimal situation for EVs
Services	**Unidirectional, no services**	**Unidirectional, all V2G services can be provided**	**Bidirectional, all V2G services**
Grid infrastructure	Conventional development	Smart grids	Advanced smart grids
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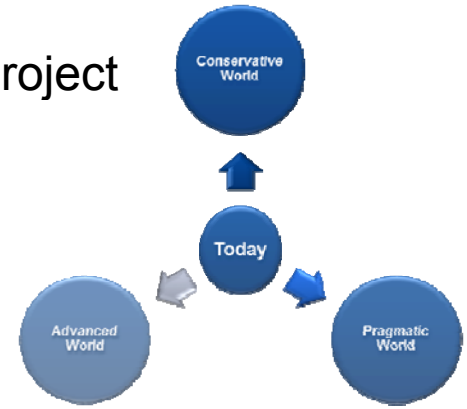
- The following important, technical parameters concerning the EV will be varied in each worlds independently
  - Penetration rate
  - Charging places
  - Charging power

Conclusions

- **A new approach** for defining scenarios have been chosen.

- **3 scenario worlds** have been developed to assess the project results in different future frameworks for EVs.
  - Conservative world
  - Pragmatic world
  - Advanced world



- Crucial parameters will be altered and compared in every world
- Every investigation in the G4V project takes the scenario worlds into account
- The results differ in every world and allow to assess the impact of EVs for different framework developments in the future

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Thank you for your attention!

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Key Parameters For Modelling EV Integration Into Electricity Networks

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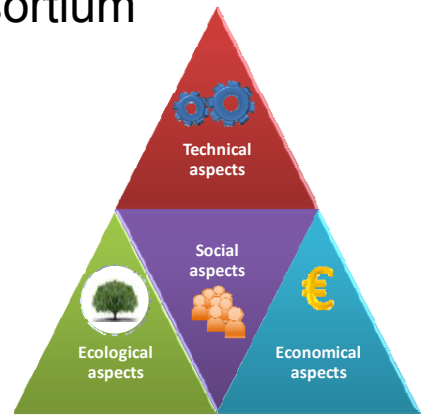
Objective

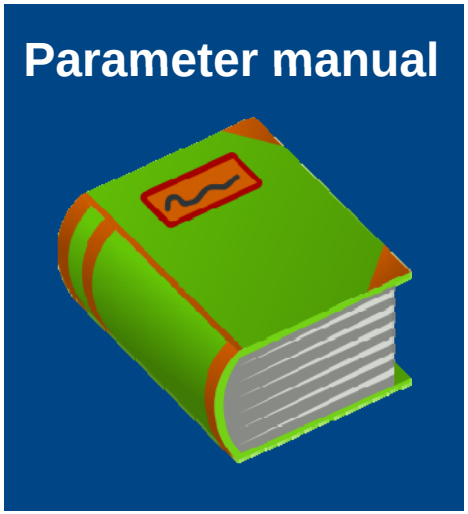
- Challenge to identify the **relevant influencing parameters** of EVs for G4V
- Creation of a **common knowledge basis** for the consortium
- Collection of all relevant parameters concerning EV
  - Technical
  - Economic
  - Ecological
  - Social



- Provision of the **main input data** for the other partners
- Definition of **parameter ranges** as a basis for the modeling within the project
- Development of **evaluation criteria** have to be able to measure and to compare all relevant aspects in every developed scenario

Methodology

- Collection of all relevant influencing parameters with help of the whole consortium
- Discussions about the relevance and ranges of the found parameters due to the high uncertainties
- SAB provided input regarding the parameters and especially the parameter ranges



- The parameter manual includes all relevant parameters concerning EVs
  - 67 parameters on 138 pages, 5th version available

  ➔ **common knowledge basis!**
- Fundamental document for every work packages containing the **key parameters and parameter ranges** for the calculations
- The first document uniting all aspects of electric vehicles!
- High influence on the G4V results

Parameter manual
Structure of each parameter

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Consumption

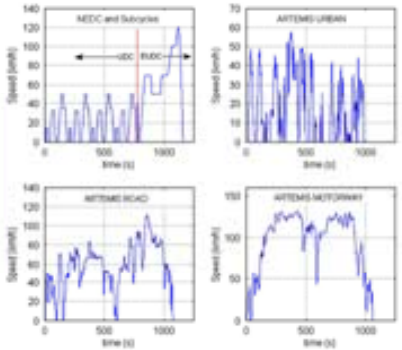
Level:	All	Category:	-	Topic:	Vehicles

Short description

The consumption describes what amount of energy an EV needs to drive 1 km in the electrical mode (in case of a PHEV).

The consumption normally is measured on a defined simulative driving cycle so that the real consumption is probably higher because of the use of the heating, cooling or media.

Status: Finished



Parameter range

BEV	0,13 – 0,25 kWh/km
City_BEV	0,12 – 0,16 kWh/km
PHEV	0,15 – 0,25 kWh/km

Development unknown.

Time frame

2010 2020 2030

Geographic restrictions

None

Additional data files None

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Overview about the parameter manual

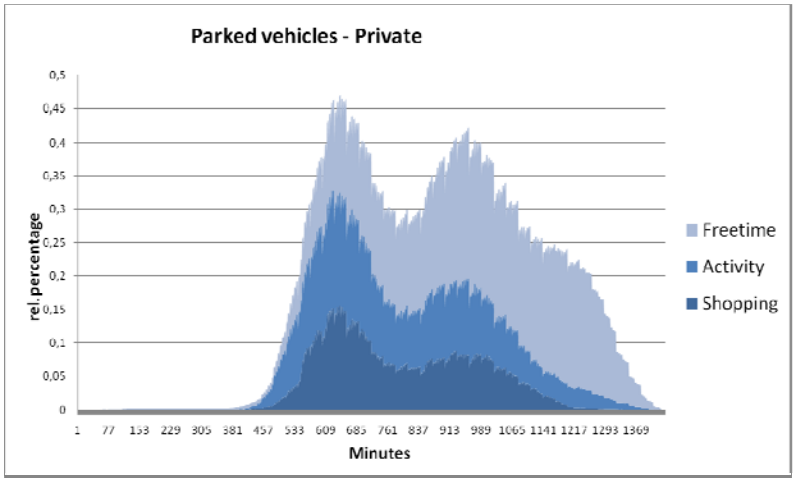
Chapters	Examples	Parameters
Vehicle level	Electric vehicles	- Consumption - Kinds of EVs
	Batteries	- Capacity - Battery lifetime
	Charging process	- Charging stations - Connection power - Charging places
Electricity Level	Grids	– Area of supply – Customer load curves
	Smart Meter and ICT	– Stages of smart metering – ICT connections
	Demand response	– Penetrations rates of DSM – Price responsiveness
Customer behavior	Driving pattern	– Trips per day – Traffic volume – Willingness to plug in
Customer information	Customer expectations	– Expectations – Doubts

Key parameters for the modeling
Driving data

- Complex information based on the driving data is available (MID 08)
- Driving ranges and parking times
- Real driving pattern for single EVs available for different countries

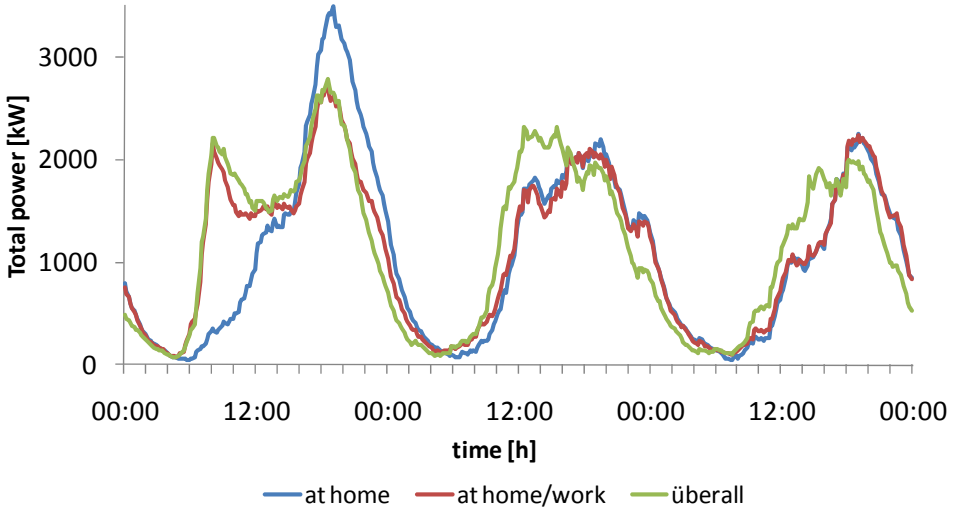
➔ The driving data is a main input for the simulations

➔ Demand of EVs based on driving data can be calculated with Matlab models



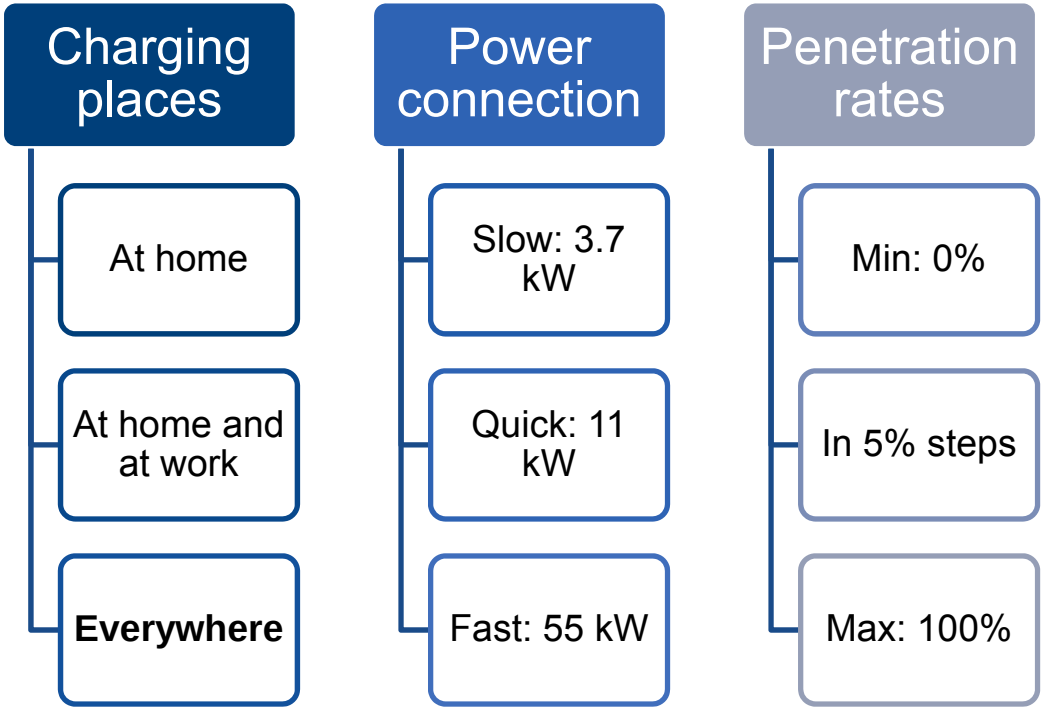
Input data

Vehicle type	SBEV	BEV	PHEV
Capacity (kWh)	16	35	18
Consumption (kWh/km)	0,12	0,2	0,2
Charging power (kW)	3,7kW	3,7kW	3,7kW
Number of vehicles	100k	50k	50k



Key parameters for the modeling

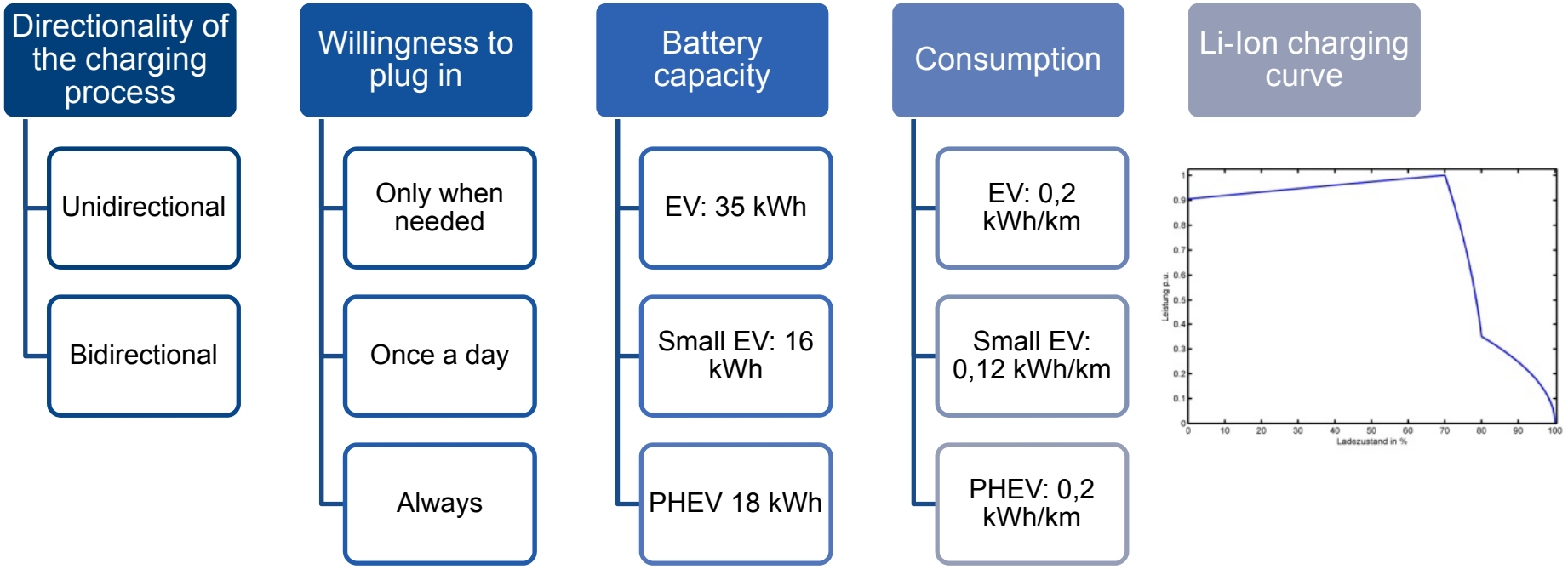
Important parameter variations



- These parameters are varied within their characteristic in every scenario world
- Every combination – in total 189 - is simulated and analyzed within the grid analysis of the project

Key parameters for the modeling
Fixed parameters

- Basic parameters that are fixed in the scenarios used in the simulations

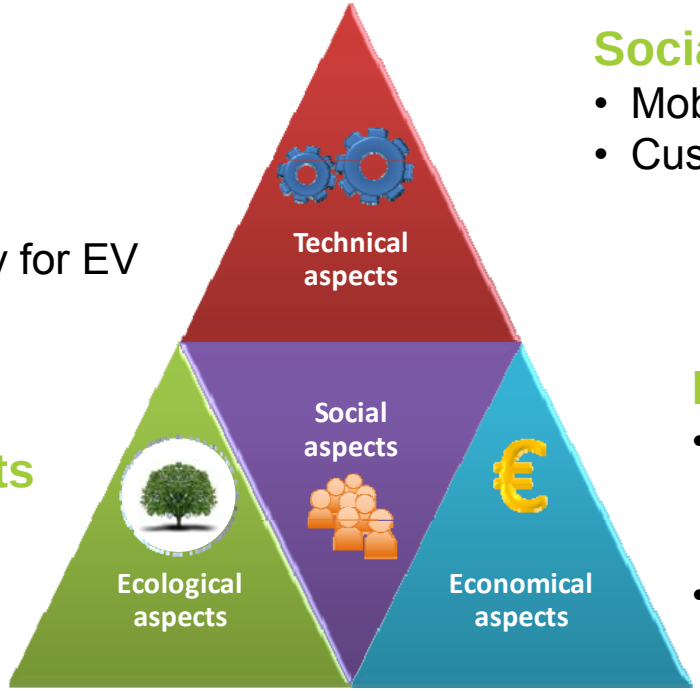


- Less important parameters are not varied in the simulations but are fix for every scenario
- More important parameters regarding the framework are varied within the scenario worlds

Assessment of the impacts of EV according the evaluation criteria

- The assessment of the impacts of EVs should apply a system-perspective contain technical, economic, ecological and social evaluation criteria.
- All evaluation within the project take the following aspects into account.

Technical aspects
- Load infrastructure
- Grid structure
- ICT structure
- Integration possibility for EV



Social aspects
- Mobility
- Customer satisfaction

Ecological aspects
- Global Warming Potential (CO_2)

Economic aspects
- Costs
  - OPEX (operational expenditure)
  - CAPEX (capital expenditure)
- Business models

Summary

- First collection of all relevant influencing parameters of EV in electricity networks in one document - **the parameter manual**
  - The manual can be used in other projects as a source for basic information like an reference book!
- All relevant **key parameters for modeling** the EV integration in the project are described in the manual
- **Parameter ranges** for these parameters are defined taking into account the high uncertainties for some of the parameters
  - The key parameters with a high influence will be varied in every scenario
  - Less important parameters are fixed either in the scenario worlds or for the whole project
- **Evaluation criteria** to assess the impacts of EVs have been developed regarding technical, economic, ecological and social aspects
- **A common basis** for a structured approach of the G4V project is given

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Questions and answers

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