



ICT for Electric Mobility

**Kristin Petersen, B.A.U.M. Consult,
Ancillary Research**



Overview

- ▶ ICT for Electric Mobility
- ▶ Seven Pilot Projects
- ▶ User Acceptance of V2G-Concept
- ▶ Results Pilot Projects – Focus V2G-Concepts and User Acceptance
- ▶ ICT for Electric Mobility II



A new world of energies and mobility



www.ikt-em.de/en

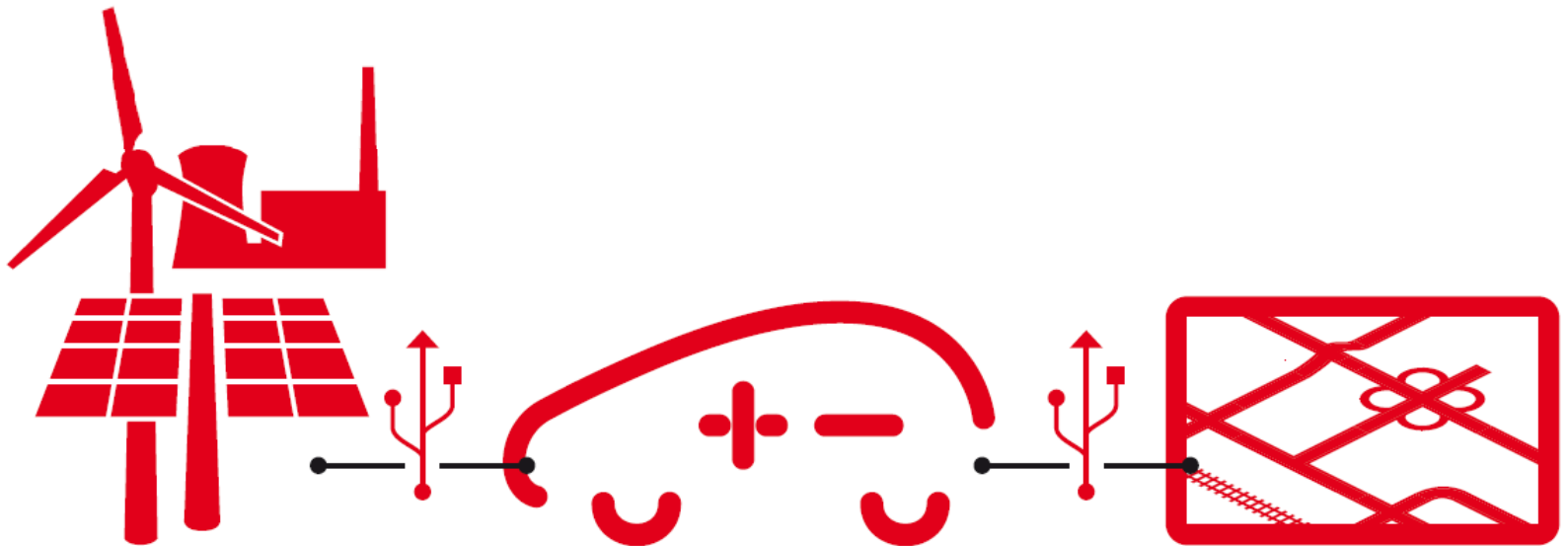


Electric Mobility: a Holistic Approach

Smart Grid

Smart Car

Smart Traffic



ICT are key for the success

eTelligence

REG MOD HARZ
Regenerative Modellregion Harz

E DeMa

Smart @ Watts

moma

MeRegio

Grid Surfer



HARZ.EE-MOBILITY

IKT

INTEGRATION DER ELEKTROMOBILITÄT
IN DIE NETZSYSTEME DER ZUKUNFT

Smart @ Wheels

FUTURE FLEET

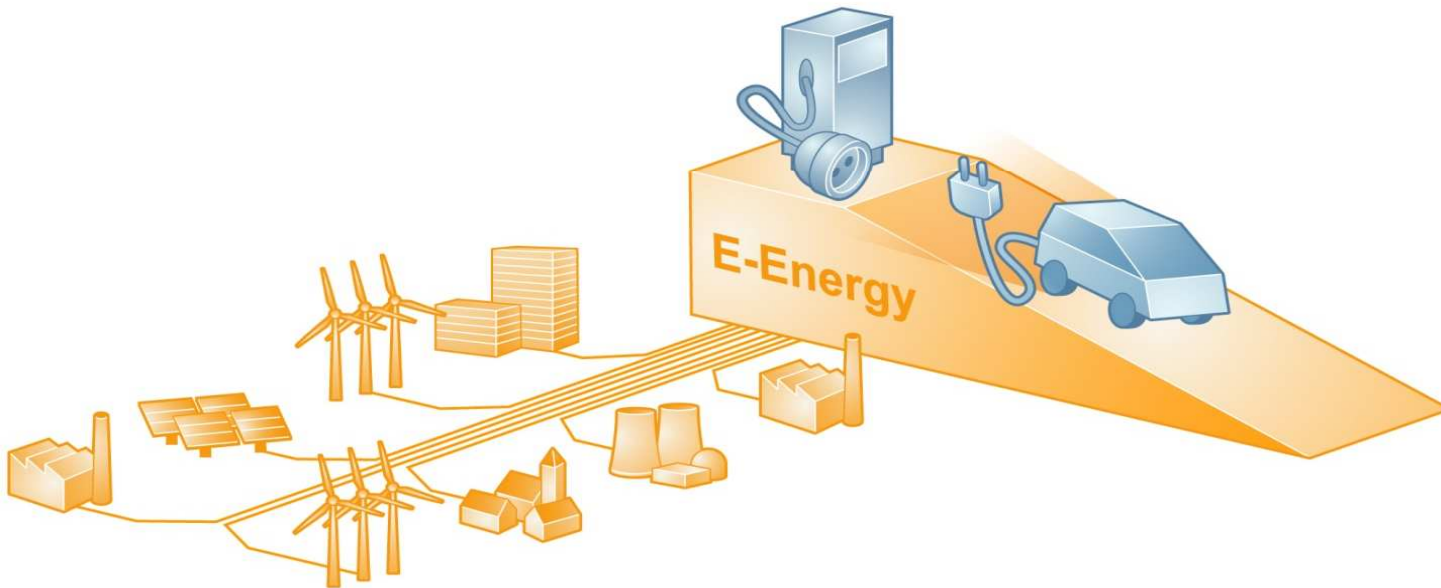
MeRegio
Mobil

e-E-Tour ALLGÄU
effiziente Elektromobilität & Tourismus



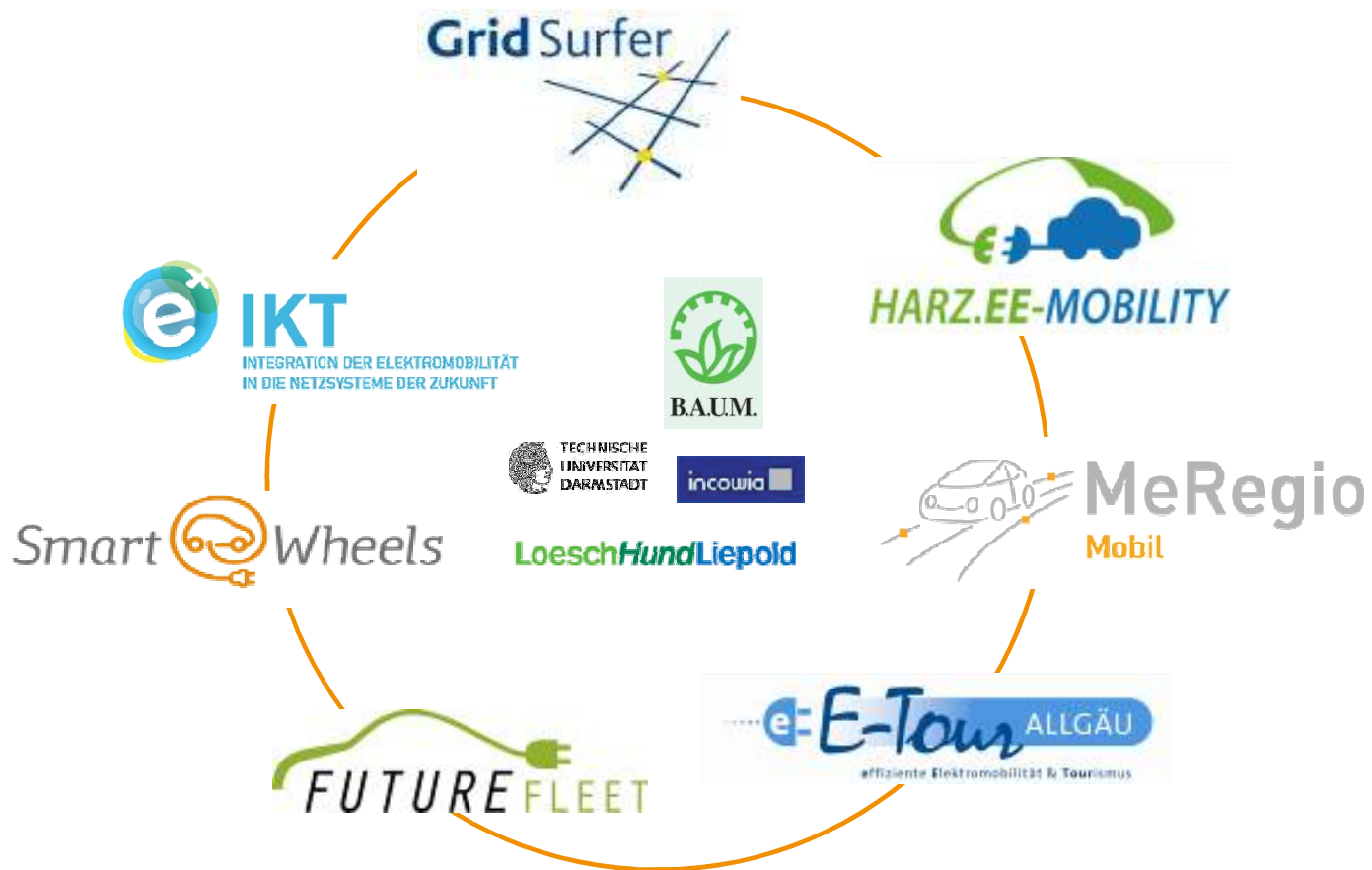


E-Energy and ICT für Electric Mobility





7 Pilot Projects plus Ancillary Research





Know-how Transfer, Networking, Public Relation



Lebenswelt Elektromobilität

Kongress für Fahrzeug, Energie, Mobilität und
Informations- und Kommunikationstechnologien

9. - 10. September 2011





Results: Charge Where You Want: Authentication

DE – AAA – 123456 - P
country provider customer check

- ✓ tested in projects (RFID-cards, charge-plug, mobile phone)
- ✓ proposed as **DINSPEC 91286**
- ✓ German proposal for work group **ISO/IEC JWG1 V2G CI**



eE-Tour Allgäu

Blazing trails with electric power

- ▶ Consortium leader: Allgäuer Überlandwerk
- ▶ Partners: Hochschule Kempten, John Deere, MoveAbout, Soloplan, ENERGY4U, TU München, Universität Tübingen
- ▶ www.ee-tour.de





e-mobility

ICT-based integration of electric mobility into the networks of the future

- ▶ Consortium leader: RWE
- ▶ Partners: Ewald & Günther Unternehmensberatung, SAP, TU Dortmund, TU Berlin
- ▶ www.e-ikt.de



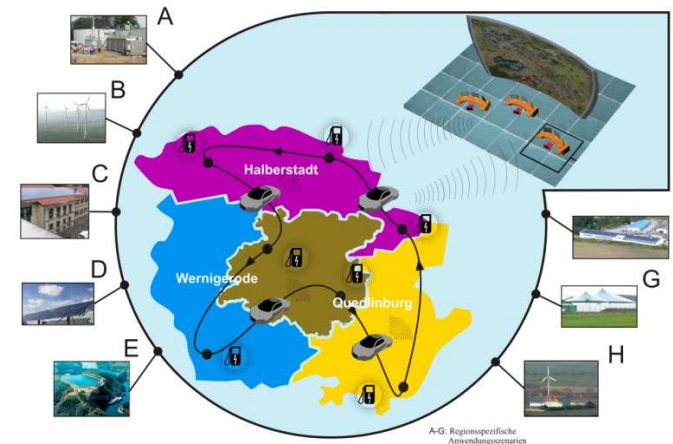


Harz.EE-Mobility

Harnessing the wind and the sun to make people mobile
Electric cars as rolling energy storage units



- ▶ Consortium leader : Otto-von-Guericke-Universität Magdeburg
- ▶ Partners: DB Rent GmbH, E.ON Avacon AG, Fraunhofer IFF und IWES, Halberstadtwerke GmbH, Hochschule Harz, in.power GmbH, Krebs & Aulich GmbH, Regenerativ Kraftwerk Harz GmbH & Co. KG, Siemens AG, Stadtwerke Blankenburg
- ▶ www.harzee-mobility.de





MeRegioMobil

MeRegioMobil - When washing machines talk to cars

Electric vehicles as mobile energy storage units in smart home energy management systems



- ▶ Consortium leader : EnBW
- ▶ Partners : Fraunhofer-Institut für System- und Innovationsforschung, Karlsruher Institut für Technologie (KIT), Adam Opel GmbH, Daimler, SAP, Robert Bosch, Stadtwerke Karlsruhe
- ▶ <http://meregionobil.forschung.kit.edu>





Grid Surfer

Taking electric mobility into the countryside

Integrating electric vehicles in rural energy systems - battery change included

- ▶ Consortium leader : EWE AG
- ▶ Partners : E3/DC GmbH, Next Energy - EWE-Forschungszentrum für Energietechnologie e.V., OFFIS
- ▶ www.ewe.de/ewe-macht-zukunft/grid_surfer.php





Future Fleet

Green energy for company cars Integrating electric vehicles into company car fleets

- ▶ Consortium leader: SAP
- ▶ Partners : MVV Energie, Öko-Institut, Institut für sozial-ökologische Forschung (ISOE), Hochschule Mannheim
- ▶ www.futurefleet.de





Smart Wheels

Smart electric mobility in the model region of Aachen

- ▶ Consortium leader: FEV Motorentechnik
- ▶ Partners : Forschungsinstitut für Rationalisierung (FIR), STAWAG Stadtwerke Aachen, MENNEKES Elektrotechnik, RWTH Aachen, regio iT Aachen
- ▶ www.smartwheels.de

Smart  Wheels





Main Issues

- ▶ V2G-Concepts
- ▶ Navigation and driver assistance
- ▶ Billing and Roaming
- ▶ Fleet management
- ▶ Mobility Services
- ▶ Business Models



V2G-Concepts

- ▶ 24 hours





V2G-Concepts – Prospective User Groups

- ▶ Fleet transport



- ▶ Individual transport

- ▶ Intermodal transport



V2G-Concepts - User Acceptance?

- ▶ Benefit User?
- ▶ Battery Performance?
- ▶ Usability?
- ▶ Incentives?

- ▶ Benefit electricity distributor?
- ▶ Business Models?



Key Factors – User Acceptance for V2G-Concepts

- ▶ User profiles
- ▶ User benefit
- ▶ Vehicles' parking time
- ▶ Grid Connection Point
- ▶ Ownership structure
- ▶ Costs
- ▶ Incentives and business models



Ownership Structure of Vehicle

	Vehicle Purchase	Vehicle Leasing	Battery Leasing	Car Sharing	Energy km
Acquisition Costs	-	+	0	++	0
Costs of Ownership <u>Dependent</u> on Usage	0	0	0	-	+
Costs of Ownership <u>Independent</u> of Usage	+	-	-	++	0
Complexity of Contractual Relation Resulting From Vehicle Purchase	+	0	-	+	-
Individual Freedom of Mobility	++	+	+	-	0
Bearer of Battery Failure Risk	Manufact. Customer	Leasing Provider	Leasing Provider	Supplier	Supplier



Parking Time / Availability for V2G-Concepts?

		Parking Time/ Year	ParkingTime / Week	Parking Time / Day
Individual Transport	Second Car	/	Infrequent, Irregular Drives	At night, otherwise infrequent, irregular drives
	Family Car	/	Rather regular distribution over the week	At mornings and at night
	Commuter	Vacation Time	At working during week days, at home during weekends	At home in the evening, at work during day time



Parking Time / Availability for V2G-Concepts?

		Parking Time/ Year	ParkingTime / Week	Parking Time / Day
Fleet Transport	Delivery Service	Holiday	Weekends	Ca. 6 a.m. – 4 p.m.
	Company Fleets	Public Holidays	Weekends	Ca. 8 a.m. – 6. p.m.
	Passenger Transport	/	/	Ca. 1 a.m. – 7 a.m.
Intermodal Transport	Flexible Carsharing	/	/	Ca. 1 a.m. – 7 a.m.
	„Traditional“ Carsharing	/	55 % during the week, 40 % during the weekends	Ca. 10 p.m. – 12 a.m.



EV: master piece of the Smart Home



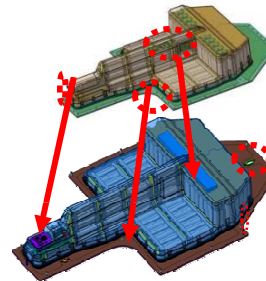
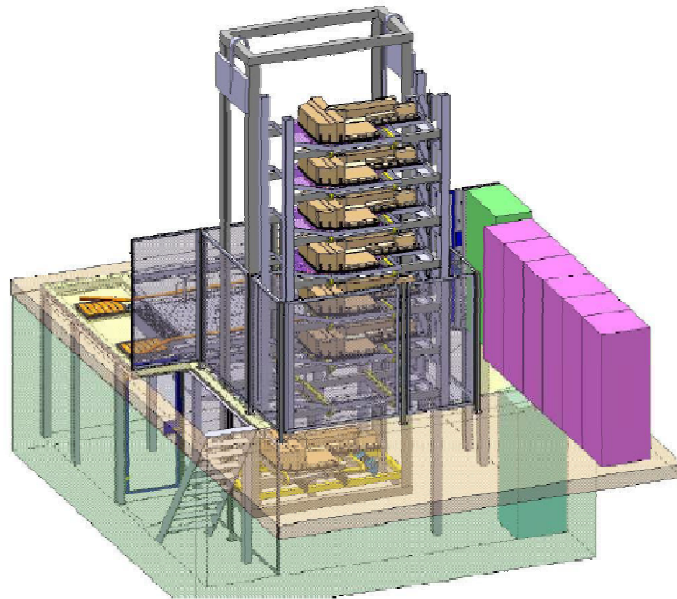
- load management
 - grid to vehicle
 - vehicle to grid
- new business models:
 - multiple use of batteries
 - combination of electric cars and renewable energies



Photos: MeRegioMobil 2011



Charging or Swapping?



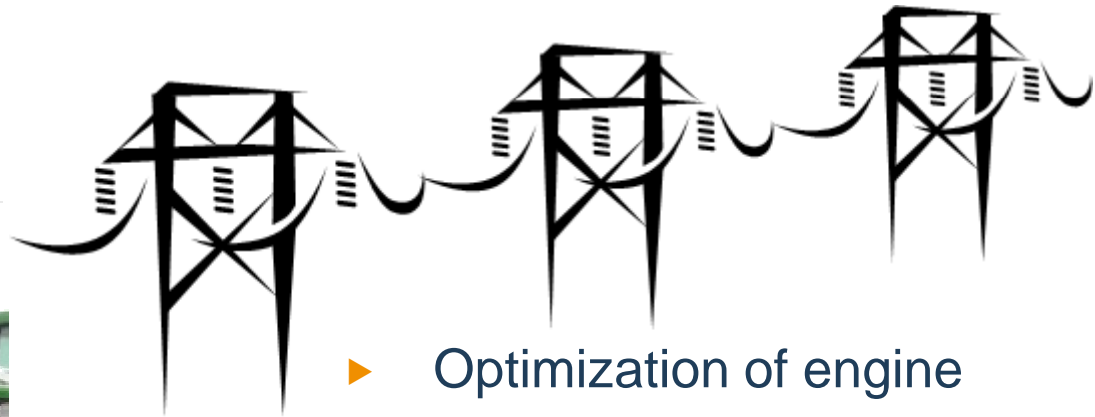
- ▶ NEXT|ENERGY:
Battery Swap Station



Graphics: NEXT ENERGY 2011



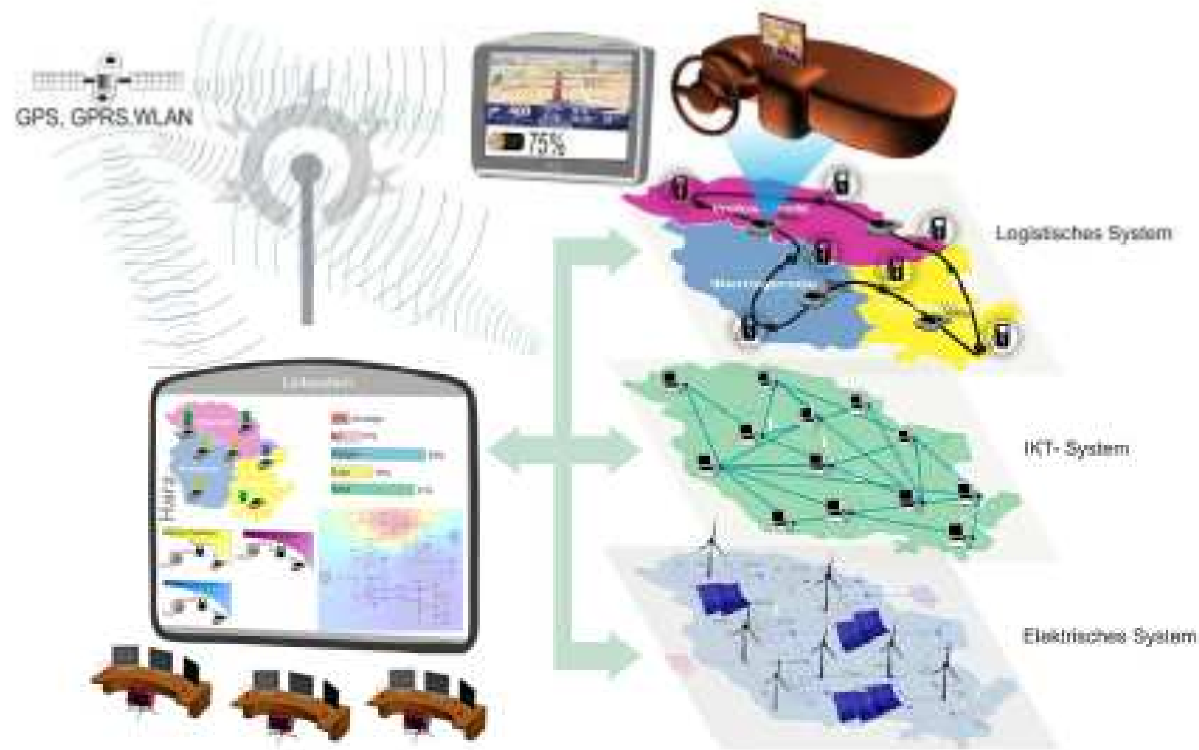
Energy Control Centre



- ▶ Optimization of engine
- ▶ Demand side management
- ▶ Feed-in into the grid as required
 - ▶ from vegetable-oil engines
 - ▶ from batteries



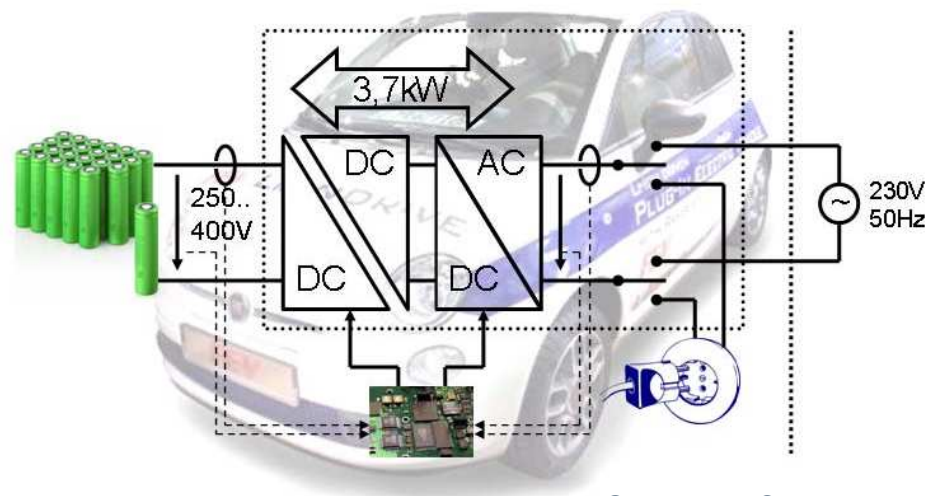
Monitoring / Grid Simulator



Graphics: Harz.EE-mobility 2011



Bi-Directional Charger for Electric Vehicles



Graphics: ISEA 2011




Further Results and Perceptions

E.g.:

- ▶ Monitoring tool for local network stations
- ▶ Surveys on
 - ▶ Acceptance
 - ▶ User Profiles
 - ▶ Fleet Management
 - ▶ Potential estimation for bi-directional Charging



Transition Projects (running)

- ▶  **IRENE**
Integration regenerativer Energien und Elektromobilität Integration of renewable Energy and Electric Mobility
- ▶ ZALM sms&charge



More to Come: ICT-EM II - 01.01.2012

- ▶ eConnect Germany  **econnect**
Germany
- ▶ iZEUS intelligent Zero Emission Urban System
- ▶ SecMobil Secure eMobility
- ▶ O(SC)²ar Open Service Cloud for the Smart Car
- ▶ RACE Robust & reliant Automotive Computing Environment for future eCars



www.ikt-em.de/en
ikt-em@baumgroup.de

