

E-Energy – the future energy internet

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E-Energy: Meeting the Challenges



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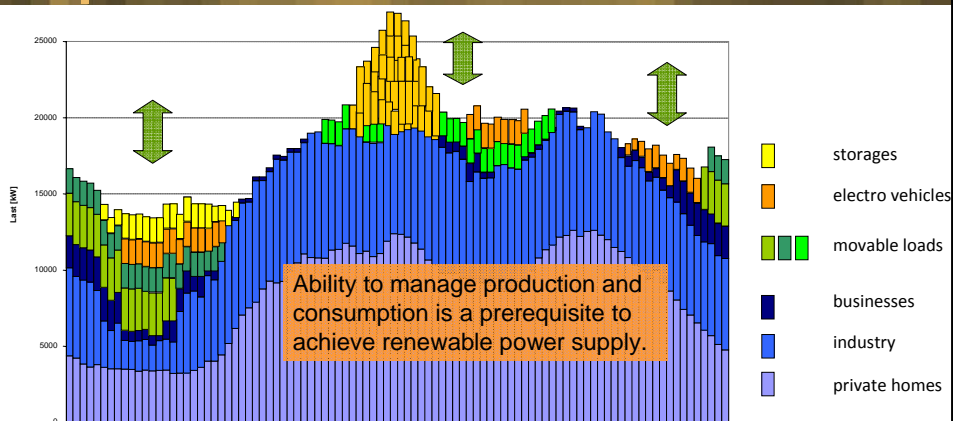
A new paradigm

consumption-oriented generation
plus
generation-oriented consumption

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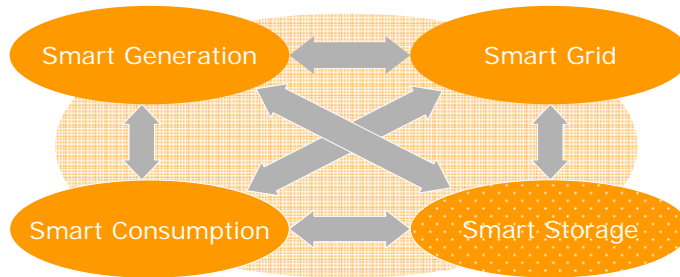
Flexible Production and Consumption



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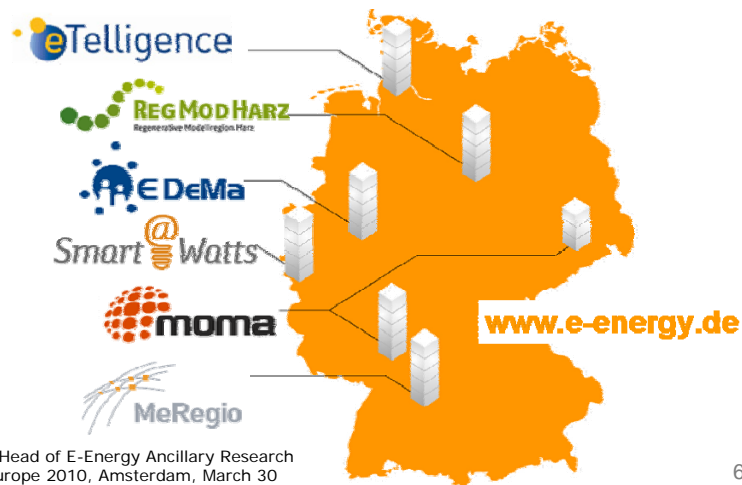
Linking all Components of a Smart Power System



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E-Energy: Germany's way to an Internet of Energy

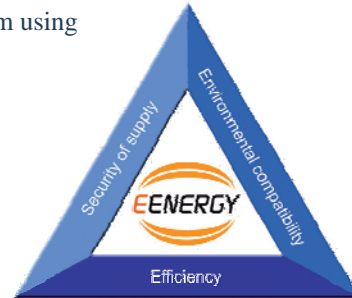


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E-Energy goals

- ▶ Security of supply, efficiency and climate protection with digital networking of power provision system
- ▶ Optimisation of the energy supply system using modern information and communication technologies (ICT)
- ▶ Sustainable, cross sectoral new fields of employment and stimulus for growth
- ▶ New market for hightech solutions
- ▶ Progress in liberalisation and decentralization



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E-Energy on a Glance

- ▶ Dr. Angela Merkel at IT-Summit: „beacon project“
- ▶ Scientific studies
- ▶ 6 pilot regions
 - ▶ 140 Mio. EUR public and private funds
 - ▶ result of technology competition
- ▶ Runtime 2008 - 2013
- ▶ Ancillary research
 - ▶ evaluation and coordination
 - ▶ task forces for cross cutting topics
 - ▶ national and international cooperation

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The Formula for the Future Energy Supply System

monitoring and control for grid operation

+ **e-trading platforms for dynamic pricing, load shaving, incorporation of virtual power plants, system services etc.**

+ **multi-agent architectures to link all technical and market elements from generation to consumption**

= Internet of Energy

Activities in Pilot Regions

▶ Developing and testing hardware and software for an

Internet of Energies

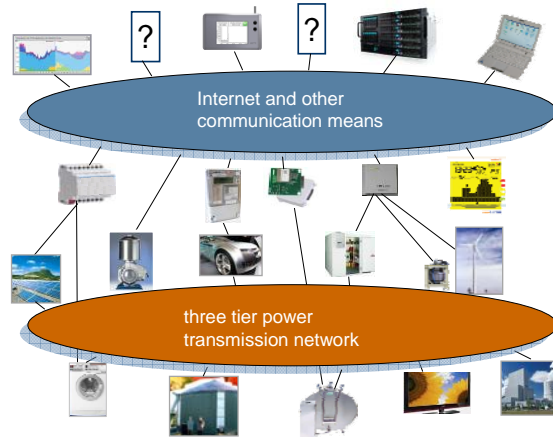
▶ Gaining knowhow on interoperability, safety and security

▶ Testing models of added value generation and business processes

▶ Analyzing market potentials and improving consumers acceptance

▶ Highlighting needs for changes in the legal framework

Copper and Silicon



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Model Region Baden

specifics:

**energy efficiency in the
integrated house incl. E-Car**

instruments:

- ▶ smart meters and StromRadar©
- ▶ price incentives at the outlet
- ▶ minimum emission certificates
- ▶ central platform to control and run the system

lead partner: EnBW Energie Baden-Württemberg AG

other partners: IBM, ABB, SAP, Systemplan, University Karlsruhe



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Model Region Rhein-Neckar

More-Itstart Mannheim

specifics:

cellular system with tariffe incentives

instruments:

- ▶ autonomous cells with agents
- ▶ „energy butlers“ to manage objects
- ▶ control devices connected via private IP-network on powerline carrier

lead partner: MVV Energie AG

other partners: IBM, Power PLUS Communications, Papendorf Software Engineering
DREWAG, University Duisburg-Essen



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Model Region Harz

specifics:

**multitude of renewable energy plants
and a hydropower storage station**

instruments:

- ▶ control system to guarantee grid stability
- ▶ Bidirectional Energy Management Interface (BEMI)
- ▶ prediction system for wind energy
- ▶ new business model: bundling distributed power generators

lead partner: RegenerativKraftwerk Harz GmbH & Co

other partners: Siemens, E.ON, in.power, ISET, Vattenfall



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Model Region Cuxhaven

specifics:

**reduction of load on distribution network
using big shiftable loads (cold stores)
as energy storage**

instruments:

- ▶ regional power portal to manage business incentives
- ▶ plug&play networking of appliances
- ▶ online visualisation with iPods

lead partner: EWE AG

other partners: OFFIS, energy & meteosystems, BTC, Fraunhofer-Verbund Energie



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Model Region Rhein-Ruhr

specifics:

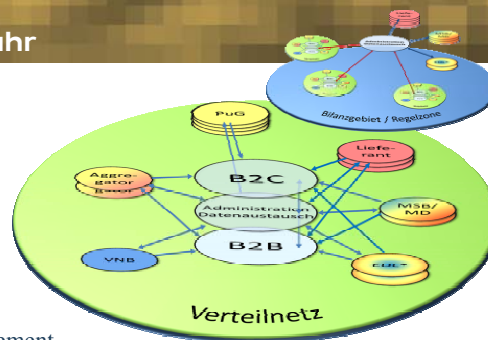
**cooperation of big supplier and
municipal utility; intelligent home
appliances; prosumer concept**

instruments:

- ▶ smart ICT gateways to move step by step towards smartgrid
- ▶ ICT for decentralized grid management in distribution networks

lead partner: RWE Energy AG

other partners: Siemens, Prosynt Software, Miele, ef.ruhr, Stadtwerke Krefeld



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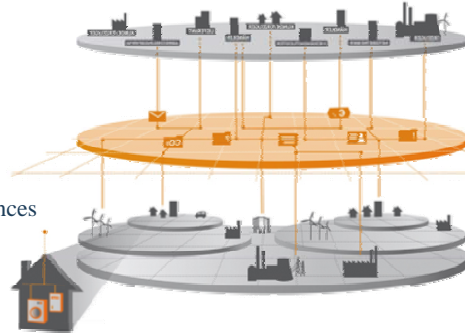
Model Region Aachen

specifics:

pricing signals, self regulating grid

instruments:

- ▶ prognosis system and optimization algorithms
- ▶ device to upgrade household appliances
- ▶ **EE BUS** to close the „last meter“



lead partner: Utilicount

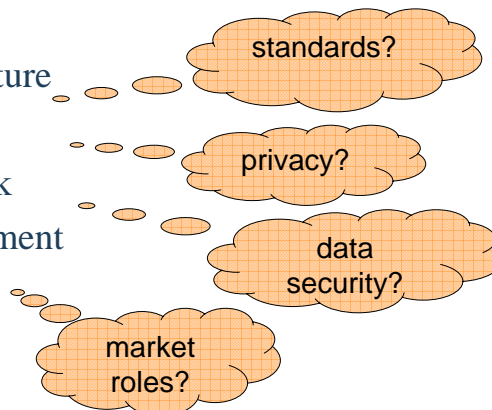
other partners: Stadtwerke Aachen, FIR at RWTH Aachen, PSI Büsing & Buchwald, Kellendonk Elektronik

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Cross Cutting Work in E-Energy Taskforces

- ▶ System Architecture
- ▶ Interoperability
- ▶ Legal Framework
- ▶ Market Development



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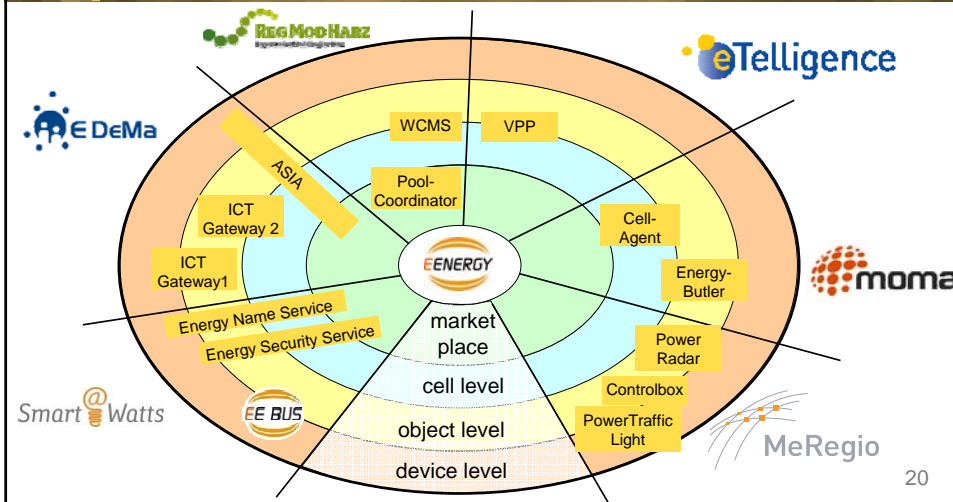
First results

- ▶ smart grids concept is much more than smart metering
- ▶ private homes react on price incentives, but quicker gains are in B2B solutions
- ▶ acceptance increases with degree of automation
- ▶ decentralised data management reduces bandwidth constraints and allows for high degree of privacy
- ▶ E-Energy market place helps to improve existing processes and to implement new business models
- ▶ intelligent integration of wind energy does not jeopardize security of supply
- ▶ load management can decrease need for grid retrofiting
- ▶ different innovation cycles of energy and ICT business must be tackled with modular systems
- ▶ aggregators are key to the involvement of distributed renewables
- ▶ legal framework (incl. feed in tariffs) should be adapted

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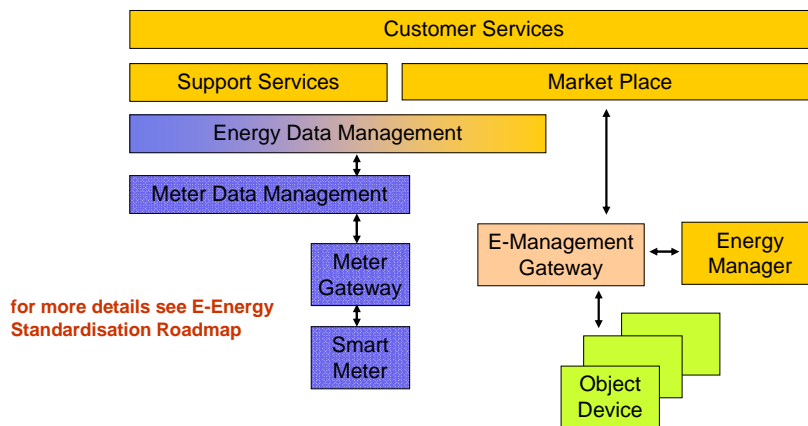
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E-Energy Layered Model



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E-Energy Architecture Building Blocks



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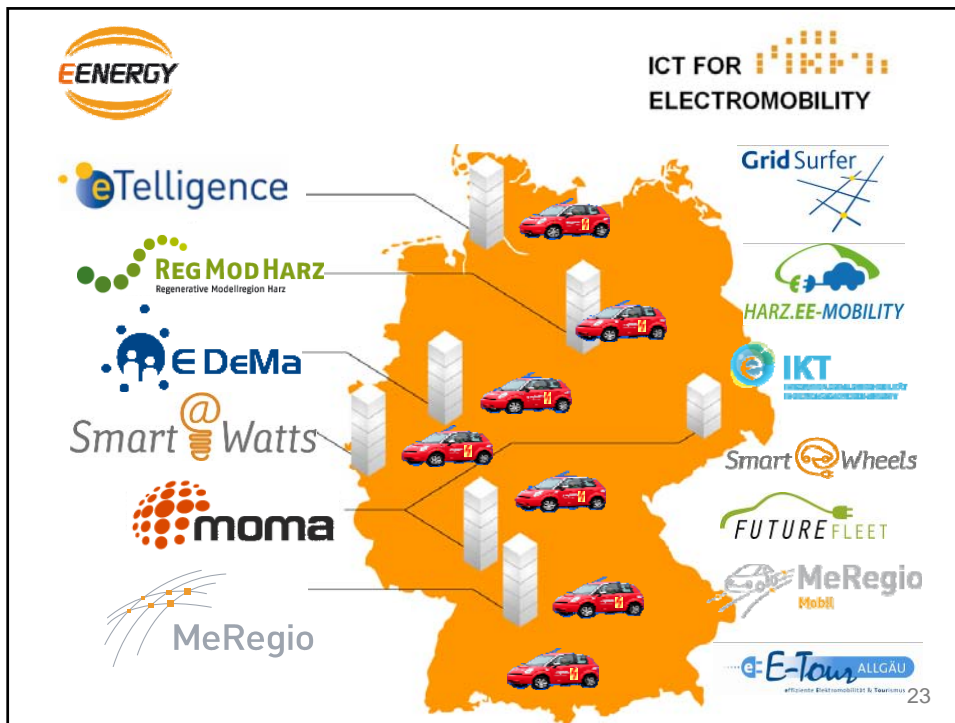
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SmartGrid Standardization Efforts


- ▶ Study: “Standards for the Electric Smart Grid: Findings for the German E-Energy program”
- ▶ E-Energy Taskforce “Interoperability”
- ▶ DKE Competence Center E-Energy
(DKE = German Commission for Electrical, Electronic & Information Technologies of DIN and VDE)
- ▶ Standardization Roadmap for E-Energy / Smart Grid Germany
- ▶ International cooperation (IEC, CIGRE, IEEE, NIST, etc.)


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 Federal Ministry of Economics and Technology

 Federal Ministry for the Environment, Nature Conservation and Nuclear Safety



on the basis of a decision by the German Bundestag

ICT FOR ELECTROMOBILITY

"ICT for Electromobility" on a Glance

- ▶ 7 pilot projects performed by more than 47 companies and scientific institutes, chosen in a competitive selection process
- ▶ runtime 2009 to 2011
- ▶ jointly funded by BMWi and BMU in the framework of a 500 Mio. EUR programme of electromobility
- ▶ Research, development and test of ICT-based technologies with focus on:
 - ▶ Grid integration of electric vehicles
 - ▶ Navigation and Advanced Driver Assistance Systems (ADAS)
 - ▶ Tariffs and accounting
 - ▶ Vehicle fleets and mobility services

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Formula for Success

$$\begin{array}{r} G2V \\ + V2G \\ \hline = V4G \end{array}$$

Requires E-Energy and smart home technologies!

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2020: Can it work?

595 TWh total consumption in D
thereof 7 % photovoltaics
/ 365 days
= ca. 100 MWh / day
/ 43 kWh (typical e-car battery)
= ca. 2,4 Mio electric vehicles

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D-A-CH Cooperation on Internet for Energy



- ▶ all levels: governmental, ancillary research, model projects
- ▶ exchange of knowledge and prototypes (e. g. joint test beds)
- ▶ public relations to foster ICT for energy efficiency
- ▶ joint solutions for cross cutting questions (including standardization)
- ▶ joint EU initiatives

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E-Energy will change the landscape



Save the Dates!

- ▶ E-Energy Annual Congress 
 - ▶ Nov. 18 & 19, Berlin
 - ▶ international event (mainly European neighbours)
 - ▶ main topic: standardization

- ▶ ICT for Electromobility 
 - ▶ Nov. 8 & 9, Leipzig
 - ▶ model consortia presenting their first results

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