CEBra Centrum für Energietechnologie Brandenburg
NEWSLETTER
Nr. 9 | June 2011

Project e-SolCar

Preliminary work on the e-SolCar project

In the research of future network structures in medium and low voltage grids, a special focus should be placed on the rapidly growing feeding-in by photovoltaic in cities and prospectively also on the growing power demand caused by electro mobility in urban areas. In the past few years large-scale renewable generation plants (wind and large photovoltaic systems) and small biogas plants have been put in operation in rural areas thanks to the renewable energy act (EEG). Nowadays an increasing growth of small photovoltaic systems is recorded in cities. Based on a digital city map, a theoretically possible photovoltaic power supply of 200 MW was determined for Cottbus under rather conservative assumptions. Influences of growing electro mobility on the urban electric power supply were identified as well. Thus, a theoretical limit for installed load capacity of 100 to 500 MW was estimated, knowing that this is a future value which impact on the grid will be reduced by a simultaneity factor. With a current maximum capacity of 60 MW in Cottbus and a purpose-built network structure, these numbers are a clear indication to engage the aspect of public utility networks betimes in the research at the BTU.

Research activities at the BTU within the project

❖ Integration of large photovoltaic feedings into utility networks

Due to constantly decreasing costs of photovoltaic power generation, a significant increase in installed capacity of urban photovoltaic systems will occur in the future. It is still unknown whether the urban power grids, especially the low-voltage systems, can integrate such an expansion of power generation. Initial estimates show that especially medium-sized cities with 40.000 to 250.000 inhabitants could be affected by significant problems. In contrast to very large cities with a high population density and the resulting highly developed network infrastructure to supply this high load density, a much smaller settlement and load density can be found in the medium-sized cities mentioned before. However, these cities offer a more extensive area for rooftop photovoltaic systems. Since 80 per cent of the European population live in cities of that size, an investigation of urban photovoltaic feed-in on the example of the city of Cottbus (100.000 inhabitants) can be seen as representative for many other cities. First estimations illustrate that the installable photovoltaic power in Cottbus can theoretically reach about 4 times the value of the peak consumption of the city. This underlines the need for further investigation regarding this issue.

The topic includes the following tasks:

- Analysis of the potential of photovoltaic for a representative medium-sized city with Cottbus as a representative example
- Determining the impact on urban supply networks
  - Systematisation of network structures for different types of settlements
  - Deduction of indicators for statements concerning the load coverage behaviour of photovoltaic systems within various types of settlements
  - Identification of grid extensions fitting all requirements
- Development of concepts for network-compatable feeding of photovoltaic power

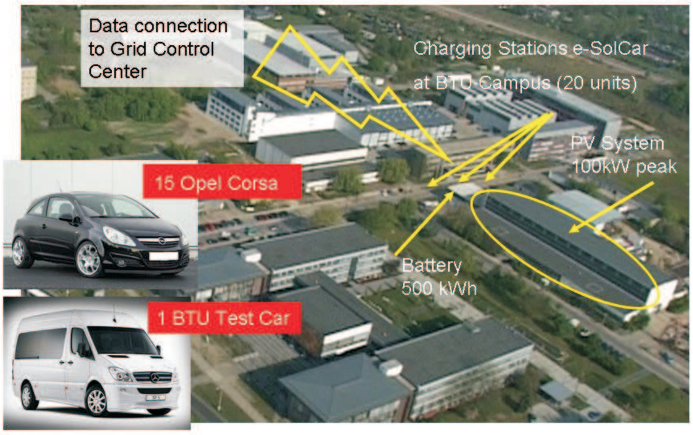
The project includes the implementation of a field trial, which comprises the following components:

- Photovoltaic system with 100 kW of peak power generation
- Photovoltaic measuring field as a test facility for the illustration of different roof pitches and directions
- Stationary battery system with 500 kWh of usable charge/discharge capacity for temporary storage for overnight charging and network controlling power range
- These field test components are combined at the BTU campus with parts (15 of 50 vehicles) of the field test described below, for electro mobility in the Lausitz

❖ Increase of system stability in the transmission network by means of car batteries and stationary batteries of the urban storage infrastructure

Brandenburg University of Technology Cottbus

Electric cars offer a possible storage capacity in the future, once they have found high penetration into society. The decentralization of storage capacity provides technical as well as service tasks that have not yet been investigated in this constellation. The contemporary procedure, where production and storage occur in the same power level, no longer exists. The feeding is done in the 400 kV and in the 110 kV-level. The storage of excess energy will be done in the low voltage grid with highly decentralized storage capacities. The interaction of multiple levels will be a central issue for network operators when supply and storage of different voltage levels will be joined together into one unit. To investigate such tasks in the preparation stage, the BTU will run a test with 50 electric cars that will be tested as a storage capacity for a so-called "virtual power plant".



❖Range Extender as a key to the rapid spread of electro mobility

Because of the currently available energy storage densities in batteries, electric vehicles today are usually available with travel ranges of 100 to 150 kilometres. This is acceptable only for small vehicles in urban traffic. In addition to high costs of batteries, these small cruising ranges are the main reason for a very slow increase in the demand for electric cars.

At present, there are two different concepts to solve this range problem. In both cases, an additional combustion engine resorts to a fuel tank that allows a greater range.

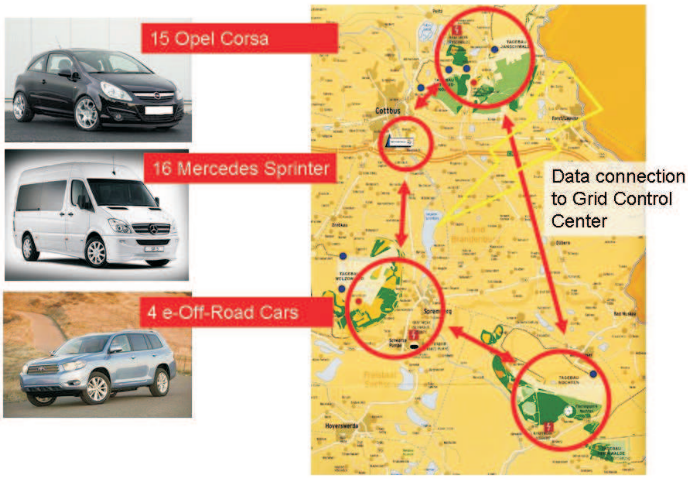
A research group at the BTU will be set up for a co-ordinated scientific examination of the diesel engines, supplied together with the vehicles for the fleet test, regarding special requirements for the operation as a range extender.

The generators will be optimised and the necessary components for power electronics and battery management will be developed.

❖Communication between network control centre of the transmission grid and local battery

For a controlled charge (by renewable energy sources) of vehicles, a communication solution has to be developed for the transmission of control commands from a master station for supervising an intelligent converter in vehicles or charging stations.

To relate the outcome of these technical innovations, charging station will be equipped with SMART-Meter components, where relevant data (charging/ discharging events) can be recorded, stored and accessed.



The BTU Cottbus conducts the E-SolCar project in co-operation with Vattenfall Europe Generation and German E-Cars GmbH.

The project is supported by the Ministry of Economics (State of Brandenburg) and the Ministry of Science and Research (State of Brandenburg).

Artur Napierala,
Chair of Energy Distribution and High Voltage Engineering, BTU Cottbus

Imprint:
Brandenburgische Technische Universität Cottbus
CEBra - Centrum für Energietechnologie Brandenburg
P. O. Box 101344, 03013 Cottbus

Telephone: +49 355 69-40 44
Fax: +49 355 69-40 39
Www.tu-cottbus.de/cebra

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