Abstract
The name Strombank (German for “electricity bank”) stands for a system and a research project that investigates a novel operational model for a cost effective battery, which stores decentrally generated power and therefore balances the generation and consumption in residential areas. Similar to a conventional bank, the Strombank provides various services to its customers on the basis of the Strombank system. In addition to storing energy in order to increase the consumption of locally self-generated energy, the Strombank system enables the customer to sell their surplus energy to other customers within the area. Due to its high degree of flexibility, the Strombank is also used to provide auxiliary services like secondary control power for the grid.
The Strombank project is realized by the Mannheim based energy company MVV Energie AG as consortium manager, Netrion GmbH as the operator of the electricity grid in Mannheim, the battery system manufacturer ads-tec GmbH from Nürtingen and the University of Stuttgart with its institute for photovoltaic (ipv) and the center for interdisciplinary risk and innovation research (ZIRIUS). The partners work together on a topic, which is gaining increasing importance: balancing the power generation of distributed energy resources (DER) and the power consumption on a local basis. The project is funded by the German state of Baden-Württemberg under the BWPLUS program. Project duration was from November 2013 until March 2016.
The operational model was realized in the Mannheim district of Rheinau. During the 15 months of field testing the project investigated technical, economical, regulatory and social aspects. The 17 participants of the field test not only consume energy but also generate power using photovoltaic systems and high-efficient combined heat and power systems (CHP). Any surplus energy generated by the participants was stored in a personal Strombank account. This energy was withdrawn whenever the self-generated electricity was lower than consumption.
The Strombank consists of a large-scale battery with 100 kW power and 100 kWh capacity and a Strombank management application run in the energy cloud. The participant side is also connected to the energy cloud. The participants monitor their energy balance with the help of a mobile application, similar to a home banking app.
During the project, it soon became obvious that the CHP systems and the photovoltaic systems complement each other. Therefore, fixed size accounts for each participant were later dynamically adjusted according to the different seasonal requirements of photovoltaic and CHP systems. Using this principle, the capacity of the battery system was put to optimal use and the amount of consumption of self-produced electricity of the participants doubled to nearly 60 and up to 80 percent. The residual surplus or shortage of supply could be balanced by other participants using the “Vermarktungskonto” (“market account”). The total import of electricity from the grid could be reduced by 75% using all Strombank mechanism or accounts respectively.
To alleviate the grid problems caused by photovoltaic systems, a peak shaving algorithm was implemented. This algorithm retards the charging of the battery system with the aim to have enough capacity left to soak up the feed-in peak of photovoltaic systems during midday. During the field test the feed-in peak could be reduced by 25 % without reducing the usable storage capacity or the rate of consumption of self-produced electricity of the consumer. Moreover, the Strombank system was qualified for providing auxiliary service like secondary control power.
The socio-scientific research within the project showed that consumers prefer a commonly used large scale battery over a home battery system. The current regulatory framework, however, prohibits the realization of the Strombank concept. In a commercial environment and using the Strombank concept, current dues and taxes would add 22 Eurocent to the price of each kilowatt hour, irrespective of the Strombank being operated within a cooperative, contracting or rent model.
Therefore, under the current regulatory framework the Strombank is not economically viable, neither for the operator nor the customer. However, if it were treated the same way as home battery systems with regard to dues and taxes, the system could even today work economically. Taking into account an ongoing decrease of the required investment for batteries, the financial aspects will be even more favorable in the future.