

Smart Home Energy System

Lukáš Prokop, Stanislav Mišák

Department of Electrical Power Engineering,
FEECS, VŠB – Technical University of Ostrava,
17. Listopadu 15/2172, 708 33 Ostrava-Poruba, Czech Republic
{stanislav.misak, lukas.prokop}@vsb.cz

Abstract. For the design of Smart home energy concept we must analyze usual energy consumption of analyzed building. Smart home energy system built in VSB-TUO campus corresponds with energy consumption of usual family house. We use wind power plant and two types of photovoltaic power plant as a power sources. General principles and concept are introduced in part of this paper. Parameters of visualization and monitoring system are discussed in this text as well.

1 Introduction

The conception of the SMART HOME system of a family house has been developed at VŠB-Technical University of Ostrava according to previous experience with off-grid power systems [2,3]. The given SMART HOME system provides electric and thermal power for an island energetic system which is feeding the appliances that has been used for the demonstration of usual power consumption common at a normal household in a flat or a family house. Exclusively the renewable sources are applied for the power supply of the SMART GRID system, using either electric or thermal energy. Specifically, a wind and solar power plants have been used as the sources for the power supply, whereas one half of the solar power plant is installed on a static structure and the other half on an auto-tracking structure. For the power supply of the SMART HOME systems by thermal energy, solar collectors are used which are currently installed and prepared for the implementation of the heat pump type air-air. The individual sources of thermal and electric energy are working into a common bus-bar. The appliances are fed by electric power through an inverters in a form of by-pass system; the energy which are not consumed directly is stored in accumulation device.

Power and energy flow of the output between the individual components is controlled via the SMART CONTROL system which controls the energy and power flow from the source to the appliance. SMART CONTROL system is based on the information obtained from a prediction model for wind and solar power prediction and the information about the actual state of the accumulation equipment and the connection priorities for the individual appliances.

2 Monitoring and Visualization system

Next system development steps is to create an on-line monitoring and visualisation system according to [6], which will inform the user about the energy and power flow between the individual components of the SMART HOME system in ON-LINE mode. The conception of the SMART HOME system will be supplemented with measuring modules in this way, which will measure the time behaviour of electric and mechanic quantities of the individual components of the resource/appliance systems, further the meteorological conditions in the locality of the installation, so that the following items may be monitored:

- The system efficiency at the individual components, as well as the efficiency of the whole system,
- Quality parameters of the electric/thermal energies,
- Contribution of the individual sources of electric/thermal energies,
- Data about the consumption of electric/thermal energies.

The given interactive monitoring and visualisation system, will be presenting its results in a form of a web interface with use of a database server, so that the information about the operation of the SMART HOME system will be accessible to wide public, and the SMART HOME conception providing power supply independently from the power grid for the units of so called off-grid systems may be popularised in this way.

As a part of the monitoring and visualisation SMART HOME conception of a family house, the post-processor will enable to analyse additionally the operation of SMART HOME conception, using database systems, to which the data will be stored continuously on a long term basis. As it has been already mentioned above in previous paragraphs, a part of the systems are also prediction models, which enable to predict the production of either electric or thermal energy within the time horizon of 72 hours for the wind power plant, and 48 hours for the solar and photovoltaic power plant. The information from the prediction models will be also presented in the form of a web interface.

3 Energy Concept

The Smart HOME concept differs from standard power supply of houses especially in decentralization of energy sources, i.e. we refrain from the idea of one main central energy source such as large power plants, but power generation is concentrated into decentralized energy sources, especially to supply one or a few houses. The Conventional Grid concept was based on equal consumed and generated power, i.e. actual power generation was regulated by actual power consumption. On the contrary, the Smart Grid and Smart HOME supply concept takes into account power generated mainly from renewable energy sources, i.e. unstable sources, while excess power generated will be accumulated in so-called accumulation stations (design of battery

bank is based on [4,5]) in case of more than one house supply and for only one house it will be accumulated into the battery bank situated directly in supplied house [1]. So-called Smart Control System provide a multi-way communication between power generation and consumption (while informing the house owner or user about actual consumption), which is an integral part of the Smart HOME concept and philosophy.

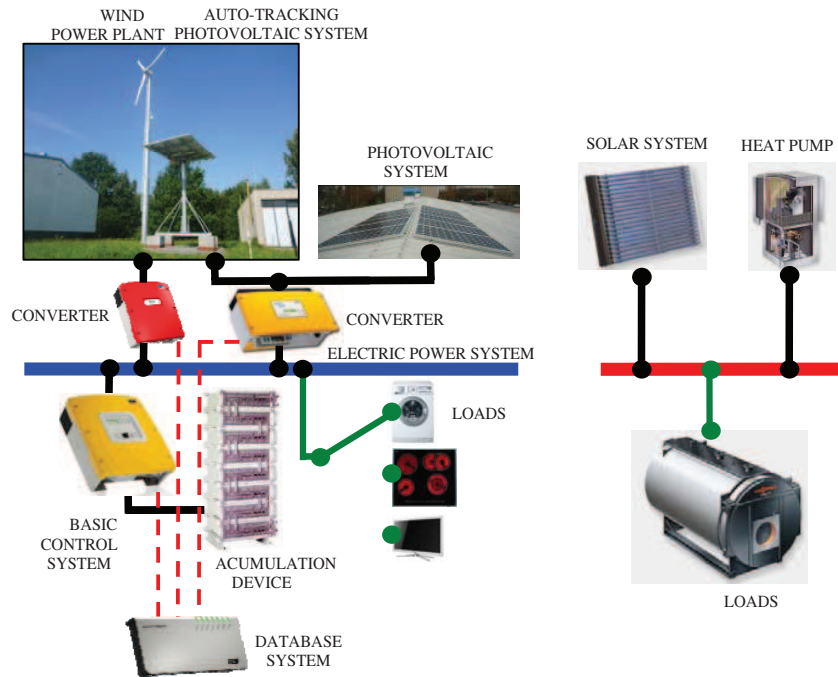


Fig. 1. Simplified power scheme of a SMART HOUSE energy concept.

3 Conclusion

It is evident that the SMART HOME model developed at the Technical University of Ostrava is very helpful in building and developing Smart Grids and Smart cities as it gives a representation of the behaviour of distribution system in changing conditions of its operation, in both operating and fault conditions. The development of this model has not been finished yet and the model will experience changes and innovations in future.

The model is currently able to operate and we create database of operating states just now.

A proposal for Smart Control System is expected in near future, when it will provide system control using a Smart Algorithm so that the system may be operated on equal power generation and consumption balance.

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