

Universal Energy Supply Protocol (UESP)

Dirk Uwe Sauer, Tim Meyer, Werner Roth, Michael Müller¹, Jochen Benz

Fraunhofer-Institute for Solar Energy Systems ISE

Heidenhofstrasse 2, D-79110 Freiburg

Phone: +49 761 4588-5221, Fax: +49 761 4588-9221, benz@ise.fhg.de

¹Steca GmbH, Solar Electronics, Mammostr. 1, D-87700 Memmingen,

Tel.:+49 8331-8558-530, Fax:+49 8331 8558-12, Michael.Mueller@steca.de

A new approach for DC coupled PV-hybrid systems is shown, which leads to simplified planning and installation, and a more cost effective and reliable operation of PV hybrid systems by means of distributed intelligence and standardised interfaces.

Today, whenever a PV-hybrid power supply system is installed, it is generally tailor-made for the specific application. Effort for development, design and sizing are large and make the system become expensive. Also from an operator point of view it is difficult to maintain a number of such systems due to their individual configuration and differences in handling or interfaces. Extension of existing systems is difficult.

To allow PV hybrid systems gaining marked share and becoming a viable alternative to stand-alone diesel generators or connections to the mains, the design and installation needs to be drastically simplified. One alternative is the AC bus bar concept which works well for large systems with a number of AC loads and AC generators, but the technical effort for the parallel operation of various AC components is rather high. Beside the technical constraints in many applications (telecommunication, data acquisition stations, small village power supplies) DC loads need to be supplied. While PV as generator delivers DC current, the batteries are always DC and in future scenarios fuel cells will also supply DC, DC coupling is the most cost effective, efficient and most reliable solution for small and medium sized systems avoiding a cascade of inverters and converters.

The idea behind the Universal Energy Supply Protocol (UESP) is to equip all components (all kinds of generators, batteries and loads) with an identical and well-defined electrical DC connection as well as with intelligence and a communication interface, speaking a defined protocol (UESP). Power flow (DC-coupling) and information flow are separated, leading to more flexibility in system sizing and standardisation. A centralised control and energy management system administers the system as a whole. Its software is able to manage the energy generation and consumption and ensures the required level of reliability while reducing the operational cost to a minimum. Therefore fuel costs, ageing effects and maintenance costs are taken into account when calculating the optimal operation strategy. In contrast to existing management concepts, the central idea behind UESP is to outsource the intelligence and the knowledge on the operational behaviour of the components out of the central management system into the components themselves. The components provide information about their current status of operation, current and future operation cost and constraints to the central management system. Here, using "virtual stock exchange" algorithms, an optimised schedule for all components is determined and fed back to the components for implementation. The central management is thus very generic and can handle any component using the UESP protocol. It automatically adapts to new or changed system configurations, as these changes impact the optimisation only by additional "players" on the virtual stock market. This allows a "plug-and-forget" concept throughout the system, meaning that no adjustment and special programming needs to take place whenever components are attached or removed. This way, obviously based on results from the provided planning tool, the hybrid system can grow flexibly with the energy demand.

Ten German companies have teamed up with Fraunhofer ISE in a challenging project (funded by the German Ministry for Environment, BMU) to define the previously described protocol and interfaces and to elaborate the various implementations. The applications range from village power supply systems to telecommunication stations and signalling systems. The business' interest ranges from component manufacturers to potential users or operators. The research institute's role lies in the development and implementation of the concept and the central software. It is foreseen to establish UESP as standardised interface in the future.

Within this presentation the general concept will be described in detail and the advantages and disadvantages of this approach will be discussed.