E2SG WORKSHOP at ISPS Prague, 26 August 2014.

The ENIAC-JU project Energy to Smart Grid www.e2sg-project.eu aims at developing and demonstrating key enabling technologies in node-grid interfaces, grid sensing/metering, over-the-grid communication, grid-topology and control:

An E2SG workshop at ISPS 2014 will be held in Room xyz, time: to be inserted.

1. Prof Martin Maerz: DC micro grids – challenges and perspectives.

Prof. Dr.-Ing. Martin März studied electrical engineering at the University of Erlangen-Nuremberg with a focus on high frequency engineering. After his PhD on a laser topic, he started his career in the semiconductor division of the Siemens AG (later Infineon Technologies AG) in Munich. Since 2000 he is head of the power electronics system department at the Fraunhofer Institute of Integrated Systems and Device Technology (IISB) in Erlangen/Germany. Since 2012 he is deputy director of the IISB, and since 2013 Honorary Professor at the University of Erlangen-Nuremberg. Under his leadership IISB operates in Erlangen extensive electronics and engineering laboratories, a test center for electric vehicles, as well as an application center for DC networks and highly efficient power solutions. He is also responsible for the branch of the IISB in the south of Nuremberg with a focus on industrial energy electronics and IISB Working Group on Energy Campus Nuremberg (EnCN).

Abstract:

In the light of the progressive decentralization of the electrical energy supply, with an increasingly larger share of volatile renewable energy sources on the one hand, and the rapidly growing number of electronic equipment in home and office on the other side, the historically grown AC grid structure is facing a change also within buildings. Local DC grids respectively DC/AC hybrid grids provide not only benefits with respect to energy efficiency, they also allow much more compact and cheaper electronic equipment.

The presentation describes future local power grid structures, their advantages and perspectives but also the challenges with respect to the required converters, switches, plugs and protection devices with a special view on the necessary power semiconductors.

2. Dr. Stefan Zeltner: Bidirectional isolating AC/DC converter for coupling DC grids with the AC mains based on a modular approach

Dr.-Ing. Stefan Zeltner studied communications engineering at the Georg Simon Ohm University of applied sciences Nuremberg and electrical engineering at the Friedrich Alexander University Erlangen. Since 2001 he is a research associate of the power electronics division at the Fraunhofer Institute for Integrated Systems and Device Technology. Since 2007 he is head of the AC/DC converters development group (former Advanced Circuit Engineering group). In 2011 he completed his Ph.D. in the field of insulating low loss gate drivers. His research interest is focused on modular high power density electronics.

Abstract:

Bidirectional AC/DC converters are important components within smart micro or nano DC grids in building applications because with them the size of local energy storages can be optimized. A novel bidirectional isolating AC/DC converter based on a modular design approach will be presented. It will be shown that by using

a simple 2-wire interface technique with integrated power transfer modularity can be achieved and effort for wiring and connections can be reduced. Moreover it will be shown how the EMI behavior of the well known bridgeless PFC topology can be improved by using the smoothing transformer principle. A complete DC grid managing system comprising a bidirectional 3.7 kW isolating AC/DC converter, two MPP DC/DC converters for connecting two PV strings and one bidirectional DC/DC converter for battery connection was realized as a prototype to show the advantages of the modular design approach.

3. Prof. Ekkanath Madathil Sankara Narayanan: Power Semiconductor Devices for Smart Grid Applications – an overview

Prof. Shankar Madathil is currently with the Electrical Machines and Drives Research Group at the University of Sheffield in the UK, where he holds the Rolls Royce/Royal Academy of Engineering Chair in Power Electronics Systems and Royal Society Industry Fellowship in Rolls-Royce, UK. His research interests include integrated and discrete power device technologies in Silicon and wide band gap materials, design for manufacturability and compact power converters for automotive/aerospace applications, functional materials, thin film transistors, RF technologies, and technology strategies in microelectronics. He is an author of more than 200 articles and holds twenty five patents, approved or pending approval. He is a Fellow of IET and IOP. He is in the editorial boards of IEEE Transactions on Electron Devices, IEEE Transactions on Devices and Materials Reliability and IET Journal of Power Electronics.

Abstract:

An overview of recent developments in high-voltage IGBT, Silicon carbide and Gallium Nitride power semiconductor device technologies for smart grid applications is presented. The IGBT technology is explored up the latest state-of-the-art developments to enhance plasma distribution to achieve a low on-state forward voltage drop. An alternative MOS gated thyristor structure is presented, called the Clustered IGBT, which is aimed as a direct replacement to the IGBT. The evolution of the CIGBT technologies is described in detail. In terms of wide band gap device developments, a p channel SiC Clustered IGBT and GaN super HFET technologies are presented and compared against alternatives.