CNECT – ENER expert round table on:

The impact of electronic components and system in the energy domain

The round table was held at the Directorate-General for Energy on 4th of September 2017 gathering experts from the energy sector, electronic components and systems R&D companies, electronic components and systems manufacturers, academics from complex power systems, and electronic components associations.

The **aim** of the round table was to find out if/where there is more room for action in the Electronic Components and Systems domain for energy applications to speed up the development and deployment of renewables aiming at the 2030 energy targets.

The need of an expert meeting and discussion on this topic was triggered by the observation that the increasing penetration of RES (Renewable Energy Sources) in the energy system during the past decade is due, for a wide part, to the broad development of **Power Electronics** which are a core component of many energy devices. As a result, the systems became more efficient and the cost per installed kW has decreased. This refers mainly to the power electronics used in wind and photovoltaic (PV) applications. Due to the high demand for renewable energy sources applications, there is a continuing research for improving the total efficiency of these applications and by improving each electronic part included[1]. Another application where power electronics is a key technology for development is the off-shore wind interconnection. New and more efficient power electronics for MTT VSC-HVDC[2] converters for submarine interconnectors and off-shore wind-farms including also DC circuit breakers can contribute to the reduction of the cost/kW and off-shore grid applications.

Another important aspect that was taken into account is the transformation of the electricity system from a centralised to an open decentralised architecture with increasing penetration at distribution level of renewable generation, demand response, load shifting, automatic market capabilities, etc. This process will require a huge effort in modernising the grid and **Micro/Nano electronics** are key elements, embedded in systems, meters, controls, etc. With the electricity grid transformation, it can be expected that advanced Micro/Nano electronics permeate further the energy sector.

Considering the power range and related applications significantly different, two panels addressed separately these two topics. Several specific technical and possible development topics were discussed and raised the interest of the audience.

- High power electronics:

The topics of the discussion addressed the issues and needs for power electronics in the renewables (mainly PV and wind) and the off-shore grid applications.

  - Development of WBG (Wide Band Gap) power electronic components (faster switching time, higher turn-off capability, less conduction losses, better temperature coefficient, etc.) for application in energy systems, especially offshore.

[1] For example, there has been a significant increase in efficiency of string inverters in PV applications through the years. According to [H. Haeberlin, Berner Fachhochshule], the inverter efficiency in 1988 was in the order of 85.5 – 90%, in the mid 90's was increased to 90 – 92% and nowadays it has reached 98%.

[2] Multi Terminal Voltage Source Converter - High Voltage Direct Current

- Techniques to monitor the "health" of electronic components to extend their longevity, especially for applications with critical maintenance accessibility.
- Embedded HVDC systems for grid planning.
- More efficient electronic components and systems aiming to increase RES efficiency.
- More collaboration between manufacturers and users of electronic components and systems.

- Low power electronics:

The discussion was focused on grid automation, DC homes, IoT domains where micro/nano electronics and smart systems components are pervading technologies.

- AC microgrids, DC microgrids and need for standardisation.
- Expected growth and impact of electronic components and systems in energy savings in house applications.
- Efficient manufacturing of electronic components and systems. Market driven production: creating a new market in the energy system can drive the production.

Conclusions for operational follow-up

- The round table made attendants aware that the implementation of the EU Energy policy creates demand in ECS for more advanced technologies and that the potential of the cooperation between the sectors is not fully exploited.
- The results of the workshop will be relevant for the SET Plan work, in particular in relation to smart solutions for consumers, smart grids, offshore wind, PV and batteries.
- The results will be relevant as well for the definition of the future orientation of research and demonstration work for the SET Plan, in line with the European Strategy for electronic components and systems.
- Stakeholders recognised the need for more collaboration between sectors and that all elements of a solution have to be optimised together addressing the objectives of individual applications.
- Energy stakeholders were encouraged to contribute/increase their contribution in the "Energy Chapter" of the annual Work Plan (WP) document that is being drafted (finalised by the end of the year).
- It was decided to form a follow-up group in charge of defining more concretely the practical actions on how to structure/better organise the R&D to streamline the value chain and defining milestones that will prepare actions related to:
  1. Proactive collaboration ETIP - European Energy Technology & Innovation Platform (wind, solar and batteries) and ECSEL submitting a report to EC in 6 months.

2. The possibility of setting up a lighthouse project on energy to demonstrate how nano/power electronics contributes to the energy sector in the ECSEL structure.
3. Recommendations for deployment.

Scenarios for tomorrow's grid configuration and need for R&D&I

The configuration of the grid of tomorrow has a high impact on the decisions to be taken today in relation to all relevant technological aspects and consequently, on the economical point of view (cost/kW generated/transported).
With the development of more efficient power electronics technologies, the dependency of the Electrical Power and Energy System exclusively based on an AC system is challenged by a DC grid or a mix of AC and DC. In the keynote, prof. Monti underlined that the development and use of power electronics in high power converters makes possible DC grids. The main advantages are higher efficiency, no need for synchronous operation, no reactive power. At the same time, new testing procedures are needed to de-risk the technologies without risking the infrastructure. The other aspect is that grids do not need to be fully interconnected. Power electronics is key enabling technology in clustering different autonomous grids in a hybrid architecture.

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