CALL 2011-1

Project profile

DCC+G

DC components and grid

Buildings consume 40% of Europe's energy. Over 50% of use in commercial buildings is for heating, ventilation, air conditioning and lighting. The European Commission has decided that, from 2020, all new construction must consume net-zero-energy. This will only be possible using integrated renewable energy sources. Direct current (DC) grids in buildings can increase efficiency of electricity distribution and equipment by 5% and boost solar power system efficiency by 7%. The ENIAC JU project DCC+G is developing energy-efficient, integrated DC energy distribution based on advanced semiconductor power technologies.

Sub Programme

- Nanoelectronics for energy efficiency

In the early days of electricity distribution, direct current was standard. However, the technical benefits of alternating current (AC) for high-voltage national grids gradually became evident. It was also more efficient to build consumer equipment to operate on AC so it became the norm for distribution within buildings as well.
Now that much modern equipment uses low-voltage DC, the rationale is swinging back towards DC distribution. A considerable amount of power is lost in the process of conversion from high-voltage AC to low-voltage DC in consumer equipment. DC power grids can also improve reliability and double lifetime of power supply modules compared with to single-phase AC supplied modules, thus resulting in less electronics waste.

Mixing AC and DC grids

The present use of AC power grids within commercial buildings is not only inefficient but also requires significant upfront investment. Furthermore, it brings about additional power losses in rectifier and inverter electronics for equipment that ultimately requires DC. These drawbacks of AC power grids can be substantially reduced by changing the electricity distribution in buildings to a mixture of AC and DC sources.
A 380-V DC power grid enables the highest efficiency in building appliances such as heating, ventilation and air conditioning and lighting systems by eliminating the need for local rectifiers and power factor correction circuits. The objectives of the ENIAC JU project DCC+G therefore include the development of novel semiconductor power devices, their application demonstrating the efficient use of electric power in buildings by means of DC power grid technology and validation of such installations in commercial building environments.
European industry has not yet started any action in this area. By addressing the topic of DC distribution in commercial buildings DCC+G will place Europe in the lead in this competitive market.

Innovative technologies

Recent advances in semiconductor technologies, nanoelectronics and software can now make a substantial contribution to the management of both AC and DC power distribution in buildings. The DCC+G project is therefore developing system components for pilot installations based on innovative semiconductor power technologies.

Original system components will be developed, ranging from safety devices such as fuses, switches, circuit breakers and protection devices to lighting systems, solar and combined heat and power systems and finally a DC grid controller and central AC/DC converter system as a mains interfacing module. This includes the development of nanoelectronics technologies, devices, circuit architectures and modules for the DC power grid system and demonstration of these components and modules in a final system to prove performance and energy-efficiency advantages through reduced power losses.

Power and high voltage electronics together with smart miniaturised systems for power management will also be specified and developed to meet the identified requirements. This will inevitably lead to research activities concerning current sensors as well as an innovative 1.2-kV micro pattern trench insulated gate bipolar transistor technology to make the 380 V DC energy-distribution system extremely reliable, cost attractive and energy efficient.

Test-bed demonstrations

Integration of these components and subsystems will be demonstrated to show their feasibility as well as proper interaction in office and retail test-bed locations. This will allow observation of system behaviour under real use conditions. The operational performance of both DC power grid test installations and AC power grid reference installations in the same location will be monitored, validated and assessed.

The DCC+G project is currently in the final stage of negotiation with major, multi-site retail companies interested in the installation of a DC grid test-bed in their flagship stores in Germany. These installations will include at least lighting and renewable power systems – both solar and wind. System architectures and measurement results will be documented and disseminated.

The overall targets are energy savings of at least 5% in commercial buildings and at least 7% higher efficiency for building-integrated solar systems. Further benefits are expected from appliances connected to the DC grid.

Global energy benefits

As a result of the opening up of a whole new field of research and development, the ENIAC JU project DCC+G will place European companies in a world-leading position and provide considerable employment. Furthermore, it will make a substantial contribution to the reduction of energy losses and, consequently, to reducing global warming.

Energy efficiency

Partners:
- Brno Technical University
- EBM Papst Mulfingen
- Eindhoven University of Technology
- Emerson
- E-T-A Elektrotechnische Apparate
- Fraunhofer IISB
- Heliox
- Infineon
- Micro Turbine Technology
- Philips Electronics
- Siemens
- Solcalor

Project co-ordinator:
- Roland Weiss, Siemens AG

Key project dates:
- Start: April 2012
- Finish: March 2015

Countries involved:
- Austria
- Czech Republic
- Germany
- The Netherlands
- Sweden

Total budget:
- €18.4 million

The ENIAC Joint Undertaking, set up in February 2008, co-ordinates European nanoelectronics research activities through competitive calls for proposals. It takes public-private partnerships to the next level, bringing together the ENIAC member states, the European Commission and AENEAS, the association of R&D actors in this field, to foster growth and reinforce sustainable European competitiveness.

Details correct at time of print but subject to possible change. Updates will be included in the project summary at the end of the project.

ENIAC Joint Undertaking • Brussels • Belgium
Tel : +32 2 221 81 02 • email: eniac@eniac.europa.eu • website: www.eniac.eu