CALL 2008

Project profile

E³Car

Nanoelectronics for an energy-efficient electric car

The current goal of most EU car manufacturers is to produce an entirely electric vehicle that protects the environment from emissions and noise. Power will be derived from batteries that are recharged by connection to the mains, with an alternative on-board solar energy source. The E³Car project addresses the development of highly-efficient electric vehicles, battery control, high-voltage components, architectures and subsystems for electronic control through the development of nanoelectronics circuits and modules for electric cars/vehicles and the demonstration of these modules in a final system.

Sub Programme

- Nanoelectronics for Transport & Mobility
- Nanoelectronics for Energy & Environment

The ENIAC E³Car project brings together the top European electronics systems developers and manufacturers to build a solid nanoelectronics technology base for the European electric-car industry, while creating standard designs and platforms for electric/hybrid cars.

E³Car will consider new architectures, technologies and modules in addition to designs and concepts for power train and power conversion, as well as power and battery management. These systems will be designed to be fail safe and fault tolerant; new methods and technologies will also be developed for improved reliability and increased lifespan.

Power and high-voltage electronics, as well as smart miniaturised systems for power-management, engine-control and energy-recovery systems, will be specified and developed as required. This will result in a need for research activities involving metal-oxide semiconductor/diffused metal-oxide semiconductor (MOS/DMOS) or insulated-gate bipolar transistor (IGBT) technologies to become highly energy efficient.

Challenging times ahead

Electric-vehicle technologies currently face several challenges such as inadequate driving range, high cost and limited overall efficiency. For most issues, solutions may be found within the subsystems for energy-storage/battery technology, power conversion, electric power train, energy management and connection to mains power.

This ENIAC JU project aims to create a breakthrough in the development of nanoelectronic technologies, devices and miniaturised subsystems for the next generation of electric vehicles and to boost their commercialisation.

Reducing vehicle emissions is a major concern for automotive manufacturers in Europe and other parts of the world. The zero-emissions capability of electric vehicles and the replacement of fuel oil by renewable energy is a challenging environmental task for present and future generations. Success will

strongly support the Kyoto protocol to reduce carbon dioxide (CO_2) levels by 20 to 30% by 2020. Furthermore, new electric vehicles will offer the ideal buffer capability for energy storage to back-up wind-power plants in terms of power-grid stability.

New EU legislation on strict emissions and fuel-efficiency standards also illustrates growing concern for public health and the impact of global warming. The ultimate aim is zero emissions and E³Car is an important step in that process.

Reducing energy needs

Most automotive manufacturers are today increasing their efforts to eliminate exhaust emissions and are promising to bring an all-electric model to market in the next four to ten years.

E³Car is addressing the issues of limited performance and range by an holistic approach to the development of the semiconductor technologies, devices, circuits and subsystems needed to increase power and energy efficiency. The project aims to raise energy efficiency in terms of mobility by more than 35% compared with existing technologies.

With such a target, E³Car hopes to achieve a significant reduction in primary energy requirements, a corresponding reduction in raw materials needs and a drastic cut in CO_2 levels towards true zero vehicle emissions. The latter will be achieved by employing solar energy for the bulk of the daily duty cycle.

Optimising power trains

The main focuses of E³Car will be on power and high-voltage electronics/nanoelectronics as well as on smart miniaturised systems for electric cars. This implies the development of devices and circuits for power conversion, energy recovery, power management – controlling the energy flow between batteries and supercapacitors as well as between batteries/storage systems and the electric motor – and the power train. In addition, it will tackle mains connection and electronic systems for increased flexibility and faster upgrades.

Miniaturised system-in-package (SiP) systems will incorporate smart power-control logic and sensors to allow for power-train regime optimisation under varying traffic and environment conditions.

Farewell to tradition

The advent of the all-electric vehicle is destined to have a significant impact on the future not only of road transport but also that of the motor industry itself. It will change the structure of the car-production supply chain and the ratio of semiconductor components to purely mechanical parts – already high – will increase substantially. The traditional design pattern of the conventional car with an internal combustion engine, gear box and heavy mechanical power distribution to the front and/or rear wheels will become obsolete.

E³Car represents a major part of this change and the achievement of its objectives will mark a milestone in the history of European vehicle development.

Transport and mobility

Partners:

- Alcatel-Thales
- ATMEL Automotive
- ATMEL France
- Audi
- austriamicrosystems
- Robert Bosch
- Brno University of Technology (BUT)
- CEA-LETI
- Centro Nacional de Microelectrónica (CSIC-CNM)
- Centro Ricerche Fiat
- CISC Semiconductor
- ElBil Norge
- Epyon
- FH-JOANNEUM Gesellschaft
- Fraunhofer-Gesellschaft
- Fundacion CiDETEC
- Infineon Austria
- Infineon Technologies
- Institute of Microelectronic Applications (IMA)
- Italian National Research Council (CNR)
- Okmetic
- ON Semiconductor
- Philips Electronics Nederland
- Siemens
- SINTEF
- STMicroelectronics Italy
- Technical Research Centre of Finland (VTT)
- Think Global
- Tyndall National Institute
- VALEO
- Vienna University of Technology (TU Wien)
- VTI Technologies

Project co-ordinator:

- Reiner John, Infineon Technologies

Key project dates:

- Start: February 2009
- Finish: January 2012

Countries involved:

- Austria
- Belgium
- Czech Republic
- Finland
- France
- Germany
- Ireland
- Italy
- The Netherlands
- Norway
- Spain

Total budget:

- €44.15 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.

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