



CA505 | Holistic approach to power consumption and energy efficiency of smart connected devices

[BENEFIC]

PROJECT CONTRIBUTES TO

Communication	✓
Automotive and transport	✓✓
Health and aging society	✓✓
Safety and security	
Energy efficiency	✓
Digital lifestyle	✓✓
Design technology	✓✓
Sensors and actuators	
Process development	✓
Manufacturing science	
More than Moore	
More Moore	
Technology node	

Important energy-related breakthroughs can only be achieved if the whole energy chain is addressed. Innovatively, BENEFIC takes a holistic approach in integrating new sources of energy harvesting, distributing energy closer to where it is used. New methods developed in this project will improve at the architecture-definition level, prediction and management strategies on power consumption.

Partners:

Ericsson
 STM - Gnb
 STM - Alps
 STM - Crolles
 NXP
 Atrenta
 Thales - TCS
 Thales - TRT
 Synopsys
 RECORE
 Beyond Vision
 TUD
 TUE
 LEAT
 CEA LIST
 CEA LETI
 TIMA
 IPCB
 IT-PT
 IMEC

Project leader:

Armand Castillejo
 STMicroelectronics

Key project dates:

Start: January 2013
 End: June 2016

Countries involved:

Netherlands
 France
 Portugal

Project Website

www.benefic-project.eu

BENEFIC's key objective is to provide a holistic approach to developing energy-efficient mobile devices and improve the performance/power ratio by a factor of five at application level.

The project is organised around several key application domains:

- Professional communication
- Connected entertainment
- Healthcare
- Space
- Advanced R&D into energy efficiency

Designing for total energy-efficiency

The trend is towards heterogeneous platforms, which includes sophisticated on-chip communication infrastructures for higher energy efficiency and performances. Moreover, heterogeneous many-cores provide a sound balance between performance and power consumption. BENEFIC's breakthrough will be in high energy-efficient design solutions, responding to the complexity increase in mobile equipment in the coming years.

BENEFIC will achieve this by:

- Selecting system-level middleware and hardware-dependent software;
- Modelling applications (appropriate model development for consumption and thermal behaviour, algorithms and protocols) and architectures;

- Building demonstrators for each domain to illustrate the impact on energy efficiency;
- Developing optimized IPs using the best-fit tool chains and minimal power design, and full custom circuit designs at transistor level in technologies of 28 nm and beyond, using also fully depleted SOI (FD-SOI) technologies.

Crucially, BENEFIC will integrate all benefits from energy collection and distribution, and transfer these innovations to other energy-constrained domains, such as portable healthcare devices, automotive and aerospace.

Europe-centric

BENEFIC is a cross-industry R&D project comprising 19 organizations including industrial, small and medium-sized enterprises (SMEs) and university partners from France, the Netherlands, and Portugal. This project strongly targets the main Work Areas of the CATRENE program: energy efficiency, automotive, wireless telecommunications and health and the ageing society. In addition, it backs the European effort towards complex, fast and low consumption applications supported by an efficient system design methodology.

Importantly, BENEFIC will also leverage breakthroughs already made in other European projects, leveraging in turn big R&D investments already made in CATRENE, ENIAC and FP7 and targeting the development of energy efficient systems.



From green energy to improved healthcare

Energy harvesting – the process by which energy is derived from external sources, like solar, thermal and kinetic – creates green energy, reduces the use of carbon-based energy, and thus environmental hazards. The distribution part of the system must be built to gather the harvested energy when available. This requires harvesting to be integrated in the whole process of storing, managing and distributing power.

BENEFIC's technological advancements will give suppliers a competitive advantage in other markets. The market for ground and satellite radios is estimated at US\$1,582 million in 2018, and the biggest growth is expected between 2012 and 2015 with the introduction of new software-defined radio systems on the market. The professional radio market is estimated at US\$9 billion a year and the equipment volume estimated between 22 million and 40 million units worldwide.

The machine-to-machine (M2M) market, also referred to as the internet of things, represents a growing opportunity for new mobile (telephone) devices, solutions and services beyond traditional voice and data. A significant increase in connections is envisaged during the project timeframe, reaching 350 million by 2016. And market analysis shows the M2M market rising twofold by 2018. Delivering digital content with the right user experience across different devices (digital convergence) is already visible; but large-scale adoption will require devices with a longer battery life.

BENEFIC developments address the many-core market, especially in the space domain where many actors are developing new applications.

The market size estimates for the space-oriented many-cores will exceed €100 million for 2016 and can reach up to €800 million in 2020. With satellite systems enabled for space use through BENEFIC techniques, this market can reach up to €1 billion by 2020.

BENEFIC will also impact advanced R&D in energy efficiency, leading to innovation which will create the next technological breakthrough and ensure competitive advantage and market opportunities. In CMOS technology, scaling has led to improvements in cost, speed and power over the years. However, as transistors dimensions get closer to atomic scale, new phenomena cause functional and performance issues. BENEFIC's advanced R&D into power reduction and energy efficiency should help industry by focussing on high-level systems and tools; architectural innovations and design and efficient technological devices at process level.

Finally, BENEFIC will play an important role in support of future healthcare's shift from today's hospital-centric approach to a more patient-centric one, enabling ubiquitous and pervasive health monitoring. Costs will be significantly reduced and well-being improved once patients are treated in their own environment. The total size of the medical devices market in 2011 was estimated to be US\$309 billion. And growth will continue to be driven by a global ageing population and the expected increase in the incidence of chronic diseases, particularly in developing countries.



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CATRENE focuses on delivering nano-/microelectronic solutions that respond to the needs of society at large, improving the economic prosperity of Europe and reinforcing the ability of its industry to be at the forefront of the global competition.

