

## Project profile

# CSSL

## Consumerising solid-state lighting



### Sub Programme

- Nanoelectronics for Environment Protection

Light-emitting diode (LED) lamps are a rapidly-emerging technology to replace incandescent light bulbs that is gaining acceptance as an alternative to the compact fluorescent lamp. Commercial versions are already available, although there is frequently no single LED retrofit product that meets all consumer requirements. The ENIAC JU project CSSI aims to develop and demonstrate inexpensive smart solid-state light sources through advances in technology and application opportunities. The project will also work vertically across the entire European value chain to achieve substantial cost reductions.

In line with EU legislation to eliminate incandescent lamps by the end of 2012, the ENIAC JU project CSSI aims to develop and expand use of LED technology. In many professional applications, LEDs have already proven to offer a realistic alternative not only to incandescent light bulbs but also to their proposed replacement by compact fluorescent lamps (CFLs).

However, current LED retrofit products are relatively expensive and the cost increase will deter many consumers from accepting this new mode of lighting. Consequently, CSSL will also work with energy companies to gain valuable end-user insights and explore a new business model that will further promote and develop the consumer LED retrofit market.

### **CFL transition technology**

Currently available CFL technology is only regarded as a transition between incandescent and alternative light sources. A CFL has unsatisfactory light quality, limited or expen-

sive dimming capability and is not an adequate replacement for reflector lamps. Many lighting experts have placed their hopes of finding a super-efficient light source on solid-state technology. There are, therefore, great market opportunities for LED replacement lamps.

CSSL aims to develop and demonstrate affordable smart solid-state light sources for consumers via both technology and application routes. The project will work vertically across the entire value chain from LED die and light source to consumer luminaires. It will also work with control and dimmer companies to ensure that LED lighting becomes a totally acceptable form of illumination meeting the needs of all consumer groups.

### **Dramatic cost reduction**

To achieve drastic cost reduction at system level, the ENIAC JU project will investigate techniques for growing gallium nitride epilayers on large-size silicon wafers, providing the potential

to halve the cost of packaged LED dies. An in-line inspection tool will also be developed which, when used in combination with a defect source analysis (DSA) tool, will help to improve the LED yield during the semiconductor manufacturing process. In addition, the micro-cavity light-emitting diode architecture, chip configuration and driver topology will be extensively studied and optimised to achieve the lowest overall system cost option – currently intending to use a system-in-package approach.

### Offering more functions

While traditional LED controllers are purely digital, the implementation of the smart lighting concept will be based on the integration of sensors, actuators and dimmer controls to use the full potential of the digital source and offer more functions to the consumer. These functions will enable extra value-added features by comparison with those of traditional light sources.

Multiple LED retrofit lamp, luminaires and system-level demonstrators will be delivered during the course of the ENIAC JU project to illustrate the research and development achievements. User perception tests and field trials of comparable LED retrofit products and demonstrators will also be carried out yearly during the project to verify and optimise the overall LED retrofit system architecture.

### Industrial impact

CSSL will have a profound impact on many European industries such as microelectronics, dimmers and con-

trollers, equipment, tools and materials industries. It will also provide new business growth opportunities by promoting cross-industry co-operation. Partners will be encouraged to secure leading positions in the emerging domain of consumer LED retrofit. The project will strengthen Europe's position in the technology race by encouraging lighting manufacturers to develop high quality, highly-efficient LED products to replace the ordinary light bulb.

The use of solid-state lighting in general and domestic applications will be a key contributor to the reduction of energy consumption by a factor of over 80% in comparison with the demands made by conventional incandescent bulbs. The results of CSSL will therefore have a direct impact on energy savings and sustainability as well as improving the quality of life in Europe and worldwide.

### Broader objectives

This ENIAC JU project is part of an extensive EU programme dealing with the development of nanoelectronics technologies and components that are required for applications in the field of energy efficiency and environment protection.

Focusing on micro-/nanoelectronics, efficient power supplies and intelligent energy control in new products can reduce electrical energy consumption in Europe by 20 to 30% in 2020, with a corresponding increase in safety, functionality and convenience. CO<sub>2</sub> emissions will be reduced by the same order of magnitude and help to achieve the Kyoto protocol targets.

## Nanoelectronics for Environment Protection

### Partners:

- Acondicionamiento Terrassense
- Aismalibar
- Archimede Elettronica
- BEST Electronique
- Boschman Technologies
- British Gas New Energy
- Cambridge University
- CEA-Leti
- Centro Nacional de Microelectrónica
- Czech Technical University
- Électricité de France R & D
- ICOS Vision Systems
- INTEESA
- Legrand
- LEITAT
- Massive
- Materials Innovation Institute
- Niko
- NXP Semiconductors France
- Philips Innovative Applications
- Philips Lighting
- Philips Research
- QinetiQ
- STMicroelectronics
- TNO
- University of Catania
- Wittenburg

### Project co-ordinator:

- Richard van Silfhout, Philips Lighting

### Key project dates:

- Start: February 2010
- Finish: January 2013

### Countries involved:

- Belgium
- Czech Republic
- Italy
- France
- The Netherlands
- Spain
- United Kingdom

### Total budget:

- €27.1 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.