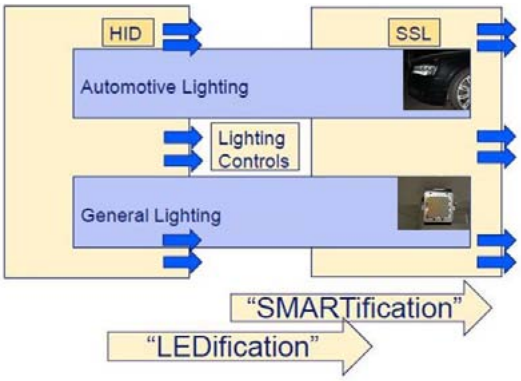
Project result

CATRENE
Cluster for Application and Technology Research in Europe on NanoElectronics

CA502 | Key lighting technologies drive energy efficiency and dynamic lighting [SEEL]

seel Solutions for Energy Efficient Lighting

Pressure by the European Union to phase out traditional incandescent technology and less efficient types of halogen lamps, together with a keen desire by lighting companies to improve energy-efficiency in lighting, were the driving force behind the SEEL (Solutions for Energy Efficient Lighting) project. They played a crucial role in the development of energy-efficient and dynamic-lighting systems, based on the high-intensity discharge lamp and solid state lighting, for general and automotive lighting for the professional market.



Prior to the SEEL project, incandescent lamps were receiving a bad press for their inefficiency and very short lifetimes. On the other hand, halogen lamps (a variant of the incandescent lamp) offered enhanced light output and double the lifetime, with efficacies of 10-25 lumen per watt (lm/W). And tubular fluorescent and high intensity discharge (HID) lamps had demonstrated efficacies of up to 100 lm/W, and emerging solid-state lighting (SSL) sources' were in the range of 30-60 lm/W. Importantly, these technologies, also capable of energy-consumption reductions and lower CO_2 emissions, could potentially boost the efficacy of the lighting system by a factor of five.

At the time, however, these HID- and SSL-based lighting systems still could not match the capabilities and characteristics of the halogen systems used in general lighting and automotive applications. Halogen lamps were well-known and accepted for such benefits as light quality, easy and deep dimming, instant-on light, small system size and their low initial cost.

Against this backdrop, the European Union issued its Energy-Using Products (EuP) directive (which took effect in 2009) to phase out all incandescent light bulbs and low-efficiency halogen lamps from the market by 2012 at the latest. This led lighting companies to search for ways of improving energy efficiency in lamps and find viable alternative light sources in order to meet legislation supporting the EuP directive.

Smart and green

SEEL's objective was to develop energy-efficient, dynamic lighting systems based on HID and SSL technologies for general lighting (initially for retail and hospitality) and automotive lighting, particularly for the professional market. Smart and energy-efficient electronics, also capable of reducing pollution and costs, were the key enablers in delivering desired performance improvements (and other objectives), as were standardisation, intelligent driving schemes and component integration.

Key to the project were four demonstrators that provided the required technology and applications to demonstrate and validate project results and deliverables. Lighting systems, for example, were developed to demonstrate the improved performance and successful integration (in a luminaire or system) of breakthroughs in lamps, drivers, controls, and optical and mechanical aspects. Some prime examples of these innovations are found in the use of spotlights in

ENERGY-EFFICIENT DEVICES AND ENERGY CONTROL SYSTEMS

Partners:

Audi
B+W
BAG
BESI
BIC
(LEFT THE CONSORTIUM)
Bochum Uni, CEA-LETI, DCD, Elmos, Infineon, IZM, Modular, NXP (DE), NXP (NL), Osram, Philips Automotive Lighting (DE), Philips Lighting (NL), Philips PL (FR), Philips Research labs Eindhoven, Philips Turnhout, TU Delft, TU/e, ULIS, Valeo.

Project leader:

René de Zwart
Philips Lighting

Key project dates:

Start: November 2010
End: October 2013

Countries involved:

Belgium
France
Germany
The Netherlands

Project website:

http://www.seel-project.eu/

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	

the retail and hospitality segments, and front-end automotive lighting. A fifth demonstrator catered to the future use of controls to further reduce energy consumption through the advanced features of presence and activity detection.

Shining examples of collaboration

SEEL's project partners from four European countries contributed to strengthening the position of Europe as a global knowledge-centre, as well as its competitive position, particularly in the field of lighting.

There are also good examples of synergy and increased effectiveness. One is SEEL's collaboration with the SCHELP project (dealing with mercury-free lamps), where both projects required an accurate description of the properties of (near-) equilibrium plasma in complex mixtures. Another example is the deployment of SSL driver technology to control SEEL-designed lamps, as well as the small form-factor LED ones used in the ENIAC CSSL project.

Benefits of collaboration are notably apparent with SEEL's academic partners. The large store of experimental data and theoretical knowledge this project generated on ignition processes, plasma-cathode interaction and discharge physics can, in fact, form the basis for further developments. Furthermore, work emanating from SEEL is well documented and is expected to find its way into PhD and master theses, as well as, scientific articles. Apart from the direct benefit, methods devised to obtain the results will also be accessible and available for further work beyond this project.

The future looks bright

Both of SEEL's lighting markets look promising. In general lighting, replacement of incandescent and halogen lamps by energy-efficient light sources has resulted in large energy savings. Affordable HID light sources and drivers with a luminous flux above 4000 lm (with dimming and hot re-strike options) will continue to be prominent players in the lighting market for the foreseeable future, securing the manufacture of HID lamps and control gear in Europe and related jobs.

In automotive, the adoption of highly efficient lighting in cars is directly driven by the reduction of pollution, where governments have defined legal requirements to cut CO_2 emission of cars. Halogen, HID and LED technologies are predicted to share the lighting market as we move towards 2018-2020, after which HID will continue to play a significant role. And automotive lighting will not experience an abrupt global change of technology, rather a shift in segmentation: while LED starts to replace HID for the top segment, HID lighting applications will shift towards mid-segment cars.

Furthermore, there will be a mass replacement of automotive halogen lamps with xenon HID ones, leading to lower fuel consumption and safer driving. This move will also create a new business with considerably increased volume, thus securing the future production of xenon HID lamps and control gear in Europe, as well as development and manufacturing jobs.

SEEL project partners are also starting to benefit directly. The flat spot developed in the SSL General Lighting work package has generated momentum as a potential successor to a lighting product from a French SEEL project partner. New-generation lighting systems with intelligent lighting control developed in SEEL are also expected to contribute to global energy savings and lower CO_2 emissions, but without sacrificing well-accepted properties of existing lighting solutions.

And standardisation in both light source and intelligent control – something to which SEEL assigned a high priority – is expected to create high-volume applications as existing lighting sources are replaced. By increasing volume demand, standardisation will reduce costs, as well as ensure a leading position for the European lighting industry, now and in the future.

CATRENE Cluster for Application and Technology Research in Europe on NanoElectronics

CATRENE Office
9 Avenue René Coty - F-75014 Paris - France
T. +33 1 40 64 45 60
E. catrene@catrene.org
www.catrene.org

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