LEDLUM

Tiny Light Engine for Large Scale LED Lighting

Project reference: **731466**
Project website: **www.ledlum-project.eu**
Project start: **1st November, 2016**
Duration: **3 years**
Total costs: **EUR 4,118,521.25**
EC contribution: **EUR 4,118,521.25**

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This project is an initiative of the Photonics Public Private Partnership.

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Mission of LEDLUM:

LEDLUM aims to develop a highly integrated cost competitive light engine technology platform for Solid State Lighting (SSL) connected directly to the electrical power grid. For the first time LEDLUM proposes to develop an integrated system level solution for realising a highly miniaturised, efficient light engine. LEDLUM will strengthen Europe's lighting business with advanced technology and is expected to create around 1,000 new highly educated jobs.

Motivation of LEDLUM:

The majority of SSL systems is using high brightness light emitting diodes (LED) as the light source. The light engine, being part of the lighting system contains a LED module as well as a driver, which is usually rather bulky and expensive and suffer from short lifetime.

Presently, the need for bully, expensive and discrete power electronics circuits to drive the light engine is a bottleneck limiting their application space. LEDLUM proposes to address these bottlenecks in miniaturisation and integration for the different components of the driver electronics, including power switching technology, control, passive components and system integration with the light engine. This innovative solution will significantly expand the scope and opportunity for smart and highly integrated light engines where size and increased functionalities are key requirements.

Concept:

LEDLUM will make major improvements to the volume, the weight, the lifetime and the size of the driver (electrical engine) of light emitting diodes (LED), that are used in the majority of solid state light (SSL) systems. These improvements will be made while keeping the power rating of the driver. To achieve this, the operating frequency of the driver will be increased by approximately a factor of 1,000.

Objectives:

The LEDLUM project aims to reach the following objectives:

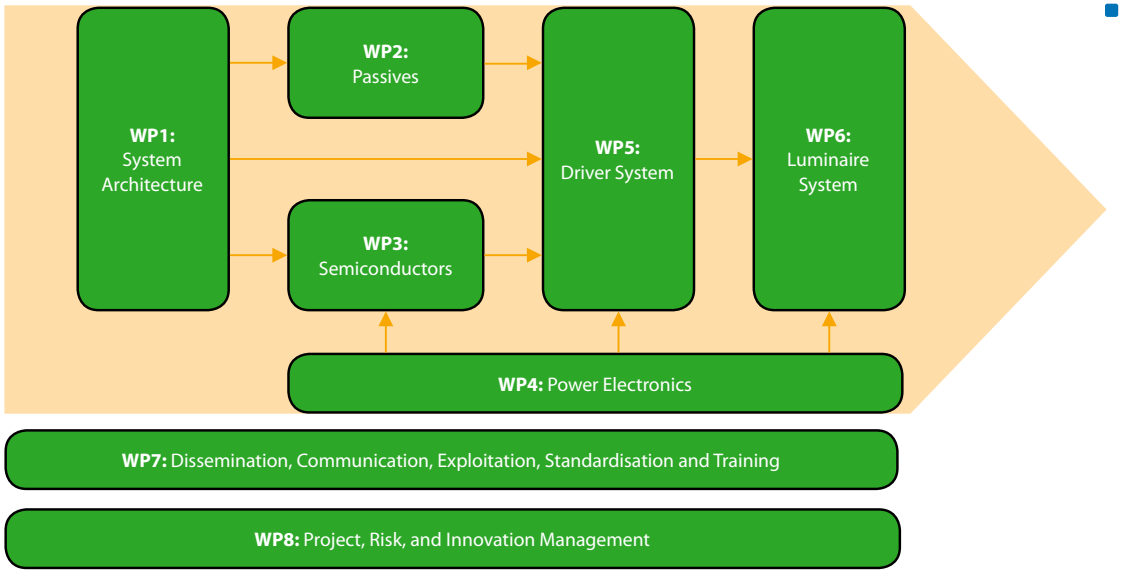
- 90% **size and weight reduction** of the power electronics part in the LED driver,
- **reduction of material cost** by a factor of 2,
- **reduction of energy losses** by 45%, and
- **increase** of the expected **lifetime** from 5 to 10 years.

Expected innovations:

To achieve these objectives, the LEDLUM project expects the following innovations:

- **New soft magnetic thin film inductors** to increase magnetic on silicon energy efficiencies.
- **Increase the capacitance of ultra high density PICS trench capacitors** for HV applications under stable temperature and voltage linearity and state-of-the-art parasitic inductance and resistance.
- **Use the most competitive power semiconductors** in terms of energy efficiency and combine with drive and control circuitry for operation in the VHF range.
- **Use silicon wafers with embedded capacitors** as mechanical and electrical base for other electrical components, especially as magnetic-on-silicon based inductors and power transistors to achieve unprecedented power densities.
- **Combine the above magnetic**, capacitors and power semiconductors in a granular approach with novel ripple port circuit topologies to form a grid-tied AC-DC converter without electrolytic capacitors.

LEDLUM structure and work packages



Technical Approach:

The LEDLUM project is planned to run for 36 months. It is organized into eight work packages (WP) with significant dependencies and expected synergies between them which are described shortly in the following.

WP1: System Architecture

WP1 will define the overall architecture of the LED driver systems, the system components and interfaces and the system requirements. The system requirements will be originated from the market view as well as from the manufacturing and supply chain point of view. These inputs will be merged and synthesized into the system architecture and requirements of the overall LED driver system.

WP2: Passives

WP2 deals with integrated passive components for use in the LEDLUM's electrical engine. Furthermore, the development on a novel magnetic material, optimisation of a laminated magnetic core structure/process as well as magnetic research will be done within this WP.

WP3: Semiconductors

WP3 focuses on the power semiconductors and integrated circuits of LEDLUM's electrical engine. Because of different operating conditions of the power device in the AC-DC and DC-DC converter, a single power device cannot be reused in all parts of the system and different options will hence be investigated for the AC-DC and DC-DC converter. The physical realization of the optimum solution for the power devices and ICs represents the goal of this WP.

WP4: Power Electronics

WP4 contains the research and development of the AC-DC and DC-DC converter as well as the fabrication of the sub-components for the demonstrators. The goal of this WP lies on the improvement of the major market drivers in respect of size, volume, cost and lifetime. This WP and its success will be reliant on the overall success of the LEDLUM project.

WP5: Driver System

WP5 targets the assembly of the AC-DC and DC-DC converter together with the controls and power management to obtain a complete driver system. This WP further focuses on the design and implementation of the overall control and interface for the LED driver. Moreover, the WP concentrates on the assembly of all the individual blocks into a single and complete LED driver, which can be tested on a system level.

WP6: Luminaire System

WP6 uses the developed LED driver in order to build complete LED light fitting systems. Two LED light fitting systems will be designed as part of this WP.

WP7: Dissemination, Communication, Exploitation, Standardisation and Training

WP7 obtains inputs from all other WPs and ensures the communication and dissemination of results achieved within the individual WPs to the outside parties as well as to participating entities. Further, WP7 will support the partners to exploit the achieved results and impacts on the European and international market. Results within each WP will lead to contributions for training measures, coordinated by this WP.

WP8: Project, Risk, and Innovation Management

Finally, WP8 interacts with all other WPs in order to ensure a successful project lifetime with respect to risk and innovation management. WP8 shows dependencies to all other WPs as it coordinates and ensures that the tasks are in line with the project work plan and performs scientific coordination as well, in order to reach the common goal of LEDLUM.

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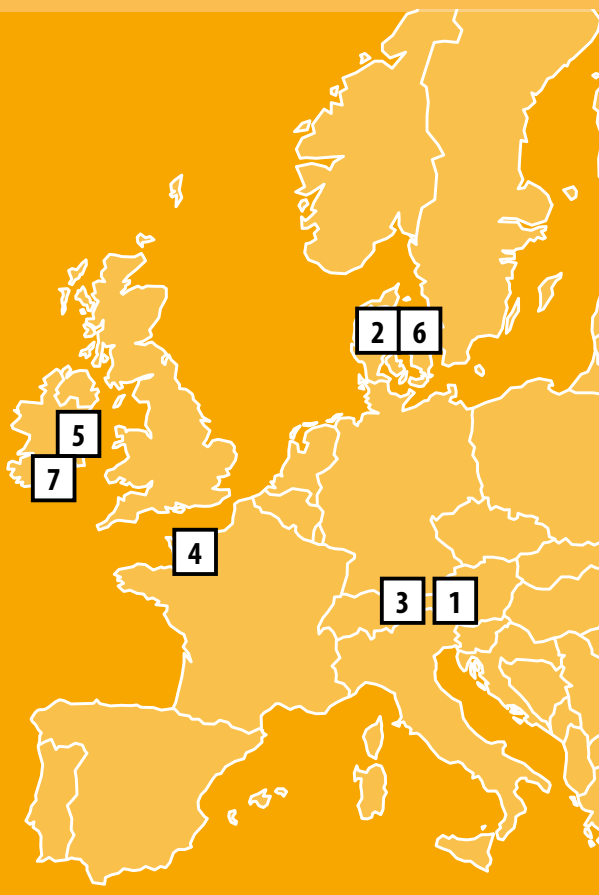
Consortium:

The consortium of the LEDLUM project brings together a European team of recognized organizations and respected universities with scientific and technological backgrounds, making it well-positioned to achieve its objectives. All in all there are 7 partners from 4 different European countries including 2 SMEs, 3 industrial companies, and 2 universities.



Project Partners:

1 **Technikon Forschungs- und Planungsgesellschaft mbH, Austria [Villach]**

2 **NPC Tech Aps, Denmark [Herlev]**

3 **Tridonic GmbH & Co KG, Austria [Dornbirn]**

4 **IPDiA SA, France [Caen]**

5 **L.E.D. Lighting and Electrical Distribution Group, Ireland [Dublin]**

6 **Danmarks Tekniske Universitet, Denmark [Lyngby]**

7 **University College Cork – National University of Ireland, Ireland [Cork]**