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Accelerate SSL Innovation for Europe

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Document history:

This report gathers information produced by the Lighting Clusters associated to the SSL-erate project, dealing with the business development experiments. It describes the way Lighting Clusters operate to stimulate innovation, and to bring interest from other stakeholders. It shows the various items, obstacles, opportunities identified in this process, and the various business development experiments conducted so far.

Revision	Date	Status
V0.1	30.11.2015	1st Draft
V0.2	01.12.2015	Updated draft
V0.3	08.12.2015	Complete draft
V1.0	05.01.2016	Final

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Summary

This report documents the outreach and matchmaking activities of the five Lighting Clusters in the SSL-erate project consortium: Cluster Lumière, Luce in Veneto, KU Leuven/Groen Licht Vlaanderen, Clúster d'Il·luminació de Catalunya, DTU / Danish Lighting Innovation Network.

Each of the Clusters reports on the events that they organized in the 2013-2015 period. Furthermore, the opportunities and barriers for business development in Solid State Lighting are documented for each cluster; these were identified and explored in these events.

Moreover, the report contains details on 24 Business Development Experiments which the five Clusters have organized or are organizing, e.g., the goals, partners involved and current status.
In addition, the report contains several preliminary reflections on the Business Development Experiments, with a focus on the process of organizing Open Innovation, as well as 'lessons learned' and tentative recommendations for policies to promote Open Innovation in SMEs.

1 Introduction – European Lighting Clusters

Five European Lighting Clusters are involved in SSL-erate. They are organizations bringing together stakeholders of the lighting value chains. On top of lighting manufacturers and lighting professionals, manufacturers for adjacent fields (IT technologies, electronics, optics, electrical equipment, etc.) are associated. Clusters have among their members research organizations, testing laboratories, and various actors of the extended lighting value chain: installers, electricity suppliers, etc. Figure 1 shows the location of the five Lighting Clusters. Information about the five Lighting Clusters' organisations can be found in Appendix I.

In the SSL-erate project, the task of the Lightings Clusters is to initiate Business Development Experiments (BDEs) using Open Innovation: this means developing new products and services through collaboration between various stakeholders (on demand and supply side).
Lighting clusters are particularly well suited to execute these tasks since they are regularly conducting actions toward and with other stakeholders. Among key stakeholders are architects and engineers, municipalities, and various professional associations.
Lighting Clusters act as business clubs, stimulating business development in facilitating matchmaking. The major strength of the Lighting Clusters is that they capitalize on local actions: meetings can be frequent, formal and informal exchanges are facilitated, mainly relying on people and not on structures.

Activities of the Lighting Clusters are normally restricted to SSL technologies. Within SSL-erate, the Clusters try to be more involved in the stimulation of ideas concerning SSL applications, and possibly innovative products and services, through the implementation of BDEs..
The task of initiating BDE started directly at the project start. It should be noted that there were significant incentives to start business innovation before documentation or tools from WP2, WP3, and WP4 became available. Fortunately, Lighting Clusters have among their members professionals and scientists of high competence, and benefit sometimes from local consultants in Open Innovation. Therefore, actions by Lighting Clusters could start from the beginning of SSL-erate.
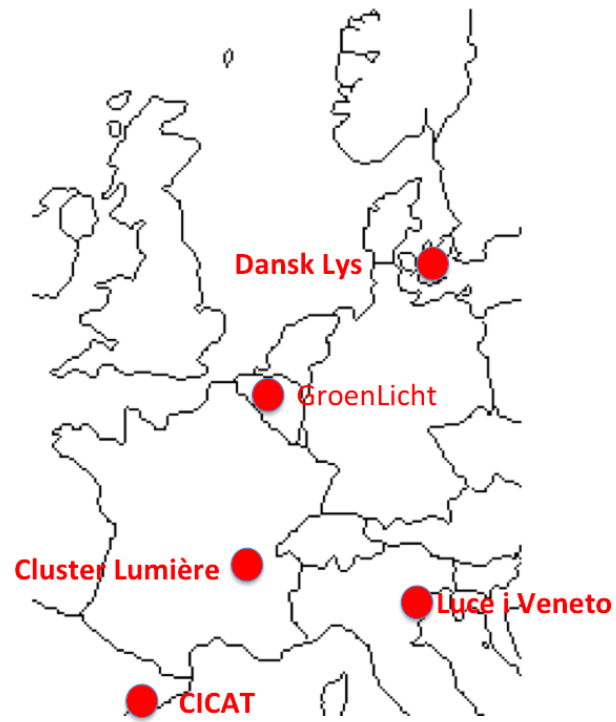
Figure 1 - Location of the five Lighting Clusters
conducting open innovation tasks within SSL-erate.

2 Open Innovation within Clusters

Open Innovation is in the genes of the Lighting Clusters. Lighting Clusters are not simple associations of lighting manufacturers; their role is to facilitate development of products and services and, at the end, stimulate economic activity.

One major part of their role is to facilitate updates on product technology among members to identify technical opportunities (supply side). Lighting Clusters invite representatives on the demand side (potential clients) to identify existing needs and possible problems.

One major issue raised is, naturally, costs, or more precisely, cost targets as well as possible markets, especially at a time when lighting become a commodity and with extraordinary pressure on small and medium sized enterprises (SMEs) to survive. Cost of SSL sources (light engines, but also products) is being reduced rapidly (expected decrease of cost by a factor of 3 between 2015 and 2020). The improvement of energy efficiency leads to reduction of costs of electricity being used. Luminous efficacy of light engines will stabilize in the 160-220 lm/W range, to be compared with the 100 lm/W of tubular fluorescent sources. Hence a significant reduction on Total Cost of Ownership of lighting products occurs and which will accelerate in the next 5 years.

This context mentioned above demonstrates that Lighting SMEs are under very high pressure. The world of lighting is getting fare more competitive, and resources for innovation are scarce.

Certainly, business innovation tasks deals with exploring possible domains where value of lighting systems could be increased. This suggests:
1) addressing improvement of products and services in the perimeter of lighting products which could contribute to an increase of the value of lighting
2) identifying possible new applications of lighting, related to the added functionalities of SSL products, for new markets.
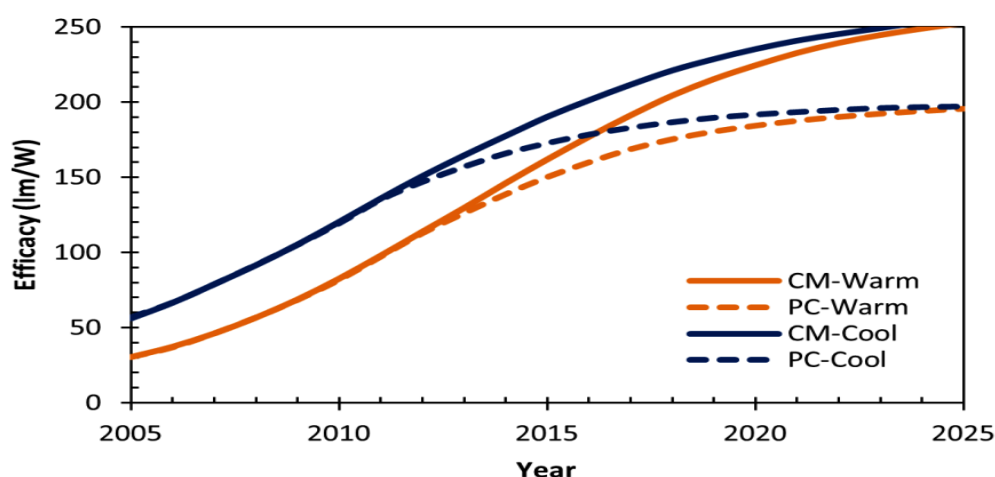
Figure 2 – Actual and projected increases in the efficacy of colour-mixed (CM) and phosphor-coated (PC) LED packages. CM-LED packages are predicted to have a higher maximum efficacy in the future, and the difference between warm white (CCT 2580 K to 3710 K, CRI 80–90) and cool white (CCT 4746 K to 7040 K, CRI 70–80) is expected to diminish (U.S. Department of Energy. Energy Efficiency & Renewable Energy, 2012).

Table 1: Prediction of evolution of LED Package cost and efficacy (U.S. Department of Energy. Energy Efficiency & Renewable Energy, 2012).

Metric	Unit	2011	2012	2013	2015	2020
LED Package Efficacy (warm white)	lm/W	97	113	129	162	224
LED Package Price (warm white)	$/klm	12.5	7.9	5.1	2.3	0.7
LED Package Efficacy (cool white)	lm/W	135	150	164	190	235
LED Package Price (cool white)	$/klm	9	6	4	2	0.7
Metric	$/klm	33	23	16.5	10	5

Notes:
Projections for cool white packages assume CCT=4746-7040K and CRI=70-80, while projections for warm white packages assume CCT=2580-3710K and CRI=80-90. All efficacy projections assume measurements at 25°C with a drive current density of 35 A/cm. Note that MYPP projections are based on price, not cost.

Figure 3 – Prediction of evolution of LED Package cost and efficacy (U.S. department of Energy. Energy Efficiency & Renewable Energy, 2012)

This was the driving force behind the actions carried out by lighting clusters. Due to the high level of expertise of members of lighting clusters, any new idea, new suggestion, was very carefully weighted in view of costs and market constraints.

3 Outreach of Clusters

Lighting clusters are part of a local Ecosystem, where they have to manage networking and partnership with other local clustering initiatives.
For these reasons, Lighting Clusters conduct sometimes joint actions with other local clustering organizations. It deals with joint workshop or events. In these the other clustering organizations, lighting is not necessary on their agenda, but their members can become significant contributors of innovation. Sharing information on technology, and application, appears essential.
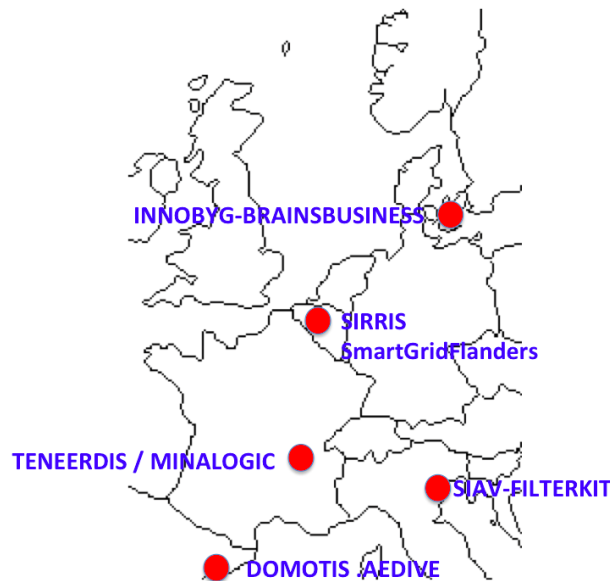
Figure 4 – Other Clustering organizations collaborating with Lighting Clusters through organization of joint events.

3.1 Cluster Lumière

3.1.1 Events

Below a Table is given of events, more or less related to SSL-erate, and organized by Cluster Lumière from fall 2013 (beginning of SSL erate project) to the end of 2015.

The following colour code is used in the Table below, and in the four similar Tables in this Chapter:
National conference
Technical workshop
Think Tank workshop
Targeted Conference

Grey background – events organized in relation to the **SSL Erate project,** partially funded by the SSL-erate project grant

These events deal with outreach to other stakeholders (architects, engineers, clients, etc.)

Blue background – event organized together with other members of the **SSL-erate consortium,** funded by the SSL-erate project grant

These events are workshops with speakers who are members of the SSL-erate project, on topics related to the scope of the SSL-erate programme.

Year 2013

Ref no.	Date	Location	Type of event / topic	Stakeholders/ members	No. of participants
2013-1	1-10-2013	Nantes	**National conference** Street lighting – Best practices	**Speakers**: 20 Members – (lighting experts, French ministry of environment, manufactures, installers…) **Audience**: municipalities, technical services	190
2013-2	15-10-2013	LYON	**Technical workshop** Lighting systems colour rendering and comfort	**Speakers**: ENTPE; Inserm PISEO, Philips, Brochier, Elecomac **Audience**: Members	38
2013-3	14-11-2013	LYON	**Think Tank workshop** Automotive Lighting Transport - safety – signing	**Speakers**: LUTB PISEO **Audience**: lighting and automotive professionals (manufacturers, designers, installers…)	40

Year 2014

Ref no.	Date	Place	Topic	Stakeholders/ members	No. of participants
2014-1	15-01-2014	LYON	**Targeted Conference**: Lighting system instalment in buildings	**Speakers**: PISEO AERIS OPUS LIGHT BEST **Audience**: EDF Energy audit team and their Clients (Club MED- FLY- BUT- Industrials …)	15
2014-2	28-01-2014	LYON	**Technical workshop** Design of innovative lighting things	**Speakers**: Weenov **Audience**: Members	15

2014-3	7-02-2014	LYON	**Think Tank workshop** Lighting and textile	**Speakers**: Weenov **Audience**: Cluster Lumière members & Techtera network members (textile professionals)	100
2014-4	20-03-2014	PARIS	**National conference**: LED Experts panel in France	**Speakers**: 10 Members – Manufacturers and Labs (Philips, PISEO, CEA, LED power…) **Audience**: BPI experts	240
2014-5	25-03-2014	LYON	**Technical workshop**: Lighting systems and sealing	**Speakers**: Chimie Tech Service-L'Ebenoid-Resilec-Samaro-LCIE **Audience**: Cluster lumière members (manufacturers engineering, consultancies…)	20
2014-6	27-03-2014	LYON	**Targeted Conference /exchanges** LED Experts panel in France	**Exchange participants:** Cluster lumière members and Aidelec network members – electricians and electricity installation professionals	12
2014-7	30-03-2014	LYON	**Targeted Conference /exchanges** Lighting in Hotels and Restaurants	**Speakers**: Club Med OPUS LIGHT – AERIS – BEST – Philips – FAGERHULT – SEET - SONEPAR **Audience**: CHIC network members (Professionals of hotel and catering -) and Cluster Lumière Members	80
2014-8	16-04-2014	LYON	**Think Tank workshop** SSL-erate Open innovation Workshop : Indoor / Outdoor	**Speakers**: ESADE, CL, LUND University **Audience**: Members	40
2014-9	13-05-2014	LYON	**Technical workshop** Lighting systems eco-conception	**Speakers**: Bureau Veritas – LCIE-PISEO-Captronic **Audience**: Cluster lumière members (manufacturers engineering Consultancies….)	12
2014-9	25/05/2014	LYON	**National conference** Architecture and lighting	**Exchange participants:** architects – general contractors-installers, lighting professionals - Municipalities…	250
2014-9	10-06-2014	LYON	**National conference** Smart Lighting technologies	**Speakers:** CEA Leti-DeltaDore –Ubiant-BH Technologie-Citylone-FiveFive-Awox-Luciom **Audience:** architects – general contractors-installers, lighting professionals	250
2014-10	04-09-2014	LYON	**Technical workshop** CEM	**Speakers:** Emitech-Laboratoire Pourquery-PISEO	33

Ref no.	Date	Place	Topic	Stakeholders/ members	No. of participants
				Audience: Cluster lumière members (manufacturers engineering, consultancies….)	
2014-11	29-09 2014	LYON	**National conference** Visual and non-visual effects of lighting	**Speakers**: INSERM – CEREMA – AFE – Institut de la Vision **Audience**: Universities – research centres…	80
2014-12	04-12-2014	LYON	**Targeted Conference**: lighting system technologies in buildings	**Speakers**: INGELUX PISEO AERIS **Audience**: ALE : environment et ecology network	150

Year 2015

Ref no.	Date	Place	Topic	Stakeholders/ members	No. of participants
2015-1	20-01-2015	LYON	**Technical workshop**: Drivers & sensors	**Speakers**: AERIS - Delta Dore – Adeunis – Irlynx - Schneider Electric - CEA Leti **Audience**: Cluster lumière members (manufacturers engineering Consultancies….)	52
2015-2	12-02-2015	LYON	**Technical workshop** CEM & Harmonic Distortions	**Speakers**: LAPAVE **Audience**: Cluster lumière members (manufacturers engineering Consultancies, municipalities, installers….)	70
2015-3	19-03-2015	PARIS	**National conference**: Smart Lighting technologies : Smart Buildings & Smart Cities	**Speakers**: 20 Members – (lighting experts, French ministry of environment, manufactures, installers…) **Audience:** architects – general contractors-installers, lighting professionals, municipalities …	250
2015-8	16-04-2015	LYON	**Think Tank workshop**: SSL Erate Open innovation Workshop : smart lighting and control systems in buildings	**Speakers**: Plan Bâtiment Durable –Best – Aeris-Tribu Energie -Weenov" **Audience**: Members + architects – general contractors-installers, lighting professionals, municipalities …	37
2015	*7-12-2015*	*LYON*	***National conference**: ForumLEDs*	***Speakers:** European Clusters organizations*	*200*

3.1.2 Opportunities for business / barriers

During the meetings and workshops, participants exchanged ideas and provided information to other participants. Cluster Lumière registered ideas of business opportunities, and recorded possible difficulties associated with these ideas. We list below some of the major opportunities and barriers.

Version: 1.0

No.	Business opportunities	Challenges / barriers to overcome
1.	Accelerate of replacement of existing lamps through radical change of TCOs. Target low hanging fruits	*Cost reduction of TCOs leads clients to wait and see and delay decisions. There are risks that new SSL products do not provide identical quality (glare, flickering, etc.…) and lead to more complex maintenance (difficulty to replace products*
2.	There may be clients interested by Dynamic lighting with shift in colour temperatures (morning/evening). This is said to improve well-being, ad reduce sleep disorders	*Benefits are not clear compared to reference installations. And the demand is non-existent (has to be created) No information is supplied on influence of values of illuminance at eye level, adjustment of CCT, duration and history of occupancy. Lack of significant evidence from field testing.*
3.	SSL is a disruptive technology with potentiality to reduce drastically lighting electricity consumption. This will lead to modification of TCO models	*Evolution is not favourable to value creation, since energy use is reduced and value of product is also reduced*
4.	Lighting service or leasing of lighting may replace traditional investment in lighting.	*This approach is made difficult due too often limited reliability of SSL, and absence of standard for light engine replacement*
5.	There are possibilities to develop urban lighting which higher adaptability to the human activity in the city	*Cost of lighting products are rather stable, energy efficiency has progressed significantly over the last 10 years, and various municipalities are happy with this situation and are not pushing for a change*
6.	There are opportunities with city beautification using innovative SSL products.	*Real costs of lighting in cities are poorly known, and are in fact rather small to some other expenses. Investment & maintenance budget are usually separated from electricity costs; Benefits associated to city beautification are hard to assess*
7.	With SSL, dimming and colour variations becomes cheap to deploy	*Not always clear that people want such variations over the long term (after the first attractive effect)*
8.	Standalone lighting sources (using local power generation and storage) becomes more attractive. Should be products to develop for the planet	*Costs of batteries and size of solar collectors are still major barriers. But this could be overcome in less than 10 years. Large global players are already leading this business.*
9.	Use best LEDs in SSL systems, to provide visible improvement in lighting quality	*Are there clear thresholds in LED qualities, suggesting SMEs should use them?*
10.	Make SSL solution with standardized light engines, which could be changed over the life of the luminaire	*Lack of standard, difficulty to agree. Any consortium fails at representing a significant fraction of the supply.*
11.	Develop reliable sensors, and communication components for luminaires	*Important volumes required to justify investments. Could partnership between SMEs at higher European level be a solution?*
12.	Make controls more simple and more intuitive	*Manual control is the reference, difficulty to make intelligence "invisible"*
13.	Make lighting more personal	*Individual lighting requires new distribution channels*
14.	Make lighting a key environmental component	*Lighting often is not considered important, in comparison to furniture, design, or temperature and air quality.*

15.	Could lighting be developed following success stories in IT?	*Need a platform (I-phone, internet based services, etc.)*
16.	Healing lighting	*Need individual understanding of benefits. Works well with daylighting*
17.	Centralization of lighting controls for simplicity	*Check some experience in hotels.*
18.	Light through images	*Technology is still expensive compared to standard lighting solutions*
19.	Lighting as a powerful experience in temporary spaces (commercial)	*Requires ambitious design. Link with media technologies*
20.	Lighting fully integrated to a task (education, work)	*Need to be in line with evolution of work places, media technologies.*
21.	Develop spectacular daylighting solutions	*Cost barriers, distribution channels*
22.	All in one objects (lighting, communication, environmental control)	*Difficulty to identify a specific actor*
23.	Develop luminous materials	*Who install the product? Who connects it?*
24.	Quick installation of products	*O/I with installers*
25.	Use light for branding	*Used already in commercial centres, could rely on innovative materials*

3.1.3 Business Developments Experiments

It appeared that business development experiments, on a short term, should focus on an evolution of lighting products adding specific functionalities asked by the client. Hence the task of exchanging with large clients and exploring with them opportunities for new developments.
In this debate, the issue 'cost' comes very quickly in the exchanges, and due to rather good quality of existing installations, problems which are reported are not very acute.

We list below the various BDEs which were launched during the SSL-erate programme. These projects focus on SSL technologies, supplying new functionalities, or contributing to overcome barriers associated to SSL technologies. Other projects were launched in the same period, but they are not relevant for the SSL-erate project.

No.	Project name	Leader
1	Green house lighting systems	Electronic company
2	Airport healthy lighting	Airport Authority
3	Plug and play SSL luminaries 1 LUMINNOV	IT Innovation Lab
4	Easy maintenance street lighting	Facility manager
5	High Performance school lighting	Lighting Manufacturer
6	Customized industrial luminaires	Electronic company
7	Flat SSL ceiling luminaires with changeable light engines	Lighting engineering
8	Plug and Play SSL Luminary 2	Facility manager
9	Citizen friendly urban lighting	Municipality

Project 1: Greenhouse lighting systems
The starting point of the project was related to observations that most existing lighting installations in greenhouses are still based on Sodium light or Metal Halide sources for reasons of costs and energy efficiency. In fact the spectrum of these lamps is not adapted to stimulate photo-synthesis. SSL solution using appropriate spectra appear to be far more efficient. This is already being developed around the world by some lighting companies,

often at high cost. This project proposes an open innovation approach involving a major developer of greenhouses to reduce TCOs of SSL solutions and optimize functionalities (more appropriate flux management). The key industrial partner has already solved such difficulties for industrial applications.

	2014	2015	2016
Brainstorming	Pre-market study conducted by Cluster Lumière		
Building consortium		Still discussion to identify best partner for greenhouse construction	
Go/no go –funding application			
Development			
Application			

Project 2: Airport healthy lighting

Brain storming session showed that often travellers for long trips (East bound and westbound) feel very uncomfortable in the waiting lounge, either before the trip, or during stop over. A major Airport Authority also mentioned the interest of welcome lights, more particularly from passengers coming from the US with morning arrival in Europe. Local expert group on Chronobiology has proposed scenarios, and feasibility study was conducted by a lighting company. Workshop was organized at airport authority.

	2014	2015	2016
Brainstorming	Done. Analysis conducted by research lab. Feasibility conducted by partner		
Building consortium	3 partners in consortium, but waiting green light from top executives of airport authority		
Go/no go –funding application		Funding under discussion with specific investment fund.	
Development			
Application			

Project 3: Plug and Play SSL Luminaire 1 (LUMINNOV)

The concept has been identified from various brainstorming sessions, and various teams have been trying to set up a project. The LUMINNOV project brings together a consortium of 6 companies and one laboratory in IT technologies. It proposes to pre-equip luminaires with intelligence for maximum flexibility in use, and for allowing easy insertion of smart lighting capabilities. The consortium has not yet succeeded to integrate the expected IT technology.

	2014	2015	2016
Brainstorming	Done during workshops		
Building consortium	Consortium built (7	Technology	

		partners)	optimization	
Go/no go –funding application			Still looking for funding Application sent.	
Development				
Application				

Project 4: Easy maintenance street lighting

The starting point dealt with assessment of demand by managing organization of street lighting system. One major company manages 80 000 light sources and conducts various experimentation dealing with operation of luminaires with various technologies, and management of networks. This companies conduct test in order to adjust tenders in street lighting for various municipalities. Key issue is TCO and flexibility of design to allow adjustment of desires by each municipality. Results of tests show that High Pressure sodium are still net winners in TCO , but that mercury lamps are progressively replaced by SSL as long as the guaranty and the assistance by suppliers over the life of the product is of high quality. These aspects reduce chances of small SMEs with difficulty to guaranty their support over long periods (more than10 years). A first approach dealt with development of customized SSL solutions, but partners could not match the performances expected by the tender.

	2014	2015	2016
Brainstorming	Exploration of TCO model	Exploration of technical solutions	
Building consortium		Results not satisfactory. No innovation planned	
Go/no go –funding application			
Development			
Application			

Project 5: High Performance school lighting

The project came from discussions between lighting engineering firms and major public client. It follows various large scale projects of school refurbishment in Rhône Alpes area, using fluorescent lighting techniques. Here the road map has been clearly defined by the public client and the partners.

	2014	2015	2016
Brainstorming		Came as a priority in two workshops	
Building consortium		Done March 2015	
Go/no go –funding application		Funding attempt 1 (failed) Funding attempt 2 (September 2015) , with larger consortium	
Development			
Application			

Project 6: Customized Industrial luminaires

	2014	2015	2016
Brainstorming		A priority from two workshops	
Building consortium		Done March 2015	
Go/no go –funding application		Funding attempt 1 (failed) Funding attempt 2 (September 2015)	
Development			
Application			

Project 7: Flat SSL ceiling luminaires with exchangeable light engines
The idea came from a brainstorming session held at the authority in charge of Paris subway. Refurbishment of ceilings required ultra-thin flat luminaires, with easy maintenance. In partnership with a lighting engineering firm, a system was proposed, using SSL. The innovation stands in the proposed easy maintenance and replacement of light engines. The lighting systems have rather large dimensions (1.8 x 0.9 m) and required the production of a new generation of light engines. First order dealt with 3000 units.

	2014	2015	2016
Brainstorming	Workshop at client, with engineers in charge of maintenance, and lighting engineering from Cluster Lumière		
Building consortium	Consortium was built only with two partners		
Go/no go –funding application		Tenders prepared , launched , and manufacturer selected	
Development		Under development	
Application			

Project 8: Plug and Play SSL Luminary
The concept has be identified from various brainstorming sessions, and various teams have been trying to set up project One project is being carried by a major installer and facility manager in France. The first priority of this project is to allow installation of super energy efficient SSL ceiling products in saving installations costs. Therefore the top priority is to measure the benefits for all partners. First task dealt with convincing all department of company (marketing, engineering, financial), together with an external engineering firm. . Next step will involve one or two major client. The leader of this project expresses the desire to be independent of the manufacturers (that is their mode of operation). The selected procedure was to work in two steps: A tender for prototypes, a second tender for large scale applications.

	2014	2015	2016
Brainstorming	Contacts established, first objectives defined	Internal discussions between department Programming and road map (sept 2015)	
Building consortium		Planned October 2015	

Go/no go –funding application		Planned November 2015	
Development			
Application			

Project 9: Citizen friendly urban lighting

This municipality conducts, every year, experimentation dealing with specific aspects of urban lighting. Among other topics, it desire to develop dimming techniques to reduce electricity consumption, with strategies which fit best expectations of citizens, whether they are pedestrians, cyclists, drivers of local inhabitants. The systems which would be developed combines appropriate movement sensors, or presence detectors, and adequate adjustment of flux or colour of public lighting sources.

	2014	2015	2016
Brainstorming	First exchanges during workshop. Objectives defined.		
Building consortium	First attempt with industry and electric utility		
Go/no go –funding application		Cluster Lumière is associated with a European Proposal (Smart City) involving these partners.	
Development			
Application			

3.2 Luce in Veneto

3.2.1 Events

Below a Table is given of events organized by Luce in Veneto (LIV) from fall 2013 (beginning of SSL-erate project) to now.

Year 2013

Ref no.	Date	Location	Type of event / topic	Stakeholders/ members	No. of participants
2013-1	21-06-2013	P. Dese	**Technical workshop** Application of ERP Directives: the new lighting fixture labelling	**Speakers**: Paolo Bassani (Bassani Dotti Srl) **Audience:** Lighting SMEs; architects; lighting designers	33
2013-2	15-11-2013	P. Dese	**Targeted Conference** Funding and business opportunities for the lighting sector. R&D and internationalization projects	**Speakers**: EURIS SRL – IB PARTNERS **Audience**: Lighting SMEs; architects; lighting designers	28

Year 2014

Ref no.	Date	Place	Topic	Stakeholders/ members	No. of participants
2014-1	29/30-04-2014	Bassano	**Think Tank workshop** SSL-erate open innovation workshop	**Speakers**: LUND, Cluster Lumière, Open Innovation Srl **Audience**: Lighting SMEs Universities, Research Centres, Stakeholders	54
2014-2	15-07-2014	P. Dese	**Think Tank workshop** SSL-erate open innovation workshop	**Speakers**: Alberto Sozza (LIV); Maurizio Scabbia (Open Innovation Scarl) **Audience**: Lighting SMEs Universities, Research Centres, Stakeholders	45
2014-3	Oct-nov-2014	P. Dese	**Targeted Conference** Conferences series on open innovation approach	**Speakers**: Maurizio Scabbio (Open Innovation Srl) **Audience**: Lighting SMEs (FSE Regional Funds)	15
2014-4	14-11-2014	P. Dese	**Targeted Conference** Innovative materials for the lighting industries	**Speakers**: Eva Tenan (Matech) **Audience**: Lighting SMEs (FSE Regional Funds)	17
2014-5	28-11-2014	P. Dese	**Targeted Conference** Creative design for the lighting industries	**Speakers**: Andrea Busato (PST Galileo) **Audience**: Lighting SMEs (FSE Regional Funds)	15
2014-6	04-12-2014	P. Dese	**Targeted Conference** Overview on the UL norms for the North America lighting market	**Speakers**: Mario Lavarone, Walter Parmiani (UL Italia); **Audience**: Lighting SMEs	36
2014-7	11-12-2014	P. Dese	**Targeted Conference**	**Speakers**: Laura Berrone	36

| | | | Short course on the new EN 6598: 2014 norm | (Apiraee); Paolo Bassani (Bassani Dotti Srl) **Audience**: Lighting SMEs | |

Year 2015

Ref no.	Date	Place	Topic	Stakeholders/ members	No. of participants
2015-1	04-03-2015	P. Dese	**Technical workshop** BIM-Object	**Speakers**: Federico Lenarduzzi (Fermat Design) **Audience**: LIV members + architects	38
2015-2	18-06-2015	P. Dese	**Targeted Conference** Human-centric lighting: From the lab into the real world (SSL-erate)	**Speakers**: Fabrizio Tironi (Flos Spa / Lighting Europe) - Philipp Novotny (Munich University) – Marc Fontoynont (Cluster Limiere) **Audience**: Lighting SMEs Universities, Research Centres, Stakeholders	62
2015-3	19-06-2015	Bassano	**Targeted Conference**: From human centric lighting to business opportunities: LIV and clusters Business Development Experiments presentation (SSL-erate)	**Speakers**: Arthur Noordhoek – City manager Eindhoven - Wim Vanhaverbeke (ESADE Barcelona) – Marc Steen (TNO) – SSL-erate clusters representatives **Audience:** Lighting SMEs Universities, Research Centres, Stakeholders	65
2015-4	26-06-2015	P. Dese	**Technical workshop**: Proposition of a common website for building sector	**Audience:** Lighting SMEs (Project funded by POR Veneto-Sardegna 2007-2013)	32

3.2.2 Opportunities for business / barriers.

During meetings and workshops, participants exchanged ideas and provided information to other participants. LIV registered ideas of business opportunities, and recorded possible difficulties associated with these ideas. We list below some of the major opportunities and barriers.

No.	Business opportunities	Challenges/barriers to overcome
1	Use the SSL systems not only for the energy saving but also for cities beautification (monuments, historical buildings etc...)	Very interesting proposal for municipalities. To overcome costs of new lighting systems.
2	Lighting management system to create specific lighting scenario depending on the type of events organized by the City and on the type of object to light (park, street, monument, historic building...)	Municipality budget for the public system is usually low in comparison to other kind of public cost. Technology ready but difficulty in justifying the cost.
3	To take advantage of the light points to give information to the blind	To identify how to implement the technology. Li-Fi could be a possibility.
4	LED lighting fixtures with high output flux and	Good business opportunity but need high

	low UGR	technical preparation for the companies.
5	Presence of sensors inside the street lighting to report situations of risk	High social impact. Difficult to convince the Municipalities.
6	New technology concerning transparent materials to use with LED lamps.	Innovative idea. Good attraction if you own the IP.
7	Sensors mounted on streetlights useful to collect different type of data (weather, presence, pollution ..) to use or sell it to third parties	Successful idea only if you have a strong business plan especially for potential customers of the data.
8	Exploiting the chromatic properties of the LEDs that govern circadian rhythms to develop appropriate lighting (from dashboard lighting to industrial machinery) to maintain high attention of the operators (drivers, workers..)	Not yet enough data about light effect on circadian rhythm. Interesting business opportunity for the lighting companies
9	Specific LED lamps for historical city centres	Business success related to Municipality budget for this kind of lamp
10	Lighting within command that allows to focus on different parts of a structure (which can be used by tour guides)	Business success related to the budget of Municipality/Private heritage owners for this kind of lamps
11	System that allows traceability of lighting points with the QR code technology	Innovative idea that can be successful if supported by an appropriate business plan

3.2.3 Business Development Experiments

During the different meetings that LIV organized locally three business ideas are the most important in the context of the SSL-erate project:
- H.Lamp focused on the sanitization effect of the LEDs
- Lighting Surface focused on nanotechnologies particles for lighting / signalling on transparent surfaces
- Edylight focused on the application for the mapping of street lights and for their management in a most "social" way

We list below the three business experiments which were launched during the SSL-erate programme.

No.	Project name	Leader
1	H-Lamp	Electronic SME
2	Lighting Surface(smart colours for smart cities)	Urban furniture SME
3	Edylight	IT SME

Project 1: H.Lamp
Air quality is determined by chemical composition, temperature, humidity, particulate matter and fine particles (VOC). These last are divided in biological (viruses, bacteria, spores, pollen, dust mites, mould, allergens etc.) and non-biological (external pollution, smoke, formaldehyde, etc.). Both types of particles can cause allergies and diseases like asthma and cancer while the particles of biological origin can cause diseases transmitted by air like a cold.
The project objectives are to develop a new LED lighting fixture that, in addition to provide light to the ambient, improves the quality of the air in indoor environments where there normally is a high concentration of people, preserving their wellbeing and health conditions. People can achieve significant direct and indirect benefits by the introduction of this technology.
The sharing of the different competences of the two companies involved have the common goal of the creation of this special lamp for installation in some experimental environments

by the beginning of 2016 (hospitals, dental clinic, public closed ambient, …) and for commercialisation just after product validation in operational environments. The consortium is running two experimental installations to evaluate the H-LAMP effect. The first testing is in an industrial site for food/beverage processing to evaluate the effect of mould/bacteria reduction in the air. The presence of mould /bacteria affect food quality with very bad effect on human health, so the permanent reduction/elimination by using the H-LAMP can results in food preparation cost reduction and reduction/elimination of the market input of potentially dangerous food. The second planned test is under discussion with the local health authority to install an initial group of lamp (4-10 pcs) to evaluate the effect in air bacterial reduction in hospitals.

The two partners are companies very prone to innovation and their collaboration is going under a good climate for innovation and creative. They are sharing the short term goals. About medium and long term goals, they are discussing about the governance of a common legal entity to share commercial benefits of the H-LAMP.

	2014	2015	2016
Brainstorming	Done. Analysis conducted by research lab. Pre-market study conducted by T2i Scarl and Open Innovation Srl		
Building consortium	2 partners in the Consortium. Waiting for a company for commercial activities		
Go/no go –funding application	Local call for training courses (FSE) and market analysis (FESR)	LIV tried to present the project in the SMEs Call	
Development		The companies presented their first prototype	
Application		Fist testing in an industrial site for food/beverage processing	

Project 2: Lighting surface (smart colours for smart cities)
The technical partner patented a new technology concerning a transparent varnish based on nanotechnologies particles for lighting / signalling on transparent surfaces (glass and or plastic) under LED illumination. This innovative technology allows transparent materials, such as glass or polymers, to transform into illuminating graphic displays of unlimited design upon command, and immediately convert back to transparent when switched off.
This technology lets glass or polymer surface to be transformed into a source of light – either full surface coverage or selected areas only – with transparent or slightly translucent colours: monochrome, multi-coloured, graphics or text.
The goal of this project is to use this innovative printing technology to enhance existing products or to generate new ones, in which transparent surfaces are innovated by adding illuminating displays of visual communication or decorative graphics in the field of urban decoration and furniture.

	2014	2015	2016
Brainstorming	Done. LIV promoted		

	meetings among the companies		
Building consortium	3 partners in consortium and a Venetian Municipality		
Go/no go –funding application		Funding under discussion	
Development		Creation of 2 prototypes	
Application		Installation in the Municipality	

Project 3: Edlylight

Edylight is a business experiment developed by the partnership of two companies that offer services for public entities:
• The technical partner: web develop, mobile solutions and social media marketing
• The application partner: heating management, cooling and public lighting
• The Municipality tester: public authority that tested Edylight beta version

	2014	2015	2016
Brainstorming	Done. LIV promoted meetings among the companies		
Building consortium		Done. Consortium among 2 companies and a Venetian Municipality	
Go/no go –funding application		Funding attempt 1 (failed) Funding under discussion	
Development		Creation of the system	
Application		Installation in the Municipality	

3.3 KU Leuven – Light and Lighting Laboratory

3.3.1 Events

Given below is a Table of events in which the SSL-erate project (and/or the *lightingforpeople* website) was discussed by Groen Licht Vlaanderen staff, with outreach to relevant local stakeholders:

Year 2013

Ref no.	Date	Location	Type of event / topic	Stakeholders/ members	No. of participants
2013-1	7-10-2013	Waregem	**Cluster conference**	**Speakers**: GLV staff & cluster members **Audience**: Cluster members	60

Year 2014

Ref no.	Date	Place	Topic	Stakeholders/ members	No. of participants
2014-1	28-01-2014	Gent	**Cluster conference**	**Speakers**: GLV staff & cluster members **Audience**: Cluster members	60
2014-2	13-03-2014	Gent	**Targeted Conference** Intelligent control systems for lighting in buildings	**Speakers**: WP2 Reine Karlsson, Lund University; GLV staff & cluster members, external experts **Audience**: Lighting, building and automation professionals from private companies, municipalities, government.	118
2014-3	24-04-2014	Gent	**Brainstorm workshop** Going faster from innovation opportunities to business development	**Speakers**: WP4 Wim Vanhaverbeke, ESADE; GLV staff **Audience**: Cluster members	12
2014-4	08-05-2014	Gent	**National conference** Sustainable lighting	**Speakers**: GLV staff & cluster members, external experts **Audience**: from the whole lighting value chain and end users	350
2014-5	11-09-2014	Leuven	**Cluster conference**	**Speakers**: GLV staff & cluster members, external experts **Audience**: Cluster members	50

| 2014-6 | 5-12-2014 | Gent | **Targeted Conference** Daylight control systems in school building | **Speakers**: GLV staff & cluster members, external experts **Audience**: Lighting, building and automation professionals. End-user: educational facilities, municipalities, government. | 211 |

Year 2015

Ref no.	Date	Location	Type of event / topic	Stakeholders/ members	No. of participants
2015-1	26-01-2015	Vilvoorde	**Cluster conference**	**Speakers**: GLV staff & cluster members **Audience**: Cluster members	60
2015-2	12-02-2015	's-Hertogen-bosch (NL)	**International conference** LED expo	**Speakers**: WP4 Peter Bracke, KU Leuven; external experts **Audience**: from the whole lighting value chain and end users	2000
2015-3	11-03-2015	Brussels	**Think Tank workshop** Eco-innovation in lighting	**Speakers**: WP4 Peter Bracke, KU Leuven; external experts **Audience**: Cycled project partners	50
2015-4	26-03-2015	Leuven	**National conference** Sustainable lighting	**Speakers**: GLV staff & cluster members, external experts **Audience**: from the whole lighting value chain and end users	320
2015-5	05-11-2015	Gent	**Targeted Conference** Fall event Laboratory of Lighting Technology KU Leuven / KAHO Sint Lieven	**Speakers**: GLV staff, including Peter Bracke on HCL **Audience**: from the whole lighting value chain and end users	170
2015-5	06-11-2015	Gent	**Targeted Conference** WP4 workshop Accelarating LED lighting	**Speakers**: WP4 Peter Bracke, Marc Fontyonont, WP4 Katherina Wulff **Audience**: from the whole lighting value chain and end users	70

3.3.2 Opportunities for business / barriers

Innovation ideas, business opportunities and barriers are regularly discussed, both in public and one-to-one during meetings, workshops and conferences. In the context of the SSL-erate project only those that concern acceleration of market-uptake through innovation are listed below. Other opportunities and barriers, such as 'low hanging fruit', subsidies schemes, adjustable colour temperature, internet-of-things, following developments in other sectors (such as IT, better/cheaper sensors & controls), off-grid lighting are not mentioned.

No.	Ideas / opportunities / targets	Difficulties / barriers
1	Investment-free lighting installations.	Schemes do exist but are not considered at the right time in the customer's procurement or specification process.
2	Sufficient melanopic light irradiance in schools to stimulate alertness and prevent ADHD.	Very limited budgets in schools. Improved student performance and ADHD prevention has only a small value for schools.
3	Stimulate vitality and sleep quality in elderly care by sufficient melanopic light irradiance during specific timeslots.	Very limited budgets: more than half of the elderly care facilities are losing money. Benefits for the elderly are clear, benefits for the investors are not. Some personnel do not like changes.
4	Stimulate sleep/wake patterns and improve patient recovery in patient rooms in hospitals by dynamic melanopic lighting.	Difficult market to approach with a long decision process. There exists a wide gap between patient care decisions and building facilities.
5	Stimulate alertness, work engagement and productivity in offices by a.o. sufficient melanopic light irradiance in a small timeslot, also improving the sleep quality of employees.	The small productivity increase has a high uncertainty and is difficult to measure. The optimal timeslot can be outside the office hours for many employees. Very limited research on alternative practical conditions.
6	No gain, no pay: no extra cost for a lighting system with additional potential benefits until the value is quantified.	Difficult to define and verify.
7	Reduced risk of breast cancer in female night shift workers by limiting the melanopic irradiance.	A focus on prevention by changes to the current lighting practice could result in reduced trust in all artificial lighting, also the innovative ones that reduce the risks.
8	Distributed lighting in offices: more light sources with smaller light flux per source.	Lack of experience in resulting visual comfort (reflection, modelling, contrast).
9	Inclusion of visual comfort in the specifications of procurement.	Good examples of 'invitation to tender' are rare. Better measurement parameters are needed for glare and colour rendition.
10	Improve trust in the new technology by warranty periods that are more than 10% of the claimed lifetime.	Very cheap time loggers need to be incorporated in the drivers. Should become easily feasible when the drivers will have a microcontroller for other functionality.
11	Better integration of daylight and artificial light.	Artificial lighting is currently something that is not considered as part of the design by architects, it is mainly an afterthought. There is very little overlap between suppliers and installers of daylight and artificial light products.
12	Integrate lighting into other functional elements.	Manufacturers and suppliers of those functional elements have insufficient experience with lighting requirements.
13	Luminaires that can increase the illumination when the user gets older.	Requires a simple setup interface that has negligible extra cost.
14	Upgradable luminaires in which the LEDs can be cheaply replaced according to the efficacy progress (and/or higher CRI). Similar for the driver and control interface.	TCO becomes complicated.
15	Better visual simulation of the lighting system in the targeted application.	Profit on lighting systems is very low in absolute terms, so too little time can be spent on simulations. A better visual simulation should be accompanied with an easier simulation tool (editing of the space and objects): this appears to be a contradiction unless ultra-complete libraries are available.

16	Cradle-to-cradle products / circular economy	Ecological advantages are difficult to valuate.

3.3.3 Business Development Experiments

An important consideration for business potential is that a combination of multiple ideas/opportunities/targets into one lighting system holds a higher potential than trying to develop the ideas/opportunities/targets by themselves. The lighting system should offer more than the functionalities a customer could ask for today. Since lighting systems are not targeted to be replaced very often (> 10 years), an innovative lighting system should be future-proof and not 'the flavour of the day'.
Since business is about value for money, either the valuation of the potential benefits needs to be established, or the extra cost should be negligible for those potential benefits that are hard to valuate.

Listed below are the various BDEs that fulfil the SSL-erate requirements:
- Innovative solid-state lighting system or business model
  improving the sustainability score (people + planet + profit)
  and accelerating the market uptake.
- An open innovation approach, involving all relevant stakeholders from the concept stage onwards.
- Monitored by the WP4 lighting cluster staff.
- Open reporting by the project.

Other projects that did not fulfil all the above requirements were launched at the same time, but are not listed below.

No.	Project name – description –consortium (if available)	Leader
1	Higher performance industrial lighting	Lighting lab
2	Improved wellbeing at the workplace through adapted lighting	Lighting lab
3	Lighting for elderly with dementia	Lighting manufacturer
4	Acoustic cloud panel with integral lighting	Lighting lab
5	Exemplary shop lighting in a shopping district	Electricity distribution network company

Experiment 1: Higher performance industrial lighting
After the first brainstorm with the system manufacturers from the lighting cluster, it was clear that too many small steps were being envisaged of the upgrade/next-gen type. A larger innovation step would be needed towards breakthrough/transformational systems. WP3 did not yet have recommendations on achieving the (potential) health & wellbeing benefits, but had this planned during the project. This could be included later on during the project. Further brainstorming with WP2 (Reine Karlsson) indicated that combining a large number a small innovation ideas could be equivalent to one breakthrough innovation with a higher return if successful, but that this will take longer to realize with a lower probability of success. The experiment consists of proposing a lighting system that includes many of the opportunities listed above (3.3.3: 1, 6, 7, 9, 10, 14) for an industrial lighting application.

	2014	2015	2016
Brainstorming	Done: workshop, WP2 input, GLV cluster		
Building consortium	3 partners	1 potential extra stakeholder	
Go/no go –funding		No budget for 2015.	

application		More ambitious application for 2016.	
Development		Ongoing	
Application			

Experiment 2: Improved wellbeing at the workplace through adapted lighting
Mood, comfort, satisfaction, motivation, alertness and night sleep quality can be improved through adapted lighting at the workplace, with a small productivity increase (~1%) as result. For alertness and night sleep quality, the WP3 experts conclude that there is a lot of evidence for the beneficial effects of increased melanopic irradiance outside the office hours. The limited research results on practical systems during the office hours and the high uncertainty on the magnitude of the benefit should be countered in the experiment by a cost-effective reduced roll-out that is still beneficial to as many employees as possible.

	2014	2015	2016
Brainstorming	Done: workshop, GLV cluster	Done: research lab Ongoing with WP3	
Building consortium	3 partners	1 potential extra stakeholder	
Go/no go –funding application			
Development		Ongoing	
Application			

Experiment 3: Lighting for elderly with dementia
The research results on lighting for dement elderly are sparse and largely inconclusive. There are good indications that the sleep quality and daytime activity level can be improved by increased melanopic irradiance during short (0.5 -1 h) daytime timespans. Light level differences between the rooms and/or hallways that the elderly use should be avoided.

	2014	2015	2016
Brainstorming	Done: GLV cluster	Done: research lab. Ongoing with WP3	
Building consortium	3 partners	1 potential extra stakeholder	
Go/no go –funding application		Proposal is under consideration	
Development		Ongoing	
Application			

Experiment 4: Acoustic cloud panel with integral lighting
Not all spaces can have their ceiling fully covered with an acoustic suspended ceiling. Since acoustic cloud panels are required for those spaces, this is a good location to integrate the lighting system in and avoid extra cluttering of the top space. There are novel acoustic absorbers that seem good candidates for the integration of lighting.

	2014	2015	2016
Brainstorming		Done: workshop	
Building consortium		Ongoing	
Go/no go –funding application			

Development		Ongoing	
Application			

Experiment 5: Exemplary shop lighting in a shopping district

There aren't many shops yet that have replaced their lighting with SSL solutions. In this experiment a shop in a shopping district will be converted to all LED-lighting with energy monitoring before and after. This local showcase combined with a communication campaign towards the other shop owners are an effort to stimulate shop owners to replace their lighting systems with LED lighting more quickly.

	2014	2015	2016
Brainstorming		Done	
Building consortium		5 partners	
Go/no go –funding application			
Development		Lighting system is under development.	
Application			

3.4 Clúster d'Il·luminació de Catalunya

3.4.1 Events

Given below is a Table of events organized by 3.4 Clúster d'Il·luminació de Catalunya (CCAT) from fall 2013 (beginning of SSL-erate project) to now.

Year 2013

Ref no.	Date	Location	Type of event / topic	Stakeholders/ members	No. of participants
2013-1	26-11-2013	Barcelona	**Targeted workshop** Lighting in the Retail sector. Fashion Shops	**Speakers**: 7 (3 manufactures, 1 decorator, 1 architect, 2 retailers) **Audience**: manufacturers, architects, fashion shops owners)	52

Year 2014

Ref no.	Date	Location	Type of event / topic	Stakeholders/ members	No. of participants
2014-1	16-01-2014	Barcelona	**Technical workshop** Intellectual property, patents and innovation in lighting	**Speakers**: 2 legal advisors (SNAbogados, Tynax) **Audience**: manufacturers and lighting designers	12
2014-2	13-03-2014	Barcelona	**Technical workshop conference** Lighting Label Regulation	**Speakers**: 1 laboratory (Grupo Sering) **Audience**: manufacturers and lighting designers	30
2014-3	20-05-2014	Barcelona	**Targeted conference** Light in cities (with Lund University and ESADE)	**Speakers**: 4 (2 Municipalities, 2 Universities) **Audience**: manufacturers, laboratories, municipalities	31
2014-4	27-05-2014	Barcelona	**Technical workshop** Lighting LED Solutions	**Speakers**: 7 (4 manufacturers, 3 laboratories) **Audience**: manufacturers	75
2014-5	18-06-2014	Barcelona	**Think Tank workshop** Inspiration, design and LED applications	**Speakers**: 4 (2manufacturer, 1component manufacturer, 1lighting designer) **Audience**: manufacturers, lighting designers, architects	60
2014-6	17-07-2014	Barcelona	**Targeted conference** Lighting in the Hotel sector	**Speakers**: 13 (3manufacturers, 2hotels, 1laboratory, 1domotic company, 5lighting designer/architect, 1furniture cluster) **Audience**:	97

Ref no.	Date	Location	Type of event / topic	Stakeholders/ members	No. of participants
				manufacturers, lighting designers, architects, hotels…	
2014-7	2-10-2014	Barcelona	**Targeted conference** Lighting in the Retail sector	**Speakers**: 7 (2manufacturers, 1audio company, 3lighting designer/architect, 1institute) **Audience**: manufacturers, lighting designers, architects, retailers	90

Year 2015

Ref no.	Date	Location	Type of event / topic	Stakeholders/ members	No. of participants
2015-1	17-03-2015	Barcelona	**Targeted conference** Lighting in the Hospital sector. Related to Human Centric Lighting. We had the point of view from the hospital, an ophthalmologist and an architect specialized in hospitals and how light can be a plus in a faster recovery.	**Speakers**: 8 (4manufacturers, 1laboratory,1hospital, 1ophthalmologist, 1architect) **Audience**: manufacturers, lighting designers, architects, hospitals	100
2015-2	25-06-2015	Barcelona	**Technical workshop** *Lighting Lovers* B2B meeting where professionals involved in a LED lighting project discuss about problems and solutions they found during the project and the opportunities LED light brings	**Speakers**: 9 (2manufacturers, 5lighting designers/architects, 1historian, 1municipality engineering) **Audience**: manufacturers, lighting designers, architects, municipalities	44
2015-3	28-09-2015	Barcelona	**Targeted conference** Lighting in the Hotel sector. Related to how light influences in guests mood and comfort. Also in how LED light can provide a better environment and energy savings (Luce in Veneto facilitate an architect speaker, ESADE participate)	**Speakers**: The expert board is being confirmed **Audience**: manufacturers, lighting designers, architects, hotels…	73
2015-5	*11-2015*	*Barcelona*	**Technical workshop** Retail sector. In collaboration with COAC – Architects of Catalonia Association	***Speakers**: The expert board is being confirmed **Audience**: manufacturers, lighting designers, architects, retailers…*	52
2015-6	10-2015	Barcelona	**Technical workshop** LED Lighting Training	**Speakers**: 42 (manufacturers, laboratories, lighting designers,	25 students per module

| 2015-7 | 3-12-2015 | Barcelona | **Face to Face meeting SSL-erate** Related to Human Centric Lighting, business development presentations and coaching on open innovation business development. | *Speakers*:WP4 Marc Fontoynont; Open Innovation coaching session with Marc Steen, Wim VanHaverbeke, **Audience**: professionals interested/in relation with LED Light, architects, lighting designers, manufacturers, engineers | 56 |

municipalities…)
Audience: professionals interested/in relation with LED Light, architects, lighting designers, manufacturers, engineers

3.4.2 Opportunities for business / barriers.

During meetings and workshops, participants exchanged ideas and provided information to other participants. CICAT has registered the ideas of business opportunities, and has recorded possible difficulties associated to these ideas. We list below some of the major outcomes.

Ref no.	Ideas / opportunities / targets	Difficulties / barriers
1	Replace the traditional light with LED light in Municipalities	- Worries about guarantee and replacement if some of the lights brakes.
2	Replace the traditional light with LED light in public institutions/places	Light is not noticed as an important matter. Air conditioning and services like that are noticed as more important. Changing lights is considered not to be a priority but a waste of money.
3	Light is a powerful tool for increasing sales. Studies have confirmed that you can give a better buying experience by illuminating shops depending on the characteristics of the costumer	People just notice light when there is a bad light because they need to force sight, they get headache… Unfortunately we don't notice good or proper illumination and that's why we don't consider light to be important.
4	To use LED light to create better environment for aged people in an elderly home	It seems that blue light of LEDs is not appropriate for aged people to see properly
5	To help people following the circadian rhythms	In Spain, because of the abundant presence of sun light, investments in recreate circadian rhythms is not a priority
6	There are a lot of possibilities for surgeon's professionals. Their job requires a high quality light: the right colour temperature, no glare or shadows…	It's important that lights don't generate too much heat for the medical comfort so it's essential to invest in heat sink components
7	LED can save energy and reduce costs	The expensive first inversion and the time that has to pass before you start recovering money
8	The OLED technology is a new business technology opportunity	- More investment has to be done - The price is higher than the convectional LED price
9	With the smart city revolution, there is a gap for intelligent lights to report	You need to test the technology in small areas before to install it in bigger ones

	information and to work by itself depending on the environment	
11	Theatre is a potential sector for LED to be used in	Difficulty in the requires of the scenario
12	There is a huge potential in city beautification which can have a positive effect in tourism	With the crisis, budget is needed for more important matters

3.4.3 Business Development Experiments

During the activities organized by CICAT the most important ideas were the following ones:

- The influence of lighting for well-being and health
- The importance of lighting in studding/working environments: concentration, headache…
- How LED light is more efficient and economical in the long run.
- How it is possible to build more comfortable places through the use of light.
- How it is possible to improve sales on retail using light depending on the costumer.

We list below the BDEs which were launched during the SSL-erate programme.

No.	Project name – description –consortium (if available)	Leader
1	Light your college	
2	LED light in the Hospital	
3	Street Lighting - LED PC-Amber	
4	LED Light in the Office	

Project 1: Light your college

Light has of role to play in education. LED light in classrooms can offer the optimum light for the learning situation and not just what is required as a minimum by a basic lighting standard. The regulation level and the kind of colours that can be provided by LED technology can make pupils to study in better conditions and to achieve higher marks. Also, luminaires with LED can outperform conventional lighting bringing lower maintenance, due to longer life time and energy saving.

The goal of the project is to replace at least in one classroom the traditional light with led light and inform pupils about energy resources and solutions for environment and energy savings about led light and energy saving. The idea is to be the starting point for other schools to do the same.

At the moment CICAT is having difficulties to keep on going with the project of the replacement because of funding. We'll try to reactivate it in September.
CICAT is collaborating with an association attending classes in a college in Spain, teaching about environment and energy saving technologies provided by photovoltaic technologies and led . A website has been launch in order to collect funds for the schools to change to led lights.

	2013	2014	2015
Brainstorming	Done. Analysis conducted by the Institute.		
Building consortium		Done. Consortium	

		among 2 companies, 1 foundation, 1 institute and 1 school	
Go/no go –funding application		Funding attempt 1 (failed). Funding attempt 2 (2015)	
Development			Classes about environment and energy saving technologies in colleges
Application			

Project 2: LED Light in Hospital

Light has an important role in well-being and health. We have a biological rhythm that works according to the sun light. To be able to create an ambiance as similar as possible to the natural one can make the difference in a recovery.

The goal of the project is to replace traditional light with led light in the hospital and measure the effect on the hospital staff and patients.

	2013	2014	2015
Brainstorming	Done. CICAT promoted meetings among the companies		
Building consortium	Done. Consortium among 3 companies and 1 hospital		
Go/no go –funding application		The hospital selected the manufacturers	
Development		Done. The traditional light has been replaced into LED light.	
Application			

Project 3: Street Lighting - LED PC-Amber

The majority of the animal life, wildlife and insects are adapted to live in the nocturnal world.
In the darkness they hide from predators, feed themselves, hunt other animals...
These species are more sensitive to blue light radiation. The red light, on the other hand, is invisible to them and doesn't disturb their life cycles.

The goal is to use the phosphor coated amber light technology, which is respectful for the environment, for the village of Santa Pau and the bridge over the river Ter, in the municipality of Girona. To installation amber colour LED lights in order to preserve the wildlife of the Natural Parc of La Garrotxa.

The substitution has been done and will save an energy consumption of 21.000 kWh per year for the municipality.

	2013	2014	2015
Brainstorming	Done. CICAT promoted meetings among the companies		

Building consortium	Done. The consortium was built with two partners and the municipality		
Go/no go –funding application		Municipality	
Development			Done. The LED PC-Amber light it is installed on the village and on the bridge.
Application			CICAT is trying to organize a session of measurement in collaboration with WP3

Project 4: Light in Office

Light is so important in office working tasks. LED light in offices can offer the optimum light for the staff to work more concentrated and less tired. This can make the company more competitive. Also, luminaires with LED can outperform conventional lighting bringing lower maintenance, due to longer life time and energy saving.

The goal of the project is to replace the traditional light of a large car manufacturer office in Madrid with LED light and to install an automated services switching on/off lighting in order to provide a better light for the staff and reduce light consumption.

The installation has been done in 1 month and will suppose a 62% of light consumption.

	2013	2014	2015
Brainstorming		Done. CICAT promoted meetings among the companies	
Building consortium		Done. The consortium was built with four partners	
Go/no go –funding application		Car manufacturer offices selected the partners	
Development		The installation has been done in 1 month	
Application			

3.5 Danmarks Tekniske Universitet – Danish Lighting Innovation Network

3.5.1 Events

Given below is a Table of events organized by the Danish Lighting Innovation Network from fall 2013 (beginning of SSL erate project) to now.

Year 2013

Ref no.	Date	Location	Topic	Stakeholders/ members	No. of participants
2013-1	17-9-2013	Copenhagen	**Targeted conference** Collaboration between China and Denmark	**Speakers**: Invest in Denmark, DOLL, Danish Lighting Innovation Network **Audience**: members and Chinese representatives	20
2013-2	4/7-12-2013	Lyon	**Think Tank workshop** Study trip to Fêtes des Lumières	**Speakers**: City of Lyon, ENTPE, Philips OLAC, Cluster Lumière, Dansk Lys etc. **Audience**: Byens Netværk members and Danish Lighting Innovation Network members	37

Year 2014

Ref no.	Date	Location	Topic	Stakeholders/ members	No. of participants
2014-1	15-1-2014	Roskilde	**Technical workshop** Opening of the Danish Outdoor Lighting Lab – quality lab	**Speakers**: Danish Outdoor Lighting Lab, DTU photonics, Albertslund Municipality, HesaLight, Danish Lighting Innovation Network **Audience**: Danish Lighting Innovation Network	78
2014-2	1-4-2014	Frankfurt	**Think Tank workshop** Get-together at the Light and Building 2014	**Audience**: members of the Danish Lighting Association and the Danish Lighting Innovation Network	53
2014-3	23-4-2014	Hørsholm	**Think Tank workshop** Light 2.0 – facilitation of new lighting product ideas	**Speakers**: Lund University, DTU Electro, Montana, Little Sun GmbH, DTU Photonics, Albertslund municipality, 1st Mile, Lund University, Chromatist, Væksthus Hovedstaden. **Audience**: Danish	70

Version: 1.0

				Lighting Innovation Network members	
2014-4	23/24-10-2014	Copenhagen	**Targeted Conference** Korea goes to Denmark – Korean/Denmark collaboration initiative	**Speakers**: Innovation Center Denmark, Korean companies, Invest in Denmark, DOLL and the Danish Lighting Innovation Network. **Audience**: Korean companies, KAPID, KOPTI and the members from DOLL and Danish Lighting Innovation Network.	29
2014-5	27-11-2014	Copenhagen	**Think Tank workshop** The creation of a new part of Copenhagen	**Speakers**: By og Havn and the Danish Lighting Innovation Network. **Audience**: The Danish Lighting Innovation Network members.	13
2014-6	7/8-12-2014	Lyon	**Think Tank workshop** Study trip to Lyon	**Speakers**: AAU CPH, City of Lyon, Cluster Lumière	13

Year 2015

Ref no.	Date	Location	Topic	Stakeholders/ members	No. of participants
2015-1	26/27-3-2015	Copenhagen	**Targeted conference** SSL Erate – findings and business opportunities workshop	**Speakers**: TNO, Cluster Lumière, CICAT, Luce In Veneto, AAU CPH and Danish Lighting Innovation Network. **Audience**: DOLL, Danish Lighting Association and Danish Lighting Innovation Network members.	20
2015-2	27-05-2015	Copenhagen	**Targeted conference:** Funding – "how to do it" workshop	**Speakers**: UpFrontEurope, the Danish Innovation Fund, ELFORSK, out-sider, PA consult. **Audience**: Danish Lighting Innovation Network	27
2015-3	26-8-2015	Roskilde	**Technical workshop:** DOLL Virtual Lab opening	**Speakers**: DOLL, DTU Photonics, Utopian City Scape, DTU Space, Philips and Danish Lighting Innovation Network. **Audience**: DOLL and Danish Lighting Innovation Network members.	92

3.5.2 Opportunities of business / barriers.

During these workshops participants exchanged ideas and were encouraged to form consortia. The Danish Lighting Innovation Network registered the following ideas of business opportunities or concepts and below these are listed with the recorded difficulties/barriers for the realisation of these.

Ref no.	Ideas / opportunities / targets	Difficulties / barriers
1	To develop a new lighting product that will be focused on human day rhythm and be appropriate for the 65+ segment.	Need test group and contact to a group that have expertise within the 65+ segment and a platform that is suitable for this. The project was chosen to be part of the SSL-erate project.
2	Investigation of how to make the window more effective in terms of transmittance of daylight.	Knowledge of different materials required in order to transmit daylight more effectively.
3	Testing of power converters that will allow to produce more efficient power converters to LED lighting.	Fierce world competition within this field of expertise.
4	Lighting for mental hospitals.	Very fierce legislation within this topic.
5	Perceptual test of lighting in order to give guidelines of how people perceive light.	Light is very subjective both personally and culturally.
6	PV OLED product for the outside	OLED very new so far and very sensitive in terms of sunlight.
7	An integrated daylight/artificial light product	Will such a combination be effective enough in order to be used as a real alternative to standard lighting solutions? The project was chosen to be part of the SSL-erate project.
8	Virtual simulation of lighting for roads	Need to be choosing software that the majority of lighting specialists use in order to ensure relevance.

3.5.3 Business Development Experiments

The Danish Lighting Innovation Network decided to focus on two different projects in terms of the business development experiments within the SSL-erate project:
- The Window
- Better Light, Better Control

Below are the two BDEs that the Danish Lighting Innovation Network identified during the SSL workshop to be suitable for the SSL Erate. Other projects were commenced on the background of the Light 2.0 workshop but were not relevant within the SSL-erate project.

No.	Project name – description –consortium (if available)	Leader
1	The window	Research institution
2	Better light, better control	Research institution

Project 1: The Window
Due to energy restrictions and to the new architecture tendencies with large windows, a new way of thinking has opened up to incorporate daylight and artificial light in a new window. Together with incorporating the daylight and artificial light function in one product, the project will also concentrate on day-rhythm lighting and how to use this more intelligently when combining the two in one product. The challenges in this are among others to ensure, that

the product will have relevance for client-side and to ensure sufficient lighting from the artificial lighting in order to be a real substitution for ordinary lighting fixtures.

Companies/organizations involved:
- Research institution
  - Role: Project leader and daylight knowledge provider
- Research institution
  - Role: Artificial light knowledge provider
- Window manufacturer
  - Role: To contribute with the design of the window
- Power converter manufacturer
  - Role: To contribute with their knowledge within power converters
- Lighting control manufacturer
  - Role: To contribute with their knowledge about artificial light in the product
- Architects
  - Role: To contribute to the overall design of the product and to give feedback as launching customer

	2014	2015	2016
Brainstorming	Done. Kick-start of brainstorming at the Light 2.0 workshop and spring/summer 2014		
Building consortium	Done. Consortia formed and kick-off meeting		
Go/no go –funding application		Done. Got funding from the Danish Lighting Innovation Network with effect from 2015. But the consortia has also submitted another application for funding for another fund.	
Development	A mock-up has been build and been tested.		
Application			

Project 2: The Better Light, Better Control
When people get older, they do not have the same ability to move and they need more light. Many companies offer solutions that can help day rhythm but the problem with these solutions is that they are too technical for elderly people. This project will test how elderly people use light and what they demand in terms of control of these products. The project aims to find a solution that is dynamic, easy to implement in private housing and finally is easy to control for people +65.

Companies/organisations involved:
- Research institution
  - Role: Project leader, knowledge provider and test of different lighting scenarios.
- Research institution
  - Role: Knowledge provider and tester of the different solutions.

- Lighting control manufacturer
   Role: This company will contribute with their knowledge about day rhythm light in the product.
- Lighting designer
   Role: The company have in-depth knowledge about the segment in question and will provide knowledge and expertise within this field
- Lighting laboratory
   Role: To act as test bed
- Municipality
   Role: The municipality will be the potential buyer of the products that will be developed in this project.

	2014	2015	2016
Brainstorming	Done. Kick-start of brainstorming at the Light 2.0 workshop and networking spring/summer 2014		
Building consortium	Done. Consortia formed and kick-off meeting	Workshops.	
Go/no go –funding application		Done. Got funding from the Danish Lighting Innovation Network with effect from 2015.	Exploration of possible funding application.
Development		Determine light specifications, sensor management and test the product with focus group.	Analysis of information from tests and report on findings.
Application			

4 Open Innovation in Business Development Experiments

4.1 Open Innovation

In the *SSL-erate* project we define Open Innovation as: organizing an innovation process in which companies and/or organizations collaborate in a network or consortium[1] in order to achieve goals collectively that they could not have achieved individually.

Open Innovation provides opportunities for radical innovation and for joint value creation. It involves the sharing of knowledge, expertise and resources between organizations during an innovation process, so they can achieve goals collectively that they cannot achieve alone.

Open Innovation typically involves open dialogues and sharing of knowledge. Additionally and typically for the SSL-erate, Open Innovation refers also to the following:

- Using scientific knowledge and customers' ideas concerning 'green business development' and/or 'lighting for health and wellbeing'
- Inviting and using input from 'lead customers', e.g. cities, local governments, schools or hospitals, or from 'lead users', e.g. citizens or the people working in schools or hospitals
- Articulating and sharing 'lessons learned' and 'best practices' in collaborative innovation within and between the participating local lighting clusters.
- Co-branding, e.g. combining the identity and communication of a city and a company, as a way to highlight the potential synergies between various interests and actors.

Typically, there will be different partners with different backgrounds, roles and interests, e.g., from the supply side as well as from the demand side who share a common goal. They collaborate to solve a specific problem, to seize a particular opportunity, to create something new together, e.g., a new product, service, process, or business model. They collaborate to achieve something that each one of them could not have done individually.

Open Innovation offers the following potential benefits:

- Use the knowledge and resources of (outside) experts, suppliers, customers or users ('outside-in')
- Use the sales and distribution capabilities of other organizations to serve 'new markets' ('inside-out')
- Opportunities to create a 'new market' through collaboration between suppliers and customers
- Overall: Make innovation more efficient and effective, e.g. by sharing costs and by sharing risks

However, Open Innovation also involves challenges:

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[1] See: Vanhaverbeke 2006; this is different from the early or mainstream literature on Open Innovation, which tends to focus on innovation within one (large) company, which 'imports' or 'exports' ideas or knowledge.

- Less control over the innovation process, development, implementation and marketing
- More complexity, e.g. regarding management, control, governance, and leadership
- Resistance in the company, e.g., 'Not Invented Here' (against 'outside-in') or 'Not Sold Here' (against 'inside-out')
- Overall: A range of challenges regarding transparency, communication and collaboration

4.2 Business Development Experiments

Open Innovation is organized in the SSL-erate project in the form of Business Development Experiments (BDEs), organized by the five Lighting Clusters. They brought together companies, knowledge institutes and local governments in a series of BDEs. Each BDE involves multiple organizations that share knowledge, expertise or resources—in order to innovate collaboratively:
- One or more companies, e.g., a developer and a manufacturer—in order to develop and manufacture the product or service
- One or more launching customers, users or distribution channels, e.g., a hospital, city or an architect office—in order to learn about their needs
- One or more knowledge institutes, e.g., a university department—in order to access and apply state-of-the-art scientific knowledge

Below a list is given the 24 Business Development Experiments and their respective statuses (November 2015):
- 6 BDEs were successfully executed and (almost) finalized:
  - 'LED Light in Hospital' of CICAT was implemented
  - 'Street Lighting LED PC-Amber' of CICAT was implemented
  - 'LED Light in Office' of CICAT was implemented
  - 'Hygienizing Lamp' of Luce in Veneto has advanced; prototype delivered and additional economic and commercial analyses and actions planned for 2016
  - 'Lighting Surface' of Luce in Veneto has advanced; prototypes delivered and additional economic and commercial analyses and actions planned for 2016
  - 'Lighting for Elderly with Dementia' of Groen Licht Vlaanderen; specifications delivered and advanced knowledge exchange with manufacturer and dementia care home
- 7 BDEs are currently being executed:
  - 'Edylight' of Luce in Veneto; prototype stage
  - 'The Window' of the Danish Lighting Innovation Network; prototype stage
  - 'Better Light, Better Control' of the Danish Lighting Innovation Network; prototype stage
  - 'Higher Performance Industrial Lighting' of Groen Licht Vlaanderen; specification for using 'yellow' light during night shifts
  - 'Improved Wellbeing in the Workplace' of Groen Licht Vlaanderen; specification for using human-centric lighting in the office restaurant
  - 'Exemplary Shop Lighting' of Groen Licht Vlaanderen; installed, exchange of experiences
  - 'Airport Healthy Lighting' of Cluster Lumière
- 9 BDEs are currently being developed:
  - 'LED Light in your College' of CICAT
  - 'Virtual glasses' of CICAT (initiated in November 2015, not yet documented)
  - 'Therapeutic light' of CICAT (initiated in November 2015, not yet documented)
  - 'Acoustic Cloud Panel with Integral Lighting' of Groen Licht Vlaanderen

- o 'Flat SSL Ceiling Luminaires with Changeable Light Engines' of Cluster Lumière
  - o 'High Performance School Lighting' of Cluster Lumière
  - o 'Customized Industrial Luminaires' of Cluster Lumière
  - o 'Plug and Play SSL Luminaire' of Cluster Lumière
  - o 'Citizen Friendly Urban Lighting' of Cluster Lumière
- And 2 BDEs were terminated or put on hold:
  - o 'Greenhouse Lighting System' of Cluster Lumière'
  - o 'Easy Maintenance Street Lighting' of Cluster Lumière

5 Reflections, first lessons learned and preliminary recommendations

5.1 Reflections on the Business Development Experiments

Looking at the BDEs in, we can see different patterns for BDEs with different sizes:

- **The relatively smaller BDEs** are easier to start and bring to a success: they involve a small number of partners and they focus on achieving a relatively small, short-term goal, e.g., developing a prototype for one customer (e.g., the BDEs of Luce in Veneto and DLIN). A possible disadvantage of relatively smaller BDEs is, of course, that their potential impact is likely to be relatively modest.
- **The relatively larger BDEs** require larger funds and more effort to align stakeholders, which results in longer lead-times for the creation of a consortium or partnership, with more complexity in relationships and interests (e.g., the BDEs of Cluster Lumière). A possible advantage of relatively larger BDEs is, of course, that their potential impact, if they are successful, can be relatively large.

Furthermore, we can see that the aim to serve a customer's needs and the aim to develop an innovative technology can be combined differently:

- **BDEs that serve a specific customer's needs** can be relatively easy to implement, but also relatively less innovative regarding technology—e.g., 'LED Light in Hospital' of CICAT, in which an existing SSL system was implemented. These BDEs are very useful because they create evidence for specific business benefits, e.g., for efficient and quick installation of an SSL system.
- **BDEs that focus on developing innovative technology** are interesting from a technology perspective, but it can be challenging to convince customers of their benefits—e.g., the BDEs of Groen Licht Vlaanderen. In such BDEs, relatively smaller steps must be made, in very close collaboration with clients, in order to move from *potential* benefits to *realized* benefits.
- **BDEs can combine these two aims**: serving customers' needs and developing an innovative technology, e.g., by collaborating with knowledge providers and with specific customers, as is the case in the BDEs of Luce in Veneto and of the Danish Lighting Innovation Network. In these cases, scientific knowledge or patents are used to create specific prototypes for one client.

The SSL-erate project aims to support relatively radical innovations, which inherently involve relatively high levels of uncertainty regarding technology and regarding business. This is generally not very attractive to companies. They tend to prefer proven technology and certainty in business. One way to solve this dilemma is to organize a portfolio of more or less customer-oriented and more or less technology-oriented BDEs, like the SSL-erate project does.

In such an approach, it is important to organize the exchange of knowledge and lessons learnt' between Clusters, and to organize co-development, which enable, e.g., one prototype to travel from one cluster, where it was developed by partners A, B and C, to another cluster, where it can be further developed by other partners D, E and F, into a marketable product.

5.2 First lessons learned

Based on an analysis of four BDEs ('Hygienizing Lamp' and 'Lighting Surface' of Luce in Veneto, and 'The Window' and 'Better Light, Better Control' of the Danish Lighting Innovation Network; described in some detail in the *Open Innovation Toolkit, version 02*) we identified the following success factors, which need to be in place in order to realize the benefits of Open Innovation:

- There need to be clear, short-term, collective goals (typically: to create a prototype and to test it in the real-world with a client) and these need to be aligned with individual goals
- The consortium needs to have all the key skills (typically: for development, manufacturing and marketing), and partners need to have complementary skills (no direct competition)
- The consortium is relatively small (e.g., partners that are no longer needed can leave), and higher management needs to be directly involved, for quick decision making
- There needs to be a clear vision (both short-term and longer term) and a leadership style that promotes collaboration and creativity (and personal contacts help a lot to get things done)
- Communication and collaboration with prospective customers (who pay) or users (who use) are key to understand their actual needs, and to develop practical solutions.
- Ideally, the project is organized in such a way that it allows for an iterative approach, e.g., with early testing, improvements, prototyping, real-world trials, improvements, etc.
- Furthermore, organizations that promote collaboration across the value chain, and the application for additional funds for innovation, can help to make innovation projects successful.

Based on the analysis of the BDEs of Cluster Lumière, we found that the highest difficulty was to get the commitment of the client (Airport Lighting BDE, Plug and Play luminaires BDE): engineers had a lot of difficulty in convincing their financial managers or CEO to commit their company.

In another case (School lighting BDE), the difference between required internal resources and market appeared to be a problem: although a large market was identified, the company resources where judged insufficient to meet the objectives of production.

For most companies, cost target is a major issue, and it is difficult to identify suppliers able to lower their costs.

5.3 Preliminary recommendations for policies for SMEs

There are many SMEs in Europe that want to innovate. They have ideas, they have expertise, they have clients. But they find it hard to find funding for innovation. They lack the funds that larger companies typically have. Moreover, SMEs often cannot handle the risks of innovation. They face many uncertainties and question marks… regarding technology, market and business model. They can only convince their clients of the benefits of their innovations if they turn these question marks into answers, if they provide clarity and facts.

That was the objective of organizing these BDEs: To enable SMEs to turn their ideas into working prototypes that have value in the real world. Only with such prototypes, can they provide clarity to their customers and convince them of the innovation's benefits.

In the SSL-erate project, the efforts of the Lighting Clusters were instrumental in setting-up the BDEs. Moreover, they helped the SMEs involved to access (relatively small) funds (e.g., of DLIN and Luce in Veneto) that enabled them to do a patent search, to develop a first prototype, to do market analyses, to conduct a first trial in a real-world setting with a client. These activities are needed to bridge the gap from a first idea to a working prototype. Without these funds, the ideas would remain ideas, and no value would have been created.

In order to help SMEs to innovate more effectively and efficiently, policies would need to focus on helping SMEs to reduce some of the risks that they currently face:
- To organize relatively small-scale innovation projects
- To collaborate with knowledge institutes and launching customers
- To articulate shared, short-term goals, e.g., developing prototypes
- To organize real-world trials or evaluations with a launching customer

Policies that promote these activities in SMEs are likely to result in successful innovation.

6 The Open Innovation Toolkit

In order to promote Open Innovation, an Open Innovation Toolkit and an Open Innovation Methodology were developed:

- The Toolkit consists of an introduction (chapters 1 and 2: Solid State Lighting; Open Innovation) and a series of checklists (similar to Business Model Generation) to develop the *content of the innovation* (chapter 3, which is very similar to the Open Innovation Methodology) and to organize the *process of collaboration* (chapter 4).
- The Methodology consists of a series of templates: from 1. Opportunities and 2. Business idea, to 3. Customer description, 4. Product, service and value, 5. Enriched idea, and 6. Value chain, and then to 7. Business Model, 8. Consortium, and 9. Project leadership, and, finally, to 10. Financial discussion and next steps.

This Toolkit and Methodology were used in interactive workshops with the companies involved in two BDEs of the Danish Lighting Innovation Network (March 2015) and the companies involved in three BDEs of Luce in Veneto (June 2015). In these workshops, Open Innovation experts Nils Erkamp and Wim Vanhaverbeke worked with the companies, and focused on the *content of the innovation,* using also the Business Model Generation Canvas. They also discussed the *process of collaboration*, but mostly indirectly. The participants in these workshops appreciated the support of these experts and the usage of the Toolkit and Methodology.
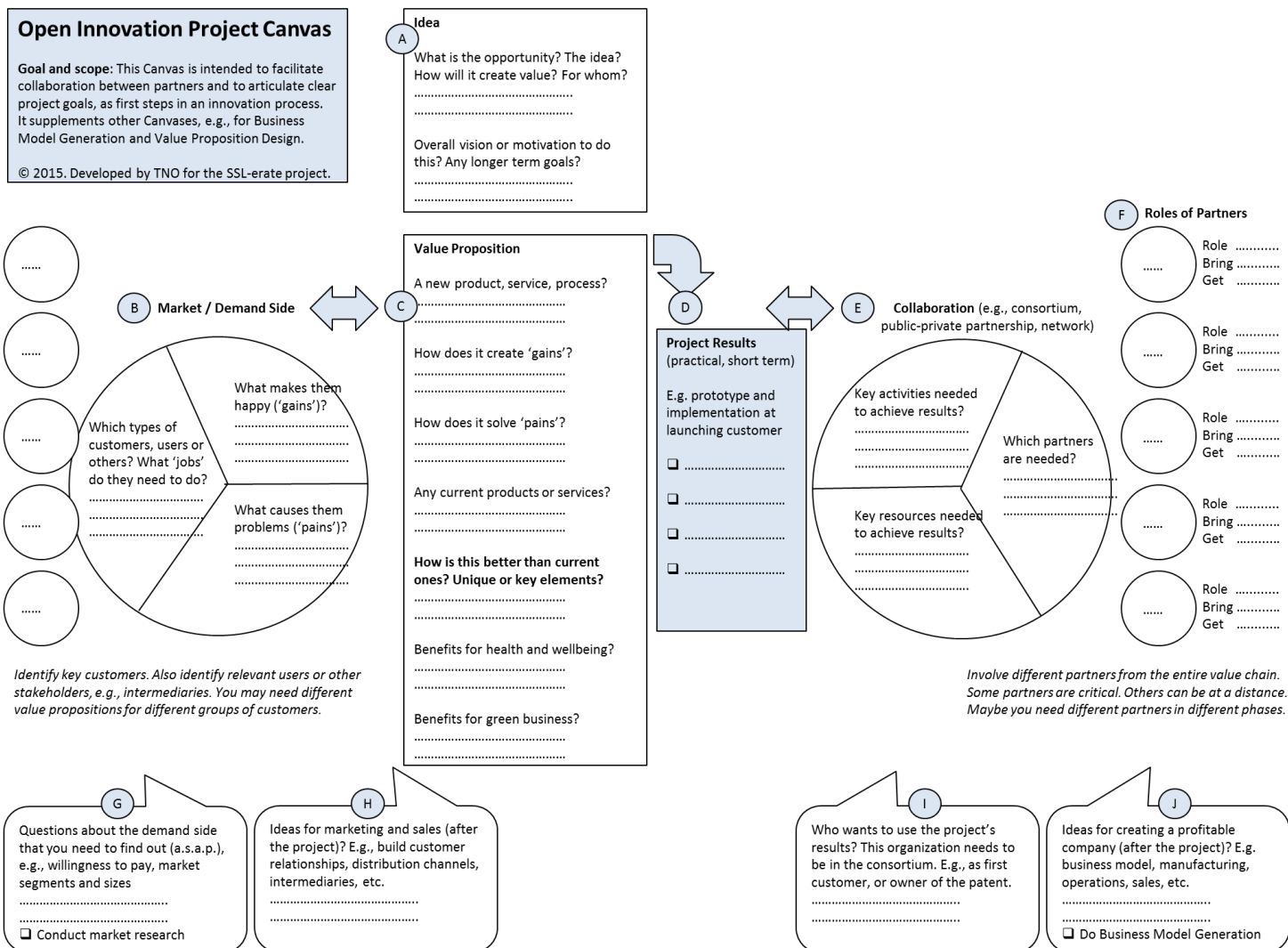
The usage of the Toolkit and Methodology outside of these workshops is, however, very limited. Cluster Coordinators did receive a one-day training to use these tools (June 2014) and they are able to use them, e.g., in workshops with companies. In practice, however, many people prefer to follow their own ways of working, to rely on their own skills and (informal) methods and tools, or to use better-known templates, e.g., of Business Model Generation. This is a well-known challenge in the field of innovation: many tools are available, but they are used relatively rarely (Daalhuizen, 2014).

In the Description of work (Task 4.1, page 21) are three questions, which we would like to tentatively address (more detailed answers will follow in the final reporting):

- How does this Open Innovation Toolkit help organizations to improve their collaboration capabilities? E.g. which methods or tools are most useful and of added value? Which challenges, and which limitations?
  - *Tentative answer: The cluster coordinators and the companies involved have used the Toolkit in several face-to-face workshops; they used the first (content-oriented) part, not the second (process-oriented) part.*

- How does the Toolkit cater for different needs, of different partners, and in different phases of development, implementation and commercialization?
  - *Tentative answer: The Toolkit helped to approach the (content-oriented) development of the new product or service in a systematic way; it helped to discuss (early) ideas just before and after the consortium had been formed. It was, however, not used to promote collaboration or creativity; therefore the (process-oriented) benefits for the process of open innovation did not materialize explicitly. Doing the workshops, however, did promote collaboration in informal manner. Moreover, the Toolkit was not yet used during further development, e.g., detailing the product or service or business model, simply because the Business Development Experiments are not yet in those stages.*

- How does the Toolkit help organizations to use their strengths capabilities productively? E.g. to align project collective goals […] with the local companies' individual ambitions and goals for business development?
  - *Tentative answer: Making explicit the BDE goals, as practical as possible, helped the companies involved to combine and align their individual goals. Moreover, making explicit the collective, societal goals (promoting health and wellbeing; green business development) helped to develop an overall vision and coherence within several BDEs.*

In November 2015 a new version (version 02) of the Open Innovation Toolkit was developed, based on the experiences in the Business Development Experiments. This version 02 integrates the Open Innovation Toolkit version 01 and the Open Innovation Methodology, and it includes a practical Open Innovation Project Canvas, which Clusters can use to organize Business Development Experiments. Moreover, this version (02) will be used in the remainder of the SSL-erate project and will be disseminated on various events (e.g., at Lux Live, London, 19 November 2015).

Open Innovation Project Canvas

Goal and scope: This Canvas is intended to facilitate collaboration between partners and to articulate clear project goals, as first steps in an innovation process. It supplements other Canvases, e.g., for Business Model Generation and Value Proposition Design.

© 2015. Developed by TNO for the SSL-erate project.

A Idea

What is the opportunity? The idea?
How will it create value? For whom?
……………………………………..
……………………………………..

Overall vision or motivation to do this? Any longer term goals?
……………………………………..
……………………………………..

F Roles of Partners

Role ………..
…… Bring ………..
Get ………..

Role ………..
…… Bring ………..
Get ………..

Role ………..
…… Bring ………..
Get ………..

Role ………..
…… Bring ………..
Get ………..

Role ………..
…… Bring ………..
Get ………..

B Market / Demand Side

Which types of customers, users or others? What 'jobs' do they need to do?
……………………………
……………………………

What makes them happy ('gains')?
……………………………
……………………………

What causes them problems ('pains')?
……………………………
……………………………
……………………………

Identify key customers. Also identify relevant users or other stakeholders, e.g., intermediaries. You may need different value propositions for different groups of customers.

C Value Proposition

A new product, service, process?
……………………………………
……………………………………

How does it create 'gains'?
……………………………………
……………………………………

How does it solve 'pains'?
……………………………………
……………………………………

Any current products or services?
……………………………………
……………………………………

How is this better than current ones? Unique or key elements?
……………………………………
……………………………………

Benefits for health and wellbeing?
……………………………………
……………………………………

Benefits for green business?
……………………………………
……………………………………

D

Project Results
(practical, short term)

E.g. prototype and implementation at launching customer

❑ …………………………
❑ …………………………
❑ …………………………
❑ …………………………

E Collaboration (e.g., consortium, public-private partnership, network)

Key activities needed to achieve results?
……………………………
……………………………

Key resources needed to achieve results?
……………………………
……………………………

Which partners are needed?
……………………………
……………………………

Involve different partners from the entire value chain. Some partners are critical. Others can be at a distance. Maybe you need different partners in different phases.

G Questions about the demand side that you need to find out (a.s.a.p.), e.g., willingness to pay, market segments and sizes
……………………………………..
……………………………………..
❑ Conduct market research

H Ideas for marketing and sales (after the project)? E.g., build customer relationships, distribution channels, intermediaries, etc.
……………………………………..
……………………………………..

I Who wants to use the project's results? This organization needs to be in the consortium. E.g., as first customer, or owner of the patent.
……………………………………..
……………………………………..

J Ideas for creating a profitable company (after the project)? E.g. business model, manufacturing, operations, sales, etc.
……………………………………..
……………………………………..
❑ Do Business Model Generation

Appendix 1 – Information on Lighting Clusters

A   Cluster Lumière

A.1 Presentation

Cluster Lumière was launched in Lyon in 2008, by 3 major companies, one scientific laboratory, and a communication organization. They are the founding members. Cluster Lumière is a non-profit organization housed by the Lyon Chamber of Commerce (CCI).

Cluster Lumière management board is composed of:
- President: EDF – François CORTEEL
- Vice-President Innovation: ENTPE – LUC DELATTRE
- Vice-President Competitiveness: PHILIPS – Benjamin AZOULAY
- Vice-President Promotion : CDO - Jean-Pierre FRANCESCHETTI
- Treasurer CLE-SONEPAR – Bruno VERNIER
- Secretary : INGELUX – Christophe MARTY

Cluster Lumière staff team is composed of:
- Managing Director : Patrick CLERT – GIRARD
- Innovation and Research Project Manager: Alix JOCTEUR MONRONZIER
- Market application and international Project Manager: Ophelie BAROU
- Executive assistant ; Martine BARRAS

Cluster Lumière   brings together companies and organizations of the lighting sector addressing the whole value chain: Laboratories, manufacturers, engineers, lighting installers and designers, see Figure A1.
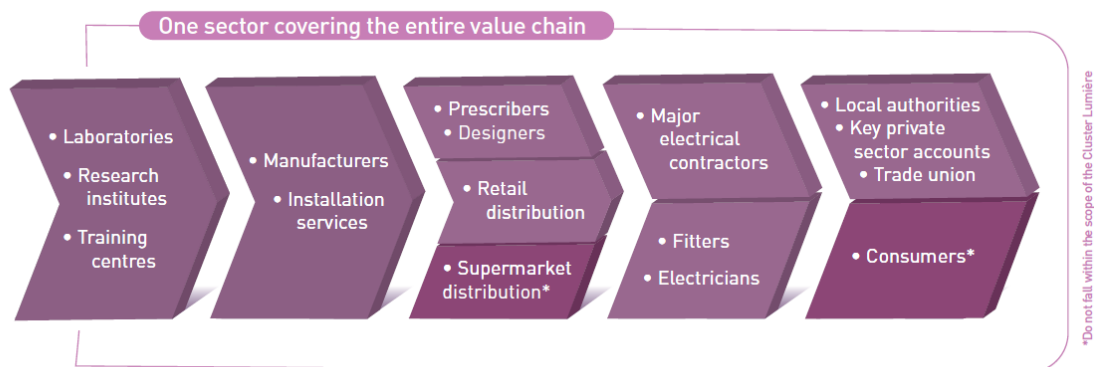
Figure A1 – The lighting value chain covered by Cluster Lumière.

Below are key words describing the activities of Cluster Lumière
Goals of the Cluster Lumière:
- Support the competitiveness and development of the lighting actors
- Federate the lighting actors all along the value chain
- Strengthen Research & Innovation in lighting
- Foster market acceptance of new technologies

Market and application: all kind of professional lighting application domains
- Indoor lighting : stores, offices, industrial premises, car parks, theatres, galleries, schools, hospitals, hotels
- Outdoor lighting : public lighting, architectural, tunnels, sport, outdoor public areas
- Signalling: signal panels, road signs, advertisement

Strong focus on new technologies
- LEDs, OLED's, IT technologies
- Lighting Controls and Management Systems

Shared Values and Principles
- Improving mankind's lighting environment, Human Centric Approach
- Development of innovative and energy-efficient lighting solutions
- Optimal use of artificial light and daylight
- Quality control and standardisation of lighting equipment
- Respect of confidentiality and Intellectual Property
- Participating in collaborative projects and working in networks

Cluster Lumière Members characteristics:
Cluster Lumière brings together over 170 Members (2015) and the number of members increases by 10 to 20% every year; see also Figure A2. We identify 3 categories of members
A Laboratories and technical centres:
POLE ORA / CSTB / ENTPE / CEA / INSA DE LYON / LNE / ESISAR / Laplace / Institut d'Optique / SOPAVIB / EMITECH / Blaise Pascal / CERTU / PISEO…
Manufacturers
PRISMAFLEX / DIFFUSELEC / SINOVIA ECCELECTRO / ZEDEL / FAGERHULT / LEC / NATURE et CONFORT / BROCHIER Tech / DIETAL / AIR STAR / ARCOM / BEST ELECTRONIQUE / SPHEREOPTICS / SGAME / SOGEXI / GAGGIONE / LENOIR SERVICES / PHILIPS / TRACEDGE / BH TECHNOLOGIES / RTONE / LUM / CIRE SAS / MAQUET SA / ADEUNIS / ARKANZ / MARMILLON / EEI SACEM / MAJANTYS / SOITEC …
Users/Specifiers/Retailers
GIRUS / INGELUX / REXEL / SONEPAR / FA Musique / OPUS LIGHT / GL EVENTS AUDIOVISUAL / CITELUM / FNCCR / VINCI Energie / ERDF / EDF / ACE / SERCE / RAMPA EC / CARIBOU CONCEPT / ALPHA JM / COBALT / SERPOLLET / INEO SA / EGIS AMENAGEMENT / XLR PROJECT / ENERGIE SDED / FORCLUM / ARROW France …
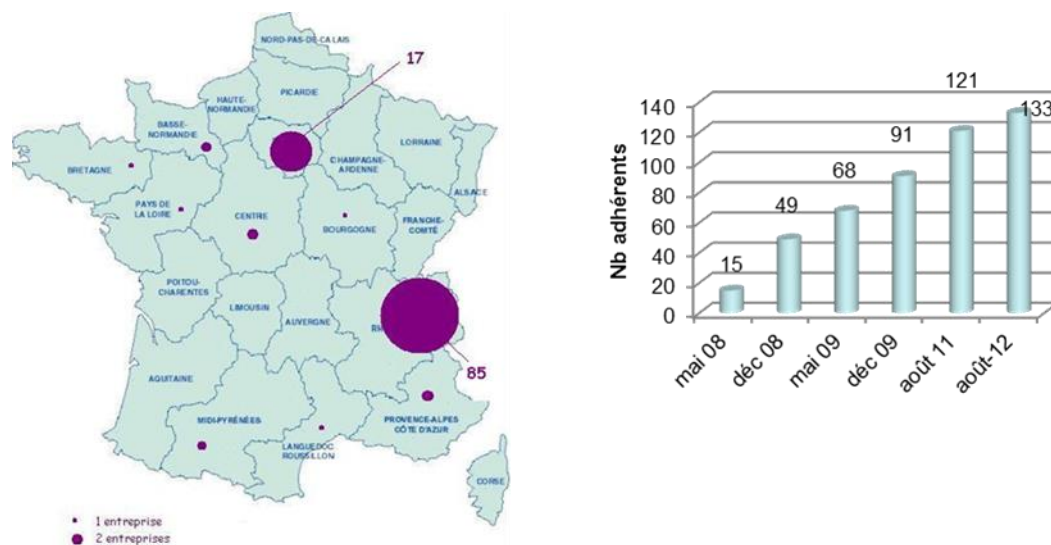
Figure A2 – Growth of members: Number of members each year from the cluster creation in 2008 and geographic distribution over the national territory.

Cluster Lumière has also developed partnership with strategic organization, some of them contributing to its funding. CCI DE LYON / AFE / SRER / Rhône-Alpes Region / LYON / GRAND LYON / CDO- LUMIVILLE-ForumLED / CCI DE L'AIN

A.2 Activities

Cluster Lumière conducts various actions for its members. The portfolio of these actions is described below, as well as their occurrence:

- **Technological** and market watch – mailing to members every second week
- **Newsletter** about actions by Cluster and members (10 per year), sent to 25 000 email addresses (partners, stakeholders)
- **Website** maintenance and development www.clusterlumiere.com targeting to present cluster members competences to potential clients and cluster actions and events (conferences, exhibitions, evenings..)
- **Internal technical Workshops** : technology, markets, standards for members (8 per year, attendance about 40-50) *(EMC, Optics, Innovative lightings, Thermal management …)*
- **Think Tank workshops** on dedicated topics with stakeholders and partnership with other networks and clusters(building, tunnels, automotive, textile, controls, etc) 3 per year, 50 persons)
- **Targeted conferences** (toward specific professional groups) 3 per year (attendance 50-80) ex: for electricians, architects…
- **National conference organization** (2 per year, 150-300 participants) : Thematic conferences Urban and street lighting/Offices and industrial premises lighting/Shops lighting..) Best practices, Market Regulations, Experience feedbacks… in Paris, Lyon, Marseille, Nantes…
- **Demonstration Projects** of Sustainable Lighting Solutions
- **Open Innovation** assistance (with consultants Weenov, Luxfit, Opin de Lune, etc.)

B   Luce in Veneto

B.1 Presentation

Luce in Veneto (LIV) was first established in 2009, by 34 SMEs located in the Venetian Region with the aim of promoting and managing new projects for the Venetian District for lighting System (140 companies, 2 Universities, 3 Research Centres and 5 local Associations).
LIV promotes, in fact, activities involving: companies of the lighting sector, local stakeholders and organizations addressing the whole value chain that are involved in the different activities proposed: laboratories, manufacturers, engineers, lighting installers and designer.
LIV groups currently 43 companies that are part of the supply chain related to the lighting industry. Its headquarter is in the Villa Cà Marcello in Piombino Dese PD.

LIV management board is composed of 5 members:
- President: Andrea Voltolina
- Vice-president: Alberto Sozza
- Giorgia Baccega
- Diego Vettore
- Claudio Manca

LIV staff team is composed of
- Cluster manager: Antonella Venza
- Innovation and R&D Manager: Alberto Sozza

LIV members characteristics:
LIV brings together 43 SMEs (2015) and promotes activities that involve all members of the Venetian District of Lighting Systems.
As District we identify different categories of members:
1) Universities and Research Centres
    a. University of Padua (Dept. of Industrial Engineering; Dept. of Information Engineering)
    b. University of Venezia (Architecture)
    c. PST Galileo of Padua
    d. T2i Scarl
2) Manufacturers
2) 140 companies (SMEs). All of them are SMEs. Their sales turnover amounts to 200 mln € and in particular: 60% with a sales turnover under 2 mln 1€; 18% between 2 and 5 mln €; 6% between 5 and 10 mln € and 4% more than 10 mln
3) Public Entities
    a. Province of Padua
    b. Province of Treviso
    c. Province of Venice
LIV has also developed partnership with strategic organization, some of them contributing to its funding: Confindustria Siav and the Filterkit cluster to share information on technology.

As in the map below, LIV companies are mainly based on the Provinces of Padua, Treviso and Venice in the Veneto Region.

LIV companies localization

- ❖ 26% province of Padova
- ❖ 30% province of Treviso
- ❖ 22 % province of Venezia
- ❖ 13 % province of Vicenza
- ❖ 7 % province of Belluno
- ❖ 2 % province of Verona
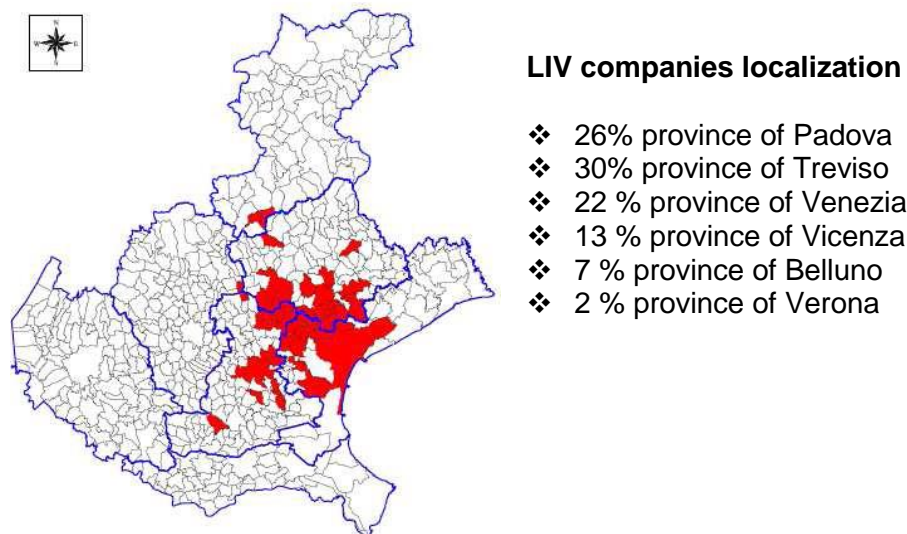
B.2 Activities

LIV promotes strategic actions to make the whole chain of technical lighting companies more competitive: starting with the bodies providing and assembling raw materials (glass, steel, electric ware, wood and plastic) to the companies dealing with packaging and trading of final products. The aim is to involve enterprises working in the field even through projects promoted by local agencies, the State and the European Union.
The entrepreneurs collaborate to increase their own innovation skill and their competitiveness on the market, exchanging information or industrial, commercial or technological services and
experiencing together one or more activities related to the subject of their own enterprise.

The projects cross the following macro-areas, see Figure A3:
- A. Export strategies
- B. Research projects
- C. Training

A. Export strategies
Since the beginning of its activities LIV has promoted a board for companies willing to go international coordinated by an expert of international marketing, with the aim of sharing the goals targeted. This approach, based on challenges and growing sharing of the projects to be implemented has been able to meet the real needs of the firms involved. The board naturally led to an "Export Plan" conceived as a tool to connect guide lines and planning to implementation and coordination of actions in the local area. The plan represents also an operative means for the drawing of the future activities of the Consortium.

B. Research projects
Together with the actions aiming to improve the position of the companies in international markets, LIV promote projects that will improve the value of the products.

C. Training

Every year LIV organizes training courses aiming to deepen the know-how of companies regarding the legislation of specific issues and subjects of common interest. The training courses are chances of mutual exchange of ideas between and within business bodies themselves and the tutors holding the courses, in order to pick out projects to be developed as a unit.
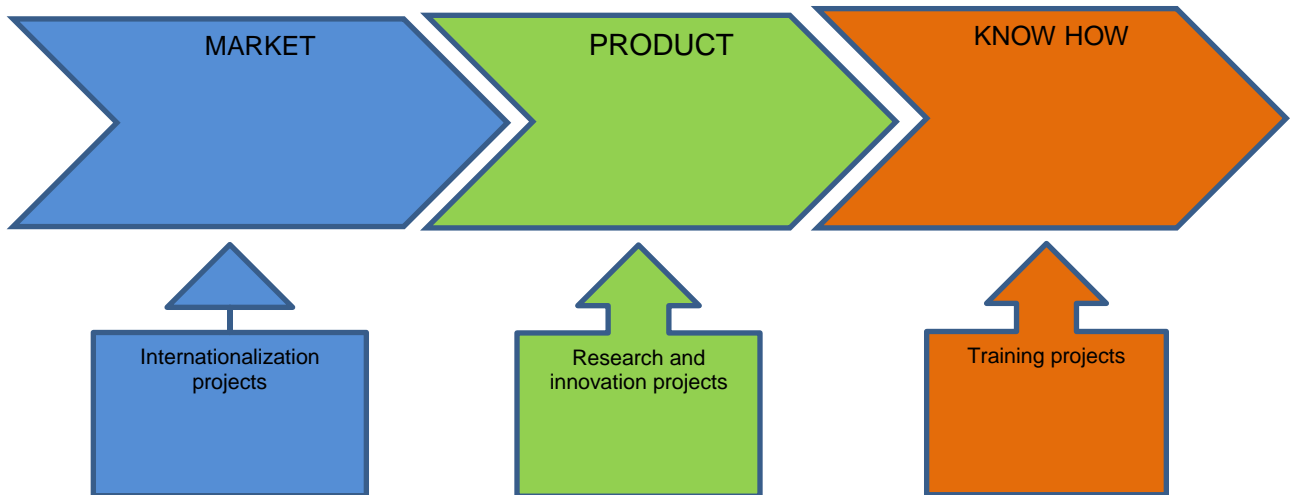
Figure A3 – Schematic view of LIV activities

C   KU Leuven – Light and Lighting Laboratory

C.1 Presentation

Groen Licht Vlaanderen is a cluster of lighting companies and other lighting stakeholders organised in a regional Thematic Innovation Partnership.
- The activities of the cluster are realised and managed by 4 partners:
- KU Leuven Light and Lighting Laboratory: 70%
- Belgian Building Research Institute: 20%
- Volta-Tecnolec: 5%
- UHasselt: 5%

The cluster activities are partially funded by the IWT, the Flemish government agency for Innovation by Science and Technology.
The Groen Licht Vlaanderen cluster started in 2004 focusing on energy efficient lighting. Since 2011 the focus lies on facilitating the transition to solid-state lighting and the strategic support of innovations in and by lighting technology towards cluster members and external actors.

The president of the management board is Marc De Taevernier (Luxendi).
The Groen Licht Vlaanderen staff are:
- KU Leuven Light and Lighting Laboratory: Wouter Ryckaert, Johan Bleumers, Peter Bracke, Catherine Lootens, Bart Van Giel and 2 PhD students.
- Belgian Building Research Institute: Stefan Danschutter, Ruben Delvaeye and Peter D'Herdt.
- Volta-Tecnolec: Danny Hermans.
- UHasselt: Jan Vanrie, Katelijn Quartier.

Groen Licht Vlaanderen has 65 members covering the whole lighting value chain:
lamp manufacturer, luminaire manufacturers, lighting controller manufacturers, subsidiaries, industry organisations, electricity distribution network company, consulting engineering firms, lighting planners, distributors.

The Light and Lighting Laboratory is a division of the Faculty of Engineering Technology of the KU Leuven University. The laboratory combines research activities (PhD research) with activities of industrial support. The main research items are indoor lighting, new light sources, optical design of secondary optics using ray-tracing software, appearance (colour and gloss) and photovoltaic technology.
The laboratory is equipped with the appropriate measurement instruments for optical characterizations: spectral intensity, spectral radiance, luminous intensity distributions, colour and colour temperature, specular and diffuse reflectance and transmittance, spectral BSDF, spectral response.
The laboratory is an active member within CIE and cooperates with several universities and more than 80 companies, especially SME's.

The Faculty of Engineering Technology gathers all Industrial Sciences programmes offered by the KU Leuven at campuses throughout Flanders. The Engineering Technology Faculty is one of the five faculties within the KU Leuven's Science, Engineering & Technology Group.
KU Leuven is an autonomous university with nearly 600 years of history and tens of thousands of students and staff. KU Leuven is a research-intensive, internationally oriented university that carries out both fundamental and applied research. It is strongly inter- and

multidisciplinary in focus and strives for international excellence. To this end, KU Leuven works together actively with its research partners at home and abroad.

C.2 Activities

Groen Licht Vlaanderen has many different one-to-one and one-to-many actions concerning lighting knowledge, perception, visual comfort and health, standards, optical design, intelligent control, daylight usage, sustainability:

- Applied research: e.g. new glare rating, new colour rendering index, lighting design based on visible contrast.
- Demonstration projects: e.g. colour difference tolerance, colour rendering, glare, OLED.
- Quarterly member conference/workshop with an attendance of 35 to 60: technology, application and standards dissemination.
- Yearly lighting conference + exhibition per year open to the public with an attendance of 350 mainly from the lighting value chain.
- Participation most often with a booth and an invited presentation (30/year)
  - in all types of lighting events: international lighting events, multi-regional events, regional events, local events (such as company events).
  - in events on related topics such as smart buildings, smart cities, energy, architecture, workplace health.
  - in events from the Chamber of Commerce, the organization for SME's, the Innovation Network.
- Newsletters: 3500 addressees.
- Website: www.groenlichtvlaanderen.be
- Technical and general articles and guidelines.
- Contributions to the general press on lighting such as on national radio and business TV channel.
- Matchmaking and funding support.
- Education and training.
- Technological advice and support activities to: companies (Q&A, small studies), government, workgroups (e.g. eco-design), electricity distribution network companies (e.g., funding schemes, street lighting), industry organisations.

D Clúster d'Il·luminació de Catalunya

D.1 Presentation

The Lighting Cluster CICAT was launched in 2010 by 7 companies, the founding members.
CICAT is a non-profit organization that brings together companies and other organizations with a role in the value chain of the sector, covering activities such as manufacturing, designing or prescribing lighting systems and their components or providing specific technical services for the Lighting industry.

CICAT management board is composed of the following members:

- President: LAMP - Ignasi Cusidó Codina
- Vice-President: VIBIA - Pere Llonch Fontanet
- Secretary: BJB PROCESA - Joaquin Bruned Adra
- Treasurer: FADISEL - Lluís Beltran Massana
- Board Member:

    SECARTYS - Aintzane Arbide Mendizabal
    CARPYEN - Roberto Carpintero Celdran
    INDELUZ - Miquel Cañas Soler
    JVV GRUP - Jordi Verdaguer Villacampa
    NEOTRONIC - Meritxell Humbert Lacruz

    SAGITARIO LIGHTING - Sergi Corominas López

    SIMON LIGHTING - Gonzalo Batista Guerrero
    VOSSLOH SCHWABE - Joan Presas Sánchez

CICAT staff team is composed of
- Cluster manager: Jessica Kamps

CICAT members characteristics:
Lighting Cluster CICAT brings together over 58 members. We identify 6 categories of members:
1. Lighting Manufacturers: LAMP, VIBIA, SAGITARIO LIGHTING…
2. Components Manufacturers: NEOTRONIC, LUZ LED SUMINISTROS…
3. Control Systems Companies: LUTRON, VOSSLOH SCHWABE…
4. Laboratories: GRUPO TECNOCREA, APPLUS…
5. Engineering: JVV GRUP, PERSPECTIVA…
6. Advisors in legal/services aspects: INSTITUT GUILLEM CABIER, MARSH…

CICAT has also developed partnerships with lighting complementary sectors such as with architects, lighting designers, electricians, hotels, retailers, hospitals, etc. These partnerships are at a personal level (with the professionals) and at an institutional level (with the representative institutions of these collectives).

D.2 Activities

CICAT offers a wide range of services to its members with the aim of improve the competitiveness of the companies:

- **Internationalization**: CICAT has 50 shared trade delegations all over the world, organize national and international exhibitions, trade missions, international trade advisors, distributors, partners and potential customers searches, management of international tenders, etc.

- **RDI**: An intelligence competitiveness and technology surveillance bulletin is sent every month to all the members.

- **Open Innovation**. CICAT has access to an international open innovation platform where the members can offer and demand all type of technology.

- **Technical Workshops**. CICAT organizes different trainings and workshops to keep the members informed and up-dated about the market: regulation, legal aspects, guarantees…

- **Networking Events**: CICAT has created competences in relevant areas with the proposal of building cross-sectorial network relations among stakeholders; strengthen the cooperation between SMEs, research, innovation centres, intermediary bodies to foster innovation and inspiring new ways of innovation. CICAT organize different types of events with complementary sectors such as solar energy, electric mobility, smart cities… where the members can meet architects, lighting designers, hotels, retailers…

- **Funding Opportunities**: CICAT offers advice, management of loans and grants, capital management / budget control, economic and financial planning, vat recovery for European companies, international service debt recovery, foreign exchange, discounts on corporate services.

CICAT has the Bronze Label of the European Cluster Excellence Initiative. Cluster management organizations that are benchmarked demonstrate their interest in striving for excellence. For being benchmarking under the ESCA benchmarking approach by one of the ESCA experts cluster management organizations are awarded with the Bronze Label of the European Cluster Excellence Initiative (ECEI).

E Danmarks Tekniske Universitet – Danish Lighting Innovation Network

E.1 Presentation

The Danish Lighting Innovation Network was established in 2010 (by the Danish Technical University's Electrical Engineering Department) as one of a total of 22 national networks with funding from the Danish Government to promote growth and innovation within different fields of expertise. The Danish Lighting Innovation Network field of expertise is within lighting both daylight and artificial lighting.

The approximately 450 personal members within the network represent the entire chain of value and the consortia has a broad range of members from industry, research, laboratories, public organisations, municipalities etc.

The network is owned by the DTU Electrical Engineering department which together with a board of directors, consortia partners and the daily management team are in charge of the network.

The Board consists of:
Mr. Niels Carsten Bluhme, Albertslund Municipality (chairman of the board) (Public org.)
Mr. Birger Schneider, DELTA (Research)
Mr. Michael Mullins, AAU AD:MT (Research)
Mr. Hans Erik Wolff, Louis Poulsen (Company)
Mr. Henning Solfeldt, PLH Architects (SME company)
Mr. Peter Olivarius, Focus Lighting (SME company)
Mr. Søren Søgaard, NCC (Company)
Mr. Per Jansen, COWI (Company)
Mr. Brian Wendin, VELUX Danmark (Company)

The consortia partners within the network represents these 14 national research and knowledge institutions:
- DTU Electrical Engineering department
- DTU Photonics department
- DTU Building department
- Aalborg University, department of planning
- Aalborg University, department of Architecture, Design and Media technology
- Aalborg University, The Danish Building Institute
- The Kolding School of Design
- The Aarhus University
- The Aarhus School of Architecture
- The Royal Danish Academy of Architecture
- The University of Southern Denmark
- The IT University
- DELTA
- The Danish Lighting Association

The daily management of Danish Lighting Innovation Network is conducted by:
- Mr. Michael A.E. Andersen, owner of the network and Network Manager, DTU Electrical Engineering Department

- Mr. Paul Michael Petersen, DOLL coordinator, DTU Photonics Department
- Mr. Ib Mogensen, innovation projects, out-sider (SME company)
- Mrs. Anne Bay, internationalization and head of secretariat, Danish Lighting Association
- Mrs. Lene Hartmeyer, network coordinator, Danish Lighting Association/DTU Electrical Engineering Department
- Mrs. Dorthe Sode, communication, Danish Lighting Association

The network goals are:
- To ensure growth and competitiveness within the lighting industry
- To promote innovation within the Danish lighting industry
- To ensure a more broad market acceptance of lighting as an expertise

To ensure a broader usage of intelligent/quality/energy efficient lighting within the public and private rooms in Denmark

Areas of focus
The Danish Lighting Innovation Network has identified 4 areas of focus within the network:

1. **Light and its biological effects and Human Centric Lighting**
   Light's physical and mental health and productivity: Day light, light for schools, offices, hospitals and elderly homes.

2. **New possibilities with LEDs and other optical elements**
   Energy efficiency and effect lighting: lighting for shops, lighting for museums, lighting for events. Outdoor lighting, street lighting, office lighting.

3. **Market development and barriers**
   International perspective: BRIC and EU markets

4. **Danish light design**
   Promotion and branding of the Danish lighting design

E.2 Activities

The Danish Lighting Innovation Network facilitates different activities for its members:

- **Website** – www.dansklys.dk – is promoting the different events and relevant knowledge such as funding opportunities, news and contacts that could be relevant for the network members.
- **Newsletter** – sent out more than 20 times each year to the members.
- **International activities** – in order to promote and ensure collaboration between relevant international stakeholders both within the EU and beyond.
- **Innovation projects** – the network has during its establishment supported 18 lighting innovation projects with participants from research, industry and the public sector. 7 of these projects are still running.
- **Conferences, workshops and seminars** – with different focuses.