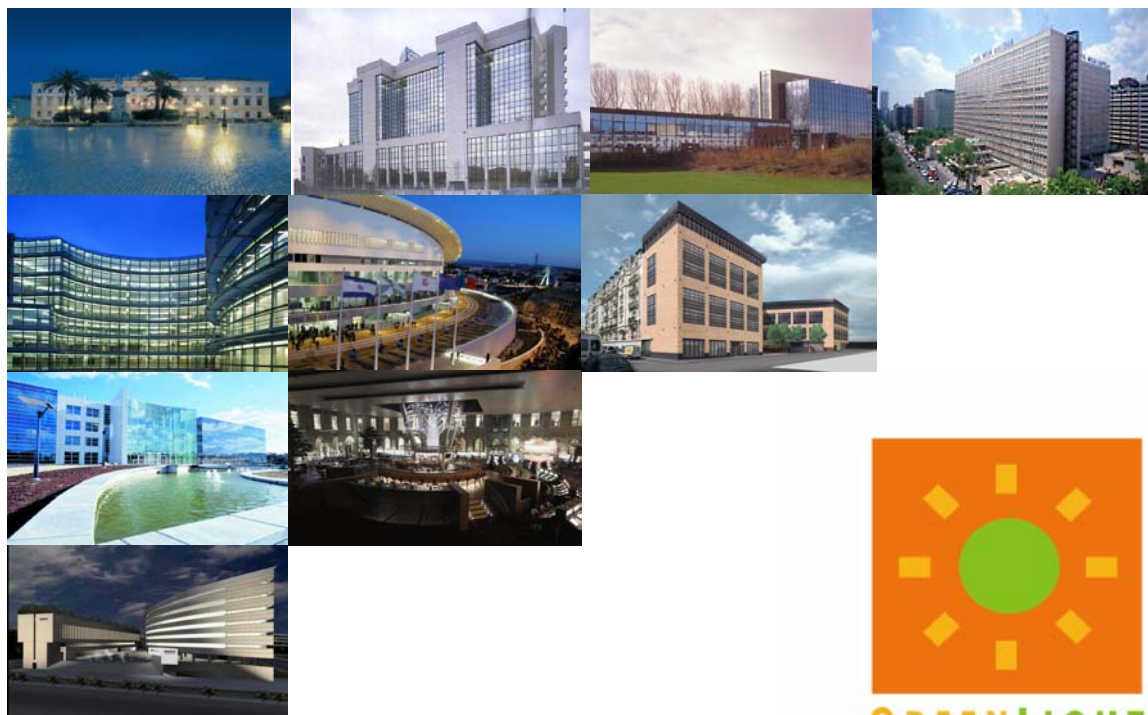


SUCCESSFUL EXAMPLES OF EFFICIENT LIGHTING



FIVE YEAR REPORT OF THE EUROPEAN GREENLIGHT PROGRAMME

PAOLO BERTOLDI AND CALIN NICOLAE CIUGUDEANU

European Commission, DG JRC,
Institute for Environment and Sustainability, Renewable Energies Unit

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Disclaimer: the examples in this brochure are self-reported by the GreenLight Partners. Their energy savings are assessed by comparison with either the pre-existing lighting (in the case of a renovation) or a conventional new installation (in the case of a new building). Energy savings potential is specific to each lighting installation, depending on the installed technologies, the operating hours, the occupancy pattern and other factors. All GreenLight upgrades shall be made in conformity with Community, national and local regulations. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use, which might be made of the contents of this brochure.

The European GreenLight Programme

GreenLight is a voluntary programme where private and public organisations commit towards the European Commission to upgrading their existing lighting, and to designing new installations, using energy efficient lighting systems when the energy savings justify the investment and lighting quality is maintained or improved.

Climate change is one of the main challenges our society will face in the coming years. The fulfilment of the Kyoto commitment for the reduction of greenhouse gas emissions cannot be obtained without the efforts of all Europeans, in particular, public and private organisations in all fields of our economy.

Lighting electricity use in the European non-residential sector represents more than 160 TWh/year. This has a substantial impact on the environment, accounting for up to 40% of electricity used in non-residential buildings. Major energy savings can be achieved. Examples from the field have shown that between 30% and 50% of electricity used for lighting could be saved investing in energy-efficient lighting systems. In most cases, such investments are not only profitable but they also maintain or improve lighting quality.

To pull the demand for efficient technologies, the European Commission (EC) launched in February 2000 the European GreenLight Programme. It is an on-going voluntary programme whereby private and public organisations (referred to as Partners) commit to adopting energy-efficient lighting measures when the cost of these measures is repaid by the associated savings and lighting quality is maintained or improved. In return for their commitment, not only do these Partners benefit from the savings, but they also receive broad public recognition for their effort in protecting the environment. GreenLight is promoted by the European Commission and a network of national energy agencies or similar bodies. The full details of the GreenLight Programme, including obligations and rewards, are available on the programme web site at www.eu-greenlight.org.

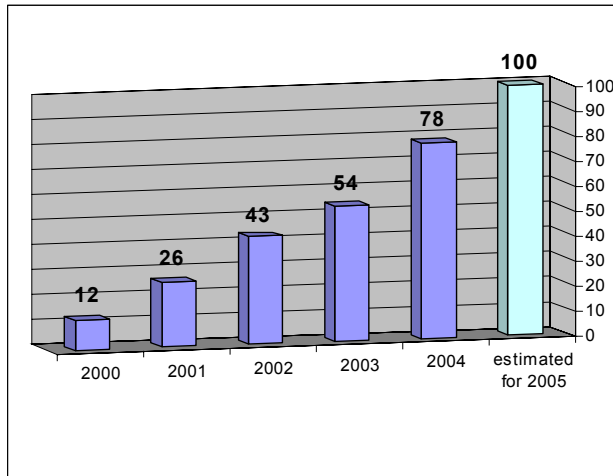


Table 1: List of GreenLight Partners

1	Aeroporto G. Marconi di Bologna Spd	74	Endesa S.A.	143	Oskomera Holding BV
2	Aeropuertos Españoles y Navegación Aérea (AENA)	75	Energias de Portugal sa	144	Pfizer
3	Agence de Maitrise d'Ouvrage des Travaux du Ministère de la Justice	76	Escuela Técnica Superior Ingeniería Industrial	145	Philips Consumer Electronics C/O
4	Ajuntament de la Vila Reial De Benigánim	77	Ethniki S.A.	146	Piraeus Bank
5	Akademiska Hus I Göteborg AB	78	Faculdade de Ciência e Tecnologia da UNL	147	Provincia di Reggio Emilia
6	Alanod Aluminium Veredlung GmbH & Co KG	79	Fastighets AB Brostaden	148	Provincia di Torino
7	Alstom Power Generation, AG, Werk Bexbach	80	Feira Nova Hipermercados, SA	149	Q8 Denmark
8	Apoteket AB, Lokalenheten	81	Fontanars dels Alforins	150	RATP
9	Aquachimica, Lda	82	Forsvarsbygg, utbyggingsprosjektet - Oesterda- len	151	Recheio - Cash & Carry, SA
10	ASRIR - Centre de Dialyse Michel Basse	83	France Telecom	152	Ringsted Kommune
11	Athens International Airport	84	Freie und Hansestadt Hamburg	153	Römisch-Katolische Kirche
12	Auchan	85	Fundacion Reina Sofia	154	Rosendo Junca Forcada S.A.
13	Ayuntamiento de Alfara del Patriarca	86	Futebol Clube do Porto	155	Roularta Media Group
14	Ayuntamiento de Macastre	87	G.E.K. S.A.	156	S.I.C. Societa' Ipermercati Cooperativi S.p.A.
15	Ayuntamiento de Potries	88	Gas Natural SDG S.A.	157	SAES Advanced Technologies SpA
16	Ayuntamiento De Sinarcas (Valencia)	89	Gemeente Buggenhout	158	Salvador Caetano, I.M.V.T., S.A
17	Azienda Sanitaria Locale n.3 Genovese	90	Gemeente Geetbets	159	Samhall Support AB
18	AZM Aargauer Zentralmolkerei AG	91	Gemeente Heers	160	SANPAOLO IMI S.p.A.
19	Beerse Metaalwerken NV	92	Gemeente Hoegaarden	161	SARL RESTO PLANET
20	Bispen AS	93	Gemeente Lebbeke	162	SAS Norway
21	Bright Special Lighting S.A.	94	Gemeente Londerzeel	163	SBSO De Richter te Genk
22	BSGO "de Duizendpoot" As	95	Gemeente Sittard Geleen	164	Servicio Extremeño de Salud
23	BSGO 'Op het Boseind' te Maasmechelen	96	Gemeentebestuur Merchtem	165	Siemens Slovenia
24	Bundesrealgymnasium Waidhofen an der Ybbs	97	Gemeentebestuur Zingem	166	Sincrotrone Trieste S.C.p.A.
25	Camara Municipal de Montijo	98	Gemeinde Möglingen	167	Skallerup Klit Feriecenter A/S
26	Camara Municipal de Oliveira de Azemeis	99	Gestiretallo - Gestao e Consultoria para a Distribuicao a retalho, SA	168	Società Italiana per l'Oleodotto Transalpino Spa (S.I.O.T. SpA)
27	Camara Municipal de Sintra	100	Grohe nv-sa	169	Sogelym Steiner
28	CARREFOUR Italia	101	Grupo Union Fenosa	170	SOMEPIK Technologie
29	CEA CHEMIE . ENERGIE . ANLAGEN . GmbH	102	Halliburton	171	Sonaecom
30	Centocor International	103	Helsingborgs City, Kärnfastigheter	172	SOPIC SA
31	Christiaan Muylgens College	104	HMZ	173	Spar (Inchicore Outlet)
32	Citigroup	105	HN Autotransport	174	Stad Mechelen
33	Città di Cossato	106	Holand Casino Breda	175	Stad Sint Truiden
34	City of Helsinki (Education Department)	107	Hospital Universitario Virgen de las Nieves de Granada	176	Stad Turnhout
35	Colombo Shopping Centre	108	Hotel Mercure Europaplatz Wien	177	Stadt Frankfurt am Main, Helmholtzschule
36	Comune di Berchidda (Prov. di Sassari)	109	Hotel Mercure Salzburg	178	Stadt Kufstein
37	Comune di Bussò	110	IKEA	179	Stadt Salzburg , Magistrat
38	Comune di CARERI (RC)	111	ING	180	Stadt Zürich
39	Comune di Costa Masnaga	112	Instituto para la Diversificacion y Ahorro de la Energia (IDEA)	181	Statoil
40	Comune di Giuggianello	113	Instituto Superior Técnico, Universidade Técnica de Lisboa	182	StoraEnsoBerhuizer Papierfabrik
41	Comune di Laino Castello	114	Instituut Voor Energie & Milieu	183	Super U Hartmann
42	Comune di Lecce dei Marsi (AQ)	115	Ipercoop Tirreno s.c.a.r.l.	184	SUPERQUINN
43	Comune di Luvinate (Varese)	116	Johnson & Johnson	185	swb Bremerhaven Ltd.
44	Comune di Marciana Marina (LI)	117	K.O.S.A. vzw	186	TAIM-TFG S.A.
45	Comune di Melissano	118	Kautex Textron Benelux B.V.B.A.	187	Tbk Sistemas de Gestió S.L.
46	Comune di Paterno	119	KLP Eiendom Trondheim AS	188	Terres et Eaux
47	Comune di Polistena (RC)	120	Koninklijk Atheneum Brasschaat	189	TESCO
48	Comune di Ripalimosani (CB)	121	La Noria del Gabriel - Hotel Restaurante	190	The Burlington Hotel
49	Comune di Roccaraso (AQ) C/O	122	Lanassa SA	191	The Directorate of Public Construction and Property
50	Comune di Rolo (Prov. di Sassari)	123	Landuyt N.V.	192	Theater Pathe Tuschinski
51	Comune di Sassari	124	Lorentz Casimir Lyceum	193	Themis Construction S.A.
52	Comune di Senise (PZ)	125	Maire de Lille	194	TIM
53	Comune di Spongano (Le)	126	Markgemeinde Frastanz	195	Transgas SGPS
54	Comune di Torella del Sannio (CB) C/O	127	McDonald's Europe Restaurant	196	Trevianum Scholengroep
55	Comune di Torre De Passeri (AQ)	128	MedicHus	197	UNICER - Bebidas de Portugal SGPS, S.A.
56	Comune di Trezzano Rosa	129	Melia Castilla Hotels	198	Unicoop Firenze s.c.a.r.l.
57	Comune di Villalago (AQ)	130	Monte dei Paschi di Siena	199	UniCredito Italiano S.p.A.
58	Comune di Vinchiatturo (CB) C/O	131	MSGO te Maaseik	200	Vennootschap Mechelse Veilingen
59	Consejo Económico y Social	132	Municipal Utility of Neunkirchen-Seelscheid (Gemeindewerke Gemeinde)	201	Vesta Forsikring AS
60	Consignia plc	133	Municipality of Neunkirchen-Seelscheid (Gemeinde Neunkirchen-Seelscheid)	202	Ville de Lyon
61	Coop Adriatica s.c.a.r.l.	134	NCC Property Development Sweden	203	Ville d'Ilkirsch-Graffenstaden
62	Coop Centro Italia s.c.a.r.l.	135	Neukauf Merz	204	Virga Jesse
63	Coop Consumatori Nordest	136	Nielsen-Gruppen AS	205	Vital Eiendomsforvaltnings AS
64	Coop Estense s.c.a.r.l.	137	Nike CSC	206	Vodafone (Greece)
65	Coop Liguria s.c.a.r.l.	138	Nova Coop s.c.a.r.l.	207	Vodafone Portugal (Lisbon Main Building)
66	Coop Lombardia s.c.a.r.l.	139	Nyborg Municipality	208	Westlodge Hotel Bantey Ireland
67	Coop Toscana Lazio s.c.a.r.l.	140	OeBB Wien Zentralverschiebebahnhof	209	WIPARK Garagen AG
68	Det Norske Radiumhospital	141	OK-Q8 AB	210	WWF/Adena (Fondo Mundial para la Natu- raleza)
69	Distribution Casino France - Branche Supermarchés	142	Openbare Basisschool Het Palet	211	Zehnder Group Produktion Gränichen c/o
70	Dolce & Gabbana SpA			212	Zuiderzeemuseum



By the end of February 2005, a total of 212 Partners signed the GreenLight Partnership, thereby committing to adopting energy-efficient lighting practices in their premises. This represents more than a 10-fold increase (Figure 1) compared to the first progress report. It confirms the observation made in the last report that the rate of registration was steadily increasing. The objective then mentioned of getting 200 signatures by the end of 2004 is almost reached.



Partners' size varies to a large extent. Some like Johnson & Johnson, McDonald's or IKEA, are multi-national groups with more than a million square meters. Others represent large cities such as Helsinki, Turin, Lyon, Hamburg, etc. Other like Luvinate or Berchidda are small towns with a few kilometers of illuminated roads and less than 10 communal buildings (e.g. city hall, schools, sport hall). Others like Beerse Metaalwerken (industry) or Terres & Eaux (retail) have one building only, representing less than 5000 m².

Figure 1: New GreenLight Signers / year

Considering all received GreenLight Reporting Forms, the total reported savings are approximately 109 GWh/year (Figure 2), which corresponds to an abatement (CO₂ reduction is given only on an indicative basis and was calculated using common carbon intensity across all countries – 500 gCO₂/kWh) of approximately 54.500 tCO₂. Around 85% of these savings were achieved within buildings. The rest arose from street lighting upgrades (mainly installation of flux dimmers).

Various business fields are covered: Commercial, educational, healthcare, hotel, industry, leisure/sport, transport, etc. In the hotel sector, barriers to introduce energy-efficient lighting were found to be particularly severe due to strong habits of using halogen lamps. In general most upgrades concerned office spaces.

There are currently more GreenLight Partners in the private sector than in the public or semi-public sector (about 37% in the public sector). While in Sweden, public organisations were said to be more incline to sign up for GreenLight than private companies, Austria, Greece, and Italy reported difficulties with public institutions. This has recently changed in Italy where many small towns have signed up for street lighting projects.

Generally speaking, the lack of capital and the inability to get financing for projects are well-known key barriers to energy efficiency investments. While in GreenLight most upgrades were self-financed by the partners, several projects were also funded through Third Party Financing (TPF) and implemented by ESCO.

GreenLight investments use proven technology, products and services which can reduce lighting energy use by 30% to 50%, earning Internal Rates of Return (IRR) above 20%. GreenLight

upgrades have covered the range of energy-efficiency measures described on the GreenLight web site ([http:// www.eu-greenlight.org / What-to-do/what1.htm](http://www.eu-greenlight.org/What-to-do/what1.htm)), e.g. replacing general lighting service incandescent bulbs or high pressure mercury lamps; installing occupancy linking control systems or light flux regulators; etc.. In many cases, the substitution of magnetic ballasts with electronic ballasts on an existing installation, also proved to be profitable.

This is now followed by many other partners such as multi-storey car parks, airports, football clubs, etc. Several upgrades were also undertaken which implied to change the complete lighting installation, including luminaires, albeit the fact that such a measure often earned rates of return below 20%. Some partners somehow surpassed their GreenLight commitment. Energy savings are specific to each lighting installation, depending on the installed technologies, the operating hours, the occupancy pattern and other factors. Sometimes GreenLight upgrades can be very simple, as simple as commissioning the control system.

By joining GreenLight, the companies have made good business sense. They found opportunities that resulted in environmental improvements and increase profits (by reducing costs) at the same time. GreenLight Partners have had direct benefits by saving money and in most cases improving working conditions. In the Figure 2, can be observed the total GreenLight electricity savings per country.

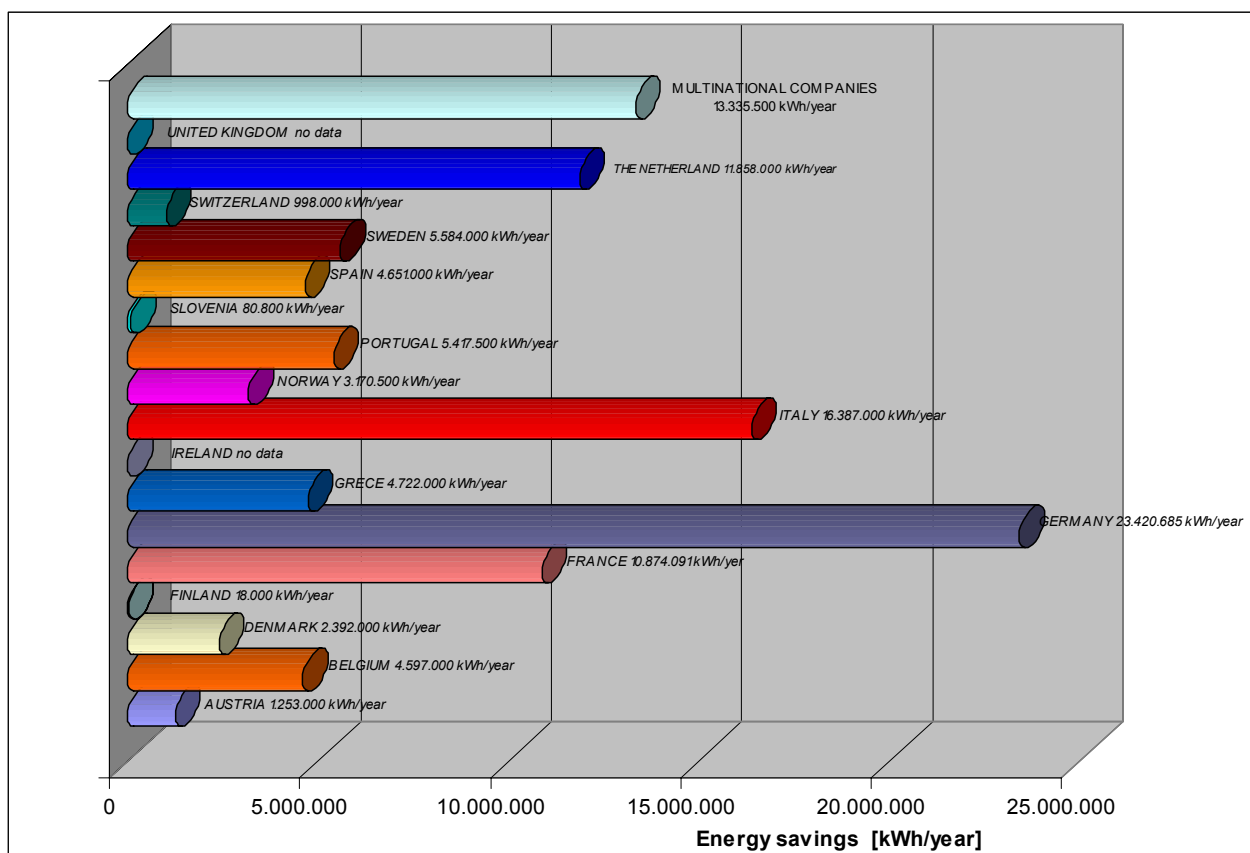


Figure 2: GreenLight in Europe – Electricity savings / country

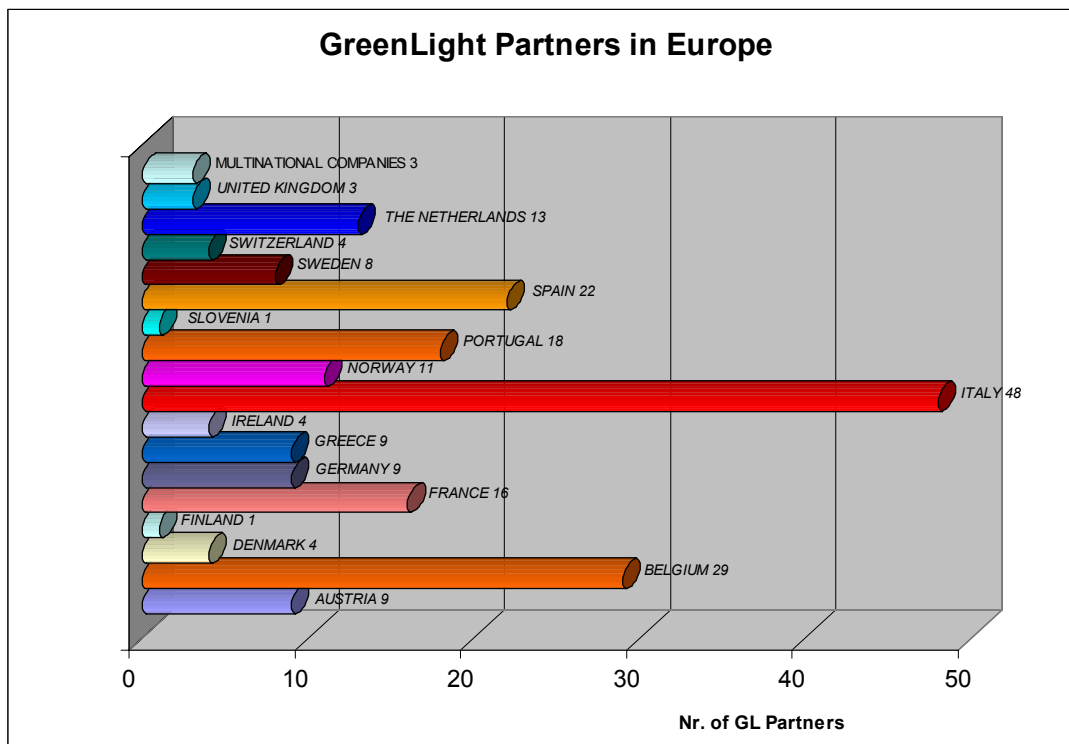


Figure 3: GreenLight in Europe – Number of Partners / country

GreenLight Partners have also had indirect benefits resulting from the growing attention of consumers and investors, which will increase their opportunities on the markets. Their ability to deal successfully with environmental issues may be considered as a credible measure of management quality. This supposes however that ad-hoc recognition and advertisement is given to their achievements; a point on which the European Commission and the National Contact Points put emphasis during the execution of the programme.

During the last year, GreenLight public recognition has taken shape and the programme has gained public image. More and more partners have joined this initiative (Figure 3). National Contact Points had several articles published in the business press and technical magazines. The programme was presented in various fairs and conferences across Europe e.g. Pollutec in France, Valo 2001 in Finland, Light+Building in Germany, IEECB'04, etc. Publicity was also carried out through direct mail, local information meetings and the internet.

A plaque is designed to allow Partners to show their responsible entrepreneurship to their clients. A new brochure was distributed to potential Partners with several GreenLight success stories inside, presented in a clear, simple, and vivid way. Indeed case studies have been found to be very useful to convince peer companies to join. The brochure is available in English, French, German and Italian and translations are foreseen in other languages. It was also distributed to various media and to the National Contact Points for distribution within their respective country.

The Commission introduced a European Award for particularly active and successful Partners and Endorsers. Technical support to Partners has continued. The GreenLight web site has been continuously updated by the European Commission - Joint Research Centre, with contributions from the National Contact Points. The number of GreenLight Endorsers has grown to 162. Endorsers are committed to offering technical support to registered Partners.



Several lessons have been learned at all stages of the GreenLight process. At the marketing stage: often energy savings alone do not constitute a sufficient reason for companies to join GreenLight. Public recognition benefits have proven to be effective additional arguments to convince them, including the fact to be seen as environmental ‘champions’. Arguments related to indirect productivity increase would also be decisive if they could be scientifically demonstrated.

In the upgrading process, GreenLight Partners need a user-friendly lighting audit procedure which they can easily follow to quickly identify which spaces can be upgraded and which cost effective measures can be applied. Complex material does not get used. Information gathered within GreenLight show that there is a need to develop further rules of thumb, simple lighting quality assessment procedures, and lighting energy benchmarks for other spaces than offices (including average and best practice figures in W/m^2 or kWh/m^2). The final decisions are often take at high levels and the information presented to the senior management as to be simpler and based on economic terms.

Finally, in the GreenLight progress monitoring, the main issue was to provide Partners with an extremely simple form to report on their achievements. This form currently consists of one page per facility. It contains a short description of the baseline and the post-installation lighting conditions.

The Commission has been assisted in the implementation of GreenLight by the energy agencies (or similar organisations) of 26 European Countries, who had a fundamental role in promoting the GreenLight at national and regional level.

GreenLight is one of many new initiatives trying to create effective public private partnership to achieve societal and environmental benefits. GreenLight has proved to help its Partners save money and reduce pollution by increasing the energy efficiency of their lighting. GreenLight is changing the way organisations make decisions about energy-efficiency, elevating decision-making to senior corporate officials.



An increasing number of companies and public entities have experienced GreenLight ‘win-win’ opportunities and begun to view energy efficiency upgrades not as cost centres, but as profit centres. The number of Partners was multiplied by more than ten fold between 2001 and end of 2004. Major players have joined the GreenLight movement. These positive results prompted most national energy agencies to catalyse and spread further the programme implementation.

The objectives shared by the European Commission together with the energy agencies for 2005 are to closely follow-up and assist current Partners, to provide Partners with suitable recognition, and to use GreenLight success stories to convince peer companies to join. The main focus will be in the New Members States and Candidate Countries, where there are currently no Partners, except one in Slovenia. In tangible terms, by end of 2005, the objectives are to increase and maintain a reporting rate of at least 80%, to pass the bar of four hundred registered Partners, and to double the current annual energy savings.

Given the success of the GreenLight Programme the European Commission is now using same concept (i.e. cost effective efficiency improvements in buildings) to other building equipment and services (e.g. HVAC, office equipment, appliances) and to introduce the concept of energy management in the new European GreenBuilding programme (<http://energyefficiency.jrc.cec.eu.int/greenbuilding/index.htm>).





SUCCESSFUL EXAMPLES OF EFFICIENT LIGHTING UPGRADES IN BUILDINGS

By GreenLight Partners



The airport infrastructures and activities produce a negative impact on the environment and are centres of noise and atmospheric pollution which have repercussions on local populations. Aware of this reality, Aena, has tried to reconcile economic development with environmental protection. Therefore, in each of its projects it has tried to minimise environmental repercussions and to achieve a harmonious balance between progress and a respect for nature.

As a commitment to the GreenLight Programme, **Aeropuertos Españoles y Navegación Aérea (AENA)**, rethought their lighting concept for three of their main airports.

► For the *Terminal de Pasajeros Aeropuerto de la Palma* they changed in 2001 the old lamps with new induction projectors for a total area of 6.197 m². The number of luminaires was also reduced and recalculated for a lower luminance level (from 350 lx to 240 lx).

The company reported the next energy savings:

- Lighting electricity savings: 131.276 kWh/year
- Energy cost savings: 7.361 euro/year
- Payback: 9,8 years

► *Barajas Madrid Airport* was also upgraded by substituting the type of control system, from general manual switch to 25 units voltage stabilizer and flux luminous dimmer. They also reduced the luminance level from 400 lx to 200 lx (reduced level all the time).

After measurements, for an area 30.000 m² from a total of 58.000 m², they reported the following results:

- Lighting electricity savings: 1.135.296 kWh/year
- Energy cost savings: 47.492 euro/year
- Payback time: 3 years
- CO₂ Emission Reduction: 1.134 Ton CO₂/year



► In the case of the *Terminal de Salidas - Aeropuerto de Tenerife*, for a total upgraded area of 4.331 m² they replaced the magnetic ballast with high frequency electronically one, using a different lighting control system, with flux luminous dimmer and zone control. The luminance level was also reduced from 400 to 300 lx (reduced level all the time).

The new system is claimed to have provided the following savings:

- Lighting electricity savings: 279.685 kWh/year
- Energy cost savings: 30.761 euro/year
- Payback: 1,7 years

 **Aeroporto di Bologna**

In Italy, **Aeroporto G. Marconi di Bologna Spd**, GreenLight Partner since 2001 upgraded the lighting systems for the airplanes parking space.

Substitutions of the projectors installed on the towers, by removing the original projectors, 2 x 400 W sap, with new projectors, 1 x 1000 W sap asymmetric, with the results of reducing the installed power in each tower from 16.200 W to 9.450 W. There are 15 tower therefore the total power savings is 15 x 6750 W = 101 kW of installed power.

The lighting pollution in the surrounding area has been also drastically reduced.

Moreover two flux regulator of 89 kW has been installed, to further reduce the electricity consumption by an additional 20 - 25 % and to extend the lamp life by regulating the input voltage.

The early energy savings are about 400.000 kWh with a payback time of about 5 years.



Aeroporto G.Marconi di Bologna did also a lighting retrofit in the hangar/car park for the ground vehicles and material, they have installed three flux regulators with the following savings:

- Lighting electricity savings: 46.253 kWh/year
- Energy cost savings: 4.163 euro/year
- Payback: 1 year



HP Sodium Lamps-1x1000 W



HP Sodium Lamps-2x400 W



In Spain, the GreenLight Partner **Ajuntament de la Vila Reial de Benigánim (Valencia)**, improved the street lightning for five Councils (Beniganim, Potries, Alfara Del Patriarca, Macastre and Sinarcas). First of all they removed the old inefficient mercury vapour lamps and replaced them with new high pressure sodium ones. By this way they saved lightning electricity and the lightning quality was improved. Moreover, in some cases, lightning control systems were installed. So lightning electricity savings were even higher. Although they saved over 37.5% in lightning costs, the results below are mean values:

- Lighting electricity savings: 673.529 kWh/year
 - Energy cost savings: 78.283 euro/year
-



In Sweden, **Akademiska Hus I Göteborg AB**, owns and manages the majority of the buildings in which universities and colleges operate. The company upgraded the *Karlstads University Library* with a total area of 6.126 m² reporting the following savings:

- Lighting electricity savings: 100.105 kWh/year
 - Energy cost savings: 8.801 euro/year
-



In Germany, the GreenLight Partner **Alanod Aluminium Veredlung GmbH & Co KG**, changed for a total area of 700 m²- Alanod

Aluminium Veredlung - the 26mm diameter fluorescent lamps with different types of 16 mm diameter lamps.

They substitute as well the conventional magnetic ballast with electronic one. The localised lightning and a control system to dim the lamps' output in response to the daylight availability was also taken into consideration.

The company reported the next savings:

- Lighting electricity savings: 11.973 kWh/year
- Energy cost savings: 1.198 euro/year
- Payback: 5 years



The Swedish GreenLight Partner, **Apoteket AB, Lokalenheten**, has refurbished almost 40 sites in 2002. All the shops look very similar so the totally savings are obtained by multiplying by 40 the savings reported for the *Apoteket Arlan*.

They installed a mix of incandescent, 26-16 mm diameter fluorescent and compact fluorescent lamps. In most of the cases they doubled the luminance level. The company reported much better visual conditions and the following savings:

- Lighting electricity savings: 166.320 kWh/year
- Energy cost savings: 12.160 euro/year

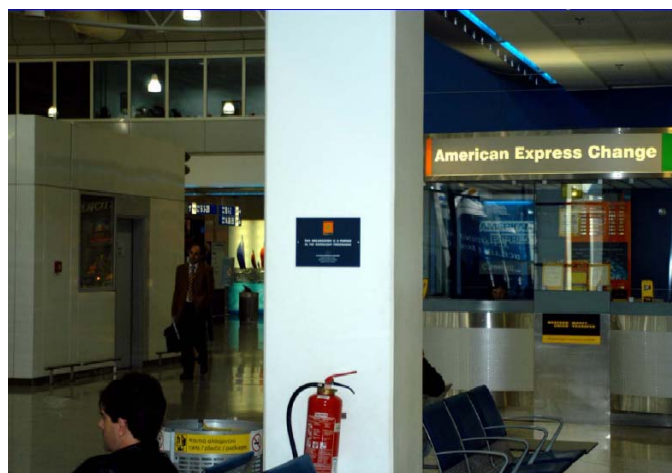


In Greece, **Athens International Airport**, as part of their commitment to the GreenLight Programme, installed new lightning systems for 3 buildings, with a total area of 195.863 m². They changed the high-loss magnetic ballasts for electronic ballasts, using as well a new lightning control system (BAS). They achieved better visual conditions, lighting electricity savings of 3.298 MWh/year, cost savings of 131.956 euro/year, everything with a payback time of less than 1 year.

- *Satellite Building*
 - Lighting electricity savings: 403.851 kWh/year
 - Energy cost savings: 16.234 euro/year
 - Payback: 1 year

- *Main Administration Building*
 - Lighting electricity savings: 444.991 kWh/year
 - Energy cost savings: 17.799 euro/year
 - Payback: 1 year

- *Main Terminal Building*
 - Lighting electricity savings: 2.448.076 kWh/year
 - Energy cost savings: 97.323 euro/year
 - Payback: 1 year





Winner of the
GreenLight Awards
2005

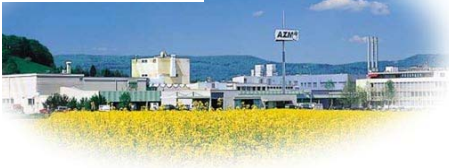
In France, the GreenLight Partner **Auchan France**, tested in eight hypermarkets, an alternative to the usual 41/2m high, 31/2-41/2 m spaced, T8 strips lighting. They used T5 lamps and electronic ballasts to maintain a much lower general lighting level and to add more light on products using localised luminaires along the shelves. They used white sodium lamps for illuminating fresh foods, and metal halide lamps for accentuation purposes and for the textile area. Compact fluorescent lamps were used for services and cashiers.



Apart from renewing the visual aspect of the shop, this new lighting is claimed to bring the savings given below.

The data are relative to the *Longuenesse Hypermarket* (St Omer, France). The comparison is made versus a conventionally lit Auchan hypermarket of equal size.

- Lighting electricity savings: 393.802 kWh/year
- Power reduction: 71.332 kW
- Reduction of electricity use: 24 %
- Energy cost savings: 21.659 euro/year



The GreenLight Switzerland Partner, **AZM Aargauer Zentralmolkerei AG**, upgraded their main production facility lighting system, for a total area of 10.222 m². The old lamps were replaced with new, more efficient ones 2*58 W - fluorescent lamps powered by electronic ballasts. It was also used a daylight responsive lighting control system. The new lamps have also a long life duty cycle (65.000 hours). They increased the lighting level from 132 lx to an average of 326 lx, achieving a much better visual comfort.



After measurements, they claimed the following savings:

- Lighting electricity savings: 463.903 kWh/year
i.e. 36% on lighting-related electricity consumption
- Payback: < 4 years



The new lighting system ►



In Belgium, the GreenLight Partner **Beerse Metaalwerken N.V.**, upgraded a total area of 4.376 m², early 2001. They replaced high pressure mercury fixtures with hammered, wide angle distribution reflectors for fluorescent luminaires. The original lighting offered a luminous intensity of only 150 lx on the shop floor. The new lamps are equipped with electronic ballasts and daylight responsive controls.



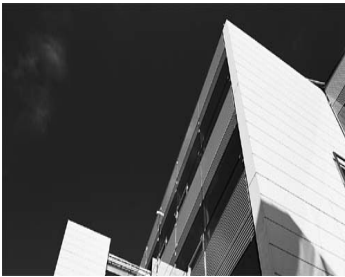
These changes generate improved lighting quality, next to following financial savings :

- Lighting electricity savings: 24.919 kWh/year i.e. 38% on lighting-related electricity consumption
- Energy cost savings: 7.133 euro/year
- Payback: < 5 years



BROSTADEN

ETT FÖRETAG I CASTELLUMKONCERNEN



In Sweden, the GreenLight Partner **Fastighets AB Brostaden**, replaced in 2002, for an area of 3.080 m², the old fixtures (4*18 W - 26mm fluorescent lamps) with modern luminaires for 26 W compact fluorescent lamps and 16 mm diameter fluorescent lamps. They also changed the high-loss magnetic ballasts with electronic one. At the general manual switch there were added localised switchers, in order to offer a better control to the users.

The company reported better visual conditions, in particular by using a localised lighting, and the following savings:

- Lighting electricity savings: 169.257 kWh/year
- Energy cost savings: 9.250 euro/year
- Payback time: 5,42 years



In Belgium, the Greenlight Partner **BSGO 'De Duizendpoot'**, an elementary school in As, has upgraded the lighting installation, resulting in a higher light comfort for the schoolchildren and energy savings of 65%:

- Lighting electricity savings: 41.148 kWh/year
- Energy cost savings: 2.708 euro/year
- Payback: 5 years

In Portugal, the GreenLight Partner **Câmara Municipal de Montijo**, upgraded the public lighting system of several streets of the municipality by the installing more efficient luminaires and by replacing the HP mercury lamps with sodium lamps.

The project created also the opportunity for a urban re-qualification of Montijo town that claimed the following energy and economic achievements:

- Lighting energy savings: 720.229 kWh/year
- Energy cost savings: 57.088 euro/year
- Payback time: 4,9 years



In Portugal, **Camara Municipal de Oliveira de Azemeis**, another GreenLight Partner, upgraded in 2004 the *Arquivo Municipal*, building with a total area of 1200 m². The old regular incandescent lamps used for the indoor lighting were changed with new 26 mm and 38 mm fluorescent lamps, equipped with aluminised reflector and electronic dimmable ballasts. For the outdoor lighting, the standard HP Mercury lamps were replaced with HP sodium ones. The lighting control systems were also different for outside and inside. Inside they used occupancy and daylight responsive systems while the outdoor lighting was geared with timers.

Besides a better visual comfort, they reported the next savings:

- Lighting electricity savings: 49.275 kWh/year
- Payback time: 1,2-5 years (depending of the type of project)



In Portugal, the GreenLight Partner **Camara Municipal de Sintra**, upgraded in 2004 the *Biblioteca Municipal de Sintra - Casa Mantero*, building with a total area of 3.566 m².

They replaced the incandescent lamps with modern luminaries for compact fluorescent lamps. The conventional magnetic ballast was also replaced with low-loss one and electronic non-dimmable ballast.

After the first estimations they reported:

- Lighting electricity savings: 70.000 kWh/year
- Energy cost savings: 7.114 euro/year
- Payback time: 5 mounts



Between 2002 and 2004, in their hypermarkets in Italy, GreenLight Partner **Carrefour Italia**, removed the old inefficient pendant luminaries for fourteen sites with an area of 117.015 m². It replaced them with new fixtures, equipped with reflectors and 26-mm diameter linear fluorescent lamps (2 x 58W). These lamps are powered by electronic ballasts and are dimmed according to the amount of natural light inside the hypermarket.

They are also dimmed before and after opening hours, when only staff is present (5 to 9:00 and 21 to 22:30). Compared to the old lighting installation, the new one is claimed to bring almost the same lighting quantity, plus the following savings:

- Lighting electricity savings: 2.378.187 kWh/year
- Energy cost savings: 217.550 euro/year



The most eloquent example is *Carrefour Valecenter* in Marcon. T8 lamps were installed after consultation and support by GreenLight staff; after measurements Carrefour claimed the following results:

- Lighting electricity savings: 423.000 kWh/year
- Power reduction: 80 kW
- Reduction of electricity use in the areas covered: 31%
- Energy cost savings: 42.300 euro/year
- Payback time: 3 years (taking into account the cost of equipment and installation)

This was used by Carrefour energy management team to persuade the company to use T5 in future lighting upgrades such as the hypermarkets in Collegno and Assago. In the latter hypermarket Carrefour installed also a lighting control system based on the contribution of natural lighting, saving more than 400.000 kWh/year and this with a very short payback time, of around 6 months.



Since November 19, 2003 **Centocor International** is participating in the EU GreenLight Programme. Before this Centocor was indirectly participating by fulfilling the agreements of Energy Star under the American GreenLight Program. Centocor commits itself, by participating in the EU GreenLight to upgrade at least 50% of all eligible space owned or long-term leased by at least 30% relatively.



For the beginning in the first year, they installed occupancy sensors in the meeting rooms. During the day the light in the meeting rooms was continuously operating. The meeting rooms are in used for approximately 6 hours a day. This means 10 hours of day the lighting was operating for no reason. Therefore the Centocor has installed occupancy sensors which switch of the lighting when there are no persons in the specific rooms. The reduction of electricity after installing the occupancy sensors has been calculated as 6.000 kWh/year (about 1% of the total consumption). With an investment of 3.600 euro the running savings costs are about 332 euro/year.



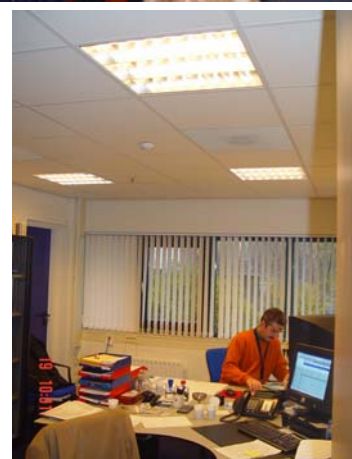
For a second stage they tried to renew the lighting system for a total production area of 9.500 m². The new system was equipped only with 26 mm diameter fluorescent lamps 36 W and 58 W, geared by electronic non-dimmable ballasts, while outdoor the old HP Standard Mercury lamps were replaced with Halogen line-voltage ones. All the outside and inside luminaires were equipped with aluminised reflectors.



Besides better visual conditions, they claimed the next electricity savings:

- Lighting electricity savings: 207.773 kWh/year
- Energy cost savings: 10.181 euro/year
- Payback time: 2 months

By this time the total lighting electricity savings are about 263.000 kWh/year (28.9 %)



Occupancy sensors



In Netherlands, the GreenLight Partner **Christiaan Huygens College**, rethought their lighting concept, using new aluminised luminaires reflectors for the 26 mm diameter fluorescent lamps powered by electronic non-dimmable ballast. Based on the idea of localised lighting they adopted occupancy and daylight responsive control systems.



Lighting installation had to be replaced because of technical reasons (end of technical life cycle). The payback time is based on the additional investment required by the HF ballasts and daylight dimming systems versus the reduction in energy consumption resulting from applying these systems.

- Lighting electricity savings: 5.119 kWh/year
- Energy cost savings: 615 euro/year
- Payback time: 7,00 years



City of Helsinki - Education Department (Finland) - GreenLight partner

Winner of the
GreenLight Awards
2004

More than 300 school buildings are maintained by the **City of Helsinki Education Department**. The renovation projects of the schools focus on the safety, health and on sustainable development as well as improving the energy efficiency and the quality of the facilities. In 2003 a total of EUR 56,4 million was spent on school construction, renovation and maintenance projects. City of Helsinki Education Department has been an active participant in the GreenLight Programme in Finland from the beginning.

Details of the typical classrooms



- **Old lighting** with T8 circular fluorescent lamps and CFL's or incandescent



- **New lighting** with pinbased fluorescent lamps and electronic ballasts

- Energy savings from 22 to 48 %
- Better lighting quality with indirect lighting
- No veiling reflections or glare
- Better vertical illumination
- Energy savings 18.000 kWh/year

Munkkivuori elementary school
Total area: 2.508 m²



Comune di Berchidda (near Sassari in Sardinia) joined GreenLight as a partner following a proposal of an ESCO Endorser, who became aware of the GreenLight Programme through the FIRE web site.

The pilot project proposed by Enersud is the retrofitting of the Elementary school, which involves the installation of new high efficiency tri-phosphor lamps, electronic ballasts, and dimmers with illuminance control, based on daylight contribution. The saving are more than 30%.



In Italy, the GreenLight Partner **Comune di Careri**, upgraded the Palazzo Municipale - office building - with total area of 462 m². They replaced the incandescent and the T12 lamps with modern ones, equipped with aluminised luminaries reflectors, compact fluorescent, T5 and T8 lamps. The conventional magnetic ballast was also replaced with high-efficiency one. Taking into account an uniform illumination level they also used daylight responsive lighting control systems. Those changes generated lighting electricity savings of 2.620 kWh/year, with a payback time of 4,50 years.



In Italy, the GreenLight Partner **Comune di Lecce dei Marsi (AQ)**, removed the old high pressure mercury lamps (D13), used for the public street lightning, with high pressure sodium lamps (D15). The lighting system was equipped with time scheduling control devices, which reduced considerably the yearly burning hours. Besides providing tele-control capabilities, their system is claimed to have provided the following savings:

- Lighting electricity savings: 136.280 kWh/year
 - Energy cost savings: 12.210 euro/year
 - Payback time: 14 years
-

Some other local authorities in Italy, adopted pretty much the same technical solutions for the refurbishment of the **public street lighting**. They removed the old high pressure mercury lamps (D13), used for the public street lighting, with high pressure sodium lamps (D15). The lighting system was equipped with new control devices like daylight responsive ones and timers with tele-control capabilities, which reduced considerably the yearly burning hours.



- ▶ An ESCO company, signed a contract with the **Comune di Giuggianello** in order to renew all the luminaires at zero cost for the town. After the first project in 2004, they claimed the next savings:
 - Lighting electricity savings: 119.000 kWh/year
 - Energy cost savings: 7.800 euro/year
 - Payback time: 10 years



► The GreenLight Partner **Comune di Melissano**

In 2002 public street lighting:

- Lighting electricity savings: 578.000 kWh/year
- Energy cost savings: 58.000 euro/year

In 2003 public street lighting:

- Lighting electricity savings: 699.661 kWh/year
- Energy cost savings: 57.722 euro/year

In 2004 public street lighting:

- Lighting electricity savings: 700.362 kWh/year
- Energy cost savings: 57.780 euro/year
- Payback time: 4 years



► **Comune di Paterno**, reported lighting electricity savings of 240.000 kWh/year by upgrading the public street light for a 70.000 m² area.

► **Comune di Ripalimosani**, claimed to have provided the following savings:

- Lighting electricity savings: 164.250 kWh/year
- Energy cost savings: 13.550 euro/year
- Payback time: 4 years

► **Comune di Roccaraso (AQ) C/O**,

- Lighting electricity savings: 187.720 kWh/year
- Energy cost savings: 14.680 euro/year
- Payback time: 15 years



► **Comune di Spongano**, their public street light design claimed to have provided the following savings:

- Lighting electricity savings: 344.925 kWh/year
- Energy cost savings: 28.456 euro/year
- Payback time: 4 years

► **Comune di Torella del Sannio (CB) C/O:**

- Lighting electricity savings: 133.590 kWh/year
- Energy cost savings: 11.021 euro/year
- Payback time: 3 years

► **Comune di Torre De Passeri (AQ):**

- Lighting electricity savings: 190.530 kWh/year
- Energy cost savings: 15.719 euro/year
- Payback time: 14 years

► **Comune di Villalago (AQ),**

- Lighting electricity savings: 127.020 kWh/year
- Energy cost savings: 10.479 euro/year



► **Comune di Vinchiatturo (CB) C/O:**

- Lighting electricity savings: 210.788 kWh/year
- Energy cost savings: 17.390 euro/year
- Payback time: 2 years



Comune di Rolo

Mainly for security reasons, in order to get a better surveillance around the centre, the municipality refurbished the entire old public street lighting system with more efficient lamps, installing in the same time, other 849 new points of light (representing 36% more than the existing ones). Now the centre of the city is lighted all over, for a better safety of the citizens. The Municipality should pay 120.000 euro/year for a period of 15 years. After that, the new system would become public property.



In Italy, the **Comune di Sassari** installed a centralised dimming system to reduce its street lighting levels and thus its energy consumption and light pollution during periods of the night where traffic is lower. The city signed a “paid from savings” contract with the power control manufacturer and the installer. These financed up-front capital improvements in exchange for a portion of the savings generated.

Besides providing tele-control capabilities, and thus easier maintenance, their system is claimed to have provided 2.412.620 kWh/year lighting electricity savings. The reduction of electricity use in the areas covered is ca. 30%.

An estimated 224.374 euro/year are saved and the investment has a payback time of 2,3 years.



Comune di Trezzano Rosa

This small town located near Milan upgraded the street lighting system by installing new luminaires, reducing the lamp power, and substituting the high pressure mercury lamps with high pressure sodium lamps. This was done through an ESCO at zero cost for the town

Winner of the
GreenLight Awards
2003

The achieved results were:

- Lighting electricity savings: 96.531 kWh/year
- Payback time: 3 years

The town will now upgrade the traffic lights changing the incandescent lamps to LEDs.



COOP Italia was the first retail chain to join the GreenLight Programme. They upgraded the lighting in 12 hypermarkets by changing their old inefficient egg-crate louvered luminaires with new fixtures including pin-based 55W fluorescent lamps, electronic ballasts, specular reflectors (90% reflectivity), double switch-on, and sometimes daylight responsive lighting control systems. This lighting solution has also been adopted in 20 new hypermarkets.



Before ▲

After ▼



■ *Montecatini* hypermarket (8.000m²).

The old 400W metal halide lamps and conventional magnetic ballast was replaced with new 55W CFL lamps powered by electronic ballast. Above a much better amount of light - all most 50% bigger - they reported the following savings:

- Lighting electricity savings: 238.655 kWh/year
- Power reduction: 51 kW
- Reduction of electricity use in the areas covered: 34%
- Energy cost savings: 26.020 euro/year
- Payback Time: 3 years

■ *Montevarchi* (4.200m²)

The old 400W metal halide lamps and conventional magnetic ballast was replaced with new 55W CFL lamps powered by electronic non-dimmable ballast.

Like before the lighting level was doubled and they achieved the next savings:

- Lighting electricity savings: 146.250 kWh/year
- Energy cost savings: 16.280 euro/year

■ *San Benedetto del Tronto* (12.000m²)

The previous examples does not include a daylight responsive lighting control system. For San Benedetto hypermarket, the installation of such a system is said to have generated additional savings of ca. 20%, sufficient to pay back the cost of the control system in less than 2,5 years. In this case the total savings are:

- Lighting electricity savings: 97.500 kWh/year
- Energy cost savings: 9.260 euro/year
- Payback Time: 2,5 years



Winner of the
GreenLight Awards
2004

In France, the GreenLight Partner **Distribution Casino France - Branche Supermarchés**, renovated 15 supermarkets with a total area of 130.000 m². The mercury vapour lamps 400W was replaced by T5 ones.

After measurements, they reported the following results:

- Reduction of installed load of 45%
- Lighting electricity savings: 9.500.000 kWh/year
- Energy cost savings: 415.000 euro/year



DOLCE & GABBANA

Winner of the
GreenLight Awards
2004

In a first main project, **Dolce&Gabbana** refurbished the lighting system for their main *show room building*.

Baseline lighting:

- 3.100 halogen lamps and 700 fluorescent lamps
- Total electricity use per year: 355.000 kWh/year
- High maintenance costs

Post-installation lighting:

- 900 T5 fluorescent lamps with regulators, metal halide and halogen lamps for the visual effects.
- Lighting supervisory control system
- Total electricity use per year: 75.000 kWh/year (1/5th than standard)



Benefits:

- Lighting electricity savings: 280.000 kWh/year (80% energy savings)
- Air conditioning energy savings (-20%)
- Lower maintenance costs
- High affordability and availability
- Investment cost decrease



Dolce&Gabbana, re-lighted as well some other shops :

- *Negozio Uomo-Milano*

In this case the achieved a reduced value of the lighting power 80W/m^2 instead of the previous 150W/m^2 , for a total area of 1500 m^2 . Here a difficult task was to integrate the new efficient lighting system into a building with very old architecture design.



- *Maximilianstrasse Munich*

Baseline lighting:

- halogen 50W - neon T8
- installed power: 46 kW
- electricity use per year: 115.000 kWh/year

Post-installation lighting:

- halogen 20W - neon T5
- installed power: 33 kW
- electricity use per year: 83.000 kWh/year

Savings:

- Lighting electricity savings: 32.000 kWh/year
- Energy cost savings: 4.800 euro/year

- *D&G Milano*

New halogen and metal halide projectors



◀ Before



◀ After

In Italy, the GreenLight Partner, **Ducati Motor Holding**, upgraded the lighting system for their workshop (5.200m²), by substituting the magnetic ballast with electronic one.

For this area they substituted a number of 250 linear fluorescent lamps (2x58), magnetic ballasts, with 250, new more efficient linear fluorescent lamps (2x58), electronic ballasts and specular reflectors. No other modification was made on the existing installation, besides removing and changing the existing starter, and the lamps.



Compared to the old lighting installation, the new system, besides a much better visual comfort, has the following savings, :

- Lighting electricity savings: 75.600 kWh/year
- Power reduction: 10.5 kW
- Reduction of electricity use in the areas covered: 30%
- Energy cost savings: 7.258 euro/year
- Payback time: 1,7 years

At the end, they also installed at the workshop some nocturnal lamps. These lamps allowed them an energy reduction use, when there is no activity in the workshop (from 2 am to 6 am). In this case, they achieved lighting electricity savings of about 4.936 euro/year.



In the frame of their commitment as GreenLight Partner, **EDP– Energias de Portugal** adopted the most efficient lighting equipment in its new building in *Coimbra*, a multifunctional facility that integrates an office area, a conference room, a parking and a medical unit.

In the office area, the conference room and the medical unit, the old 26 mm fluorescent lamps were replaced by T5 lamps equipped with electronic non-dimmable ballasts associated to efficient fixtures. For those spaces there is also an intelligent lighting management system that includes occupancy sensors.

In the parking area, there were installed T8 lamps, also equipped with electronic non-dimmable ballasts. They operate managed by the building lighting control system – between 7 am and 9 pm, the limits scheduled for permanence.

After measurements, the company reported lighting electricity savings of 108.179 kWh/year and energy cost reduction of 10.439 euro/year.



To manage engineering efforts in energy efficiency, **Escuela Técnica Superior de Ingeniería Industrial (ETSII)** has decided to accomplish a project to reduce energy costs during the next five years. To validate the feasibility and cost-effectiveness of different policies, a lot of demonstration actions applied to the *Old Navy Hospital*, headquarters of Escuela Técnica Superior de Ingeniería Industrial (ETSII), will be accomplished in the very near future.



This project consists of an evaluation of the advantages of energy efficiency upgrading in some lighting end-uses. For example these end-uses will be classrooms, computer rooms, libraries etc.

Obviously the lighting system presents some problems: technology of lamps and ballasts (58 W T12 single phosphor lamps or 70 W HID, halogen lamps, with magnetic ballasts), lighting axle, actual switching circuit. Also the rooms are not designed to provide adequate daylight throughout most of the year.

In most of the cases, for simplicity, they have considered two policies:

- Ballast upgrading (electronic ballast or dimming electronic ballast)
- Hall lamp upgrading (CFL lamps)

In future development of the project, another policies will be considered (dimmable ballast, photo sensors, occupancy sensors etc.) in detail.

After the first estimations for these pilot projects (3.120 m²), they claimed the next savings:

- Lighting electricity savings: 25.110 kWh/year
- Energy cost savings: 2.316 euro/year

Ethniki Asfalistiki - Insurance Company applied the GreenLight Programme to their new, under construction, central building, in the centre of Athens (total area 70.000 m²).

Energy efficient lighting design parameters were foreseen in the final phase of the building study and included high performance luminaires, adequate zoning, lighting control systems etc.

The energy part of the lighting study was carried out by an GreenLight Endorser.



In Portugal, the GreenLight Partner **Faculdade de Ciencia e Tecnologia**, upgraded the indoor and outdoor lighting system. More than replacing the old lamps with new ones more efficient, they substitute the magnetic ballast with electronic one. The lighting control system was equipped with daylight and occupancy responsive devices.

The company started as well a general users awareness campaign, claiming the following results:

- Lighting electricity savings: 182.076 kWh/year
- Energy cost savings: 13.291 euro/year
- Payback time: 1 year



In Portugal, the GreenLight Partner **Feira Nova Hipermercados SA**, rethought their lighting concept for three different facilities with a total area of 15.125 m². The old lamps (HPL-N400W) were changed with some more efficient new ones (TLD 58-36W). They used as well a very

complex lighting control system equipped with time scheduling, daylight and occupancy responsive devices.

Taking into consideration as well, the idea of localised lighting and a regular maintenance plan, the company reported the following savings:

- Lighting electricity savings: 1.058.186 kWh/year
- Energy cost savings: 64.550 euro/year
- Payback time: 7 months

Another Portuguese GreenLight Partner, **Recheio - Cash & Carry**, upgraded three facilities with a total area of 9.558 m². They Used the same main ideas, as for the model of Feira Nova Hipermercados. After measurements, they achieved the next savings:

- Lighting electricity savings: 159.631 kWh/year
- Energy cost savings: 9.736 euro/year
- Payback time: 2 years

Winner of the
GreenLight Awards
2004

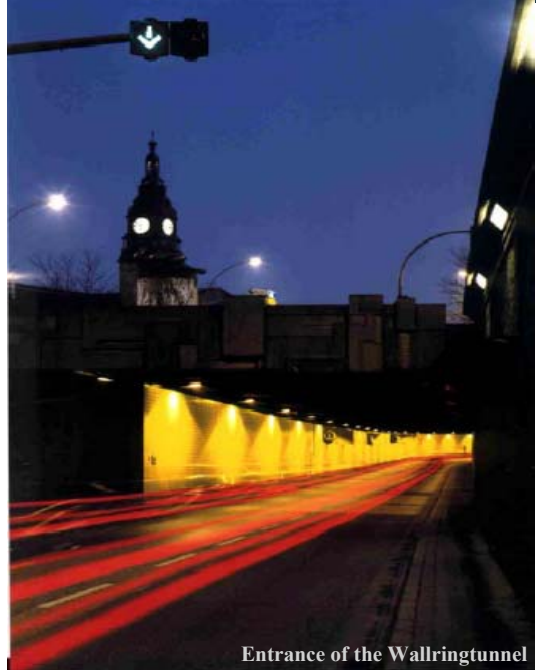
In 1992 the **Free and Hanseatic City of Hamburg** started the comprehensive campaign “Leuchtentausch – 2:1 fürs Klima” (luminaire exchange – 2:1 for the climate) for luminaire refurbishment in public buildings as schools, universities, sanitary arrangements, tunnelling, theatres and museums etc..

The results:

- Refurbishment in 450 projects
- Investment volume: 22.700.000 euro
- Electricity savings: 22.500.000 kWh/year

An example of smart lighting upgrade:

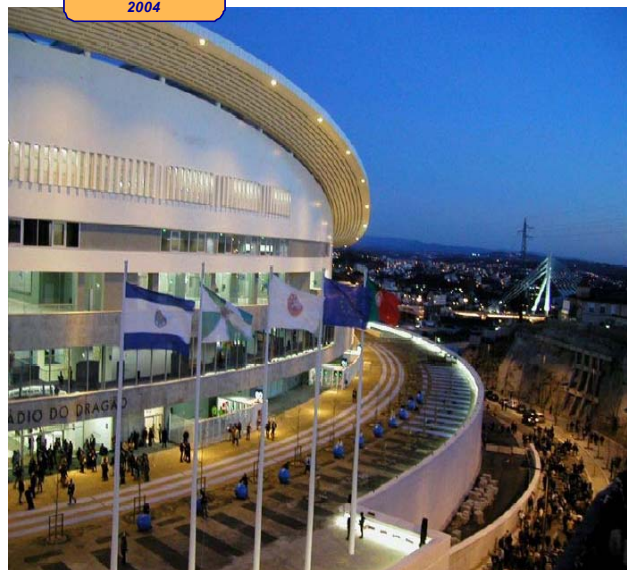
Tunnel lighting burns 24 hours a day. In January 2000, the city of Hamburg reduced its tunnel lighting electricity use by one million KWh/year (72%), replacing the old fluorescent lamps with 463 efficient sodium steam - lamps. The cost savings amounts were about 82.100 euro/year.



Entrance of the Wallringtunnel

Winner of the
GreenLight Awards
2004

The GreenLight Partner from Portugal, **Futebol Clube do Porto**, installed electronic non-dimmable ballast instead of the old magnetic conventional one. The lightning control system was equipped with time scheduling, daylight and occupancy devices. Moreover, they used as other as saving measures, a regular maintenance plan, the awareness of the users and the alternative of turning off the lightning control systems.





After measurements they claimed the following savings:

- Lighting electricity savings: 1.044.667 kWh/year
- Energy cost savings: 59.095 euro/year
- Payback time: 5 years



In their headquarter in Madrid, the GreenLight Partner **Gas Natural** replaced the incandescent fixtures with modern compact fluorescent lamps for the hallways of each floor. As a general rule, comparable total light output from a compact fluorescent scheme may be obtained for only around 20-30% of the wattage required using standard incandescent lamp.

In the offices, they changed their halophosphate fluorescent lamps, high-loss magnetic ballasts and poor-efficiency luminaires, for triphosphor lamps, electronic ballasts, and parabolic troffers. They also replaced their general manual switch by localised switches, offering a better control to the users.

The company reported much better visual conditions, in particular higher illuminance levels, and the following savings:

- Lighting electricity savings: 533.028 kWh/year
- Reduction of electricity use in the areas covered: 60%
- Energy cost savings: 27 230 euro/year
- Payback time: 3.5 - 8 years (depending on the project).





In Greece, **GEK** - Group of companies - joined The European GreenLight Programme.

Their project concerns the new headquarter building of the GEK group of companies, one of the largest construction and real estate development groups in Greece. The building has an area of 10.500 m² and is located in the central Athens area.

High energy efficiency standards have been incorporated in the building design and construction.

Maximum use of daylight is achieved through adequate window design, atrium integration and external shading devices. Artificial lighting is accomplished with the use of T5 lamps in the corridors and indirect light beam -high efficiency -luminaires with time switching in the offices. The building management system (BMS) compensates for outdoor light. Motion detectors have been installed in the offices and are coupled with the BMS.

As a result the energy consumption for lighting has dropped by 142.300 kWh/year from the conventional 263.800 kWh/year i.e. a decrease of over 50 %.



Gemmente Buggenhout in Belgium achieved energy savings of 73 % and a decrease in the amount of waste (lamps) of 43 %, by relighting the sport hall. This was done by replacing the 4-lamp fixtures with 3-lamps fixtures equipped with an electronic ballast that can be dimmed.

Gemmente Geetbets, in Belgium has re-lighted the municipal sport halls. The energy use was decreased with 64 % and the maintenance costs were lowered with two thirds. The entire installation was financed with the savings through the principle of third party financing by an GreenLight Endorser.



In Belgium, the GreenLight Partner **Gemeente Heers**, rethought their lighting system replacing the magnetic ballast with electronic one. As a consequence to this they used three different lightning levels: 150 lx - 300 lx - 500 lx.

After the measurements they claimed the following savings:

- Lighting electricity savings: 18.805 kWh/year
- Energy cost savings: 3.345 euro/year



In Belgium, the Greenlight Partner **Gemeente Hoegaarden** has upgraded the lighting in the municipal sport hall, leading to an energy saving of about 46 %.

Gemmente Lebbeke in Belgium has re-lighted the sport halls in 2003. Energy savings amounted to over 50 % thanks to the dimming of the lighting levels according to the activity. Also maintenance costs were cut by two thirds:

- Lighting electricity savings: 129.723 kWh/year
 - Energy cost savings: 3.069 euro/year
 - Payback: 5 years
-

In Belgium, **Gemmente Londerzeel**, upgraded the lighting system of theirs sport hall.



The light level increased from 250 lx before to 500 lx after the relighting. The installed power on the other hand decreased from 32,4 kW to 16,45 kW, which is a reduction of 49%. On top of this extra savings will be possible because the entire lighting installation can be dimmed (30 - 100 - 300 -500 lx) according to the use of the hall.

Gemmente Merchtem in Belgium has re-lighted the sport halls in 2004. With an increase in the light level (from 340 lx to 500 lx) still 29 % could be saved on installed power. With the use of an advanced dimming system, much higher savings (till 69 %) were attained:

- Lighting electricity savings: 8.800 kWh/year
 - Energy cost savings: 355 euro/year
 - Payback: 12 years
-



**Gemeinde
Möglingen**

In Germany, the GreenLight Partner **Gemeinde Moglingen**, upgraded 5 facilities. The total lighting electricity savings achieved were about 219.300 kWh/year.

Löscher Schule - lighting electricity savings: 10.800 kWh/year

Stadionhalle - lighting electricity savings: 71.000 kWh/year

Sporthalle Wackenberg - lighting electricity savings: 18.000 kWh/year

Baresa - lighting electricity savings: 107.100 kWh/year



In Nederland, the GreenLight Partner **Gemeente Sittard Geleen**, upgraded the Stadhuis Sittard, 2.100 m² office building. The old 26 mm fluorescent lamps with new T5, 16 mm fluorescent lamps, more efficient, with aluminised reflector. As many others GreenLight Partners, they changed the magnetic conventional ballast with electronic dimmable ballast.

Using a daylight and occupancy responsive lighting control system they achieved the next savings:

- Lighting electricity savings: 149.990 kWh/year
- Energy cost savings: 7.350 euro/year



In Belgium, **Gemmente Zingem** has relighted a sport hall in 2004 and is now in the midst of the relighting of one entire elementary school.

In the sport hall the electricity consumption decreased with almost 82% : from 58.178 kWh to 10.647 kWh. This was thanks to a decrease in installed power even though the light level went up from 360 lx to 500 lx. Important savings could also be made by dimming the installation in response to presence and in accordance to the light level necessary for a certain activity.

For the school - the ESCO that is implementing the project - has calculated that the savings would amount to 74 %, which -together with the savings in maintenance - renders the project profitable in 6 years.

In Portugal, the GreenLight Partner **Gestiretalho - Gestão e Consultoria para a Distribuição à Retalho**, upgraded the *Centro Distribuição Azambuja*, facility with an total area refurbished of 23.108 m².

The old lamps (HPL-N400W) were changed with some more efficient ones (TLD 58-36W). The lighting control system was equipped with time scheduling, daylight and occupancy responsive devices.

Taking into consideration as well the idea of localised lighting and a regular maintenance plan, the company reported the following savings:

- Lighting electricity savings: 516.310 kWh/year
- Energy cost savings: 31.495 euro/year
- Payback time: 4,20 years



Grohe, the leading global brand for high-quality fittings and sanitary systems, has re-lighted its building in Belgium with the assistance of one ESCO endorser. The savings on installed power amounted to 40 %.



In Spain, the GreenLight Partner **Grupo Union Fenosa**, achieved the following results:

- Lighting electricity savings: 507.050 kWh/year
 - Payback time: 5,26 years
-

HALLIBURTON

Winner of the
GreenLight Awards
2005



Halliburton, in Norway, owns a total area of 40.000 m² which includes: offices 19.000 m², canteen/kitchen 1.000 m², workshop 10.000 m², parking 7.500 m², storage/warehouse 2.000 m². In the first completed project in January 2004, the company upgraded the lighting system for 5.000 m² of their office area.

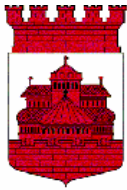
They changed the old fixtures 2*36W - 26 mm diameter fluorescent lamps with new 3*28W - 16 mm diameter ones (T5). The new lamps are powered by new electronic non-dimmable ballasts. The meeting rooms were also equipped with movement sensors. In addition they started to install building-automation-system which includes the light-system as well.

After measurements they claimed the next savings:

- Lighting electricity savings: 71.000 kWh/year
- Energy cost savings: 3.561 euro/year
- Payback time: 10 years

The remaining office-area which has not been upgraded so far is about 4.000 m², and will hopefully be completed during this year. The rest of the office-area has already installed modern lighting equipment with a high efficiency.





HELSINGBORG

In 2002, the Swedish GreenLight Partner, **Helsingborgs City**, rethought the lighting systems for three main facilities: *Påarps sport hall*, *Fredriksdalsskolan*, *Olympiaskolan*.

Mainly the post installation lighting is very much the same, except the control system, an integrated system that controls the light and the ventilation. For some cases they installed occupancy responsive devices, claiming the next savings:

- *Påarps sport hall* (1.650 m²)
 - Lighting electricity savings: 70.000 kWh/year
 - Energy cost savings: 5.414 euro/year
 - Payback time: 1,6 years

- *Fredriksdalsskolan* (4.300 m²)
 - Lighting electricity savings: 23.500 kWh/year
 - Energy cost savings: 1.823 euro/year
 - Payback time: 12 years

- *Olympiaskolan*
 - Lighting electricity savings: 22.900 kWh/year
 - Energy cost savings: 1.767 euro/year
 - Payback time: 4,5 years



In Belgium, the GreenLight Partner **HMZ**, upgraded the *HMZ St.Truiden*. HMZ (Belgium) is a leading company with regard to the development and production of the packaging material in steel, aluminium and stainless steel. As part of their GreenLight Partner commitment, from 2004, they changed the old mercury luminaries with new T8 (2*58W). Replacing in the same time the magnetic ballast with electronic one. They reported the following results:

- Lighting electricity savings: 99.170 kWh/year
- Energy cost savings: 7.228 euro/year

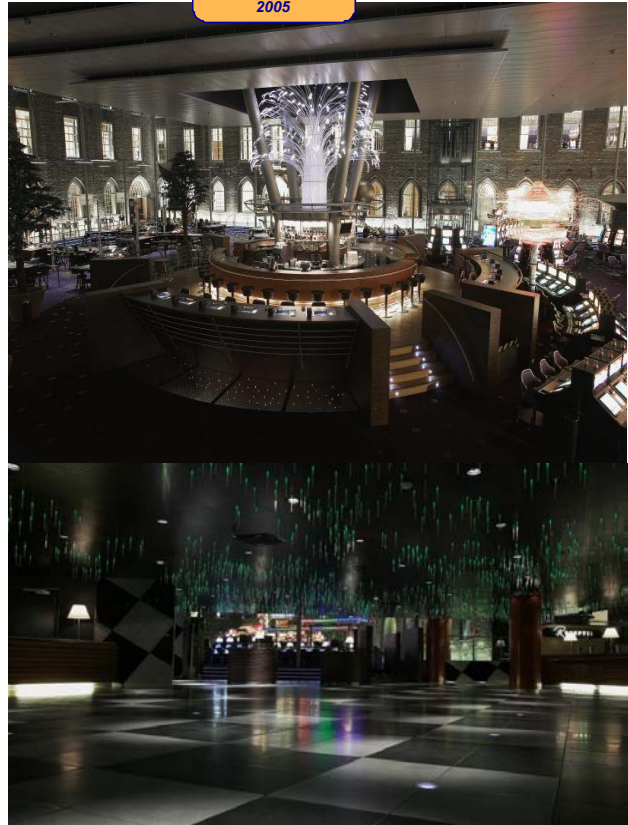
In Belgium, the GreenLight Partner **HN Autotransport**, upgraded the *HN Autotransport Tongeren*. The claimed savings were:

- Lighting electricity savings: 60.359 kWh/year
- Energy cost savings: 6.957 euro/year

The Netherlands, GreenLight Partner **Holland Casino Breda**, upgraded in 2003, 15 sites with a total area of 127.760 m². Mainly they replaced all the old mercury lamps (400W) with new 16 mm diameter fluorescent lamps more efficient, with a longer life time and a smaller quantity of recyclable tubes.

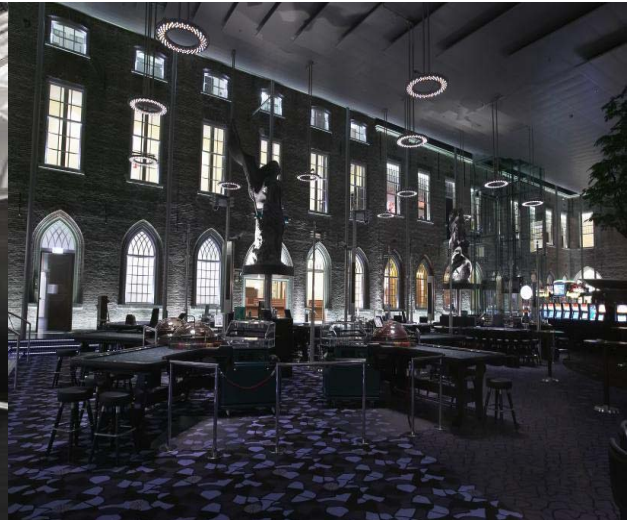
The Holland Casino Breda used more calculation methods, compared different solutions and finally achieved the most suitable way of saving energy. The old lighting system (400 W mercury lamps), for an area of 127.760 m² was re-equipped with 16 mm diameter fluorescent tubes. The new lamps are much more efficient, have a longer burning period, reducing in the same time the amount of recyclable tubes.

Winner of the
GreenLight Awards
2005



After measurements, for 2004, they claimed the following savings:

- Lighting electricity savings: 9.450.000 kWh/year
- Energy cost savings: 414.000 euro/year
- Payback time: 6 years





In Spain, the GreenLight Partner **Hospital Universitario Virgen de las Nieves de Granada**, rethought their lighting system changing the old incandescent lamps with new ones, more efficient, geared with electronic ballasts and aluminised reflectors.

Moreover they adopted a regular maintenance plan, achieving at the end the following savings:

- Lighting electricity savings: 782.025 kWh/year
- Energy cost savings: 49.585 euro/year
- Payback time: 5 years



The **Hotel Princess Lanassa SA**, a GreenLight Partner from Greece, upgraded 1.320 m², a boutique 5-star hotel close to the city of Ioannina (North-West Greece).



The actions undertaken in the frame of the GreenLight Programme focused on the improvement of the energy performance of the lighting fittings as well as the effective time control of the operation of the lighting systems.

Upgrading actions included:

- Use of low consumption fluorescent rather than incandescent lamps, wherever possible.
- Use of motion detectors and photo sensors in areas continuously lit, such as kitchen.
- Installation of presence cards in the rooms and time switches for corridors and external lights.

The actions resulted in significant energy savings and an adequate grouping of light sources creating an attractive visual environment provided by energy efficient lighting schemes. Taking into consideration the idea that the price of CFL is equal with the price of incandescent, since the life span of CFL is much higher than the one of incandescent, after measurements, they achieved:

- Lighting electricity savings: 74.127 kWh/year
- Energy cost savings: 7.413 euro/year





Instituto para la Diversificación y Ahorro de la Energía (IDAE), another Spanish GreenLight Partner, upgraded the new IDAE main building (4.380 m²). The old lighting system was

pretty much composed from metal halide, line-voltage and low-voltage halogen lamps. They replaced those with fluorescent linear (26mm diameter) and CFL pin-based ones. Those lamps are powered by electronic ballasts and in some case they are also dimmed according with the amount of natural light.

Apart from renewing the visual aspect of the interior of the building, the new lighting system is claimed to bring the savings given below:

- Lighting electricity savings: 152.676 kWh/year
- Energy cost savings: 8.580 euro/year



◀ Before

After ▶



◀ Before

- Lighting installed power: 83.316 W
- Lighting energy use: 237.462 kWh/year
- Initial cost: 128.000 euro
- Yearly running cost: 13.344 euro



◀ After

- Lighting installed power: 46.572 W
- Lighting energy use: 84.785 kWh/year
- Initial cost: 128.000 euro
- Yearly running cost: 4.765 euro





IKEA, the famous home furnishings stores, joined GreenLight on December 2002. They stated that environmental work is a natural part of their responsibility to the customers. as a part of its Social and Environmental strategy, participated at the energy savings competition “KILL A WATT”. The aims were to reduce both the amount of electricity used and increase awareness of the electricity costs and associated problems caused by emissions of Carbon Dioxide. The competition was designed to involve as many units and co-workers as possible. Our energy bills and emissions are largely dependent on how the co-

workers behave. Raising awareness of the value of energy consumption and conservation is a key part of our efforts to control this area. The competition was also organized to promote the sharing of good ideas and best practice across all IKEA units.

Summary of the competition and results:

Number of registered Units	149
Number of Participating countries	30
Net savings in consumption	3.104.321 kWh
Calculated Net savings in Euro	85.348 Euro
Positive Net savings of CO ₂ emissions	3.500.000 kg/ CO ₂
Equivalent to electricity for	2.000 homes or 2 IKEA stores x 1 year

Some good examples where IKEA has made savings, by reducing the amount of lighting in some retail units:

- ▶ *Dresden store – Germany*: Lighting energy savings of 12.529 KWh/ (November 2003-January 2004), respectively 21% savings.
 - Optimisation of the lighting system.
 - Turning off the show room lights immediately after inspection, followed by market hall and then self serve.
 - Making sure the decorating lights is not on the emergency circuits.
 - Any deviations of the lighting schedule should be reported to the technician
 - Use an independent halogen lamp and not the decoration lighting system, during renovation.
 - Daylight sensors for the parking area and no use of compacting lighting areas.
 - Switches for goods receiving area permit flexibility.
 - Monthly reporting to the staff instead of yearly.

► *Ostrava store - Czech Republic*: Lighting electricity savings: 27.548 kWh/(November 2003-January 2004); Energy cost savings: 3.249 euro/(November 2003-January 2004).

- Reducing the lighting output from 100% to 50%, 20% during the day.
- Roof windows for day light.
- Switching off 70% of the lighting tubes, after 4.00 p.m., in the receiving goods area, according with the warehouse workers needs.
- switching off the lighting system in dressing rooms, storages, conference rooms, corridors, according with the safety & security rules.
- designing the lighting system for the offices as small rings, to achieve a better control and efficiency, considering the different needs of the workers; placing lamps on all the desks.
- Organizing an employees workshop in order to raise the users awareness.
- Switching of the lighting for the IKEA sign and for the entrance to the store after 10:00 p.m.



The Belgium GreenLight Partner, **ING (formerly BBL)**, refurbish the lighting system for the 6th floor of BBL Cours Saint Michel.

The baseline lighting age was 1977, the same year when the building was made. The old lamps were 2 TL - 65 W with conventional magnetic ballast. In the 80' the 2 TL lamps were replaced with TL'D (24 mm diameter - 58W) ones achieving an luminance level of 500 lx.

In 2000 the baseline lamps were replaced with 690 new ones (TL5, 16 mm diameter - 49 W), equipped with electronic ballasts, with a efficiency of 83 %. They reported a luminance level of 450 lx and energy savings of 154.830 kWh, in order to cover the difference of light produced by the old lamps. For the air conditioning they estimated energy savings of 60.000 kWh.

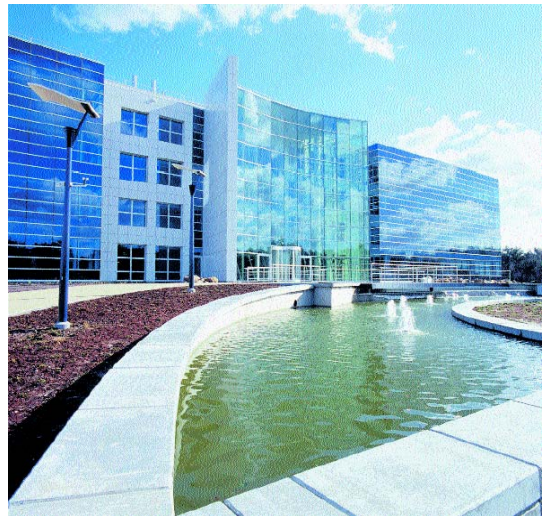
The healthcare company, **Johnson & Johnson**, was the first organisation to join the European GreenLight Programme in 2000. In their *Janssen Pharmaceutica* facility in Belgium they have performed a relighting study for 75% of their 410.000 m² workspace. The actual re-lighted surface amounts 62.000 m². All new facilities are equipped with daylight and occupancy-sensors, 26 mm diameter fluorescent tubes with high efficiency ballasts and reflectors.

In addition to less cooling needs, lower maintenance costs and better working conditions for employees, they reported the following savings:

- Lighting electricity savings: 1.240.000 kWh/year
- Reduction of electricity use : 40%
- Energy cost savings: 62.000 euro/year
- Payback time: 1.5 to 6 years (depending on the project)

In present, after the successfully story of this first study project, the company, extended their actions all over Europe (Austria, Belgium, France, Germany, Ireland, Italy, The Netherlands, Portugal, Spain, Sweden and UK). After measurements, they reported for the interval of time between 1997-2003, the following results, for an upgraded area of 379.944 m²:

- Lighting electricity savings: 4.062.568 kWh/year
- Energy cost savings: 311.890 euro/year
- Payback time: 7 years (the average - depending on the project)



“We see the European GreenLight Programme as increasing the awareness within our companies in Europe and providing technical information and tools to accelerate our lighting upgrades”

Harry Kauffman
Corporate Energy Director
Johnson & Johnson

In Belgium, the GreenLight Partner **Kautex Textron Benelux B.V.B.A.**, upgraded a total area of 8600 m² in January 2003. Basically they replaced the old HP mercury lamps with metal halide and 26 mm fluorescent ones, changing in the same time the conventional magnetic ballast with new electronic non dimmable ballast. Moreover they changed the luminaries with new ones equipped with aluminised reflectors.

The company reported the next savings:

- Lighting electricity savings: 427.748 kWh/year
- Energy cost savings: 21.821 euro/year



In Norway, **KLP Eiendom Trondheim AS**, upgraded in 2003 the *Leutenhaven Parkeringshus*. In the parking garage all existing light fittings were dismantled and new light fittings are mounted. The new fittings are of the type 1*49 W T5 full colour, and they are placed in the same location as the existing ones. By the entrance there were mounted fewer than before. The existing light control is used together with new motion detectors to reduce the amount of fittings used in periods with less traffic density. There is also installed a fixed-time control according to the agreement with the rental and building owner.



Apart from renewing the visual aspect of the interior, the new lighting system is claimed to bring the savings given below:

- Lighting electricity savings: 159.450 kWh/year
- Energy cost savings: 15.945 euro/year
- Payback time: 2,7 years

Kosa vzw in Belgium, has an events hall and tennis hall under its control. In the tennis hall the amount of fixtures was halved.

Also a reservation system was linked to the lighting installation with a result that only when someone is playing the lights are on.

In Belgium, the GreenLight Partner **Landuyt NV**, upgraded in 2001 the *Metal Industrie*. Like many other GreenLight partners, they re-lit their facility, using a new, much more energy-efficient equipment.

After measurements, they claimed the following savings:

- Energy savings: 55%
- Lighting electricity savings: 121.023 kWh/year
- Payback time: 5,50 years

In the Netherlands, the GreenLight Partner **Lorentz Casimir Lyceum**, upgraded an area of 1.084 m² from a total of 5.568 m². The lamps were unchanged (26 mm diameter fluorescent ones), but the conventional magnetic ballast was replaced with a new electronic dimmable one. They used as well a very complex lighting control system equipped with time scheduling, day-light and occupancy responsive devices. After measurements they have reported lighting electricity savings of 20.224 kWh/year with a payback time of about 7 years.

Before renovation ▼



After renovation ▼





McDonald's Europe joined GreenLight for their currently over 6.000 restaurants in Europe (average size: 350 m²) in 2002.

From the original submission the situation has changed somehow since the company:

- a. had greatly reduced the number of new restaurant openings and focus more on remodels / refits
- b. is using a more complex lighting design in the lobby - using more lamps than the old restaurants - but through use of newest technology still containing the overall usage than if they would do this lighting concept with the old/existing tech. The figures below still provide a strong incentive for SME and the message is still the same - if you refit your lighting system you have a chance to save energy and money. In fact because of the increased energy cost the message is even clearer.

In 2004, approx 300 restaurants were remodelled/refitted and 137 new restaurants were opened. Using latest lighting technology the average new/refitted restaurant uses 11 kW lighting installed power, compared to the 13 kW, if previous standard technology would be used, representing savings of 13.200 kWh/year.



◀ Before: - Standard neon (T8)
- 4.510 KWh/year



◀ After: - Aura lamps (T5)
- 4.100 KWh/year
- 10% less consumption
- Lower mercury usage
- Longlife: approx. 3 x longer standard

In 2003, McDonald's Franchisee, Oliver Bayer, upgraded the kitchen lighting in his restaurant together with the support and guidance of the City of Hamburg, a further Greenlight partner. This concept has since been adopted by all 46 McDonald's in Hamburg, saving approx. 400.000 kWh/year - an approx. CO₂ reduction of 250 tons.

Old		New	Total Savings
2 x 58, KVG	Lamps	1 x 55 W, EVG	400.000 kWh per year
14	No. of lights	11	Cost Savings (Average per Restaurant)
28	No. of lamps	11	1.100 EUR per year
2 KW	Performance	0,6 KW	Total CO₂ Reduction

The total lighting electricity savings (restaurants and kitchen) would be:
 $[(300+137) * 13.200] + 400.000 = 6.168.400 \text{ kWh/year}$





In Spain, the GreenLight Partner **Meliá Castilla Hotel**, located in the modern commercial and financial district of Madrid upgraded their lighting system, claiming at the end the next savings:

- Lighting electricity savings: 438.292 kWh/year
- Payback time: 4 years



Winner of the
GreenLight Awards
2003

In Italy, the GreenLight Partner since November 2001, **Monte dei Paschi di Siena**, upgraded 108 different facilities.

For a total area of 42.809m², the company achieved the next savings:

- Lighting electricity savings: 229.790 kWh/year
- Energy cost savings: 62.696 euro/year
- Payback time: 4 years



Agenzia n° 2 di Milano

For 2004 they done twelve more upgrade projects for their branches in Italy. The twelve projects cover an area of 6.000 m². Mainly they changed the old luminaires for incandescent lamps without any reflectors with new ones for 26 mm (T8) fluorescent lamps and aluminised reflectors, powered by electronic ballasts. Moreover they installed localised switchers and adopted an regular maintenance plan, measures that lead to even bigger energy savings.

The reported savings were:

- Lighting electricity savings: 79.000 kWh/year
- Energy cost savings: 20.880 euro/year
- Payback time: 2,8 years

Filiale di Roma
New lighting system (1800m²)
Lamps dimming correlated with
Daylight responsive sensors



An initiative promoted by the European Commission

In Belgium, the GreenLight Partner **MSGO te Maaseik**, upgraded in 2004 the lighting system for one elementary school building.

Besides better visual conditions, they claimed the next savings:

- Lighting electricity savings: 55.915 kWh/year (70 %)
 - Energy cost savings: 2.321 euro/year
 - Payback time: 6 years
-



In Germany, the GreenLight Partners, **Municipality of Neunkirchen-Seelscheid** and **Municipal Utility Neunkirchen-Seelscheid (Gemeinde Neunkirchen-Seelscheid)**, are a positive example for a successfully implemented innovative lighting concept. The energy consumption for lighting has been reduced about 70 % through the refurbishment in the classrooms as well as in the gymnasiums. The reduction of the electricity bill finances the essential part of the investments costs of about 500.000 euro for the refurbishment of the lighting. Last but not least the environment profits through the relevant reduced pollutant emission and energy consumption.

The focus of every lighting concept has been laid on the installation of modern best available technology which has been harmonised to the respective building conditions. For example the connection power in the *secondary school Neunkirchen* could be reduced about more than the triple from 61,5 kW to 18,13 kW. The energy costs as for the lighting in the multipurpose gymnasium Neunkirchen could be reduced about 10.000 euro/year. Consequential costs respectively impacts have been taken into consideration in the cost comparison respectively the capital value calculation.

Per total the lighting refurbishment has achieved an yearly reduction of 590.000 kWh. With this effort the CO₂ equivalent emission could be reduced about nearly 400 tons per year.



Winner of the
GreenLight Awards
2005

In May 2004 **Nike Laakdal** received the GreenLight Certificate. The biggest energy reduction program Nike Laakdal has installed is called the "relighting" project. In this project they replaced the "old" light tubes and fixtures with new technology fixtures and tubes. These tubes give twice as much light. During the engineering study, Nike made sure that their employees have the right light level for their job.

The project reduces Nike Laakdal's annual energy consumption by 2.000.000 kWh. This is a contribution of more than 10% in reducing our green house gas emissions. The good news is also that this project has a positive Net Present Value (NPV) in less than 4 years.



An initiative promoted by the European Commission

For one of their first facilities they reported the next changes:

	Baseline Lighting	Post installation lighting
Number of luminaires	3157	1977
Type of luminaires	2x58 KVSA	E5200/x35/x49p 1HW
Type of lamp	TL lamp (T8)	TL lamp (T5)
Type of ballast	Conventionele ballast & T8	Elektronisch ballast & T5
Lamp total power	58 Watt	35 Watt
Lighting electricity use per year (kWh)	1.190.189	449.768
Payback time		3 - 4 years



In Germany, GreenLight Partner **Neukauf-Merz** upgraded the lighting in one shop by changing all T8, 26-mm diameter fluorescent lamps with T5, 16-mm diameter lamps. They used a substitution kit including the lamp, its electronic ballast, its reflector and shielding. No other modification was made on the existing installation than removing the existing starter.

Not only did they claim to have improved glare control and luminance levels, but they also reported the following savings:

- Lighting electricity savings: 18.624 kWh/year
- Power reduction: 4.7 kW
- Reduction of electricity use in the areas covered: 32%
- Energy cost savings: 1.443 euro/year
- Internal Rate of Return of the investment: 20%



Before ▲

After ▼



This lighting upgrade, coupled to other energy efficiency measures, solved their indoor over-heating problems and avoided investing in extra air-conditioning capacity.

Edeka Neukauf
 Wilhelmstr. 160
 D-64625 Bensheim-Auerbach

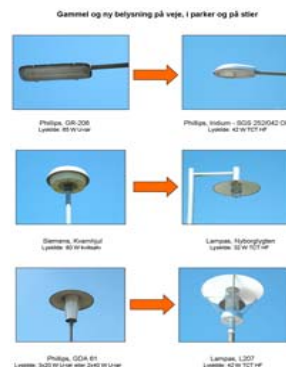




In Spring 2004 the Danish vice-premier minister was handing over the first GreenLight Plaque to the mayor of **Nyborg Municipality** for their shift to energy efficient street lighting and development of new harbour lighting.

The new lighting system at the harbour area is one of the first energy efficient lighting activities already performed.

- In the parking area, 12 fixtures with two 80 W HPL were replaced by two 32 W PL-T (CFL) giving a saving of: $1.152 \text{ W} \cdot 4200\text{h} = 4.800 \text{ kWh}$
- In the living area, 30 fixtures with 80 W HPL were replaced by 42 W PL-T giving a saving of $1140\text{W} \cdot 4200\text{h} = 4.780 \text{ kWh}$.
- In the park, 18 fixtures including 50 W HPL were replaced by 18 W PL-T giving a saving of $576\text{W} \cdot 4200\text{h} = 2.420 \text{ kWh}$.
- All the 42 new fixtures are including a blue 5,5 W LED at the top giving an extra consumption of $231\text{W} \cdot 4200\text{h} = 970 \text{ kWh}$



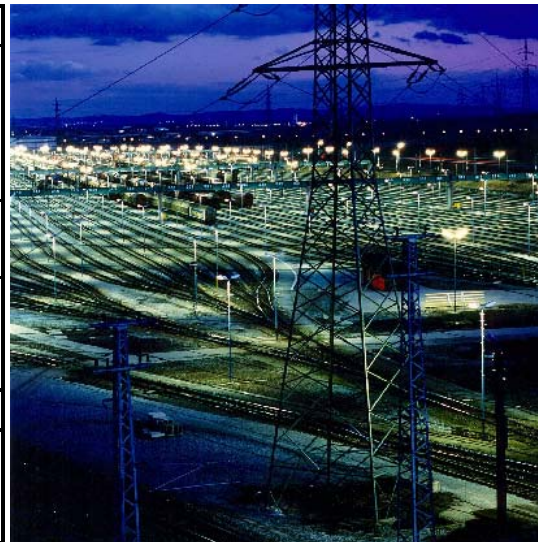
For the next year, the planned energy efficient lighting activities include 50% of the street lighting. The Nyborg street lighting system will be replaced by new energy efficient lighting. The new system gives a better quality of lighting and is fulfilling the standards for street lighting (within limitations of placement of masts). The total lighting electricity savings are estimated to be around: 390.000 kWh/year.

OeBB Wien Zentralverschiebebahn

As important link in the international goods traffic the central good train station *Kledering* in the south of Vienna is busy around the clock. On a total area of approximately 1.000.000 m² and a maximum length of 8 km altogether 120 km tracks, approximately 6.100 railroad cars can be formed within 24 hours to new courses.

1.860 lights ensure for the last 20 years for the fact that also in the night hours safe working was possible. In the framework necessary renewal of these lights, took place now an adjustment age causes to the state of the art. Owing to the technical progress thereby the connected load for each light could be reduced by 80 Watts or 48.5 %. In the entire area thereby the connected load for the lighting is now reduced by approximately 150 KW, which leads in consequence to a saving of approx. 480.000 kWh - or 240 toneCO₂ -. This sum corresponds to the current consumption of approx. 130 Austrian households.

	Old	New
Name	Austria Email Street lighting with 3x TL 40 W (with KVG)	Staco Kofferleuchte SR100 induction lamp
Power per Lamp	155 Watt 8.550 lm	85 Watt 6.000 lm
Bleaching steering element	NON	Optimized high level mirror
Life span	5.000 hours	42.000 hours
Light-current decrease during life time	20 %	23 %



The old lights had only one beginning of a light steering element, whereby a considerable portion of the light was directed as light emission into the sky and additionally also a direct glare of the engine drivers was given. The new lights have now an optimized light steering element, which prevents on the one hand light emissions, on the other hand in addition, the working safety by the avoided glare of the engine drivers increased. At the same time the lighting level could be increased by approximately 10 %. Since the new lamps are protected from environmental influences better, maintenance costs reduce substantially.

Before nearly annually a lamp change was necessary, is assumed now the lights must be only cleaned every 6 years. Under view of the saved energy costs and the reduction of maintenance costs an amortization period of approximately 6 years results.

In Sweden, the GreenLight Partner **Open bare Basisschool Het Palet**, upgraded the Gemeente Hattem, facility with a total area of 1.530 m².

The old lamps T12 (38 mm diameter fluorescent lamps) were changed with some more efficient new ones T8 (26 mm diameter fluorescent lamps), equipped with . The lighting control system was equipped with time scheduling and day-light responsive devices.

Taking into consideration also the idea of localised lighting and a regular maintenance plan, the company reported lighting electricity savings of 132.000 kWh/year.





Oskomera Emdee (2.825 m²)

The Netherlands GreenLight Partner, **Oskomera Holding BV**, replaced the old lighting installation for two main facilities: *Oskomera Emdee* (2.825 m²) and *Oskomera Headoffice* (9.809 m²). Bought the new solutions were installed at the end of 2001.

In general they used the same lamps (26 mm diameter fluorescent lamps), only in some cases they changed the self-ballasted compact fluorescent lamps with pin-based ones. The new lighting design uses the localised lighting concept. The company installed new fixtures with aluminised reflectors and powered by electronic ballasts. For some cases (when it was proved to be useful), the occupancy responsive lighting controls were used.

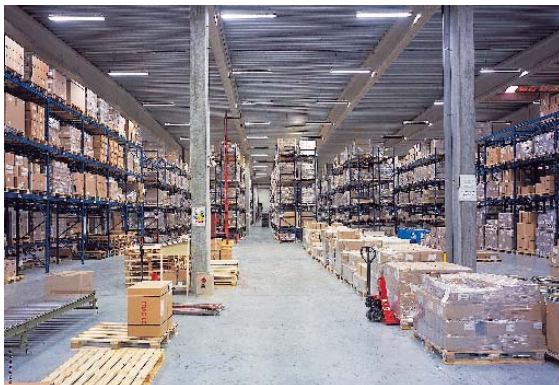
After measurements, the company claimed total lighting electricity savings of 195.700 kWh/year. The payback time of total installation is less than 7 years, but it was accepted because the existing lighting system was very old. Moreover optimised lighting levels were achieved in the same time with the elimination of the reflections from the computer screens and a low level of the maintenance measures.



Oskomera Head office (9.809 m²)



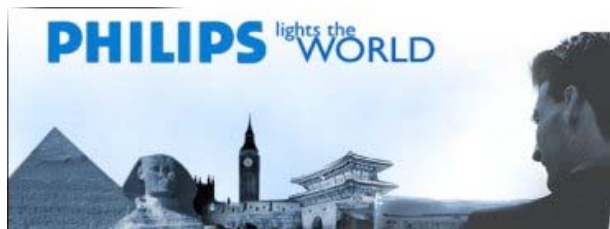
Pfizer's site in Puurs (Belgium) is a strategically important production centre for injectable drugs and services more than 170 countries. Recently the company has expanded. The new building (CSP) consists of warehouses, production units, offices, labs and "clean rooms" and covers more than 20.000 m². For Pfizer, qualitative and energy-efficient lighting is crucial and aligned with their objective of "improving life-expectancy and -quality". Pfizer has been using electronic ballasts since the technology has been available and is using daylight control systems where possible. For those reasons, Pfizer has been awarded the GreenLight Partnership for their new CSP building.



Besides improved visual conditions, they reported the following savings:

- Lighting electricity savings: 204.998 kWh/year
- Energy cost savings: 22.454 euro/year
- Payback time: <5 years





In Netherlands, the GreenLight Partner **Philips Consumer Electronics C/O** as part of their commitment refurbish their lighting system claiming, besides much better visual conditions, the following results:

- Lighting electricity savings: 1.096.677 kWh/year
- Energy cost savings: 25.778 euro/year
- Payback time: 6 years



The GreenLight Partner **Piraeus Bank - Greece.**

The building that initially joined the GreenLight programme was the *Bank's Headquarters* building (of a total area of 6.000 m²), in the centre of Athens.

After examining various detailed scenario, the type of intervention decided was the new zoning of the ceiling recessed luminaires in the open plan office areas and the installation of local on/off switching. Energy savings exceeded 22%, with low investment cost and a pay back period of a few months.

- Lighting electricity savings: 89.179 kWh/year
- Energy cost savings: 8.918 euro/year

Energy saving actions through the use of efficient lighting technology are progressively expanded to other central buildings and in the 220 branches of the Bank.

In the “*ETBA*” building of the bank, in Athens, (total area 19,000 m²), the lighting system is being upgraded. The project includes rearrangement of existing ceiling luminaires and installation of new high energy performance lighting fittings with T5 fluorescent lamps.

Improvements in the building lighting will continue following approval of an RUE proposal from Greek authorities. Proposal includes control of natural lighting through improved shading, dimming of selected luminaires based on photo sensors etc.



BENVENUTI NELLA PROVINCIA DI REGGIO EMILIA



Provincia di Reggio Emilia, Italian GreenLight Partner refurbished the lighting systems for five schools:

- I.T.I. "Nobili" - Via Makallè - Reggio E.
- I.T.G. "Secchi" - Via Makallè - Reggio E.
- I.T.G. "Pascal" - Via Makallè - Reggio E.
- Magistrali "M. di Canossa" Via Makallè - Reggio E.
- I.T.C.G.I. "Cattaneo" - Via M. di Canossa Castelnovo né Monti (RE)

For upgrading those school buildings they changed the lamps with new, more efficient ones, with a much higher value of lumen/watt, using in the same time low consumption power supplies. The lighting control system was thought to dim the lamps' output in response to daylight availability and occupancy of the rooms.



Summarising the five different facilities. For an area of 30.081m² they installed 2.419 new lamps with a modern lighting control system, the price of the total investment being around 492.966 euro.

The schools reported much better visual conditions and the following savings:

- Lighting electricity savings: 1.724.000 kWh/year (38%)
- Energy cost savings: 98.268 euro/year
- Payback time: 4 years



In Italy, the GreenLight Partner, **Provincia di Torino**, reported in 2004 the following savings for a total area of 1.100 m²:

- Lighting electricity savings: 71.001 kWh/year
- Energy cost savings: 7.100 euro/year
- Payback time: 3,47 years



Winner of the
GreenLight Awards
2005

The GreenLight Partner **Q8 Denmark** is saving more than 400.000 euro/year. Q8 is shifting to much more efficient outdoors lighting at 70 gasoline stations. The largest part of the electricity saving comes from replacement of neon facade lighting by LED lighting giving a reduction from 55 W/meter (neon) to 8 W/meter (LED). The lifetime is 65.000 hours that is more than the double of before. The rest of the savings comes from use of better armatures leading to use of a smaller number of fluorescent T8 tubes and finally installation of HF compensation.

The total savings for the 70 stations is 1.724.000 kWh/year with a simple payback period for the investment of 3.9 years and 270.000 euro/year.

Q8 has recently decided to expand the activity all their 150 gasoline stations. This will give a saving of at least 400.000 euro/year. Q8 will also replace fluorescent tubes (10 * 56W) in price advertisement boards with LED, which will increase the savings further.



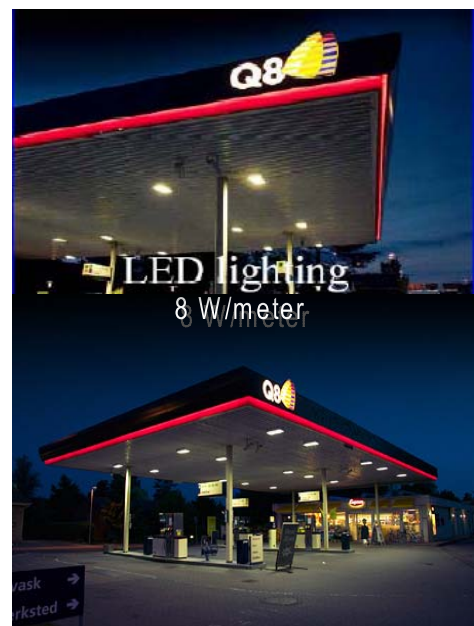
70 gas stations

51 meters

2-3 T8 32+8 W

replaced by

1 T8 36 W



RATP, the famous Paris metro company has chosen a new lighting for its bus depots. The maintenance management wanted to improve the working conditions, to save energy and to facilitate the maintenance.

They made an invitation to tenders of lighting manufacturers to select the most efficient solution.



The management chose luminaires with reflectors in high reflection aluminium with electronic dimmable ballast and a daylight sensor that use the daylight to reduce the consumption.

The visual comfort has been improved and the light level is 67 % higher, going now over 250 lx instead of 150 lx previously. Despite that, the energy savings reach 45 %:

- Lighting electricity savings: 132.218 kWh/year
- Power reduction: 12kW (36 %)
- Maintenance costs savings: 59%



In Denmark, **Ringsted Municipality** joined the GreenLight Programme and as a part of their commitment they introduced energy efficient lighting in schools.

Ringsted Municipality has the last five years done renovation of their lighting installations. The municipality has 80 buildings including 12 schools with electricity consumption from 18 to 28 kWh/m². In many building especially schools, luminaries as well as lamps (CFL) have been changed. In some cases sensors (PIR) have been installed, if this was economically justified.



Total savings per year are 110.000 kWh or 16.700 euro which is around 50 % of the electricity consumption (in the area in question) before renovating the lighting. The payback time is 9.3 years, which is accepted since the lifetime of the armatures, are evaluated to be much longer.

Despite of increased electricity consumption for more use of IT equipment, Ringsted Municipality has obtained total savings of 3% the last year. The municipality used 31,7 kWh/m² which is lower than the average 37 kWh/m² used in municipalities taking part in the competition " *The best electricity saving municipality in 2004* " .



In Belgium, the GreenLight Partner **Roularta Media Group**, rethought the old lighting design for an industrial facility with a total area of 8.000 m². All the metal halide lamps were changed with 26 mm diameter fluorescent ones, powered by electronic dimmable ballasts. The new fixtures are all equipped with aluminised luminaries reflectors. The lightning control system was equipped with time scheduling, daylight and occupancy responsive devices, which reduced considerably the yearly burning hours.

Besides improved visual conditions, they reported the following savings:

- Lighting electricity savings: 554.286 kWh/year
- Energy cost savings: 35.020 euro/year



In Portugal, the GreenLight Partner **Salvador Caetano I.M.V.T. S.A.**, implemented only immediate lighting efficiency measures. A detailed lighting audit to Salvador Caetano - Ovar industrial building was conducted by a specialized consultant. Currently there is a complete knowledge of the all the lighting systems in the plant. The main conclusions were that, generally, the existing lighting systems are very inefficient in terms of energy use, do not offer adequate lighting for the tasks and in some cases can be a risk for the health and safety of the workers. This is mainly due to the old age of the existing lighting systems, which are nearly 30 years old. The Energy Management Team organised a workshop to present the results of the audit and managed to convince the administration to act.

The audit work identified and quantified important electricity saving opportunities in the lighting systems, at the same time that the lighting quality of the factory is improved. An action plan was prepared based on the audit results. The action plan was then approved by the administration, and some improvements were already made. However the larger intervention will start in January 2005 and it will be phased in 2 years.



The total investment cost of the improvement of the lighting systems is around 150.000 euro, and this includes the installation of new lighting systems in most of plant area.



	OLD	
Incandescent 60 W		Lamps 400 W
↓		↓
CFL 12 W	NEW	Lamps 250 W



- After the first upgrades in March-October 2004, the company reported the next savings:
- Lighting electricity savings: 6.466 kWh/year
 - Energy cost savings: 1.550 euro/year
 - Payback time: 1 year

Another major Italian GreenLight Partner, **SANPAOLO IMI S.p.A.**, refurbish in 2002 the old lighting system for their building in Turin, facility with a total area of 2.021 m², taking into consideration some new and modern concepts. The illumination level was kept at a medium - high level of 500 lx for the offices, taking into account the decrease of the lamp's lighting output in time. The new system was designed to reduce as far as possible the blinding effect of direct lighting, using different schemes of dark lighting (low level of illumination), in order to give a good visual comfort of the computers' monitors. They used lamps with colour characteristics closed to the natural light (3500 - 4500°K). Moreover they installed only high efficiency lamps (>75 lumen/W) in order to achieve even bigger energy savings. The yearly burning hours were also reduced by using localised and general switches together with the concern in raising users' awareness.

Taking into consideration all the above measures and using the new 26 mm diameter fluorescent lamps and the CFL pin-based ones they achieved following total savings:

- Lighting electricity savings: 90.429 kWh/year
- Energy cost savings: 13.564 euro/year
- Payback time: 5 years

Because in the last 4 years they upgraded over 116 branches all over Italy the projects were

1) First, they compared the SanPaolo IMI standard and existing conventional baseline lighting for an area of 100 m².

<i>Baseline lighting</i>	<i>Post-installation lighting</i>	<i>Post-installation results</i>
38 mm fluorescent lamps Halogen line voltage lamps Incandescent lamps Magnetic ballast (where applicable) Painted luminaire reflector	26 mm fluorescent lamps Electronic non-dimmable ballast Aluminised luminaire reflector Time scheduling lighting control system Raising users awareness Regular maintenance plan	Lighting electricity savings: 46.703 kWh/year Energy cost savings: 15.846 euro/year Payback time: 2.9 years Lighting quality improved

2) In the second report form they made a standard comparison between 4x18 W luminaires and the conventional baseline lighting for an area of 100 m².

<i>Baseline lighting</i>	<i>Post-installation lighting</i>	<i>Post-installation results</i>
38 mm fluorescent lamps Halogen line voltage lamps Incandescent lamps Magnetic ballast (where applicable) Painted luminaire reflector	26 mm fluorescent lamps Electronic non-dimmable ballast Aluminised luminaire reflector Time scheduling lighting control system Raising users awareness Regular maintenance plan	- Lighting electricity savings: 3.159 kWh/year - Energy cost savings: 928 euro/year - Payback time: 3.2 years (Baseline investment not considered as cost) - Lighting quality improved

3) In the second report form they made a standard comparison between 4x18 W luminaires and the conventional baseline lighting for an area of 100 m².

<i>Baseline lighting</i>	<i>Post-installation lighting</i>	<i>Post-installation results</i>
38 mm fluorescent lamps Halogen line voltage lamps Incandescent lamps Magnetic ballast (where applicable) Painted luminaire reflector	26 mm fluorescent lamps Electronic non-dimmable ballast Aluminised luminaire reflector Time scheduling lighting control system Raising users awareness Regular maintenance plan	- Lighting electricity savings: 3.159 kWh/year - Energy cost savings: 928 euro/year - Payback time: 0 years (Baseline investment considered, case of design and restructuring with conventional technologies) - Lighting quality improved

4) In the second report form they made a standard comparison between 4x18 W luminaires and the new T5 lamps, for an area of 100 m².

<i>Baseline lighting</i>	<i>Post-installation lighting</i>	<i>Post-installation results</i>
26 mm fluorescent lamps Electronic non-dimmable ballast Time scheduling lighting control system	16 mm fluorescent lamps Electronic dimmable ballast Time scheduling lighting control system Occupancy linking lighting control system Daylight responsive lighting control system	- Lighting electricity savings: 468 kWh/year - Energy cost savings: 79 euro/year - Payback time: 13.2 years - Lighting quality improved



Plafoniere 4x18W



Plafoniere Nx58W
(dark direct and indirect light)

For some projects they have measured the savings and for the others they extrapolated the results, getting at the end the next energy savings, based on the 4 standard groups:

	Surface / 100	Lighting electricity savings (kWh/year)	Savings in running cost (€/year)	Payback time (years)
STANDARD REPORT 1	363	1.047.333	354.961	2,9
STANDARD REPORT 2	363	1.145.373	336.669	3,2
STANDARD REPORT 3	363	1.145.373	336.669	0
STANDARD REPORT 4	363	169.685	28.593	13,2
TOTAL	1.450	3.507.765	1.056.891	4,825



In 1998, after their EIB bus system had been installed, no real commissioning was performed. While joining the GreenLight Programme, **SAS Norway** undertook a survey of their building and exterior spaces. They hired a consultant to propose actions and calculate the energy savings. They realised that, by simply tuning up the existing bus system, they would reduce lighting operating time and save 30% of their lighting electricity use. They managed to do it themselves and since the building has separate measurements on each of the electrical distribution systems' main risers, it was easy for them to measure the electricity consumption before and after the bus system was optimised.



The result shows the importance of commissioning properly the lighting control systems. It shows also that it doesn't need a lot of money to achieve significant savings. In the present case, the total investment was 0.30 euro/m². It was reimbursed within 5 months. SAS is keen on repeating this successful experience in other buildings.

Results:

- Total upgraded floor area: 49.210 m²
- Lighting electricity savings: 813.280 kWh/year
- Energy cost savings: 39.200 euro/year
- Payback time: 4 months

In Slovenia, **Siemens**, upgraded an office area of 2.000 m². Mainly they changed the old standard incandescent lamps with 26 mm diameter fluorescent lamps and CFL pin-based lamps geared by electronic non-dimmable ballast. For the new lighting system, the luminaires painted reflectors were also replaced by aluminised ones.

After measurements, they claimed the following savings:

- Lighting electricity savings: 80.800 kWh/year
- Energy cost savings: 8.900 euro/year
- Payback time: less than one year





In Italy, the GreenLight Partner **SAES Advanced Technologies SpA**, installed a new lighting system in 2001 for an industrial building with a total surface of 4.600 m². They analysed different lighting designs in order to take the most suitable decision in order to apply for their new building an efficient lighting system. Finally they chose the new T5 lamps, powered by electronic non dimmable ballasts. The baseline lighting in their report is considered to be a regular one equipped with conventional lamps (26 mm diameter fluorescent ones) geared with magnetic conventional ballast.

After measurements they reported major savings between the two systems:

- Lighting electricity savings: 77.207 kWh/year
- Energy cost savings: 10.082 euro/year
- Payback time: 2,6 years

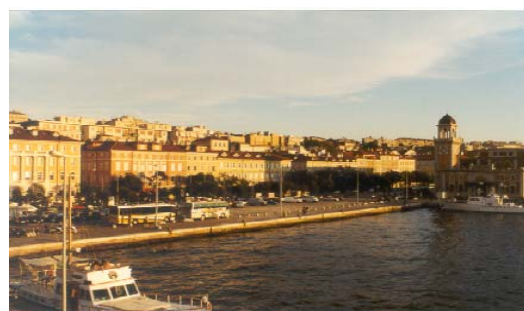


Sincrotrone Trieste S.C.p.A. Italy, as a part of their commitment to the GreenLight Programme started a few new lighting projects. The first pilot lighting design was finished in 2001, for the *ES4* office and research laboratories building. The facility was equipped with two different lighting systems: the first one using T8 fluorescent lamps with electromagnetic ballast; the second one using T8 fluorescent lamps and electronic dimmable ballast. This option was chosen mainly to define if a little intervention like this (changing the type of ballast) could be acceptable. From the preliminary data analysis they saw that there was no energy saving with such an illuminating plan. In the second phase during the first half of 2002 the *ES3* building lighting installation was completed. In this case they used T5 fluorescent lamps with a dimming device for each lamp.

After measurements they achieved the following savings:

- Lighting electricity savings: 31.726 kWh/year
- Energy cost savings: 2.538 euro/year

Considering the preliminary data analysis the new projects will be designed using the T5 dimmed lamps. According with the general planning of Elettra Offices and Laboratories re-arrangement, they defined a schedule of intervention to retrofit the existing plants.





In Denmark, the GreenLight Partner **Skallerup Klit Feriecenter A/S**, upgraded the Skallerup Holiday Centre using four types of lighting management

The centre includes 262 holiday houses divided on 9 types and a large central building including swimming bath with many activities, bowling hall, restaurant, shop, administration and other activities. Yearly, the centre is visited by 300.000 guests and the turnaround is around 10.000.000 euro with 70 employers.

The management of the holiday centre has along with their utility energy audit consult for many years been focusing on energy efficient use of energy in order to be competitive. Skallerup Klit has as the first Danish holiday centre been certificated under the new energy management standard DS2403.

The total use of energy is 7.500.000 kWh/year where electricity consumption constitutes 4.800.000 kWh/year with the share from lighting being 729.000 kWh/year. The lighting systems are designed nicely with architectural care because lighting creates atmosphere and is important for the holiday experience of the customers.

Lighting savings are obtained by lighting management are around 17% including:

- Sports - and activity hall, reservation management system 13.000 kWh/year
 - Swimming bath and tropical area, daylight management system 120.000 kWh/year
 - Administration, person sensor lighting management system 10-18.000 kWh/year
 - Holiday houses, lighting activated only when people there 8.000 kWh/year
- Total** 159.000 kWh/year

The yearly running cost savings about 9.000 euro were the results of a total investment cost of about 88.000 euro with a payback period of 10 years.

Audits have been performed in all types of buildings noting use of every lighting source and with calculation of yearly consumption. Potential savings are use of more energy efficient lighting sources and HF ballast. Skallerup Klit will replace the lighting sources in all cases where the payback period (lower than around 5 years) and the lighting quality are acceptable.





Sogelym Steiner, in France installed in 2001 a new advanced lighting for a building with a total area of 25.000 m². As a consequence of a short study between two different solutions they claimed the following savings:

- Lighting electricity savings: 303.462 kWh/year
- Energy cost savings: 30.346 euro/year
- Payback time: 2,5 years

The so called upgraded system was equipped with new 16 mm diameter fluorescent lamps geared by electronic non-dimmable ballast and aluminised luminaire reflector, instead of 26 mm fluorescent lamps, magnetic ballast and painted reflector. The lighting control system was unchanged.



SOMEPIE Technologie, France, upgraded the lighting system for their offices and the technological areas (3.000 m²).

Mainly they rethought the new lighting in order to get an adequate quantity (illumination level) and quality of the light, to reduce the global cost of the investment, to have simple and easy maintenance solutions and to use the support of the existing old lighting system.

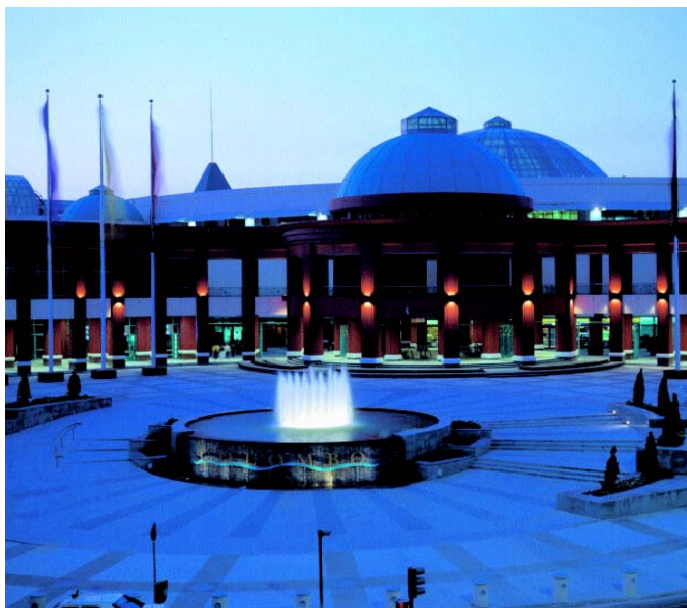


After investing 33.980 euro for the new illumination concept, the company reported the following results:

- Lighting electricity savings: 31.000 kWh/year
- Energy cost savings: 2.145 euro/year
- Payback time: 15 years



In Portugal, GreenLight Partner **Sonae Imobiliária** upgraded the Centro Colombo covered car park, one of the largest in Europe, by substituting the magnetic ballasts with electronic ones. These operate fluorescent lamps at higher frequencies and offer significant advantages compared to magnetic ballasts, inter alia lower power losses.



Centro Colombo
Av. Lusíada P-1500-392 Lisboa
Contact: Alberto Faias

After measurements, they claimed the following results:

- Lighting electricity savings: 400.838 kWh/year
- Reduction of electricity use in the areas covered: 11.5%
- Energy cost savings: 23.814 euro/year
- Internal Rate of Return of the investment: 20%

"The GreenLight Programme gives us the possibility to show our partners and clients our objective to reduce energy consumption"

Alberto Faias
Energy Manager
Sonae Imobiliária



Sonaecom, a Portuguese GreenLight Partner that belongs to the same Group of Sonae Imobiliária, decided to upgrade, in July 2004, their head office. For a total area of 4.760 m² they kept the same 26 mm diameter fluorescent lamps, powered by conventional magnetic ballast, but they installed in the same time a modern time scheduling control system.

After the preliminary data analysis the company claimed important energy savings:

- Lighting electricity savings: 198.598 kWh/year
- Energy cost savings: 13.902 euro/year
- Payback time: 4 months



An initiative promoted by the European Commission



The French GreenLight Partner, **SOPIC-Paris**, refurbished the lighting system for an offices facility, with an total area of 18.400 m² .



They needed a 200 lx in the offices and 350 lx in the open spaces. The first idea was to use some 3x14W luminaires as they did in another building they have built . The goal was to find a lower power consumption and a better lightning. To fulfil their requirement they replaced the old lamps with new T5 fluorescent lamps. The luminaires are build with only 1x24W fluorescent lamp with 4000°K colour temperature and an 850 or 840 IRC to improve the lightning level up to 30%.



Furthermore, the price of a 1x24 W luminaire was 1.5 times cheaper than 3x14W luminaires.

In conclusion, using those 1x24W lamps they improved the lightning of their office building reducing in the same time the power consumption of each luminaire. Instead an electric consumption of 48W/m² per day they get only 27W/m² in their offices.

The company reported total lighting electricity savings of 100.000 kWh/year



In Belgium, **Stad Mechelen**, as a part of their commitment to the GreenLight Programme, refurbished in July 2004 the lighting system of the public swimming pool, building with a total area of 1.403m². In the past they have around 85 lx. They need to have 300 lx normally and 750 lx when there is a swimming competition. The base line lighting was equipped with halogen (low-volt. And line-volt.) and metal halide lamps powered by magnetic conventional ballast. For the post installation lighting system they used only 26 mm diameter fluorescent lamps, aluminised luminaire reflector and electronic dimmable ballast. They also installed a control system to dim the lamps' output in response to the daylight availability. Moreover, the new system was equipped with a time scheduling control device.

Besides improving the visual conditions, they reported the following savings:

- Lighting electricity savings: 23.720 kWh/year
- Energy cost savings: 1.942 euro/year



Gemmente, **Stad Sint Truiden** Belgium, GreenLight Partner since April 2004 upgraded the *St-Truiden Library*. They replaced the old luminaries with new more energy efficient ones using T5 lamps, geared by electronic ballast instead the old magnetic one.



After measurements they reported the following energy savings:

- Lighting electricity savings: 24.979 kWh/year
- Energy cost savings: 3.886 euro/year



In Germany, the GreenLight Partner **Stadt Frankfurt am Main**, elaborated a short study about planning the efficient lighting for classrooms.

The lighting measurements in bought older and recently modernised schools of the City of Frankfurt showed substantial excesses of the measured density of light demanded by standards. This does not only lead to substantial additional costs for electricity, maintenance, and less comfort at the PC stations, but the capital outlays could also have been considerably lower. As a consequence of those results, new planning methods and planning tools should be investigated and optimized.



A) Over dimensioning, possible optimization, computer simulation and practical examples. An example can be a standard classroom. This classroom (7.20m*8.40m*3m; working surface at 85cm) requires 300 lx. According to “AMEV-Guidelines for indoor lighting with artificial light in public buildings” as automatic calculated with Dialux 1.2 according to DIN, it was proposed: 8* 58W T8 (26mm) electronic ballast luminaires with 5.200 lm, *no consideration of the radiation characteristics*. One optimized design using Dialux could be achieved at little expense buy individual adjustments, showed the following equipment to be sufficient for 300 lx:

- 35 W T5 (16 mm) electronic ballast luminaires with 3.650 lm
- planning factor: 0.95
- boundary area in classrooms: 0.5 m
- broad-radiating luminaires
- arrangement in 2 rows of 3 luminaires plus 2 to illuminate the board
- improved distance between the rows
- average density of the light almost 400 lx

Even with a planning factor of 0.8 the optimised design with 8 T5 electronic ballast luminaires shows sufficient clearance for the demanded 300 lx. The savings in capacity and energy of this optimisation is about 30 %.

B) Examination of the results of the EDP planning tools in practice

In Frankfurt the practice of renovating classrooms shows that, regarding the planning factor, the density of light calculated with Dialux represents only the lower limits which are actually measured after implementation. Safety margins in the lighting layout beyond the planning factor are hardly justifiable if the plans are carefully cared out.

C) Radiation pattern and indirect proportion

A classroom of the HelmHolz School in Frankfurt was renovated as a model using suspended luminaires with flexible radiation pattern and a 10 % indirect portion. An indirect portion of up to 10 % improves the visual comfort of the room substantially, as was also found in different projects of the City of Frankfurt (inexpensive using perforated mirror). The total losses of 3 % (10% * 70% reflection on the ceiling) are kept within limits.

D) Warning of over dimensioning, adjustment to the age of the users
Lighting programmes should also include an alarm function for over dimensioning. Exceeding standard densities of light are not only expensive, but lead to impairments to the users as a result of the high brilliance difference between the PC monitor and the surrounding surfaces.

E) Remuneration of the planning service
For the planner, as with all planning services with remuneration according to HOAI, there is the question of conscience between offering a generous design or an economically optimised solution.

Concrete experiences show that there is a potential for obtaining substantial cost savings in investment and marketing through the individually optimized planning of luminaires without incurring greater expenses.



In Austria, the GreenLight Partner **Stadt Salzburg**, upgraded the *Old Town public lighting* by substituting 1.069 mercury lamps with metal halide lamps.

To carry out the planned project, the Engineering Department developed a lighting concept, which was approved by the provincial heritage agency and put out to tender. The new old town lighting concept was then implemented in cooperation with manufacturers Abele and Geiger and contractors BG – Light.



- Lamps: Ceramic metal halide (CMH)
- Power: 35W (instead of 80W) in the pedestrian precinct,
70W/50W (instead of 125W) in mixed traffic areas and squares
- Technology: High intensity discharge with adjustable light distribution



Previous
Steel plate
Exposed design
Improved insulation retrofitted from 1985
Diffuse scattering
Free standing in lamp space
Light to be dismantled: ½ hour work
Open
Individual glass to be fitted, opal glass (up to 40% less light)



New
Aluminium casting
Safety class IP 54
Degree of protection: totally insulated
Light directing with adjustable high-power reflector
Bulb lying in roof
Quick assembly replacement in 2 steps
Terminal compartment insulated and sealed
Sealed plastic bowl, textured glass

After measurements they reported the next savings:

- Lighting electricity savings: 243.000 kWh/year (50% energy reduction)
- Energy cost savings: 60.000 euro/year
- Payback time: 6 years



Salzburg Mayor receives the GreenLight plaque



In Belgium, **Stadt Turnhout** has re-lighted its sport hall in 2004 saving a total of 69 % on energy use and 91 % on toxic waste by using eco-lamps.



The mayor of Turnhout was pleased with the GreenLight logo, handed to him by an endorser.

“Energy efficient lighting was part of the durable policy the city was advocating.”



An initiative promoted by the European Commission

Winner of the
GreenLight Awards
2004



The **Stadt Zurich** is one of the building industry's biggest clients in Switzerland. As priority for the next 10 years the building department issued 7 milestones for environmental friendly and low energy building construction. The lighting in new buildings and in 50% of refurbishment projects should meet the MINERGIE specifications (www.minergie.ch) which are based on the recommendation SIA 380/4 "Electrical Energy in Buildings"



The Results:

- 15 new and refurbished projects with 71.000 m² in operation
- Power saving: 4,9 million kWh in 15 years(327.000 kWh/year)

Winner of the
GreenLight Awards
2003



In Norway, **Statoil** joined GreenLight in January 2001. As part of their commitment, they installed occupancy controls in their research centre. These controls turn off the lights once they have failed to detect occupancy for a set time. When occupancy is detected, they switch the lighting on again. Previously, the lights remained on the whole day in all offices and

laboratories with a common switching system. This was a waste of energy given that occupancy patterns were intermittent and unpredictable. Lighting electricity savings amount 219.000 kWh/year (Internal Rate of Return of the investment: 40%.) After this pilot project they lunched some others new ones, reporting the following achievements:

- *41 different facilities* with a total area of 19.854 m², upgraded in 2004:
 - Lighting electricity savings: 765.363 kWh/year
 - Energy cost savings: 29.242 euro/year
 - Payback time: 4,5 years
- *Forus West - Block B*, 4.500 m², upgraded in 2002:
 - Lighting electricity savings: 66.028 kWh/year
 - Energy cost savings: 9.631 euro/year
 - Payback time: 11 years
- *Forus East FH-D4+D5*, 1.291m², upgraded in 2002:
 - Lighting electricity savings: 12.512 kWh/year
 - Energy cost savings: 2.903 euro/year
 - Payback time: 9 years
- *Forus East FO-E3*, 1.376 m², upgraded in 2002:
 - Lighting electricity savings: 32.076 kWh/year
 - Energy cost savings: 4.733 euro/year
 - Payback time: 7 years
- *Kaarsto*, 1.515 m², upgraded in 2002:
 - Lighting electricity savings: 34.284 kWh/year
 - Energy cost savings: 4.720 euro/year
 - Payback time: 10,60 years



An initiative promoted by the European Commission

In Netherlands, the GreenLight Partner **StoraEnsoBerhuizer Papierfabrik**, upgraded in 2003 one of their facility by changing the old T12 fluorescent lamps and fitting based induction lamps with new T8 (26 mm diameter fluorescent lamp) powered by electronic ballast. The new luminaires were equipped with aluminised reflector. The lighting system was designed taking into consideration the day-light optimisation factor. As a consequence the lighting control system included above a general switcher, the daylight responsive controls.

After measurements they reported the following savings:

- Lighting electricity savings: 27.561 kWh/year
- Energy cost savings: 3.804 euro/year
- Payback time: 3,7 years

SUPER U

In France, GreenLight Partner, **Super U**, rethought their lighting concept for all new supermarkets. Until recently, all new shops were equipped with 26 mm diameter lamps, magnetic ballasts, and white-painted industrial reflectors. Luminaires were traditionally placed at a height of about 5m and distributed so that lighting levels exceed 1.000 lx on the floor. Their new lighting concept consists in lowering the fixtures and using 16 mm fluorescent lamps, electronic ballasts, and flat-bladed louvers. Lighting levels are reduced to 600 lx and 1/3 or 2/3 of the general lighting can be switched off when less light is needed.

The results below were reported for their shop in *Dannemarie*. The comparison is made versus a new installation that would have used the standard new lighting layout used before they joined GreenLight:

- Lighting electricity savings: 78.680 kWh/year
- Power reduction: 15.6 kW
- Reduction of electricity use in the areas covered: 36 %
- Energy cost savings: 5.901 euro/year
- Payback time: 3 years and 6 months

As a part of their new lighting concept they reported also the next savings for other upgraded shops:

- *Boofzheim* (2.218 m²) lighting electricity savings: 57.000 kWh/year
- *Bonne / Menoge* (1.229 m²) lighting electricity savings: 61.880 kWh/year
- *Vinzier* (2.097 m²) lighting electricity savings: 93.000 kWh/year
- *Ville* (2.680 m²) lighting electricity savings: 68.000 kWh/year
- *Mutzing* (1.990 m²) lighting electricity savings: 63.200 kWh/year



Super U Hartmann
42 r Belfort F-68210 Dannemarie
General Director: Bruno Mandroyant
Tel. 03 89 25 02 87



The **swb Bremerhaven Ltd.** Germany, as a part of their commitment at the GreenLight Programme, refurbished their public street lighting. By replacing the old HP Mercury lamps with new CFL self-ballasted ones and equipping the new luminaires with aluminised reflectors, they claim the following energy savings:

- Lighting electricity savings: 79.043 kWh/year
- Energy cost savings: 7.905 euro/year
- Payback time: 1 year (less than one year because the luminaires needed to be replaced)



◀ Before

After ▼



In Spain, the GreenLight Partner **TBK Sistemas de gestio**, upgraded the *Mesa direccion - Barcelona*. They changed 26 lamps from the old 36 W fluorescent lamps, with 13 new more efficient ones. The new ones have 4.000 running hours in compared with the old conventional ones. Whit half of the tubes they have increased with an average of 37% the lighting level, reducing in the same time with 50% the installed power demand (from 936 W to 468 W).

After measurements, with a total investment of 195 euro, the company reported the fallowing electricity savings:

- Lighting electricity savings: 1.420 kWh/year
- Energy cost savings: 115 euro/year
- Payback time: 1,68 years



TERRES & EAUX

The French GreenLight Partner, **Terres et Eaux**, installed a high efficient lighting system for their *shop in Amiens*. The total surface is composed from an total sales area of 2.300 m², plus the parking and the accesses areas. Mainly in all the cases they used high efficiency luminaires.

For the sales area the lighting system was composed from T5 lamps geared by electronic ballasts. The number of lamps was calculated taking into account a lighting level of 600 lx. The company achieved an electricity consumption of 14,5 W/m² or 2,5 W/m²/100 lx.



In Greece, the Ministry of Justice signed the GreenLight Partnership. The Ministry created **Themis SA**, an engineering company, to plan and oversee constructions and refurbishment of all its buildings. In a first pilot project they upgraded the lighting system for the *Courthouse of Athens*. After the rejection of changing luminaries or installing daylight sensors, due to building construction reasons, the only action adopted was timed switching of lights. The results were the following:

- Lighting electricity savings: 9.930 kWh/year
- Payback time: 2 years



Δεν υπάρχουν όρια.

Winner of the
GreenLight Awards
2005

In Greece, the GreenLight Partner **TIM**, upgraded three administrative buildings composed from offices (22.160 m²) and underground parking (33.600 m²) areas. Based on the same technical solutions, the new lighting system for all the three facilities tried to prove one more time, the major electricity savings potential of the newest technologies on the market.

Mainly for the offices areas they changed all 4x18W (T8) conventional ballast fixtures to 4x14W (T5) ones, changing in the same time the conventional ballasts to electronic ballasts. Moreover there were introduced local light sensors around T5 fixtures in order to perform dimming in the windows zone.

For the underground garages it was changed the ballast from conventional to electronic on 2x58W fixtures the system being equipped in the same time with timers.

From the first estimations they claimed the next savings for the entire project (three administrative buildings plus an operations centre):

- Lighting electricity savings: 806.250 kWh/year
- Energy savings for lighting 40%
- Energy cost savings: 110.977 euro/year
- Payback time: 2,7 years



Pathe is a leading movie theatre operator in Europe. With more than 280 screens in France and Netherlands, the company is expanding into other high potential markets, including Italy. Cinema audiences have been on a strong upward trend in all major European countries for several years.

The cinema theatre **Tuschinski** in centre Amsterdam is one of the most famous and beautiful cinemas in Netherlands and also supposed to be the most beautiful in Europe. In 2002 the theatre is reopened after a renovation of the interior and technical installations, including the lighting installation. Very innovative in the use of LEDs in the more than 500 decorative luminaires in the main theatre. The LEDs are used to replaced the incandescent lamps and are even dimmable. This dimming includes the colour shift to more warm light, typical for incandescent lamps. In order to reach this, a special “light source” consisting of white and yellow LEDs was constructed. In the big lantern on the ceiling the incandescent lamps were replaced by a combination of long life fluorescent lamps and long life incandescent lamps. The incandescent lamps are only used at the start and the end of the dimming.



Beside improved visual comfort, the company reported the following savings for the total area of 1.700 m²:

- Lighting electricity savings: 96.360 kWh/year
- Energy cost savings: 104.810 euro/year





UniCredito Italiano

In Italy, the GreenLight Partner **UniCredito Italiano S.p.A.**, upgraded the lighting system for *Centro S. Elia*'s corridors and garages.



They reported the following savings:

- Electrical consumption 2001: 403.100. kWh (the equivalent of 1.465 luminaires)
- Energy and maintenance savings: 14.385 euro
- Investment value: 56.000 euro
- Contract duration: 4 years



Vennootschap Mechelse Veilingen

To save on energy and maintenance costs, the Mechelse Veilingen (fruit- and vegetables auction) renovated its lighting. Before the relighting exercise, the lighting of the 16.000 m² warehouse consisted of hermetically sealed luminaires with two 58W tubes. The temperature in these luminaires typically rises, thereby reducing the lifetime of the tubes which in turn leads to high maintenance- and operating costs. Next to this, the original luminaires were photo-metrically inefficient.



The warehouse has been renovated with compact luminaires with wide angle distribution reflector en electronic ballast. De 1x58W tubes are equipped with PET-foil, preventing glass to fall on the merchandise in case a tube breaks. In the auction-hall, luminaires with MICROLUM®-reflector and electronic ballasts have been installed.

The renovation has resulted in a functional building, properly- and energy-efficiently lighted. The payback term for the entire exercise amounts to only 2,4 years.



Vesta Forsikring is Norway's third-largest company in the area of non-marine general insurance. As a part of their commitment to the GreenLight Programme the company installed a new lighting system for their head office building, by replacing lighting fittings. This solution results in a somewhat longer payback time. This was better than expected. When the internal rate of interest is above 20% and the cost of the equipment will be recouped in under half of its life time it is still financially justified to implement the project.

Vesta claims the following results:

- Lighting electricity savings: 75.400 kWh/year
- Payback time: 7,4 years



In France, the GreenLight Partner **Ville de Lyon**, upgraded in 2003 the public lighting in two different areas of the city.

The first project takes into consideration the *Highway A6-A7*. The baseline lighting was installed on concrete pillars of 30 m high equipped with a mobile corona which was refurbished. By replacing this corona fixtures they reduced the number of luminaires by 1/3 getting in the same time a better visual comfort. The system was also equipped with a day light responsive control system.



An initiative promoted by the European Commission

Baseline lighting:

- Pillar 30 m high
- Mobile corona 4,80m diameter, 2m high
- 1.000 kg weight
- 22 HP Sodium projectors 8.800 W
- Total installed power: 26.400 W

Post-installed lighting:

- Pillar 30 m high
- Mobile corona 4,50m diameter, 0.5m high
- 400 kg weight
- 7-8 HP Sodium projectors 4.200 - 4.800 W
- Total installed power: 13.800 W



After the first estimations the following savings are claimed:

- Lighting electricity savings: 51.282 kWh/year
- Energy cost savings: 6.330 euro/year

For the other project, *Quai Saint Antoine*, they refurbished the street public lighting for a area of approximately 1.600 m². All the high pressure mercury lamps (250 W and 525 W) were changed with high pressure sodium (white, 400 W) and metal halide (220 W and 140 W) ones, powered by electronic dimmable ballast. The day light responsive lighting control system was also doubled by time scheduling devices. They dimmed the lighting power level with 25% for the late night hours.



Baseline lighting:

- 15 HP Mercury 250 W
- 11 luminaires / 2 lamps HP Mercury 525 W

Post-installed lighting:

- 11 luminaires /1 lamp HP Sodium 400 W
- 10 luminaires / 2 lamps metal halide 220 W
- 6 luminaires / 2 lamps metal halide 140 W

Above doubling the lighting level when the system is working at 100% of its capacity, they claimed the next savings:

- Lighting electricity savings: 9.000 kWh/year
- Energy cost savings: 700 euro/year



In France, **Ville d'Ilkirch-Graffenstaden**, as a part of their commitment to the GreenLight Programme decided to upgrade the lighting of their main facilities and also the public lighting. For the first pilot project the company rethought in 2004, the lighting system for the two classrooms (1.600 m²) of a public school. They replaced 14 old luminaries of 162 W powered by ferromagnetic ballasts with 88 W luminaries equipped with electronic ballasts and aluminised optical reflectors.



Besides improved visual conditions, from a lighting level of 220 lx to 255 lx (300 lx at the installation, but taking into account the performance losses after one year of working), the company reported the next energy savings:

- Lighting electricity savings: 2.070 kWh/year, about (30% less than before)
- Energy cost savings: 310 euro/year
- Payback time: 4.5 years.



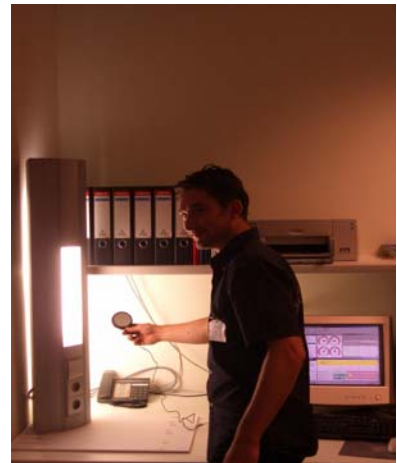
Virga Jesseziekenhuis
HASSELT

Virga Jesse is a public hospital in Hasselt - Belgium, that offers classic medicines and high quality care. As a part of their commitment to the GreenLight Programme, they rethought the old lighting system. The energy consumption of the lighting installation represents approximately 42,2 % of the total energy consumption of the hospital. The total lighting installed power is 402.978 W, which for a total of 3.276 burning hours a year represents an yearly electrical consumption of 1.320.156 kWh/year. In previously executed projects, the lighting installations was optimised. Approximately 55 % of the installation has been equipped with electronic ballasts high efficiency luminaries. As a consequence of this they used a lower power input per lamp and less luminaries. The energy consumption of the new light installation was reduced with 50 %.



The total energy savings reported, are as follows:

- Lighting electricity savings: 363.043 kWh/year (27.5% of the total energy consumption of 1.320.156 kWh)
- Energy cost savings: 32.311 euro/year



In the future the remaining 45 % of the lighting installation will be optimised in the next projects, another 26.436 euro could have been saved yearly. The energy consumption can be reduced with 22.5 % (=297.035 kWh). Supposing that 50 % energy of this part can be saved by using electronic ballasts and energy efficient luminaries.



Winner of the
GreenLight Awards
2004

The Norway GreenLight Partner, **Vital Eiendomsforvaltning AS**, replaced the T8 lamps with new T5 ones:

Baseline installation 2 x 36W T8
 1 x 36W T8 30,8 w/ m²

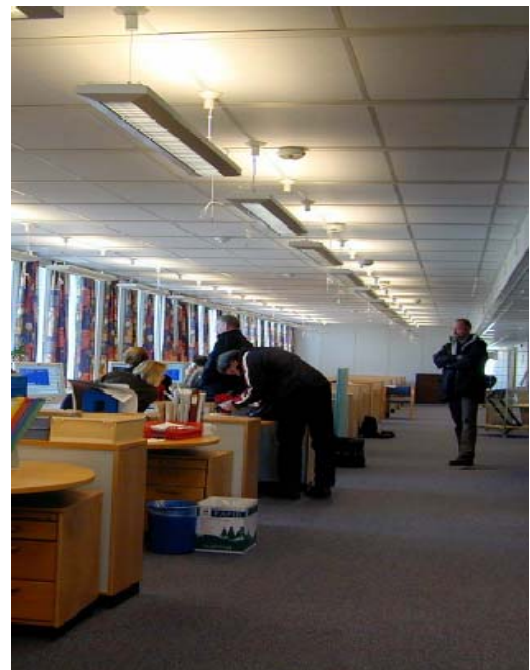
Post installation 1 x 49 W T5
 1 x 28 W T5 10,2 w/ m²

Total area: 13.000 m²

- reduced installed kW by 60 %
- reduced running hours by 20 %
- reduced energy consumption by 67 %

Total yearly energy consumption (lighting):

- Baseline 1.200.000 kWh
- Post installation 400.000 kWh
- Payback time: 4 years





The GreenLight Partner **Vodafone (Greece)**, upgraded in 2003 the *Kifissos Opening Center*, office building with a total area of 7.000 m². The company decided to partially follow the recommendations of a study of CRES and exchange the magnetic ballasts of operations building with electronic non-dimmable ones. They also used new lamps TCL 55 W to replace the old ones.

After measurements, with an initial cost (including equipment and installation) of 76.000 euro the company reported the following savings:

- Lighting electricity savings: 142.560 kWh/year
- Energy cost savings: 9.267 euro/year
- Payback time: 8,20 years



In a second project in 2004, *Vodafone House* (building with a total area of 17.500 m²), they installed the same TCL 55 W lamps, powered by electronic ballast. In this case the company reported as follows:

- Lighting electricity savings: 135.011 kWh/year
- Energy cost savings: 9.675 euro/year
- Payback time: 4,5 years



Vodafone (Portugal), also a GreenLight Partner, decided to adopt new lighting solutions for their main building in Lisbon for the spring of 2005.

Vodafone Portugal decided the renewing of the outdoor lighting system for an entertainment place and a square by installing day light responsive lighting control systems.

After the estimations they claim the next energy savings:

- Lighting electricity savings: 32.285 kWh/year
- Energy cost savings: 3.850 euro/year
- Payback time: 4,5 years

For the indoor lighting for an entertainment area of 23.404 m² they will replace the old lamps with more efficient 26 mm fluorescent ones powered by dimmable ballast (before electronic non-dimmable). The lighting control system will be also equipped with localised manual switchers and occupancy responsive devices. In this case the estimated savings are:

- Lighting electricity savings: 315.814 kWh/year
- Energy cost savings: 31.581 euro/year
- Payback time: 4,8 years





Together with Austrian Energy Agency, the GreenLight Partner **WIPARK Garagen AG** (Austria), evaluated the energy savings technologies that were already applied in the majority of their car park facilities, in the last years. Those technologies are mainly summarised but not limited to the following:

- Time driven part-load [1/3,2/3,3/3] control of car park lighting system
- Light sensors driven lighting controls [1/3,2/3,3/3] in open designed car parks with a large amount of daylight.
- Sensitive motion detectors in the lower level of the car parks
- Dimmable and non-dimmable electronic ballasts

Latest optimisations resulted in more than 30% energy savings in the last year's activities [2003] by implementing central voltage controllers at remaining installations with magnetic ballast conceptions. Summarising the basic facts, the optimisations of 6 car parks by implementing intelligent central voltage controllers have resulted in annual savings of more than 25.000 euro which means a return on investment of 100% within 1.66 years (average).

Together with these energy savings projects in many cases they combined these actions with improvements in lighting quality. Recently practice measures there were:

- implementation of high quality long life tubes with constant line output over their life span.
- lighting optimisation in key areas e.g. entrance, exit areas etc.
- recurrent painting of walls and renovation of floors for a higher degrees of reflection
- pilot implementation of integrated reflector tubes.

Beside a better visual comfort, the company claims the next savings for a total number of 22 parking houses:

- Lighting electricity savings: 140.000 kWh/year
- Energy cost savings: 22.000 euro/year
- Payback time: 2,6 years (average)

As an estimation, about 50.000 to 70.000 euro energy costs were saved during the last two to three years. According with an energy price of 12 cent/W, lighting electricity savings of about 500.000 kWh/year were achieved. During the next two years they expect about 60.000 kWh/year additional savings.

Before ▼



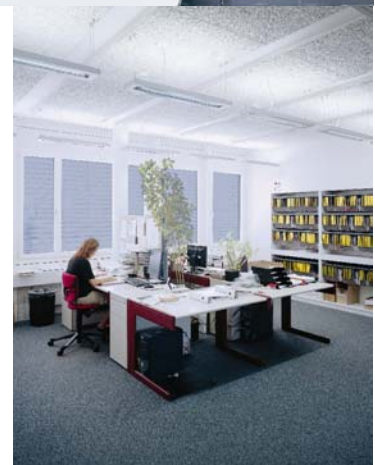
After ▼



The GreenLight Switzerland Partner, **Zehnder Group Produktion Gränichen c/o**, upgraded their main production and offices facility lighting system, for a total area of 8.683 m². The old lamps were replaced with new, more efficient ones powered by electronic ballasts. As lighting control devices, they used manual switchers, time scheduling and daylight responsive systems. The lighting level was increased from 185 lx to an average of 229 lx.



After measurements, besides a much better visual comfort, they claimed lighting electricity savings: 535.887 kWh/year i.e. 46,5% on lighting-related electricity consumption.

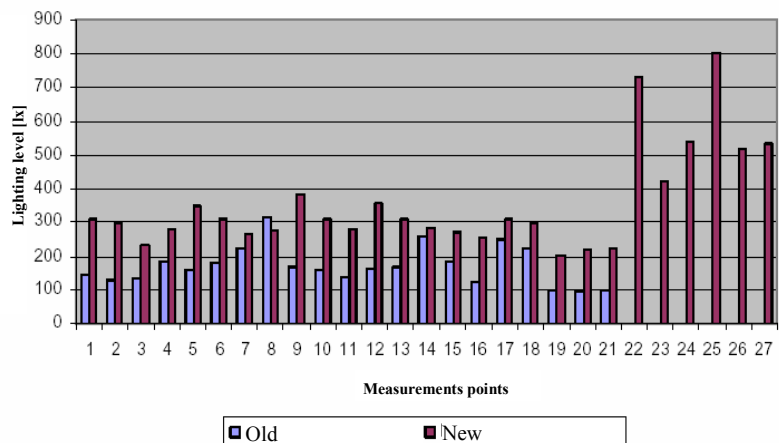


Post-installation lighting for offices ▲

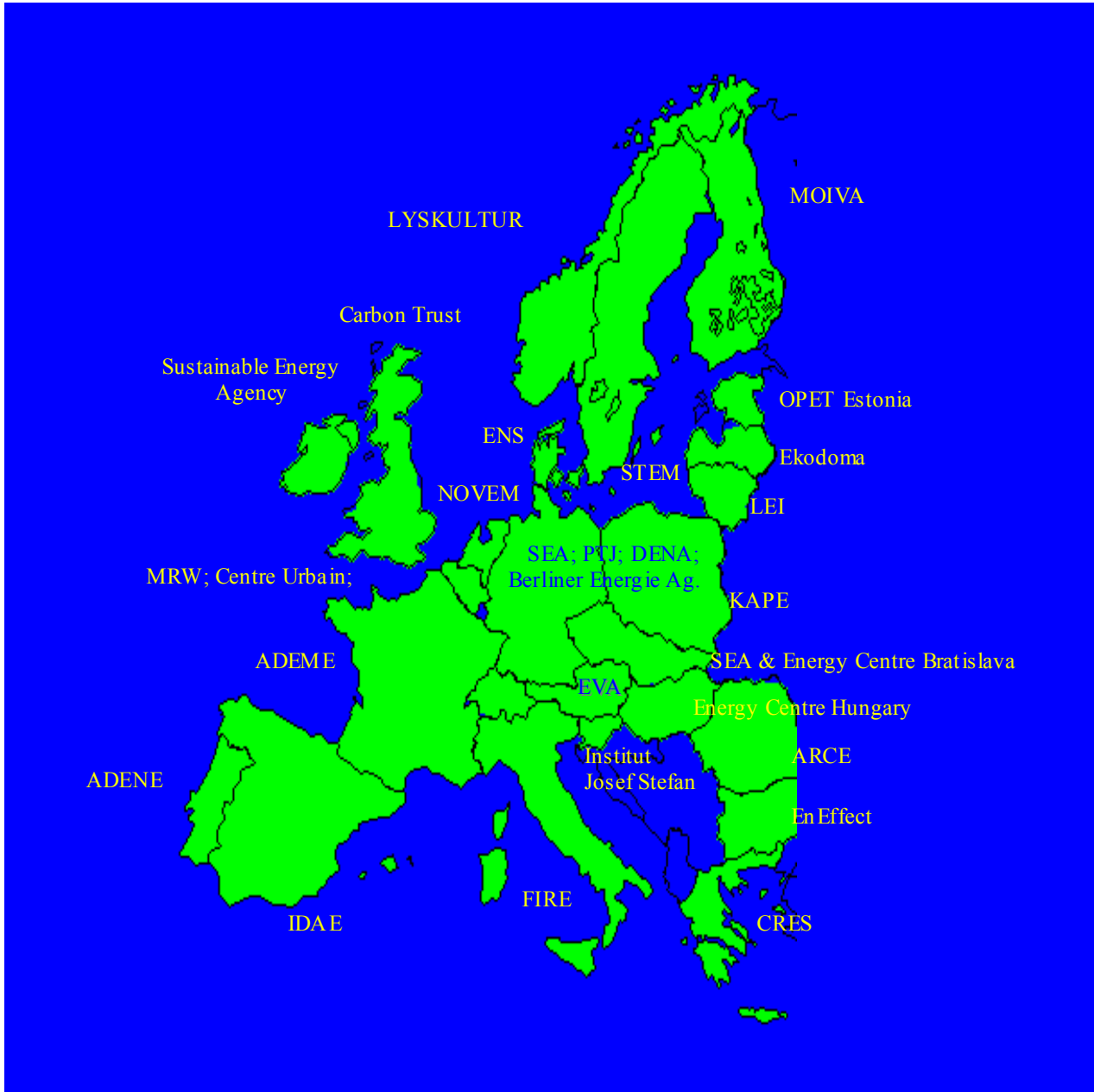


◀ Post-installation lighting for the production area

Lighting level Old / New



GreenLight National Contact Points in 26 countries



For more information on the European GreenLight programme,
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The GreenLight Programme is an initiative of the European Commission Directorate General Energy & Transport. It is managed by the European Commission's Joint Research Centre (JRC). The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.



An initiative promoted by the European Commission

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