SPRING 2013

# european energyinnovation

## Green photonics

## LED Lighting

## Heating and cooling

## Fuel cells

Country profile

**Italy**

Includes editorial contributions from:

**Neelie Kroes**
Vice–President,
European Commission

**Günther Oettinger**
European Commissioner
for Energy

**Philip Lowe**
Director General,
European Commission,
DG ENER

European Commission

# EU SUSTAINABLE ENERGY WEEK 24-28 JUNE 2013

## JOIN US NOW

ONE SMALL STEP FROM YOU
ONE GIANT LEAP FOR EUROPE

EUSEW.EU
FACEBOOK.COM/EUENERGYWEEK
TWITTER.COM/EUENERGYWEEK

SUSTAINABLE ENERGY
WEEK 24-28 JUNE 2013

Energy

# Contents




12


37


58


80

# WHAT LINKS SUSTAINABLE IDEAS TO REAL-WORLD RESULTS?


## Cable solutions to further the development of the renewable energy sector

To meet an ever-growing need for power, the world is increasingly turning to renewable and sustainably sourced wind and solar energy. In response to this demand, Prysmian cables are helping businesses in the renewable industry around the globe convert these new opportunities into reality.

Our technologies – which cover cables used in wind turbine and tower operations, submarine inter-array, platform connection and export cables to link the various turbines and underground power transmission and distribution cable systems for wind power applications – are at work across the renewable sector, supporting the operations of turbine manufacturers, contractors and developers, grid operators, system integrators and panel makers.

Always aware of our responsibility to the planet, we're constantly driving innovation in our industry, aiming to help renewable industry partners deliver projects with benefits for the future of both our world and their businesses.

www.prysmiangroup.com

Prysmian Group

PRYSMIAN

Draka

The publishers of European Energy Innovation would like to offer their sincere thanks to all individuals and organisations who have contributed editorial images photos and illustrations to the magazine. Whilst every effort has been made to ensure accuracy of the content, the publishers of European Energy Innovation accept no responsibility for errors or omissions.



European Energy Innovation is published by:
Prologue Media Ltd
1a Shire Lane
Chorleywood
Hertfordshire WD3 5NQ
United Kingdom

Tel: +44 1923 286238
www.europeanenergyinnovation.eu

**HEAD OF BRUSSELS OFFICE**
Sophia Silvert
145/15 Avenue Molière
B-1190 – Brussels
Belgium
Tel: + 32 2 347 70 19
Mob: +32 4737 30322
sophia@europeanenergyinnovation.eu

To obtain additional copies please email info@europeanenergyinnovation.eu

**BUSINESS DEVELOPMENT DIRECTOR**
Philip Beausire
philip@europeanenergyinnovation.eu

**EDITOR**
Michael Edmund
editor@europeanenergyinnovation.eu

**DESIGN & PRODUCTION**
RayHeathDesign.com

**WEBSITE DESIGN**
pulseart.co.uk

**PRINT**
The Magazine Printing Company,
Enfield, Middlesex, United Kingdom

# Foreword

We are delighted to feature three articles from the Commission in this issue. Vice-President Neelie Kroes, writing in her role as Commissioner for Digital Agenda, describes the potential role of Green Photonics, explaining the potential of this technology in generating energy, in reducing energy consumption and in reducing greenhouse emissions and pollution. She outlines the Commission's €550M 7th Framework funding as an illustration of the commitment to green photonics and the importance of its role in the economic future of Europe.

Commissioner Günther Oettinger writes about the Internal Energy Market: he restates how consumers and industry alike stand to benefit from a single European energy market rather than 27 individual national ones. In reminding us how the project is now behind schedule, the Commissioner also warns that without significant changes, we face less reliability of supply, higher costs, declining competitiveness and wealth; and slower progress towards decarbonisation.

Our third article from the Commission comes from Philip Lowe, Director-General at the Energy DG. He reviews the growth in renewable energy under the influence of binding targets; and explores how renewables contribute to domestic and industrial heating and cooling, which consume much of Europe's energy. Lowe suggests we face a technological challenge to provide optimally-integrated sustainable solutions for households, industry and for district heating and cooling. He adds that we also face a legislative challenge to ensure that these technologies are optimised across national and local plans, citing three EU Directives within the necessary framework.

Our Country Focus looks at Italy, where it can have escaped no-one's attention that a new Government has recently been elected. We are therefore particularly pleased that Leonardo Senni, Head of the Energy Department at the Ministry of Economic Development, has written about Italy's new Energy Strategy. Between now and 2020, this outlines 7 priorities, each with specific supporting measures, designed to achieve an investment of €180 Billion, a 21% reduction in greenhouse emissions; and a renewable energy contribution of 19-20% of a total consumption figure that will itself reduce by 24%. Ugo Farinelli, Secretary General of AIEE, explores the peculiar characteristics of the supply side of the Italian Energy System, where there is an unusually high dependence upon natural gas; and the demand side, where, he says, Italy is one of the more "virtuous" countries in terms of low energy intensity of the GDP. Dr.Vanessa Gallo, National Secretary of FIPER, examines the opportunity for more efficient use of biomass, supported by a government incentive for cogeneration systems, to increase national power by 1000-1500 thermal MW and 200-400 electric MW.

We have a technical contribution from a team from the Martin-Luther-University of Halle-Wittenberg and the Fraunhofer Institute, who review the extraordinary light trapping properties of black silicon, a material that possesses significant potential to increase the efficiency of photovoltaic technology. We have two market-orientated contributions: one from Jamie Fox of IHS, who runs his eye over the winners and losers in the LED lighting market; and one from Nils Borg, Operating Agent of the IEA 4E SSL Annex. He explores demand-side management as a means of stimulating LED innovation. We have contributions on district heating, on building renovation, on micro CHP and Fuel Cells and on building performance.

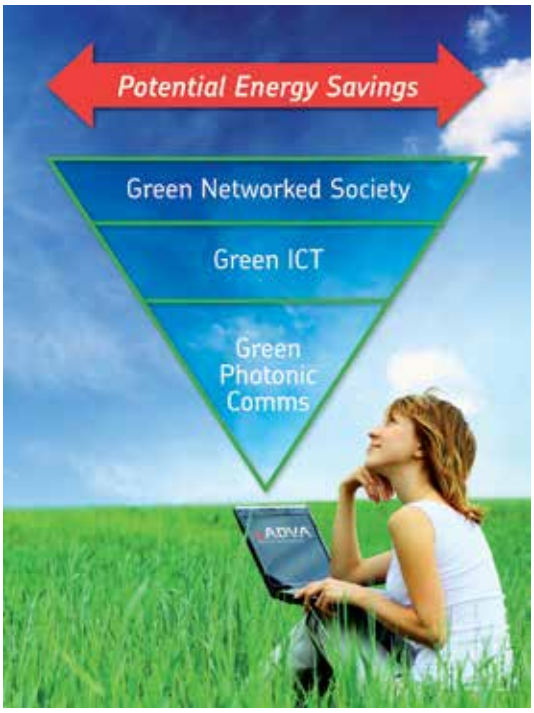
So there is much more for you to read inside...

**Michael Edmund**
Editor

# Energy-efficient Photonic Communications

## Paving the Way to the Green Networked Society

Building a competitive low-carbon economy that makes efficient, sustainable use of resources is one of the pillars of the European Commission's Europe 2020 strategy. Global carbon emissions reached 33 billion tons of CO2 in 2010[1] and are forecasted to increase ~10% by 2020[2]. To counteract this development, the EU has committed itself to reduce greenhouse gas emissions by 2020 to 80% of the 1990 level. While Information and Communication Technology (ICT) is only responsible for 2% of the total carbon footprint today, its contribution is projected to increase exponentially[3]. Digital data is growing at 50% and Internet traffic at 33% per year, mandating ICT to become much greener in the future. Studies by the Japanese GPIC show that Green ICT has the potential to maintain or even reduce the ICT carbon footprint over the next 20 years despite the exponential growth in capacity. What is more, the pervasive use of Green ICT in a Green Networked Society can create a leverage effect which is forecasted to reduce the global energy-derived carbon emissions by more than 25% in 2030[4].




*The road towards the green networked society*

Green Photonic Communications will play a pivotal role in achieving these ambitious goals. Fibre-optic communications are well known for delivering the best capacity-distance product consuming the lowest amount of energy. They are extensively used in core, metro and aggregation networks world-wide. As network traffic continues to grow, photonic communications will become even more ubiquitous: Photonics will move closer to the end users, will find widespread adoption in data centre, home, vehicle and sensor networks, and will be established as short-distance interconnect technology.

Given that electronic processing and switching functions account for the more than 90% of the global network energy consumption[5], the consolidation of these functions in fewer locations combined with photonic connectivity is seen by many experts as the most promising if not only way to reach the Green ICT targets.

At ADVA Optical Networking, we serve more than 10,000 enterprise and 250 carrier customers world-wide with energy-efficient optical network technology. Our current products can reduce energy consumption by up to 50% over competing approaches, but this is not a reason to rest: We continue to research new architectures, protocols, and system and component technologies to foster Green Photonic Communications. Through internal programs, partnerships and collaborative EU projects we seek solutions to ensure that the 10-fold growth in Internet traffic by 2020 is not accompanied by an energy increase of the same size.

**Jörg-Peter Elbers and Klaus Grobe**

ADVA Optical Networking SE, Advanced Technology, Fraunhoferstr. 9a, 82152 Martinsried, Germany

JElbers@ADVAoptical.com
KGrobe@ADVAoptical.com

1 Trends in global CO2 emissions, 2012 Report, PBL publication number 500114022, ISBN: 978-92-79-25381-2

2 Based on results from Copenhagen Accord, low-emission scenario

3 SMART 2020: Enabling the low carbon economy in the information age, The Climate Group on behalf of the Global eSustainability Initiative (GeSI), 2008

4 ICTs – The 98% Solution(s), S. Harper, Copenhagen Climate Conference COP15, 2009

5 A Review of Energy Efficiency in Telecommunication Networks, G. Koutitas, P. Demestichas, Telfor Journal, 2010

# EU-ETS: SOS

*"Failure is the foundation of success, and the means by which it is achieved"*
*- Lao Tzu*

*By Mike Edmund*

Its *raison d'être* is ambitious: controlling greenhouse emissions, no less. But it has recently been criticised as irrelevant; and its prognosis so poor as to need "life support"; while Climate Commissioner Hedegaard, apparently attempting its resurrection, has spoken in terms of a "final wake-up call." Notwithstanding the progress on emissions that has been made in the fifteen years since Kyoto, these recent comments might suggest that the European Emissions Trading System (ETS) has collapsed; they may even support a charge that it has failed completely. Whether or not this final accusation is justified, there can be little doubt that the ETS is in crisis. But it was not always like this. Conceived as the cornerstone of the European response to the 1997 Kyoto protocol, the ETS was the first - and is still the largest - international system for trading greenhouse gas emission allowances.

*Does the ETS matter? Has the market failed? Is an interventionist stance now more appropriate?*

*In short, the answers are:* ***Yes****,* ***No*** *and* ***Maybe.***

## DOES ANY OF THIS MATTER?

A cornerstone is relied upon for the integrity of the edifice it supports and, like all good ideas, the ETS is simple. In essence, a carbon permit allows the holder to emit one ton of carbon dioxide, and is issued to countries or groups that have reduced emissions below their Kyoto quota. If an environmentalist organisation plants enough trees to absorb one ton of $CO_2$, it might sell the resulting permit to a steel producer that expects to exceed its emissions quota. An industrialised nation, for which reducing emissions might be relatively difficult, may buy permits from a less industrialised one. Carbon (or the right to emit it) therefore acquires an economic value; and a market is created for the buying and selling of the rights to emit it. This market becomes possible because the goal of the Kyoto Protocol is to reduce emissions on a global basis.

Back in April 2006, the price of carbon permits hit a peak of €32 per ton, but has since almost completely collapsed. It dropped by more than one-third during 2012 alone and recently traded below €3, less than 10% of its peak value. This is somewhat lower than the €20 to €30 price point suggested by analysts as necessary to support investment in clean technology. Therein lies a clue to the split personality of the ETS: it is an economic device but it has been set environmental objectives. Unsurprising, then, that Germany's 'Der Spiegel' has asked pointedly if it can ever be relevant again.

However, the environmental side of the debate was made crystal clear earlier this month, when the American National Snow and Ice Data Center [NSIDC] launched a website offering "the latest satellite data and periodic scientific analysis on surface melting of the Greenland Ice Sheet." According to the NSDIC, 2012 was the first year on record when the *entire ice sheet experienced melting at some point in the season* [my italics - Editor]; moreover, the overall extent of the melt was the largest in over thirty years, and it lasted almost two months longer than average.

*Greenland, it seems, is melting.*

The extent of mankind's role in climate change has been a subject of what might be termed heated debate; and it is beyond the scope of this article to discuss it further than simply repeating one of the findings of the 2007 Fourth Intergovernmental Panel on Climate Change [IPCC] Assessment Report. It found that "Anthropogenic change has been detected in surface temperature with very high significance levels (less than 1% error probability)."

*Mankind, it seems, is melting it.*

Elsewhere, recent figures compiled by the The European Environment Agency indicate that greenhouse gas emissions for the European Union increased by 2.4% in 2010, despite the economic recession and the

policies intended to tackle climate change. The Agency attributes the rise to signs of economic recovery in some areas, and to a colder winter, adding that emissions might have been higher still if it were not for a strong increase in the production of energy from renewable sources. The rise followed a sharp decline in emissions between 2008 and 2009, itself largely attributed to the financial crisis and recession.

*Emissions are no longer falling, but rising once again.*

Therefore, and for these reasons at least, the success of the ETS matters a great deal.

## HAS THE MARKET FAILED?

The recent economic recession has acted like lead weight, dragging down national economies as well as the price of emission. That much is pure economics; and this is no forum for economic theory. But it is hardly a revelation that a market is nothing more than than a vehicle for transactions, where price is set by buyers and sellers and influenced by factors such as the levels of competition and of supply and demand. As such, a market can neither succeed nor fail: it is what it is.

One significant factor in the spectacular collapse of the price of carbon permits is reduced demand because of the recession: emitters need fewer permits because they are emitting less. And when recession finally gives way to economic growth, the usual wisdom is that increasing demand will force the price back upwards. The problem will therefore take care of itself naturally, there is no need to intervene and we have at a single stroke answered two of the questions posed above. Inevitably, the situation that faces the ETS is much more complicated and there is certainly no room for this degree of complacency. Many other factors are in play, one of which is the relationship between availability of shale gas in America and coal exports to the EU. In short, supply of carbon has dramatically increased at the same time as demand for permits has shrivelled away. These circumstances have conspired to create the ridiculous situation (in environmental terms anyway, if not in economic ones) that it is profitable in Europe to burn "new" coal for electricity, and loss-making to burn "old" gas, bought at prices negotiated some time ago.

In essence, therefore, carbon permits constitute the point where environmental concerns collide head-on with economic realities.

And so the real problem is that, economically speaking, emission needs to be cheap (particularly in a time of recession) because of the need for a low price for energy and manufactured goods. Environmentally speaking, however, emission must be made expensive - because ultimately the price is paid by the planet. A final thought is that as emission becomes more expensive, green alternatives become more economically appealing, raising the attractive prospect of a market-oriented positive feedback mechanism requiring no intervention.

## IS AN INTERVENTIONIST STANCE NOW MORE APPROPRIATE?

In purely economic terms, market interventions represent an artificial distortion of the price. No clearer example can be given than that of the recent decision on backloading: the vote in the European Parliament to restrict temporarily the supply of emission permits has raised hopes that the carbon price will rise by €2-3. The environmental aspect is the hoped-for prevention of the release of 900 million tonnes of carbon dioxide into the atmosphere. The original design of the ETS incorporated a steady reduction in the supply of permits over time, and so this latest intervention does not represent a major shift in policy. More generally however, once a market price is judged according to external criteria, then it ceases to be purely a market. The twist is that intervention will increase the price of emissions - that is the intent, after all - and ultimately it will be the hard pressed consumer who will pay - one way or another. In other words, intervention equals political unpopularity, perhaps particularly acutely in a time of recession. But this is by itself no reason not to intervene: perhaps the market needs a different measurement of the price of a carbon permit, one that takes more account of the environment. And it definitely needs a great deal more public concern over climate change.

The ETS was conceived long before the current economic crisis; and the price of a carbon permit is variable, simply a reflection of prevailing market conditions at the time it is determined. These market conditions have clearly changed dramatically in the last fifteen years - even if the environmental issues have not. "Business as usual", on a new surge of cheap carbon, is no way to protect the planet. The money needed for investment in renewable technology must be found from somewhere, at a time when there is not much money to be found anywhere: one might say that the economic climate is not conducive. Philosophically, this represents the difference between genuinely investing in the future (as distinct from the weasel words used to disguise mere current spending); and repaying the (environmental) debt accrued from past carbon use. Either way, if the market is to be judged by some other yardstick, such as its ability to raise this money, then it should be also judged by the standards that apply to other revenue-raising measures - such as a carbon tax, for example.

## CONCLUSIONS

The ETS may be in crisis, but it has not failed. And Lao Tzu's encouragement was never more appropriate. He also suggested that a journey of a thousand miles begins with a single step. We have made the first steps with the ETS; now it is clear that we must make more. This journey is far from over. Or, as Vance Havner once put it, albeit in a different context, "It is not enough to stare up the steps - we must step up the stairs."

# Energy conservation – the new mantra

*By Alexander Cohr Pachai, Technology Manager*
*Morten Deding, Product Manager*
*Johnson Controls Denmark*

## ENERGY

According to the first law of thermodynamics energy cannot arise on its own. Neither can it disappear. Energy comes at a price, and the present energy prices are very high compared with the prices just a few years ago. This fact has aroused increased attention to the questions how energy is used and how much it costs to run a given process. Creative minds have reduced the energy consumption or started using the energy in different ways in order optimise the process. This development entails a number of benefits, including:

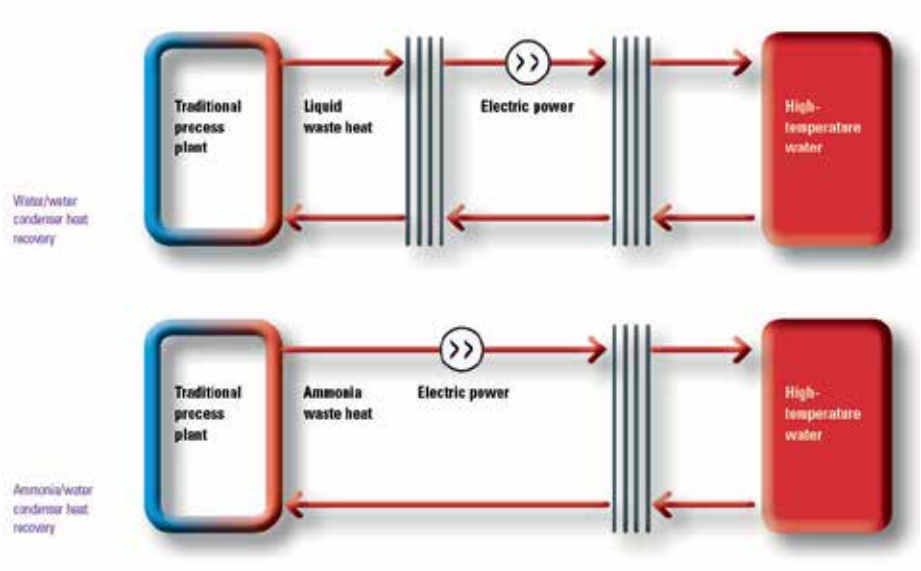
- Saving money
- Doing things more smart
- Reducing the CO2 emissions to the benefit of the environment.

In this way, saving energy becomes an advantage to both wallet and environment.

It is a well-known fact that in industrial processes you consume a lot of energy which is later removed by a refrigeration plant. This energy is then rejected to the surroundings during the condensation process. But a lot of energy in the form of heat is also rejected from office buildings using air-conditioning systems.

The energy or heat is normally rejected at a temperature level which is not so useful in order to keep the condensation temperature as low as possible and thus save energy. The energy can be used for room heating, but not for process heating, and it is not always warm enough to heat tap water.

The introduction of modern heat pumps that supplies hot water up to 90°C enables you to save energy in the form of fossil fuels or electricity for heaters. The use of waste energy makes it possible to achieve a high efficiency on the heat pump. In many cases you get a Coefficient Of Performance (COP) between 4 and 6. This means that for each kW of energy you put into the heat pump, you get 4 to 6 times more energy out in the form of hot water. You may therefore also call the heat pump an energy booster. Basically, you boost the temperature from a not interesting level to a level where it is useful.




## HEAT PUMPS

Heap pump technology has now been defined as a sustainable technology. Although the motor that drives the heat pump consumes energy, which is not necessarily sustainable, the major part of the boosted energy is sustainable - hence the definition 'sustainable energy'.

Modern heat pumps using ammonia (a well-known refrigerant in industrial systems) can be used to produce hot water up to 90°C. This is useful for bacterial killing without chemicals, for

*Customized two stage SABROE heat pump*

waste water or polluted water that needs heat treatment. The hot water can also be used in various processes, e.g. pasteurisation of milk products.

The hot water can also be used for room heating or district heating. Not only waste heat, but also ground source heat or sewage can be used as heat sources. Some waste water can be relatively hot, and the energy content is therefore high. This energy can be recovered by a heat pump system in which some of the water can be used to pre-heat water until the heat pump can use the rest of the energy to heat the water to the final temperature. The technology is very flexible and can be used in a variety of ways to yield the maximum performance. It is important to avoid using higher temperatures than are actually required for the process. This will only result in waste – Read: energy losses and thus money.

## ENERGY PRICES

Energy prices are much regulated, and the prices vary from country to country and region to region. It is therefore important to make an analysis and compare the different solutions in all details.

The main alternatives to heat pumps are boilers fired by gas or oil. Electrical heaters are also an alternative and they are used in some countries. To get started, it is recommended to use the energy portal on www.energy.eu. Here you can find prices for different fuel types in the EU. Outside the EU the prices are very different and the information is not always transparent due to different qualities of oils used.

The cost reduction on cooling towers and other expenses should also be included in the analysis. The chemicals used for the water treatment and energy consumption are one thing, but also water is in many cases quite expensive. Reducing the energy load on the cooling tower and moving on to the heat pump also reduces the demand for treatment of the tower to reduce the risk of legionella. The energy load on a cooling tower used by a heat pump will result in less use of the cooling tower. If you use dry coolers you must subtract the energy expenditure for not having to run the fans.

The noise emissions from cooling towers and/or dry coolers can be minimised by using a heat pump. By using heat pumps the outdoor heat rejection will be limited to situations where the heat pump cannot remove all the heat from the cooled object.

What is not always considered is the fact that hot water can be sold to nearby companies or for domestic heating. In such cases the price of the hot water is a commercial consideration and it should be compared with alternative supplies and the cost of producing the hot water.

## IN CONCLUSION

Heating systems and cooling systems used to be treated as two different systems. Today we have to see the site as an energy-consuming unit where the energy can be used in different ways, and we must try to avoid waste heat leaving the site.

Heat pumps form a part of the solution if you wish to start reducing energy waste from a modern production facility or office building. The amount of energy emitted to the surroundings through condensers and cooling towers globally is extremely large. This energy can be recovered and used for other purposes by using heat pumps that can boost the water temperature from a low level to a level that makes it interesting for many applications. Let your imagination run wild!

# What the Internal Energy Market brings for Consumers

*By Günther H. Oetttinger, European Commissioner for Energy*

It is somewhat fitting to be writing this in November as the nights get longer and the days get darker. Across Europe people are turning up their thermostats to fight off winter's chill and turning their lights on in the mornings as well as the evenings. They might also look at their energy bills and wonder why prices are behaving so differently over Europe, whether constantly high, climbing or seemingly so low as to be too good to be true. Governments are being called to take action, but what can they do?

EU Member States have given themselves the deadline of 2014 to complete the internal energy market, but they are not on track to do so. The case for having a common market across Europe rather than 27 individual national markets is clear: a properly functioning market in energy will stimulate competition and keep costs down for consumers and companies alike.

How much these two are linked shows the following example: Wholesale electricity prices have not risen to the same extent as the import prices for fuels which are the basis for electricity production. While the price for crude oil has risen annually by 14%, for gas by almost 10% and for coal by 8% in recent years, wholesale electricity prices in the EU have risen much less, namely by 3.4% thanks to increased cross-border trade and market integration.

But we are still not finished. Even 20 months after expiry of the deadline, transposition of the 3rd internal energy market package is slow and incomplete. This is why I am pursuing infringement procedures for non-transposition and incorrect implementation of the legislation in place: the 3rd internal energy market package and, after its adoption the infrastructure regulation. Market opening and integration will not happen by itself. The effective implementation of the legislation in place is a necessity. The Commission must be a strong player in ensuring that Member States adopt the necessary legislation as energy issues can no longer be seen as solely the responsibility of the Member States. With our electricity and gas markets increasingly integrated, what happens in one Member State has automatic consequences in other Member States.

What will the effect be for the consumer? We will ensure that the consumer rights enshrined in the legislation have to be visible in national law and properly respected by all market players: Consumer need to have the information and practical means to switch from one supplier to the other in three weeks time without any financial costs. Active communicating these rights is essential: The companies should upfront inform the consumers about their rights and the Commission will provide a web-site with dedicated practical information.

But we need to look also ahead: The energy framework of tomorrow and its transition to a low-carbon future poses a lot of challenges. Inputs from renewables, which, by their nature, cannot provide power at all times, such as sun and wind, need appropriate back-up, for example from gas. Some Member States are creating so called 'capacity mechanisms' to provide for their own national power needs but without joined-up working we risk paying a lot and the market across Europe being undermined. Similarly, a Europe-wide market will be undermined if individual states grant harmful subsidies to their energy sector. Whilst for the consumer, subsidised energy may seem desirable, it is their taxes that fund the subsidy, so either way they are paying the real cost for their energy. Cooperating across borders on energy is therefore a perfect example as to how the EU adds value to all Member States.

In the wider economic picture the internal energy market is not an objective in itself, nor is reform driven solely by our goal to reduce greenhouse gas emissions by 80% -95% by 2050, but it is a significant expedient in delivering key EU goals: economic growth, jobs, secure coverage of their basic needs at an affordable price, and sustainable use of limited resources. Without considerable changes in the functioning of the energy market, we will face a less reliable and more costly European energy system, declining EU competitiveness and wealth, and slow progress towards decarbonisation. Investing in generation, transmission and distribution infrastructure and storage, and implementing more efficiency measures will deliver growth and jobs and boost economies across Europe.

Our Internal Market Communication adopted on November 15, outlines in more details why the completion of the internal market is so important and the accompanying working paper gives specific recommendations to each country to speed up its accomplishment. By 2014 there is much to be done but the benefits that will be reaped by delivery of a Europe-wide internal market are evident.

# Sustainable ultra efficient building-climate controlsystems: a leading role for ultra performance fans

## A SUSTAINABLE WORLD VISION WITH WHIZZ-WHEEL® TECHNOLOGY

The electricity consumption of the so-called "prime movers" in the industrialised countries, meaning pumps, compressors and especially fans, exceeds 50%. Building-climate control systems are large-scale consumers of such equipment, for instance for air handling, air comfort and air quality, and heat recuperation and the like. The operational efficiency of this equipment - measured across the entire operating range - averages significantly less than 50%. This inefficient energy use amounts to more than 25% of the total electricity generation. This underlines the importance of and interest in global energy saving by increasing the operational efficiency of such equipment. There is therefore a strong motivation to develop new technology aimed at increasing the efficiency of liquid and gas handling equipment.

In the climate control market, air heat exchangers are the tool for air handling processes. These heat exchangers are constructed from multiple layers of stacked finned pipes (called a pipe bundle) and often use multiple axial fans. Energy saving, noise and, as a result, overall efficiency and sustainability play an increasingly important role when considering the performance quality of these conventional components. The Whizz-Wheel® axial fan systems are designed to deliver ultra-high efficiency aerodynamic performance at ultra-low noise levels. The key here is the use of an innovative concept, involving a greatly increased number of aerodynamically optimally shaped blades that serve as the spokes in a wheel, with the blade tips connected to a new lightweight yet rigid air guiding outer ring. The development and actual performance of these fans over the last five years have demonstrated that this results in a reduction of energy consumption of over 50% and noise reduction of more than 6dB (a) compared to the most silent fans. The potential impact of this saving of over 50% on current global electricity consumption is so important that we have assessed a market expansion to all industrial fan markets. Energy consumption can be reduced on an even greater scale by using diameter sizes from 15 m to a few centimetres for use in computers, data centres, for example. Over the last five years, we have set up cooperation structures with top players in all the niche areas of fan application. This allows generation of the total global savings potential per segment within the foreseeable future. In all niches, the savings of over 50% create a fast payback time, which is an economic motivation to actually use the ultra-high efficiency fans.

## VIEWING BACK AND LOOKING FORWARD

Five years ago, when Bronswerk started its development, we mainly focused on noise reduction. The focal point for the markets in which Bronswerk operates, i.e. the oil, gas, chemical and utilities sectors, was compliance with the stricter noise requirements. The development objective was therefore set at a noise reduction of three decibels compared to the most silent fan (application) on the world market at the time in the application of air driven industrial equipment. Currently, the noise reduction is six decibels, comparable to the difference in noise between a passing motorcycle and a bicycle. This is quite enormous. Furthermore, Bronswerk predicted that the way to achieve ground-breaking noise reduction would be by maximising the aerodynamic performance, resulting in over twenty percent energy saving in the market: cooling for the oil and gas industry and utility companies. This actually ended up being fifty percent. It is almost inconceivable that in an industrial branch that has been around for over fifty years a technology is introduced that saves ten or twenty percent, let alone fifty percent. Talk about ground-breaking! At first, customers could not believe it, until these staggering results were spread all over the Internet. In the large diameter fan systems (2.5m => 15m) it is now fully accepted. The time has now come for market niches with much larger numbers of fans and with a greater diversity in applications. Now, the market expansion has actively been put into motion for very small sizes up to just a few centimetres. The technology and above all the necessary know-how relating to the aerodynamics of a range of devices and the special production technology they require have since been established. The improvements in noise performance are even such that other sources of noise have become prominent in exceeding noise standards. In particular, the drives are a new expansion area for noise reduction as well as for improving efficiency. New roads are therefore being explored to enable us to assure extreme performance in this area too in the near future.


## ADDED VALUE

The new fan technology enables more compact and lighter heat exchangers within the required noise standards and desired energy performance. Besides the environmental considerations, the resulting material savings are also often of key economic importance. The new fan system itself often weighs 75% less than other fans. **Four birds with one stone: Whizz-Wheel® systems are more silent, more energy-efficient, smaller and lighter. And, in all modesty, much nicer to look at.**

# Knowledge and Data Collaboration for

## Better Building Energy Performance Policies to Mitigate Climate Change

*New Global Knowledge Platform – www.gbpn.org*

The Global Buildings Performance Network (GBPN) launched its brand new website on the 21st of February. This web-based tool is unique in that it has been designed as a global participative and open data knowledge hub harvesting, sharing and curating best practice policies in building energy performance globally. Behind this project lies the GBPN core philosophy: stimulating collective knowledge from experts worldwide to support better decision-making.

As buildings account for more than 30% of the global final energy use and energy-related carbon emissions, it is clear that this sector has the potential to play a crucial role in mitigating climate change. For this reason the GBPN's mission is to significantly reduce greenhouse gas emissions from buildings. The GBPN research shows that by 2050, it is possible to reduce global building final energy use by one third of 2005 levels and works to change the focus of policy makers and building experts towards this goal.

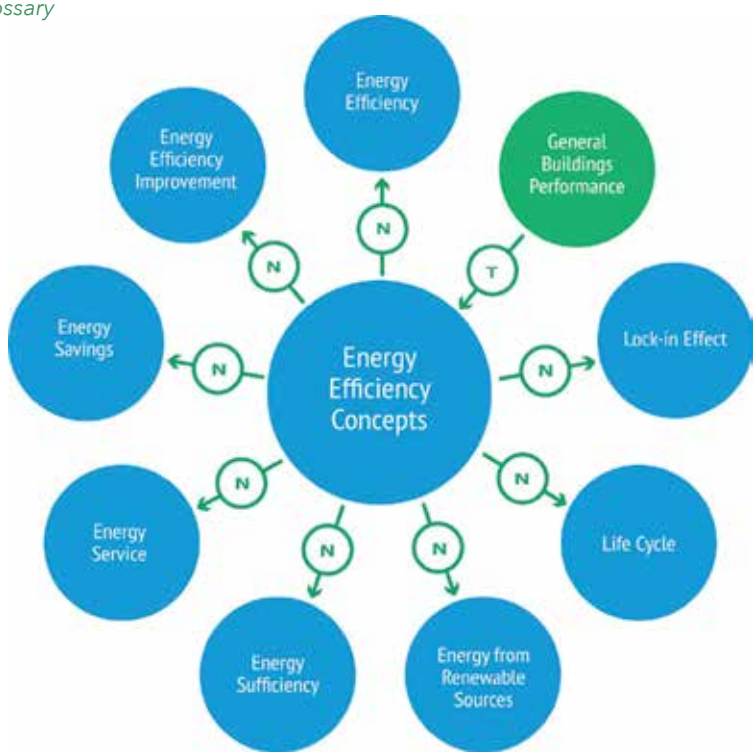
Available in English and soon in Chinese, the new Knowledge Platform is at the cornerstone of the GBPN "deep path" strategy. It aims to support researchers & experts, policy-makers, building professionals, members of governmental institutions and multilateral organisations to gather around a common participatory tool and a common purpose: creating global best knowledge and data on building performance policies.

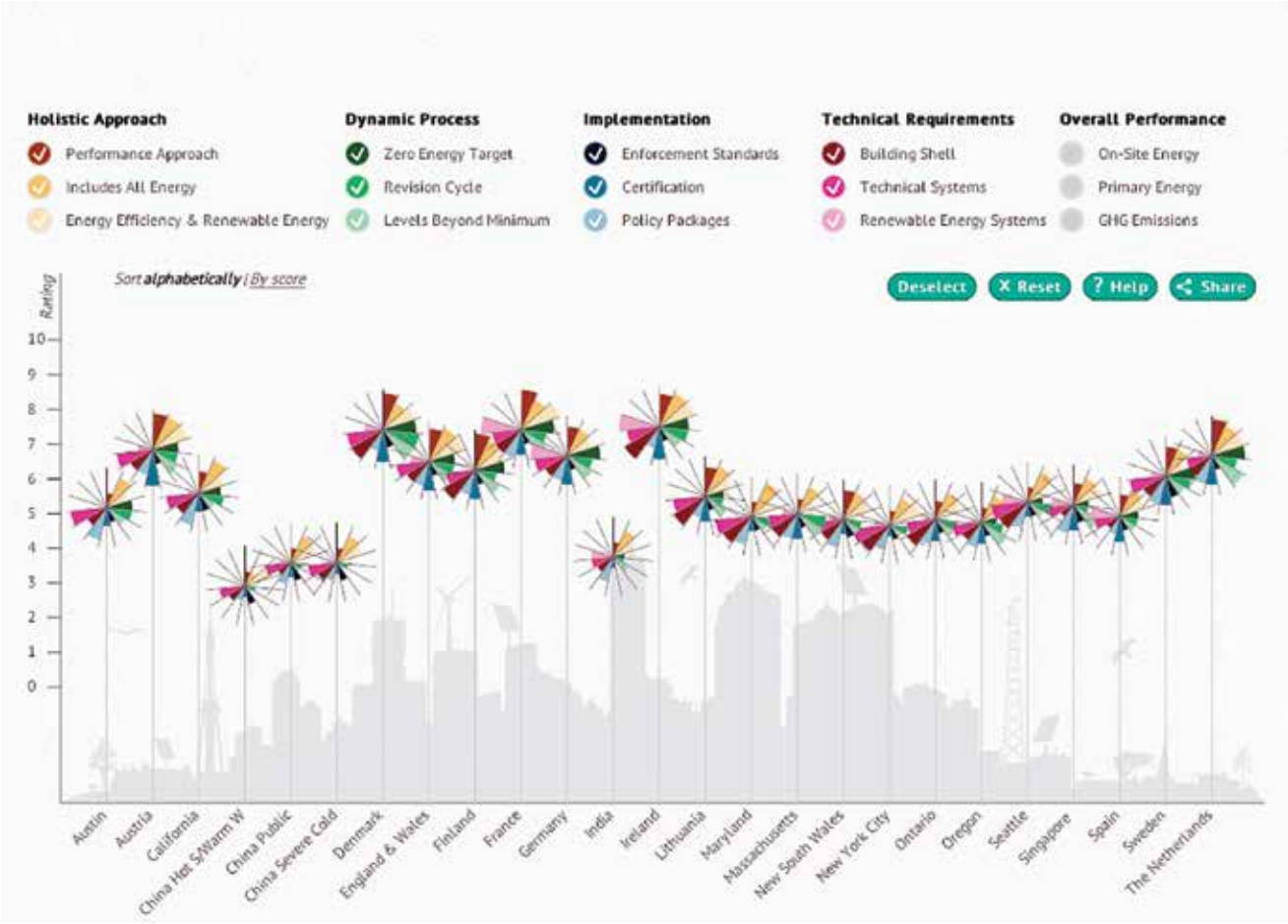
One of the main features is the Policy Comparative Tool enabling comparison of the world's best practice policies for new buildings. By understanding how countries have designed and implemented best practice codes, policy makers can use this information to strengthen the future design of dynamic policies. The tool provides interactive data visualization and analytics.

The website also proposes a Report Database, a unique knowledge pyramid presenting all of our Reports in 10 different formats to address the information needs of different stakeholders (highlights, one page summary briefing to policy markers, infographics, technical reports and data series, etc).

The GBPN aims to facilitate new synergies with energy efficiency experts and building professionals worldwide. For this purpose, the new website offers a Laboratory, a participative research collaboration tool for

*GBPN Smart Glossary*






*GBPN Policy Comparative Tool*

building energy efficiency experts to share information and generate new knowledge on how best to develop ambitious building energy performance policies globally.

The GBPN encourages transparent availability and access to reliable data. As the energy performance of buildings becomes central to any effective strategy to mitigate climate change, policy-makers need more and better data to design, evaluate and compare policies and programmes. The GBPN data can be freely used, reused and redistributed by anyone – subject to the requirement to attribute and sharealike.

In addition, the GBPN Knowledge Platform has been developed under the Linked Open Data technology to connect with the best online resources. The GBPN Glossary is linked to DBpedia as well as the Reegle's Clean Energy and Climate Change Thesaurus developed by the Renewable Energy and Energy Efficiency Partnership (REEEP) and the Renewable Energy Policy Network for the 21st Century (REN21). A "News Aggregator Tool" service is also available. And our platform connects to our Regional Hubs data portals: Buildingsdata.eu, the open data portal for energy efficiency in European buildings developed by the Buildings Performance Institute Europe (BPIE), and Buildingrating.org, the leading online tool for sharing global best practices on building rating and disclosure policies launched by the Institute for Market Transformation (IMT) in 2011.

The GBPN will be enriching its data over time with additional topics and information generated through data exchange projects and research partnerships and is inviting any interested organisations to suggest any opportunities for collaboration.

**About the GBPN:**
The Global Buildings Performance Network (GBPN) is a globally organised and regionally focused network whose mission is to advance best practice policies that can significantly reduce energy consumption and associated CO2 emissions from buildings. We operate a Global Centre based in Paris and are represented by Hubs and Partners in four regions: China, India, Europe and the United States. By promoting building energy performance globally, we strive to tackle climate change while contributing to the planet's economic and social wellbeing.

**Follow us on Twitter** @GBPNetwork
**Contact us at** info@gbpn.org
www.gbpn.org

# E-HUB

## Energy-Hub for residential and commercial districts and transport

E-HUB project "Energy-Hub for residential and commercial districts and transport" is a proposal funded in the FP7-2010-NMP-EeB call launched by EeB-PPP initiative. The ambition of this project is to enable the utilisation of the full potential of renewable energy (up to covering 100% of the energy demand on district level) through the development of the E-Hub concept. An E-Hub is a physical cross point, similar to an energy station, in which energy and information streams are interconnected, and where the different forms of energy can be converted into each other or can be stored for later use.

The E-hub exchanges energy via the energy grids between the different actors (e.g. households, renewable energy plants, offices), who may be a consumer at one time, and a supplier at another time. The consumers and suppliers exchange information on their energy needs and energy production with the energy hub, the hub then distributes the energy available in the most efficient way. The consumers and suppliers are connected to the E-hub by means of bi-directional energy grids (low and/or high temperature heat grid, cold grid for cooling, electrical grid, gas grid). The renewable energy may be generated locally (e.g. from PV on residences) or by centralised means (a geothermal plant or a large CHP located within the district). The E-Hub concept holds for all types of energy flow, from heating and cooling to electricity and gas, and may connect not only households but also (electrical) cars, commercial buildings or industry.

**The challenge.** To achieve low energy or even energy neutral districts - the share of renewable energy must increase drastically over present levels. Accommodating a large supplier of renewable energy in the existing energy infrastructure is complicated by the fluctuating character of the energy supply. Mismatches between supply and demand may be solved by a combination of intelligent control of conventional back-up equipment, temporary (or long term) storage, and postponing the demand of energy consumers like heat pumps, refrigerators or washing machines to a period of cheaper supply.

**Smart control.** Smart energy control system is developed to match supply and demand for electricity, heat and cold on district level. This includes shifting the demand of heating installations, refrigerators or washing machines or by intelligent charging of electric vehicles.

Several technologies are available for matching supply and demand of energy. This project uses agent based technology. In this technology all consumers and producers are represented by an agent, connected to a power matching auctioneer agent. Producers of energy are interested in supplying energy at a high price, while consumers are interested in consuming energy when the price is low. Each device makes a bid to an auctioneer in the form of a bid curve. The bid curve shows how much energy the device is willing to supply/consume at different prices and at different times.

A particular challenge is how to deal with the simultaneous optimization of heat and electricity generation in the face of competing technologies. Depending on the price of each commodity (gas, electricity), a preference may be given to either equipment.

Currently, the price is used as a means to arrive at a match of supply and demand. In alternative systems, it is called 'priority'. However, the mechanism offers the possibility, through a so-called 'objective agent' or 'business agent' to represent an external factor to affect the price on the energy market. It can have the effect that in times of energy abundance (low prices) energy is stored and sold in times of scarcity, when prices are high, thus representing a particular 'business case'. The development of new business models and service concepts that are attractive to both users and suppliers is part of the project.

**Thermal storage.** Thermal storage is another important technology developed in the E-Hub project for matching supply and demand of heat. Renewable heat can be stored underground, in distributed heat storage or in thermo-chemical materials (TCM's) for prolonged periods without heat losses and used in periods of high demand.

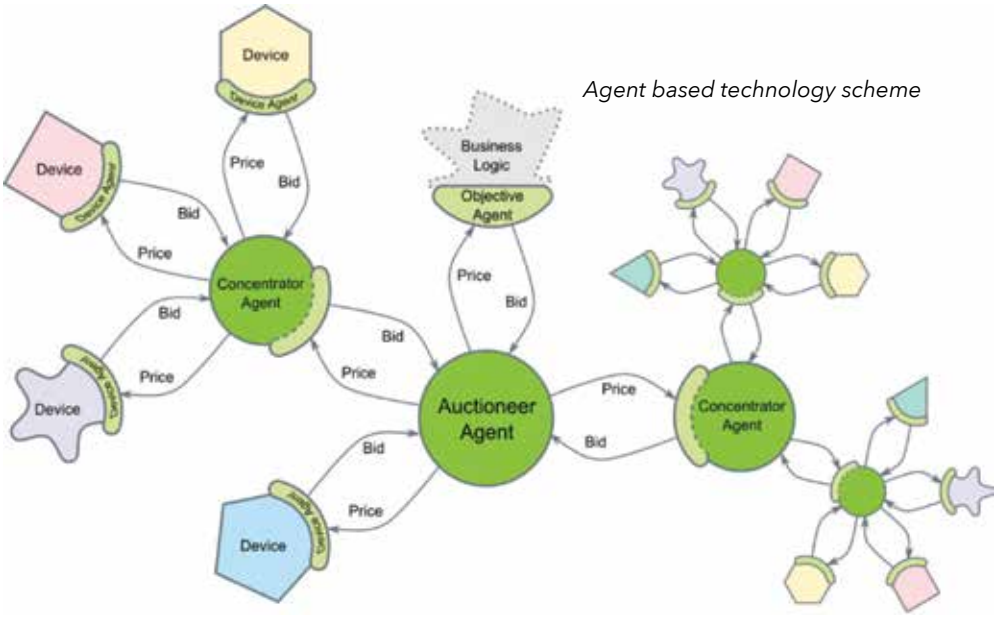
**Demonstration.** The new type of energy system will be demonstrated in the district of Tweewaters in Leuven, Belgium. The heart of the energy supply is a biomass fired cogeneration unit, which is expected to provide 80% of renewable heat and 100% of renewable electricity to the district. A new type of business model will be applied, offering energy related and other services, called MyJames.

**Impact.** Energy prices are expected to rise in the future because of the decrease of fossil fuel stocks and increasing demand for energy. If the increasing public awareness of the effects of the greenhouse gas emissions is added, the future energy supply systems are expected to change.

The share of renewable energy will grow considerably and due to the fluctuating nature of this energy supply, the application of energy buffers and energy management systems will become essential to match the demand with the supply of energy.

The energy rating system is expected to change from the current flat rate to a price differentiation being more expensive in times of shortage of energy supply. The software to be developed in the E-hub project already uses a pricing mechanism to match the supply and demand of energy. This system therefore is well prepared for future price differentiation.

**Contact:**
Leonardo Subias Subias
Telephone: +34 954 98 15 56
seviag05@acciona.es
E-HUB Project
www.e-hub.org




*Agent based technology scheme*

*Render of Tweewaters district in Leuven (Belgium)*

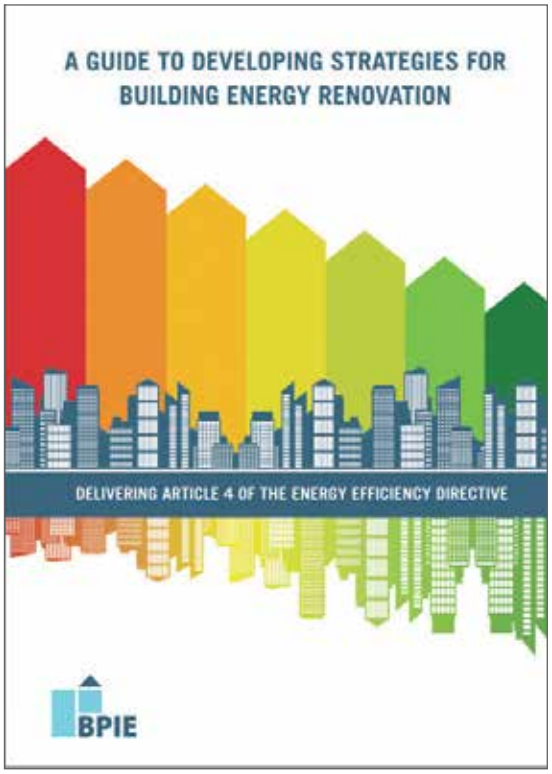
# Renovating buildings to high energy performance standards:

## an effective investment delivering multiple benefits – if done properly

*The Buildings Performance Institute Europe (BPIE) has recently published a guide on how to efficiently develop national building renovation strategies. The concise document highlights the multiple benefits arising from improving the energy performance of buildings and looks into the important challenges and their achievement.*

In Europe, deep renovations are specifically encouraged by article 4 of the Energy Efficiency Directive (EED, 2012/27/EU) through the requirement for Member States to establish long term strategies for the renovation of national building stocks covering all building types, including residential and non-residential buildings, whether in private, public or mixed ownership.

Alongside EED, the Energy Performance of Buildings Directive (EPBD, 2010/31/EU), recast in 2010, sets out numerous requirements including energy performance certification of buildings, inspection regimes for boilers and air conditioning plants, and requirements for new buildings to be nearly zero energy. EPBD also sets minimum energy performance standards for buildings undergoing major renovation. Together, EED and EPBD provide a framework for Member States to drive the reduction of energy use in buildings, thereby delivering a range of economic, environmental, societal and energy security benefits described below.




BPIE's renovation guide argues for Member States to be visionary when planning for a long term strategy for building stock renovation: it is vital that national renovation strategies are ambitious in their scope and coverage, and that they take full advantage of the state of the art, in terms of technology, policy and institutional arrangements. The guide describes the strategy development process in detail, zooms in on the five key phases and a suggested list of actions Member States could take to underpin the strategy.

The five key phases are:

- Identifying key stakeholders and information sources
- Technical and economic appraisal
- Policy appraisal
- Drafting and consulting on the renovation strategy
- Finalisation, publication and delivery

"The renovation of buildings to high energy performance standards", says Oliver Rapf, Executive Director of BPIE, "could be the most cost-effective investment a nation can make, given the benefits in terms of job creation, quality of life, economic stimulus and energy security that such investments deliver."

There are, indeed, multiple benefits arising when the energy performance of existing buildings is improved. The most obvious ones are the savings on energy bills that accrue to the building owner or investor. Additional benefits are improved comfort, better internal air quality, improved sound insulation and increased property value (sale or rental). These additional benefits are rarely factored into the investment calculation.

However, the full range of benefits can only be appreciated at a societal level. These include: reduced energy imports, thereby improving balance of payments; job creation – in manufacturing, installation and throughout the extensive supply chain of products and services; in turn, these new jobs reduce unemployment costs, increase tax receipts and stimulate local economic growth through increased disposable income. Other benefits are linked to health and improved living conditions, lower air pollution, resulting in fewer working days lost to ill health and a lower burden on state health services, as well as energy system benefits: saving a unit of energy is cheaper than supplying one, thereby avoiding the cost of new generation capacity and other supply infrastructure. Lower heating demand in winter, and cooling demand in summer, reduce the traditional peaks in energy use which are the most expensive to supply, so costs are reduced for all users. In addition, cutting energy use in buildings is the cheapest way of reducing carbon emissions, according to the Intergovernmental Panel on Climate Change.

Quantifying all these impacts is not an easy task, yet it is one that the energy efficiency team at the International Energy Agency has taken on board as a current assignment[1]. If the co-benefits were systematically monetised in economic appraisals of renovation investments, they could significantly exceed the energy cost savings, according to leading experts in the field. The key challenge is to find a way to reflect the societal benefits in the decision making processes of millions of individual building owners.

BPIE encourages Member States to view the requirement to develop renovation strategies as an opportunity to modernise building stocks and in the process, reap these multiple benefits.

*Example of a renovation in Czech Republic*
Photos courtesy of CECODHAS

*Download the reports on the BPIE website at:* **http://bpie.eu/renovation_strategy.html**

**About BPIE**
The Buildings Performance Institute Europe (BPIE) is a European not-for-profit think-do-tank, delivering policy analysis, advice and implementation support. Its focus lays on knowledge creation and dissemination in the field of energy performance in buildings. The Brussels-based institute, in operation since February 2010, is the European Hub of the Global Buildings Performance Network.
Visit **www.bpie.eu**

[1] http://www.iea.org/media/workshops/2012/energyefficiency/description.pdf

Messe München International

21st International Trade Fair and Congress
for Optical Technologies–
Components, Systems and Applications

# LASER World of PHOTONICS

LIGHT APPLIED

40 YEARS
DRIVING INNOVATION
1973–2013

WE GIVE
PHOTOVOLTAICS
THE GREEN LIGHT.

As the world's leading trade fair, LASER World of PHOTONICS has been bringing together all of the industry's key players for 40 years. It combines research and industry, which promotes the cost-effective use of lasers in photovoltaic production. And it gives you a complete overview of suppliers and concrete solutions for your daily business. Innovations and trends? They are presented here first. Practice-oriented? Our application panels thrive on it. Join us as we take the lead. Register online at **www.world-of-photonics.net**

MAY 13–16, 2013

www.world-of-photonics.net

MESSE MÜNCHEN

# Green Photonics: at the heart of Europe's innovation

*Article by Commission Vice-President Neelie Kroes*

In the coming decades, Europe is faced with a number of daunting challenges in the energy field. We now know that traditional means cannot help us deal with them. We need modern tools to tackle modern needs. Photonics is very well placed to help us deal with these energy challenges, as described in Europe 2020, the EU strategy for smart, sustainable and inclusive growth for the coming years.

Green photonics technologies, in particular, are a solution to many of our energy problems. They are used for generating energy (solar photovoltaics). And they are also used for substantially reducing energy consumption, be it in lighting through LEDs and Organic LEDs, laser-based manufacturing or optical fibres and photonics devices for broadband communication networks and large data centres. In practice, this means they generate less greenhouse gas emissions and less pollution than traditional technologies.

To explore all the options photonics can offer, the European Commission is funding many research and innovation (R&I) initiatives under the EU's 7th research framework programme (2007-2013). Our aim is to strengthen the industrial competitiveness and the green technology and market potential of the European photonics industry. The budget for the programme's 7 years is more than €550 million, of which around €130 million will be spent on green photonic technologies (optical communications, lighting, and lasers for manufacturing). Another €180 to €200 million will be spent on solar photovoltaics. With all these R&I initiatives we contribute to strengthening the photonics knowledge base and to creating stronger industrial value chains which require closer cooperation between industrial players and end-users.

And that's not all. We are now in the process of preparing a photonics public private partnership, as part of Horizon 2020, the new EU framework programme for R&I for the period 2014-2020. This will be a partnership between the European Commission and industry (both large industry and SMEs), research & academia, end-users, as well as regional and national innovation clusters. The aim is to ensure Europe's industrial leadership in this high growth global market. In fact, we are particularly aiming at areas like solid state lighting (SSL), photonics-enabled devices for health or optical photonics technologies and systems. These are areas where photonics is driving innovation, where new markets can be created, and where Europe is strong. We expect that this long term investment commitment by both industry and the EU will accelerate Europe's innovation process and time to market, it will foster photonics manufacturing, and ultimately, it will create growth and jobs in Europe.

And we also want to mobilise Europe's potential to provide answers for some of the major societal challenges we are facing today, such as in healthcare, in well-being, or in energy efficiency.

*Neelie Kroes*

There is a long way to go. But the good news is this: there is huge potential in photonics applications. For example, SSL is not just the best lighting solution. It is also a way for us to save up to 70% energy and reduce costs compared to other lighting technologies. SSL can drive innovation in the lighting, construction and transport sectors and offers tremendous opportunities for our businesses – many of them SMEs – leading to jobs and growth in Europe (let's not forget the European lighting sector today employs around 150,000 people). Another example is clean laser-based manufacturing. Europe has a leading position in developing, supplying and applying laser systems for resource-efficient and energy-efficient manufacturing. This is a large market area with continuing growth as laser-based manufacturing is used in an increasing range of applications.

Green photonics is key to providing new and better solutions to many of the challenges we are facing today and in the future. In Europe, we need to build further on our current strengths and translate them into economic growth for Europe and Europeans.

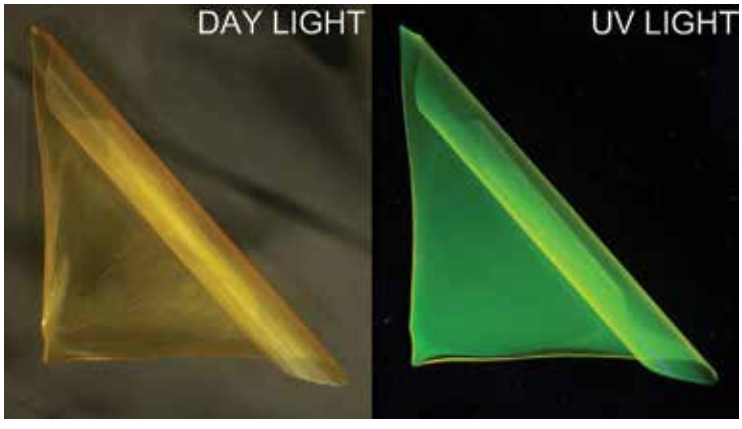
# Can Nanophotonics Help to Combat Energy Problem?

*Asst. Prof. Dr. Nihan Kosku Perkgoz, Anadolu University, and Projects Coordinator, Bilkent University and UNAM Nanophotonics for Energy Efficiency – N4E*

Nanophotonics can simply be defined as the study of light-matter interactions at the nanometer scale and can potentially find its place in energy related research studies, e.g., for generating light with less energy consumption, harvesting light more efficiently and reducing the polluting emission using photocatalytic activity. Our energy future is a growing and universal problem to be addressed collectively. For sustainable Earth, reducing energy consumption, increasing alternative energy sources and decreasing polluting emission are crucial. As a remedial action, there are different possible approaches. The Devices and Sensors Research Group at Bilkent University and UNAM (Ankara, Turkey) under the supervision of Professor Hilmi Volkan Demir investigates innovative nanophotonic approaches to address the global energy problem. The Demir Group has been working on innovative chip-scale nanophotonic and optoelectronic platforms, embedded with nano- and micro-scale functional structures in hybrid architectures.

The Demir Group mainly focuses on efficient energy utilization and sustainable energy generation by developing new nanophotonic and optoelectronic systems. Among the Demir Group research projects are high-quality high-efficiency semiconductor LED lighting, FRET-based light generation and harvesting, energy transfer phenomena, and nanocrystal optoelectronics, metal nanoparticle and nanowire optoelectronics. Bilkent attracts the top high school graduates and faculty in the fields of fundamental sciences and engineering in Turkey. Bilkent prides on well-established research infrastructure along with UNAM facilities and ranks among the top in terms of research outputs in science/engineering in Turkey. With over 60 separate labs, UNAM houses state-of-the-art nanofabrication and nanocharacterization tools including TEM, ESEM, SEM, EBX, XPS, XRD, NMR, EBL, and FIB.

*Professor Hilmi Volkan Demir*




When the Demir Group at Bilkent started its research activities in 2005, the team focused on high-quality white light sources based on nanocrystal hybridization with tunable photometric properties. These nanocrystals exhibit favorable electronic and optical properties with their tunable bandgap by controlling their size. Making use of multiple combinations of nanocrystals, the Group demonstrated high-quality white light generation with tunable photometric properties (Nanotechnology and Nano Letters). The Group still holds the records of the best photometric

http://www.devicesandsensors.bilkent.edu.tr/en/
http://www.bilkent.edu.tr/~volkan/
www.n4e.eu

performance of white LEDs (Optics Letters and Applied Physics Letters) In parallel with these studies, the world's first nanocrystal based UV scintillator was carried out in the Demir Group, demonstrating doubled solar conversion efficiency in UV using amorphous silicon photovoltaic platform. (Optics Express). Promising results have been achieved by using nanopillar structure for enhanced photovoltaic efficiency as well. Likewise, by a comparative study of nanoparticles, a substantially enhanced photocatalytic activity has been achieved for massive environmental decontamination (Applied Catalysis B: Environmental). Recently, the Group has also reported large-area (over 50 cm × 50 cm) freestanding sheets of colloidal quantum dots (Nano Letters) and polarized emission using isotropic quantum dots in plasmonic cavities (ACS Nano).

The Demir Group is a partner of the Nanophotonics for Energy Efficiency (N4E) Network of Excellence, which focuses on nanophotonics research towards the challenges in energy efficiency. The Network clusters nanophotonic laboratories and research groups in Europe, combining their expertise in the development of disruptive approaches to lighting and solar cell technology. The consortium consolidates know-how and resources of 9 different institutions in 6 European countries with complementary research and development expertise, integrating over 130 scientists, engineers, technicians and managers in nanophotonics. Moreover, it is open to participation and collaborations with other stakeholders through two key instruments: Associate Membership and participation in the Seed Project scheme. The project pursues a scientific bottom-up approach to ensure that novel ideas and scientific breakthroughs as well as established proof-of-concepts in academia are promoted along the value chain towards reaching their eventual goal of commercialization. Market and industrial relevance is ensured through the involvement of industry leaders in the Advisory Board. This approach complements the existing top-down, industry-driven projects.

The Demir Group is also very active in synergic entrepreneurship activities in Turkey, Europe, the US and Asia, based on high-technology prototypes the Group have developed and in taking new ideas from the lab to the market. Professor Demir is a co-founder and a partner of several successful startup companies. Based on their joint research work and intellectual property, he first co-founded a nanotechnology based company, called InnovNano, which was then successfully turned into a joint venture, called InnovCoat, together with Materis, France.

As a result, the answer to the question of **"Can nanophotonics help to combat energy problem?"** is YES but a cautious yes… There are very important and promising results to be optimistic about but still there are some essential wide-scale commercialization efforts required for such scientific results to become practical.

# Black Silicon Photovoltaics

Silicon Photovoltaics is one of the most promising technologies for renewable and sustainable energy sources. This is in particular true within the context of protecting our environment, climate, and resources. Reducing the costs of photovoltaic systems is essential to accelerate the market launch and the wide distribution of this technology. Therefore, a significant increase of the conversion efficiency from solar to electrical energy is necessary. Black Silicon (b-Si) is a novel material which is currently under investigation by several research groups to explore its potential for innovative high-efficiency solar cells.

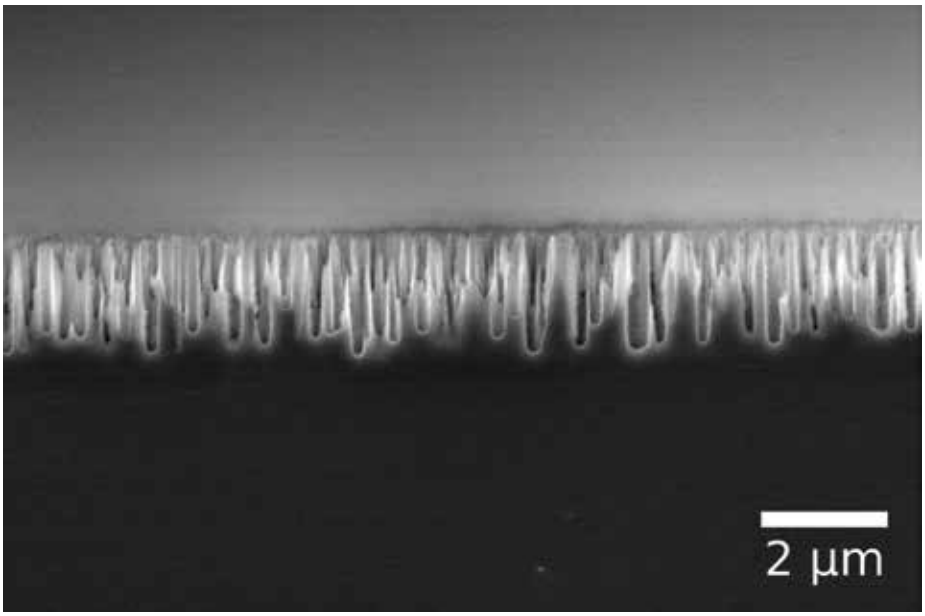
The conversion efficiency of solar cells is closely related to the efficient use of the materials involved. The current trend in photovoltaic devices is directed towards thinner solar cells seeking for higher efficiencies. A promising route to enhance the efficiency is to increase the absorption probability for the solar photons (the energy quanta of light) impinging on the photovoltaic device. The more solar photons are absorbed by the solar cell, the more electron-hole pairs are generated which contribute to the attained electrical current and voltage. Therefore, photon management becomes essential, i. e. approaches that influence the properties of the impinging light with the aim to increase the efficiency of the solar cell, such as the manipulation of the light path (e. g. light trapping) or changing the photon energy (e. g. up-/down-conversion). Due to the tremendous progress in nano-optical technologies within the last decade advanced photon management concepts become feasible.

B-Si posseses extraordinary light trapping properties. Essentially, b-Si is a surface modification of silicon. The surface texture consists of densly packed needle-like peaks and pits of irregular shape and high aspect ratios with feature sizes in the sub-µm range (see Figure 1). B-Si surfaces can be prepared by several methods such as metal-assisted wet-chemical eching or inductively coupled reactive ion etching. The special morphology of b-Si leads to a strong diffuse scattering of the sunlight, i. e. the angular distribution of the light rays is randomized after entering the solar cell. This and subsequent utilization of total internal reflection captures the light inside the cell. Consequentely, the light path is highly increased compared to the case of planar interfaces. Enhanced light trapping takes place and thus, the light absorption probability is strongly increased.

The experimentally measured spectral absorption of a b-Si sample prepared by inductively coupled plasma reactive ion etching is plotted in Figure 2. Nearly complete suppression of the reflectivity over a broad spectral range ist achieved, making b-Si far more effective than conventional approaches, such as planar anti-reflection coatings. In the spectral region of the electronic band gap of silicon (around a wavelength of 1100 nm) b-Si clearly outperforms even a theoretical perfect anti-reflection coating. Furthermore, the absorption virtually reaches the Yablanovitch limit, which is the theoretical upper limit for light trapping concepts. First solar cell prototypes made of b-Si have already been demonstrated with efficiencies of up to 18.2%.

However, strongly textured surfaces, such as that of b-Si, usually reveal low charge carrier lifetimes. This limits the device perfomance because low charge carrier lifetimes prevent an efficient extraction of the photo-generated charge carriers needed to generate a usable electrical current. Great efforts are currently undertaken to reliably overcome this drawback. Nevertheless, it has been shown recently by our group that an appropiate passivation of the b-Si surface

*Figure 1: Scanning electron microscope image of a b-Si surface.*




by a thin dielectric layer, i. e. a conformally deposited layer of $Al_2O_3$, can effectively suppress these negative effects. Treating a b-Si sample by this approach recovers the electronic properties of Silicon almost completely, and thus enables the further development of a new generation of high-efficiency b-Si solar cells.

***Authors:***

**Alexander Sprafke**
**Martin Otto**
**Johannes Ziegler**
Institute of Physics, Martin-Luther-University of Halle-Wittenberg, Heinrich-Damerow-Str. 4, 06120 Halle (Saale), Germany

**Ralf B. Wehrspohn**
Fraunhofer Institute for Mechanics of Materials IWM, Walter-Hülse-Str. 1, 06120 Halle (Saale), Germany,

and

Institute of Physics, Martin-Luther-University of Halle-Wittenberg, Heinrich-Damerow-Str. 4, 06120 Halle (Saale), Germany

**Kevin Füchsel**
**Andreas Tümmermann**
Fraunhofer Instituts for Applied Optics and Precision Engineering IOF

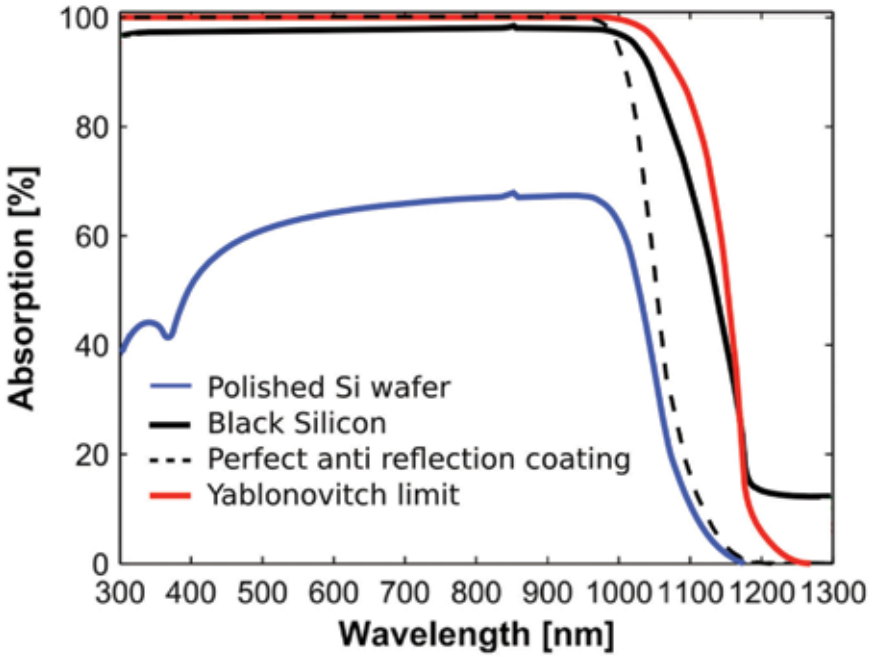



*Figure 2: Spectral absorption of a b-Si sample (black), an unstructured Si surface (blue), a perfect planar anti reflection coating (dashed), and the theoretical upper limit (Yablonovitch limit, red).*

# From nanoscale to gigawatt:
## how photonics empowers photovoltaics

*Ounsi El Daif, Christos Trompoukis, Valérie Depauw, Jef Poortmans*
*IMEC-PV, Leuven, Belgium*

### Rationale

Crystalline silicon (c-Si) wafers dominate the field of photovoltaics (PV). This material is processed in cells that are then assembled together into modules. This method is however reaching its limits both in terms of cost and concepts.

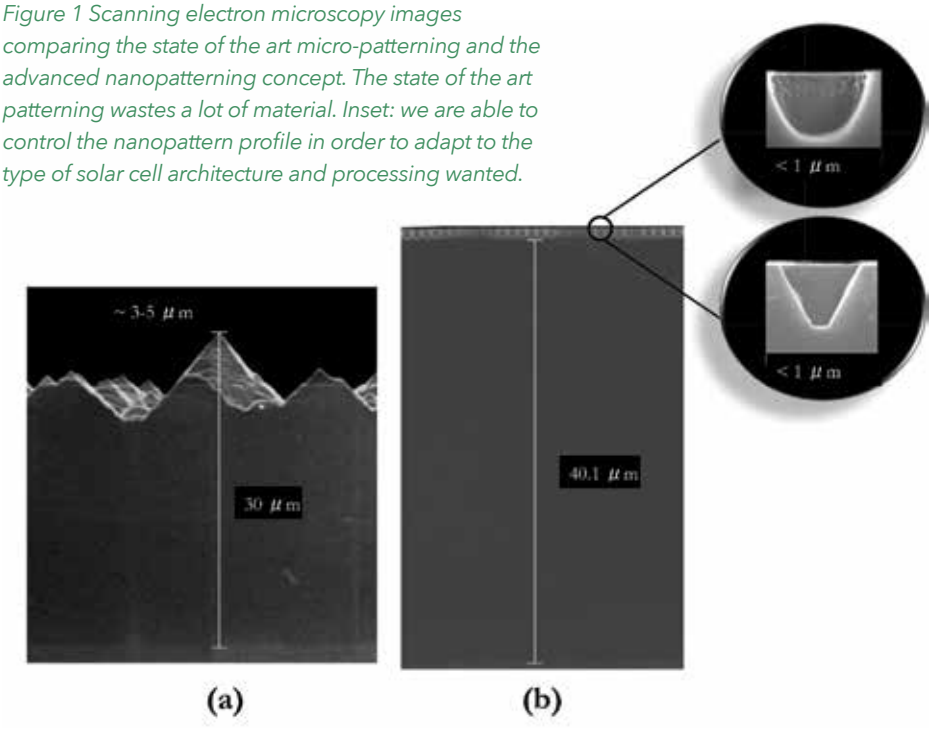
Imec proposes to combine the strong aspects of c-Si and of thin films, through the direct cell-on-module engineering of very thin c-Si layers (some tens of microns thick[i]).

### The concept

However, using an integrated type of engineering at the module level is not enough to empower those c-Si thin layers. Indeed c-Si is weakly absorbing and becomes even semi-transparent when thinned down below 40 microns. This is where nanophotonics enter the game and offers a breakthrough solution. The recent advances in the exploitation of the wave-nature of light, combined with the new possibilities in the manipulation of matter's shape at the nanoscale (the visible light's wavelength is around a few hundreds of nm), allow implementing a unique combination of features in order to make thin c-Si modules come to reality:

- A progressive and smooth nanopatterning of the silicon surface allows decreasing further the amount of light lost by reflection. Combined with a back contacting concept, this can yield perfectly black surfaces.
- A well designed patterning parameters and stack architecture allows taking advantage of interference-based effects in order to efficiently trap light into the thin-film layers of cSi, thus further enhancing their absorption.
- Overall, a patterning of less than one micron deep reducing the c-Si material loss that goes together with the traditional texturing methods by one order of magnitude.

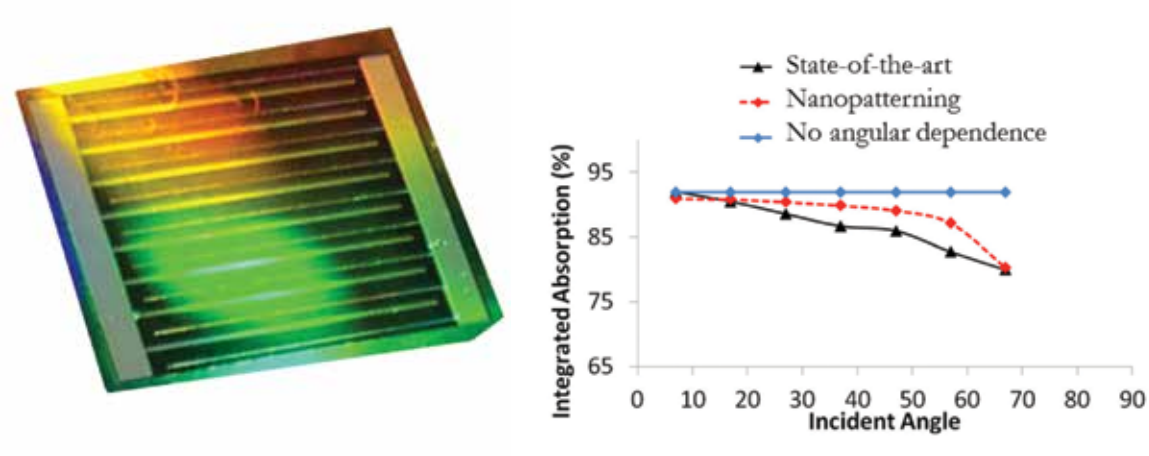
*Figure 1 Scanning electron microscopy images comparing the state of the art micro-patterning and the advanced nanopatterning concept. The state of the art patterning wastes a lot of material. Inset: we are able to control the nanopattern profile in order to adapt to the type of solar cell architecture and processing wanted.*




### The achievements

At the crossroads between industrial PV, photonics, and microelectronics, the PV group at imec has developed innovative ideas based on nanophotonic concepts allowing the control of the c-Si's

*Figure 2 (a) A picture of the surface of the 1st lab-scale cell made with nanopatterning (ref ii): its visible effect is a rainbow due to diffraction of light on the periodic nanotexture (b) Evolution of the integrated absorption with the angle of incident light for: an ideal cell, a state-of-the art cell, a nanopatterned cell (with our present parameters, before optimization).*




pattern profile at the nanoscale.

A control of this profile over broad surfaces allowed reaching the performances of the state-of-the-art random pyramidal texturing in terms of decrease of reflection. And allowed even reaching further than state-of-the-art by allowing a relative angular independence of the cells' optical properties

## THE PLAN

We were able to make a first lab scale demonstrator cell[ii]. We are now in the process of improving this thanks to optimised nanopatterning parameters[iii], including concepts of a beneficial disorder, through collaborations with universities working on the theoretical aspects.

The final device will feature a synergetic integration of cell and module engineering, with the best light trapping possible through nanopatterned surfaces, while keeping the good material properties offered by c-Si. The use of nanopatterning will empower thin c-Si modules, and help the use of PV modules in any weather condition; even cloudy. Further, the use of nanophotonics concepts can be taken deeper and help controlling e.g. the colour of the panels or their infrared absorption, so as to combine aesthetics with usefulness.

**Acknowledgment**

PhotoNVoltaics European project (European FP7 nr. 309127)

SiLaSol Flemish project (IWT-project nr. 90047)

[i] Dross, F.; O'Sullivan, B.; Debucquoy, M.; Bearda, T.; Govaerts, J.; Labie, R.; Loozen, X.; Granata, S.; El Daif, O.; Trompoukis, C.; van Nieuwenhuysen, K.; Meuris, M.; Gordon, I.; Posthuma, N.; Baert, K.; Poortmans, J.; Boulord, C.; Beaucarne, G., "18% Efficiency IBC Cell With Rear-Surface Processed on Quartz," Photovoltaics, IEEE Journal of , vol.PP, no.99, pp.1-6, 2013

[ii] Trompoukis, C.; El Daif, O.; Depauw, Valerie; Gordon, I.; Poortmans, Jef, "Photonic assisted light trapping integrated in ultrathin crystalline silicon solar cells by nanoimprint lithography," Applied Physics Letters , vol.101, no.10, pp.103901,103901-4, Sep 2012

[iii] Herman, Aline; Trompoukis, Christos; Depauw, Valerie; El Daif, Ounsi; Deparis, Olivier, "Influence of the pattern shape on the efficiency of front-side periodically patterned ultrathin crystalline silicon solar cells," Journal of Applied Physics , vol.112, no.11, pp.113107, 2012

# Photonics Technologies for the Low Carbon Economy

*Iain Weir, Director, Optimat Ltd*

*Iain Weir*

Photonic technologies have an important role to play in the development of the low carbon economy. This was detailed in a study funded by DG Connect, European Commission[1] that assessed five applications of photonics (photovoltaics, energy efficient lighting, energy efficient communications, advanced sensors and instrumentation and clean manufacturing) to

- analyse Europe's market position in "green photonics technologies"
- assess the potential to develop promising new technologies
- identify potential intervention options that address the barriers to the adoption of photonics.

It is estimated[2] that photovoltaics can produce 12% of Europe's energy needs by 2020 and make a significant contribution to CO2 savings. The potential of photonics technologies to support this is significant. Developments in materials, cells, modules and manufacturing technology are expected to enable electricity generation at lower costs. This has been recognised by the European Commission which has funded a significant portfolio of relevant[3] projects. However, the Far East has become the main manufacturing region for photovoltaics.

Energy efficient lighting is a rapidly developing application for photonics. Light emitting diodes (LEDs) are already available for lighting applications and by 2020 are expected to account for over 90% of this market[4]. In the longer term organic LEDs will be used in numerous lighting and display applications. The key barrier to development is cost and new photonics technologies are important in overcoming it.. The utilisation of energy efficient lighting is expected to achieve between 40% and 70% energy savings, thus making a significant contribution to CO2 reduction.

Energy efficient communications are critically dependent on a range of photonics materials, components and systems. Significant demand for increased capacity in communications networks is expected to be addressed by applying a range of photonics technologies. The European industry is in a strong position to address these requirements, based on its recognised manufacturing and research capability. The adoption of these new photonics technologies is expected to enable significantly higher network capacity without concomitant increases in energy consumption.

Advanced sensors and instrumentation contribute significantly to the monitoring of greenhouse gas emissions. Photonics technologies underpin current and developing products. It is expected that these technologies will support better measurement and control and thus reduced emissions.

Laser systems are already used significantly in clean manufacturing and Europe is a major player in both manufacturing and technology development. It is expected that Europe will retain this position and will benefit from wider exploitation of lasers as manufacturing tools in the future.

Photonics technologies for low carbon applications is already a €billion global market and this is expected to continue to grow in all areas. The ongoing use of these technologies is expected to deliver significant environmental impacts. However, a number of barriers to the maximum deployment of photonics technologies have been highlighted and a range of potential interventions to address these barriers have been identified. These interventions are (a) research, development and innovation programmes, (b) subsidised market development programmes, (c) market "re-engineering" and (d) overcoming regulatory and standards issues. The overall focus of the first two of these interventions is fully consistent with the analysis carried out by the High Level Expert Group on Key Enabling Technologies[5] while the latter two address specific market related barriers for photonics technologies.

**1** "Photonics and Markets for a Low Carbon Economy", Ref: SMART 2010/0066, DG Connect, European Commission, published 2012 – see http://cordis.europa.eu/fp7/ict/photonics/studies_en.html

**2** Solar Generation 6 – Solar Photovoltaic Electricity Empowering the World, EPIA and Greenpeace, 2011

**3** Solar Generation 6 – Solar Photovoltaic Electricity Empowering the World, EPIA and Greenpeace, 2011

**4** Electical engineering and semiconductor equipment: Winners and losers in a radically changing lighting market driven by LED, J.P. Morgan Cazenove, March 2010 and Lighting the Way. Perspectives on the Global Lighting Market, McKinsey and Co., July 2011

**5** Final Report, High Level Expert Group on Key enabling Technologies, European Commission, June 2011

**Contact:**
Dr. Jan Christoph Goldschmidt, Dr. Martin Hermle, Dr. Benedikt Bläsi
Fraunhofer Institute for Solar Energy Systems ISE, Heidenhofstr. 2, 79110 Freiburg
Jan.christoph.goldschmidt@ise.fraunhofer.de

# Photonics for Photovoltaics

Photovoltaics is the technology to harvest sunlight to generate electricity. Due to enormous cost reductions, the cost of photovoltaic electricity is now equal or lower than the consumer price in large areas of Europe, e.g. in southern Spain or Germany. Economies of scale, progress in production technologies and the improved solar cells and module achieved this tremendous result.

To continue the path of cost reduction and to maintain cost competiveness of the European photovoltaic industries, further innovation is necessary.

In solar cells, the photons of the sunlight transfer their energy to electrons. Those free electrons then flow to the solar cell's contacts, and further into electrical appliances to perform useful work. In the past, most optimization of solar cell technology concentrated on "working" with the electrons, for example maximizing the yield of free electrons reaching the contacts.

Photonic technologies allow to modify the spectral composition of the sunlight or to alter the path of the light, to increase absorption of photons in the solar cell. This so-called photon management can increase solar cell efficiencies beyond fundamental limits of current solar cell technologies by utilizing a complete new range of yet unexplored functionalities. By "working" with both the photons and the electrons, technological progress from different fields combines to propel innovation in photovoltaics.

A first example is advanced light trapping. Silicon is a weak absorber. Light trapping increases the path of the light within the solar cell, thus increasing the absorption of light. Photonic crystals and other plasmonic or photonic structures can improve light trapping substantially. This is critical for the realization of thin silicon solar cells with wafer thicknesses down to 40 µm. Since silicon wafer production amounts to 30-40% of the solar module's costs, thinner wafers are the key to both more cost and resource efficient solar cell production.

The second example is upconversion. Silicon solar cells lose about 20% of the incident energy, because some photons have too little energy to generate free electrons. Upconversion materials generate one photon with sufficient energy out of two low energy photons. First proof of concept has been achieved, e.g. in the EU FP7 project Nanospec (www.nanospec.eu), but the impact on solar cell efficiency still remains low. Here, the coupling with luminescent nano-crystalline quantum dots and the incorporation in photonic resonator structure promises to boost efficiency, contributing to higher solar cell efficiencies and lower cost of PV electricity in the long term.

*Rear side diffraction grating imprinted on a silicon solar cell precursor*

*A NaYF:Er upconverter material embedded into a transparent matrix emits visible light under excitation with invisible infrared radiation.*

# Stimulating LED innovation new focus for demand-side management

*Nils Borg*

DSM, or demand-side management, is an old term that seems to be reinvented from time to time and given new content to suit our devloping understanding of how to stimlate energy savings in our economies. As the understanding on how to deliver savings, i.e., the continuing process of redefining DSM, the technologies targeted by such programmes are quickly evolving.

LEDs, short for light emitting diodes, applied to lighting is one of the most promosing technologies offering cost-effective solutions with low life-cycle costs. Since the turn of the century, LEDs eventually started to offer such good lumen per watt performance that they become interesting as a light source to replace incandescents and fluorescents. It didn't happen as fast as we had hoped, but since around 2007 LED lighting solutions have begun to move out of the niche applications where they were hiding, into the mainstream lighting applications.

Today, LEDs offer roughly the same performance as fluorescent technologies and their colour performance is now generally acceptable, and in some cases even superior to fluorescent lighting. LEDs offer much better opportunities for control and dynamic lighting, so beyond the pure energy effieincy (lm/W) substantial savings can be harvested from intelligent lighting.

Things thus seem to be on track. Why bother about DSM or other activities that governments or utilties launch to stimulate savings? Can't we just let the market take care of this? Well, yes, and no.

The price of LED light sources are still prohibitive, especially for domestic consumers. LED manufacturers who invest in product innovation and product development face an uphill battle. Cheap and inferior products are offered to the market. Disappointed consumers shun the new technology and are simply unwilling to buy the products with a substantially higher cost than that of comparable technologies. Many serious and well established manufacturers struggle to make reasonable profits.

The US Department of Energy (DOE) recently completed a technology competition called the L prize where the winning lamp should be a viable replacement for a 60W incandescent lamp. The large and prestigeous prize was a way to create an incentive for manufacturers to invest in developing a quality product despite uncertainty in the market. DOE offered prestige, a clear target in terms of a good specification, and a comprehensive system of consumer information, testing and quality assurance to help the winner and its peers to market quality products. It is the systematic way of organising the market that is part of managing the energy demand and help securing investments in product development.

The International Energy Agency's Implementing Agreement for Efficient Electrical End-Use Equipment (4E) runs an Annex on Solid State Lighting for which I happen to be the Operating Agent. DOE and nine other governments around the world co-operate in the SSL Annex around activities aimed at creating confidence in the market place.

The SSL Annex aims at providing funding governments with:

- Tools to assess the performance of SSL,
- Information assisting formation of energy-efficient lighting policies, and
- Provision for harmonized test procedures and laboratory accreditation

By working with stakeholders all around the world, the SSL Annex is promoting a framework for innovation and investment in SSL technologies. The market forces are very much at play here, but we hope to level the playing field and to broaden the market.

Another aspect of DSM is *technology procurement*. Here, the government works with important buyer groups to establish functional specifications for a product or system. Typically, these specifications outline a product that does not exist on the market but that is technically feasible, and most likely commercially realistic. The specifications should focus on *functional* requirements and not on specific technical solutions. This is up to innovative manufacturers to solve, and this is also the reason why this sort of process is sometimes called *innovation procurement*.

Winners of the competition are typically promised a first order. The important point, however, is not the size of the first order (it may in fact be unimpressive). Prestige and visibility plays a large role, as in the L Prize above. But more important is the fact that a carefully designed technology procurement activity brings together leading and competent buyers. Their functional specification represents something that the market is likely to ask for in the future, and a smart manufacturer will take notice.

The Swedish Energy Agency is currently looking into the possibility of setting up a technology procurement for LED street lighting equipment. Many readers will note that LED street lighting is already being installed at an increasing speed. So why would a procurement be needed here?

Many of the new luminaires may be efficient and offer very long life. But far too often, the optical performance is poor and it is very hard for buyers to know how to solve end-of-life problems. Unlike traditional fixtures it is not just to change a lamp. With LEDs, should a buyer go for an offer to replace the luminaire or replacing the modules? And how is easy is that? Another important aspect is to find luminaires that can be used to replace old luminaires on existing poles and thus utilizing the existing infrastructure.

**Nils Borg**
Nils Borg is the Operating Agent of the IEA 4E SSL Annex

www.ssl.iea-4e.org

**See also IEA's DSM Implementing Agreement.**
www.ieadsm.org

# LED lighting @ crossroads

*Author: Klaus Vamberszky*

*(above) Figure 1: Gordon Moore*

*(below) Figure 3: Dr Roland Haitz*

For many years, Europe has led the way in the area of lighting. No other region in the world surpasses us in the quality of our lighting solutions.

LEDs are currently in the process of superseding fluorescent lamps for indoor lighting and high-pressure lamps for outdoor applications as the most commonly used light source. This transformation has been enabled first and foremost by the success of the semiconductor industry in increasing efficiency while simultaneously reducing costs.

The semiconductor industry has "laws" of its own – the most well-known being Moore's Law *(Figure 1 and 2)*, which states that component density will double every two years.

This was the basis for Moore's idea that the processing capacity of computers can be doubled every two years, which gave rise to great expectations. The fall in prices led to even higher expectations and an even greater pressure to innovate. Moore's Law has ultimately become a self-fulfilling prophecy for the semiconductor industry.

The computer industry continues to see an "insatiable" demand for ever higher volumes of chips offering ever greater capacity and for ever more devices – with no end in sight for this trend.

The LED industry also has its "law", which is named after Dr. Roland Haitz. *(Figure 3 and 4)*.

This states that every decade, the cost per lumen falls by a factor of 10, while the amount of light generated per LED package (chip) increases by a factor of 20. In the year 2000, Haitz also predicted that LED efficiency would cross the magical 100 lm/W mark in 2010 and achieve 200 lm/W in 2020.

Haitz was therefore following in Moore's footsteps; he sought and found a similar mathematical law and – based on this similarity – held out the prospect of the lighting industry experiencing a similar development to that of the IT industry.

"You can't cheat physics" is a well-known catch phrase in technical and scientific circles, and it also applies in this case. The energy efficiency of the LED has clear physical limits; they are reached at roughly 250 lm/W for colour conversion, or 300 lm/W for colour mixing to achieve white light. *(Figure 5)*.

When it comes to cost, however, the picture is quite different. Cost development is determined on the one hand by process improvements (increases in yield) as well as new materials and methods (LED on silicon), and on the other by economies of scale (bigger wafers) and merciless competition. That development still has a long way to go.

LEDs will therefore become cheaper but increasingly comparable in terms of performance. This will pave the

*Figure 2: Moore's Law*

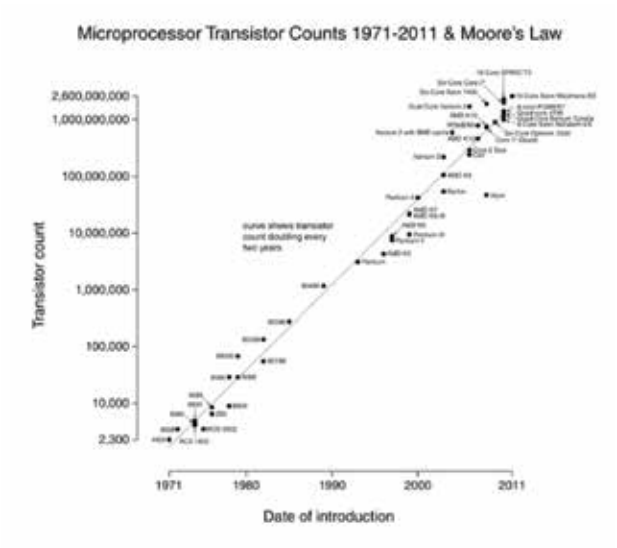
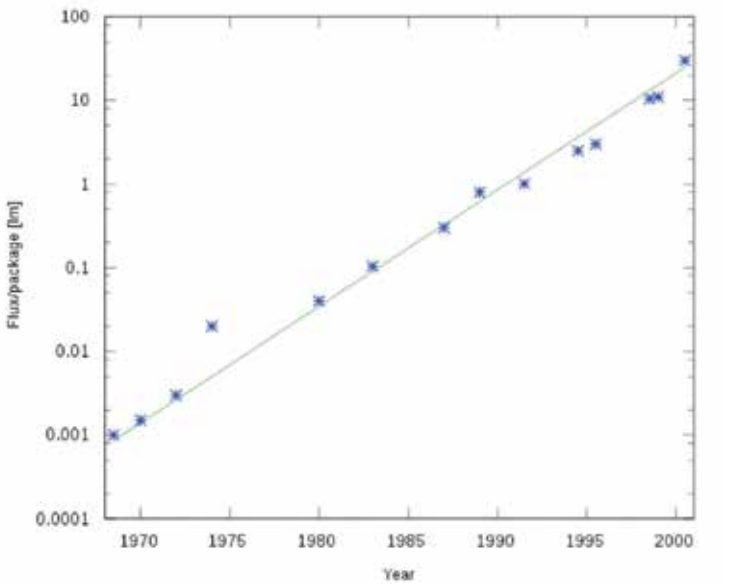



*Figure 4: Haitz Law*



way for cost-effective, energy-efficient lighting solutions with little to choose between them. Their only chance to shine will be with price/performance.

But are we overlooking something here?

Lighting is not consumer electronics; the purpose of lighting is not to entertain or pass the time; nor is it "l'art pour l'art". Its role is to serve the purposes of human beings and architecture, to fulfil a task – and to do so in the best way possible.

We only need to go back a few centuries in cultural history to discover what artificial lighting is, and we find that there is a "hierarchy of needs" with ascending levels of requirements and necessities to be met by the lighting: (Figure 6)

- We illuminate to provide safety and security
- We illuminate to enable work to be performed
- We illuminate to present objects
- We illuminate to enhance architecture
- We illuminate to promote wellbeing and health, and to address factors such as ageing and failing eyesight

The automotive industry points the way forward. To a certain extent, car manufacturers use the new opportunities for lighting and light control to differentiate and improve the styling of their vehicles for the purpose of brand building. However, the prime emphasis is on sensible new functions which enhance traffic safety and visibility – particularly in adverse conditions – such as daytime running lights, adaptive forward lighting, intersection lighting, etc.

New scientific research driven by the conventional lighting industry shows that the targeted use of light with variations in the lighting situation over the course of the day *(Figure 7)* can increase concentration, motivation and wellbeing, and compensate perception deficits due to age or illness. *(Figure 8)*

*Figure 5: LED performance roadmap*


*Figure 6: Hierarchy of Lighting needs*

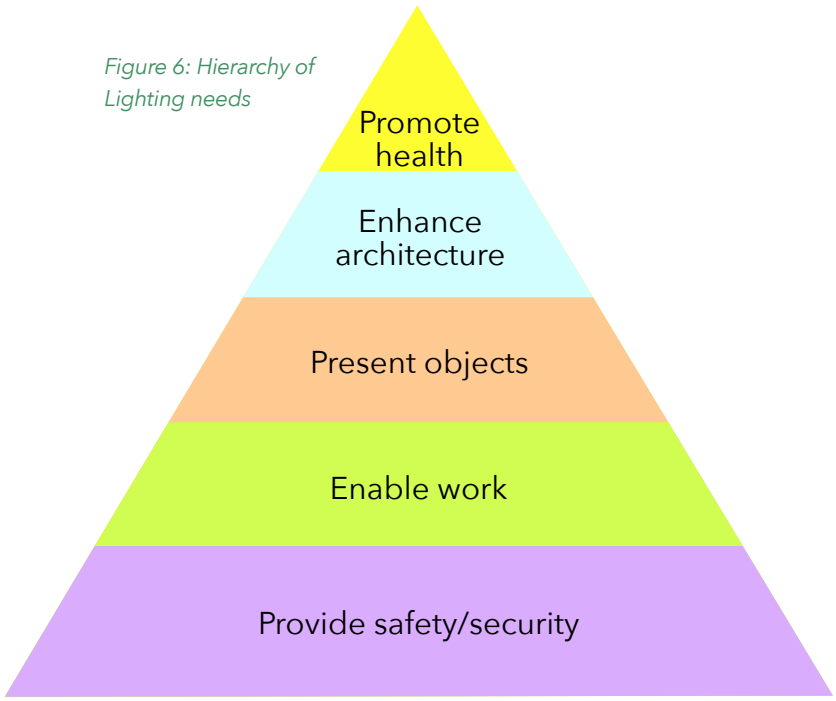
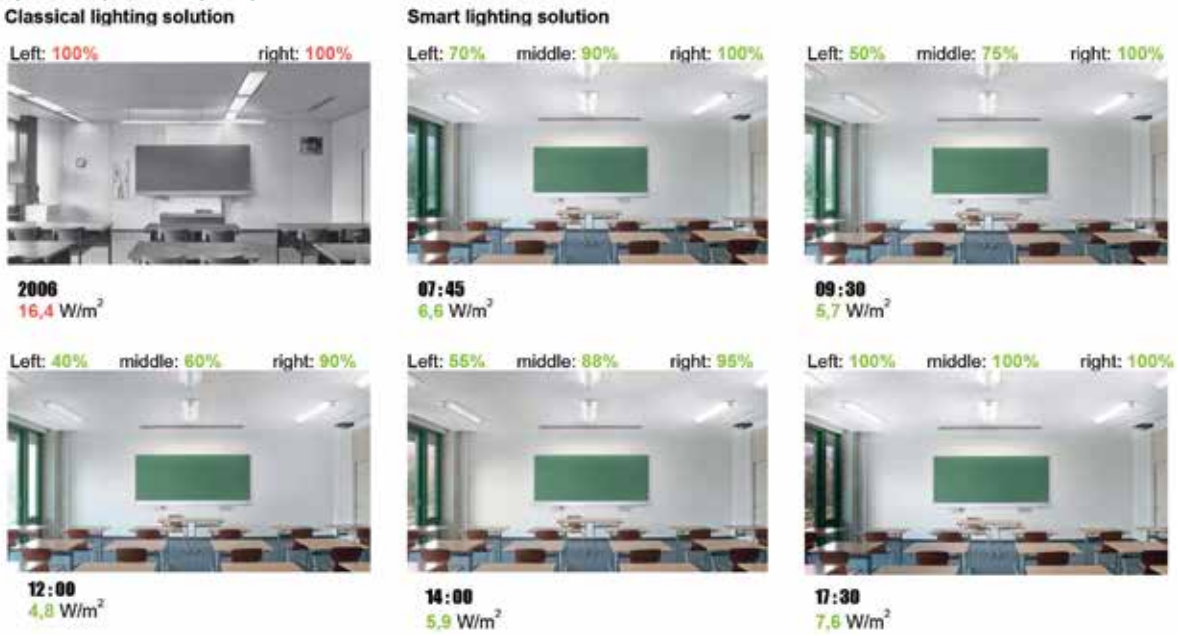


*Figure 7: Dynamic Lighting scenes*



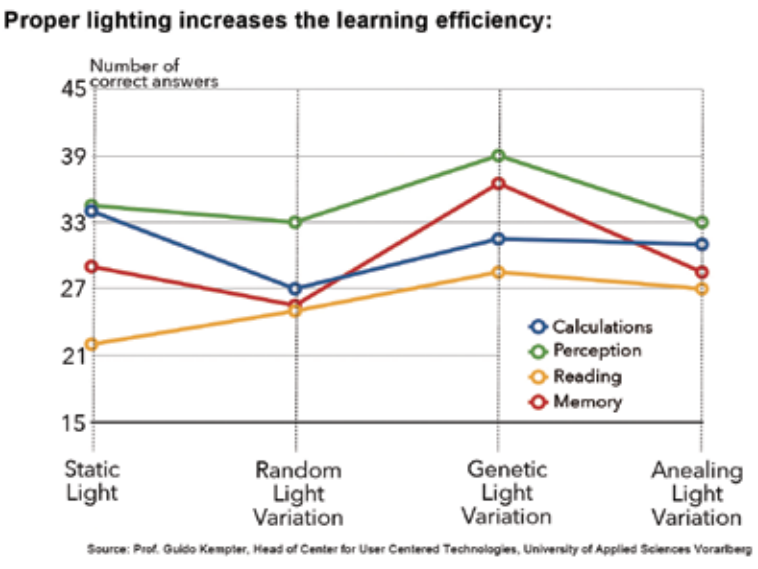

The LED is therefore the only light source that can combine energy efficiency and lighting comfort at an acceptable cost. However, LED lighting should not be seen merely as a "means to an end" (i.e. energy efficiency). It is not simply a case of creating highly standardised components that comply with the laws of electronics and semiconductor technology in order to achieve low complexity and high volumes. In other words, LED light fittings should not be regarded as commodity products.

General lighting is a B2B (business to business) sector, frequently involving several levels of trade. The users have no say in the matter; they play no part in the decision-making structure and have no influence on the choice of the lighting system. Nobody asks the industrial worker or office employee what kind of light they would prefer in the workplace – or the teacher or student about the type of light that best addresses their needs.

As experts, we are called upon to ensure that the qualitative factors of lighting do not fall by the wayside amid the euphoria over low energy consumption and low costs. It is our responsibility to champion and defend our customers, the light users, and their interests such as visual comfort, safety and quality in the workplace.

The lighting industry currently finds itself at a decisive crossroads – but the technology has the capability to satisfy both requirements: energy efficiency and lighting comfort. It is up to us to achieve precisely that. ●

*Figure 8: Results of dynamic Lighting*

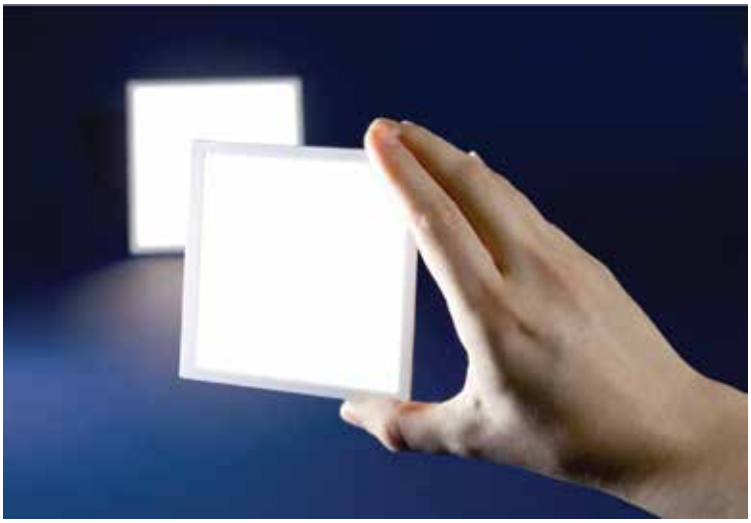



**Contact details:**
Zumtobel Lighting GmbH
Schweizer Straße 30
A-6850 Dornbirn
Tel.: +43 (5572) 390 - 1303
Fax: +43 (5572) 390 - 91303
E-Mail: press@zumtobel.com
Web: www.zumtobel.com

LEDON

# Energy Efficient Lighting: Organic Light Emitting Diodes


"Will OLED be one of the most efficient light sources till end of the decade?" *challenges Carlos Lee, Director General of the European Photonics Industry Consortium EPIC.*



*Highly efficient OLEDs – 50 lm/W OLED modules by Tridonic.*

Lighting is an important aspect of total energy consumption, about 19% of the total electrical energy is accountable to lighting. Based on this fact a lighting revolution started a decade ago, the transition from traditional light sources to solid state light sources. Inorganic Light Emitting Diodes (LED) are already in the transition to mass market and available to consumers in traditional retail stores, the Organic Light Emitting Diodes (OLED) though are still in a starting phase but will be in the future the second solid state light source for efficient lighting solutions.

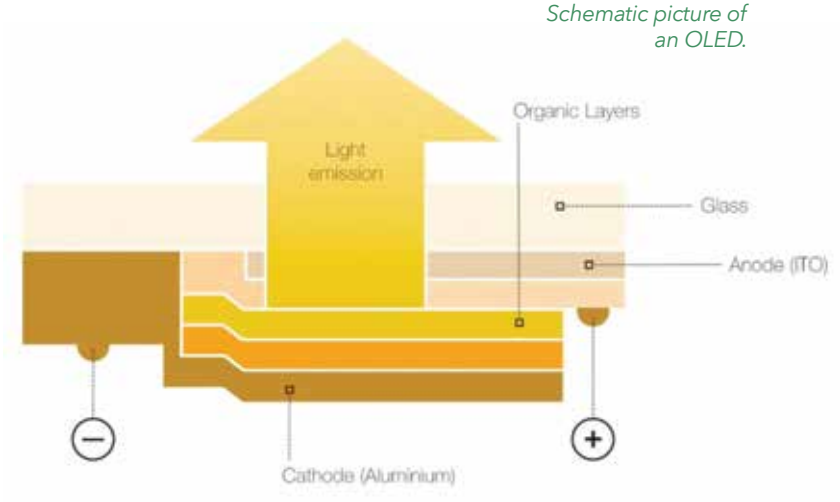
The OLED technology is the first real "area light source" technology in history. It overcomes traditional restrictions by "point source" lighting technologies. OLED lighting is a very new technology on the market and design, technology and integration aspects influence in a very strong way the performance of the lighting system.

## OLED TECHNOLOGY

From a purely technical point of view, both OLEDs and LEDs are semiconductors that convert electric current into light. While LEDs produce a point of light based on a tiny light-emitting chip, OLED panels are an area of diffuse light.

OLEDs consist of stacks of organic layers, which are inserted between a cathode and an anode. Usually, the substrate is glass coated with a transparent conductive oxide being the anode, followed by the organic stack, followed by the inorganic cathode. Usually OLEDs are in total thinner than 2 mm. In a white OLED a mixture of three coloured emitter (red, green and blue) will be used, which generates a high quality lighting.

*Schematic picture of an OLED.*



## OLED APPLICATIONS

OLEDs are characterised by glare-free light and uniform luminance distribution, small mounting heights and simple robust connections. The light source emits heat across its entire surface so there is no need for a heat sink. Even heat-sensitive objects can therefore be illuminated safely.

OLEDs offer so many possible applications, including ones that have not even been conceived yet. Thanks to their simple control, they are suitable not only for ultra low-profile luminaires but also for a wide range of intelligent lighting solutions – everything from dimming to scenario programming. OLEDs with transparent surfaces, in addition to those with milky diffuse surfaces, hold out the promise of some unusual lighting installations.

OLEDs have huge potential in a large number of applications. They are extremely thin and can be manufactured in almost any shape on substrates. This exceptional versatility in terms of design and application makes them very attractive to designers, luminaire manufacturers and end users.

## ENERGY EFFICIENT OLEDS

The efficacy of OLEDs for lighting solutions grew rapidly in the last years based on extensive material and device research. Europe is one of the leading region

*OLED Application scenario – Ultra thin OLED pendant luminaires.*

for OLED Lighting, companies like Philips, Osram, Tridonic and BlackBody and a lot of research institutes work hard to enhance the OLED performance parameters.

One additional advantage of OLEDs is that the device enables 100% use of the light generated without reduction through the use of reflectors.

Actually the top efficacy in the market is around 50 lm/W, comparable to an energy-saving bulb. In the next years the OLED efficacy will grow over 100 lm/W, till end of the decade OLEDs will be one of the most efficient light sources on the market.

## CONCLUSION

OLEDs will be in the future the second solid state lighting source to achieve highly efficient lighting solutions to reduce the energy consumption for the world lighting. Based on the slim format and non-glare solutions OLEDs allows also new innovative lighting design which will change the future type of lighting.

**ABOUT THE AUTHOR:**
Jörg Amelung is responsible for the company LEDON OLED Lighting, located in Dresden, the OLED division for Tridonic. He received his diploma in physics from the University of Duisburg, Germany. From 1999 till 2008 he was responsible for the OLED activities inside the Fraunhofer Institute for Photonic Microsystems IPMS. In 2009 he founded LEDON OLED Lightingwith the mission to develop and manufacture OLED module solutions. In 2012 Tridonic integrated the first OLED components in their product portfolio.

LEDON OLED Lighting GmbH & Co. KG, Manfred-von-Ardenne-Ring 20, Haus F, 01099 Dresden, Germany.

# Progress towards Low Cost Flexible Lighting Solutions

The European Project "Cost-Efficient lighting devices based on liquid processes and ionic organometallic complexes" (CELLO) (FP7-ICT-248043) has led to a strong improvement of the understanding, performance and market potential of light-emitting electrochemical cells (LECs). LECs are solution processed and molecule based light-emitting devices which make use of ions to overcome electronic injection barriers at the electrodes. The presence of the ions allows the use of air-stable electrodes and makes the devices less sensitive to thickness variations.

LECs are promising candidates for use in thin-film lighting technologies as they:

- Operate at very low voltages, yielding highly power efficient devices
- Can be processed from benign solvents
- Have high tolerance for the active layer thickness
- Operate with air-stable electrodes that allow for simple architectures and passivation approaches.

Demonstrator LECs were successfully prepared on large and small area substrates. Sub-second turn-on in combination with high efficiencies and stabilities reaching 17 lum/Watt and a lifetime in excess of 6000 hours (at an initial luminance of 1000 cd/m$^2$) have been demonstrated.

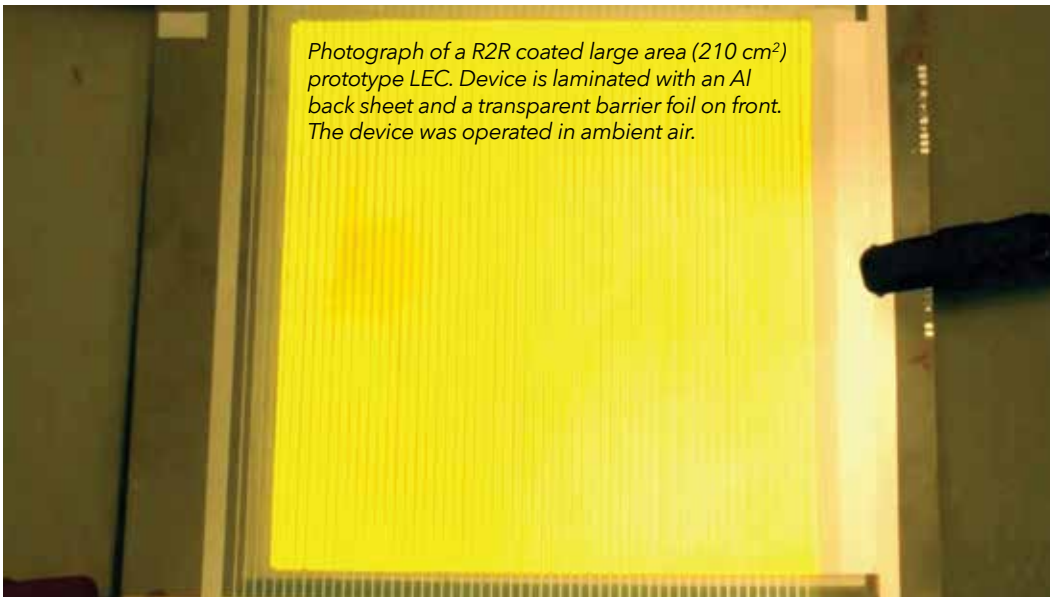
Using embedded grid lines, large area (210 cm$^2$) flexible LECs were prepared on a roll-to-roll (R2R) coating line.

Based on the processes developed and the demonstrator evaluation, a feasibility study was performed. This study showed that due to the robustness of the LEC architecture R2R processing equipment can be implemented at low investment costs. This makes the production of LECs profitable at much lower production volumes (when compared to vacuum and evaporation based OLEDs) initially allowing for the targeting of smaller markets and reducing economic risks. Hence, manufacturing sites are possible in Europe and, as a consequence, the technology development can keep pace in Europe in the long term.

To further enhance the performance levels of LECs a coordinated activity towards the development of improved materials and device architecture compatible with the developed coating and printing techniques is required. Furthermore the integration of measures to improve the optical out-coupling is essential to reach the requirements of market applications. Without these measures only 20 % of the generated light can leave the device.

CELLO ran from January 1st 2010 to December 31st 2012 with the partners Universidad de Valencia (coordinator), Siemens, Universitaet Basel, Consiglio Nazionale delle Ricerche, Ecole Polytechnique Fédérale de Lausanne, OSRAM GmbH and Teknologian tutkimuskeskus (VTT). More information can be found at the website: www.cello-project.eu or you can contact the scientific coordinator, Dr. H. Bolink at the University of Valencia (henk.bolink@uv.es).

*Image of a small area flexible LEC.*



*Photograph of a R2R coated large area (210 cm$^2$) prototype LEC. Device is laminated with an Al back sheet and a transparent barrier foil on front. The device was operated in ambient air.*

# Energy efficiency drives ongoing transformation of the lighting industry to LEDs

*Tim Whitaker*

The global lighting industry is going through a period of tremendous upheaval, due to the emergence in recent years of high-quality lighting products based on light-emitting diode (LED) technology. European lighting companies are at the forefront of this transition, which has already resulted in the penetration of LED lighting into many different application areas. LightingEurope, a group formed recently from more than 30 European lighting manufacturers and national lighting associations, says it intends to "meet the challenges and opportunities created by the current unprecedented change in lighting technology and production caused by the introduction of LED lighting."

The LED has already had a significant impact on a number of industrial sectors. For example, the vast majority of screens in new TVs, laptops and other mobile devices are backlit using LEDs. Many road vehicles use LEDs for their brake lights, indicators and daytime running lights, while LED signs and traffic signals are a common feature of everyday life.

But the biggest impact of LEDs is likely to be in the lighting sector. Already, LED lamps can be found in hardware stores throughout Europe, and the home-furnishings giant Ikea recently announced plans to sell only LED-based lighting products by 2016. The use of LED lamps has been boosted to some extent by the European directives that have outlawed the production of certain traditional light-bulb types with low energy efficiency. However, many other lamp types remain on the market, and LED lamps face stiff competition in some quarters, for example from directional halogen spotlights.

Energy efficiency is one of the key benefits of LED technology, although it would be wrong to claim that LEDs always offer the most efficient solution for a particular product type or application. Higher energy efficiency brings the dual (and related) benefits of reduced carbon emissions, and reduced cost of consumed electrical

*LED lighting has been used on a number of high-profile projects, such as the illumination of London's Tower Bridge by GE Lighting to coincide with last year's Olympic Games.*

power. Often, an LED-based product or lighting scheme is a more expensive option, but this higher initial cost is offset by electricity-bill savings. A number of financing schemes offer lighting products without any upfront payment; instead, the customer agrees to repay a certain amount each month based on the estimated savings that will be made in electricity consumption. Often these schemes can be cash-flow positive for the customer from the outset.

The long lifetime of LED-based lighting products, based on the robust nature of the technology, can provide another financial benefit. A lower number of breakages and failures can result in a significant reduction in the cost of maintenance. In some applications this can even outweigh the cost benefits of reduced energy consumption. Consider the cost of sending a maintenance crew with a crane to change the lamp in a streetlight, or in a fixture hanging from a high ceiling in a warehouse.

Maintenance and replacement are a concern as the commercial lighting sector adopts LEDs. Traditionally, lighting manufacturers would design their fixtures to accommodate a certain lamp type, and the customer would then be able to easily replace the lamp in case of a breakage or failure. However, in many LED fixtures it is not possible to replace the LED light source. This is very wasteful when the LED source reaches its end of life, and also prevents the customer from upgrading the fixture to include the latest generation of LED technology.

*Ceiling-mounted LED fixtures from MHA Lighting illuminate Scott Safety's factory in Skelmersdale, UK.*


One solution is to develop a series of specifications for interchangeable LED light sources. A fixture designed according to such a specification is able to use compatible components from a range of different suppliers. Such specifications are currently in development by the Zhaga Consortium, a global association of companies that includes many European lighting manufacturers.

Zhaga is one example of an effort to create industrial standards for LED lighting that will help to further accelerate market growth. Meanwhile, the industry continues to promote the advantages of LEDs in terms of energy efficiency, environmental impact and consumer well-being. The transformation to LED lighting is well underway, and shows no signs of stopping.


*Different types of LED light engines have been developed according to Zhaga specifications. Such products can be easily interchanged with others from different suppliers, which is helping to stimulate growth in the LED lighting market.*

Tim Whitaker is a regular contributor and former Editor-in-Chief of LEDs Magazine, a trade publication for the LED lighting industry. He is also the Marketing Communications Director for the Zhaga Consortium (marcom@zhagastandard.org), which is developing specifications for interchangeable LED light engines.

# New LED technologies for residential and commercial smart lighting

*Authors: Jacob van der Pol, Colin Faulkner, Alex Kengen, NXP Semiconductors*

Energy efficiency has driven the LED market over the past decade. Today, new growth opportunities for LED lighting applications have emerged in the area of smart lighting solutions, resulting in greater control of LED-generated light. Internet-connected wireless smart lighting systems have become a reality in response to market needs not only for energy-consumption reduction but also for the need for an enhanced user experience and for lower total cost of ownership (TCO) in residential and commercial buildings.

In NXP's smart lighting solutions (fig.1) every lamp has its own IP address. These lamps can be wirelessly controlled by any IP device, such as a smartphone, tablet, laptop, or Internet-enabled TV. These solutions make it possible to create a highly personalized, intelligent lighting environment in addition to electricity cost savings of 40%.

Consumers can control groups of lamps and define lighting scenarios that use different light levels according to the task, such as warm lighting for watching TV or bright lighting for reading a book or change lamp's colors to create a warmer atmosphere. Lights can also be controlled from a remote location, allowing travellers to use their smartphone to ward off burglars and intruders. In the case of street lighting it is now possible to dim lights or only illuminate street crossings instead of entire streets during the late night hours. As part of a building-management system, IP-enabled lights can provide self-diagnostic information like the number of burn hours, switching cycles and submit early failure reports to optimize maintenance schedules and reduce maintenance costs. Basically, the use cases are limitless...

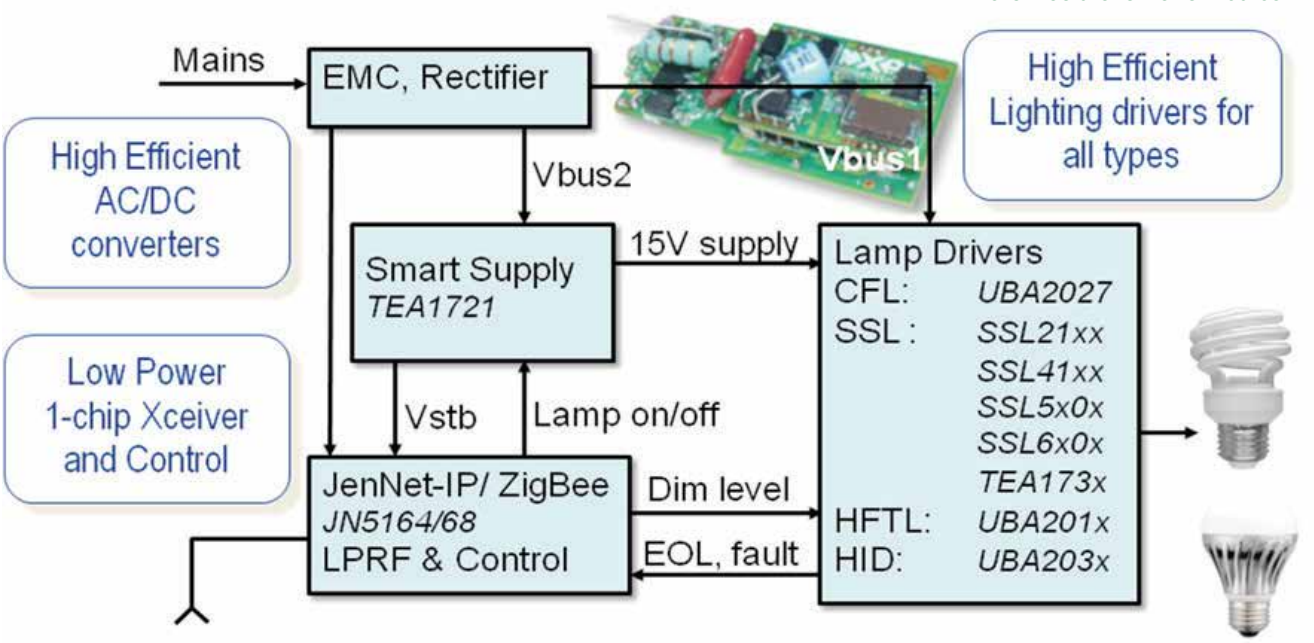
## WHY NOW?

Recent hardware and software innovations have removed barriers to adoption. Wireless connectivity removes the high installation and cabling cost of wired networks like DALI or DMX and adds flexibility. High performance low power wireless microcontrollers are now available at a cost close to $1. So with LED lamp lifetimes of more than 25 years, it is now cost effective to include a wireless control chip in each lamp. Standardized networking protocols guarantee interoperability between devices from different vendors and enable robust, secure wireless networks. Finally, smartphones, tablets and related apps, now also provide intuitive graphical user interfaces for commissioning and control of


*Fig. 1: Smart Lighting and Home Automation Architecture*

*Fig. 2: Smart lighting system (courtesy Greenwave Reality)*

*Fig. 3: Hardware architecture for retrofit bulbs*




a smart lighting systems removing the complexity of usage.

As lights are prevalent in every building, the wireless smart lighting network can serve as the backbone of a home automation or energy management network, enabling the "Internet of Things" - a world in which appliances can be monitored and controlled via an IP address.

## SYSTEM REQUIREMENTS

Basic requirements for a smart lighting system (fig.2) are ease of installation and commissioning, internet connectivity and ability to upgrade firmware, ease of use and flexibility of control, low latency, robust and self-repairing wireless connectivity, security, scalability to hundreds of nodes and low power consumption both when lamp is on and off. Note that the radio in the lamp always has to 'listen' for commands so it also consumes power when the LEDs in the lamp are off. This standby power should be less than 5% of the nominal power of the lamps as otherwise it will be a significant part of the energy bill.

## SMART LIGHTING SYSTEM IMPLEMENTATION

The above requirements are fulfilled by NXP's smart lighting solution. Fig.3 shows the hardware architecture for LED retrofit bulbs using the most advanced LED lamp drivers (SSL2108x and SSL2129), radio chips (JN5164/68) and standby power supply chips (TEA1721) available in the market today. Standby power is an industry-low of only 140mW. NXP offers full smart lighting reference designs consisting of schematics, bill-of-materials, PCB layouts, antenna designs and firmware for all relevant LED lamp types (A19, MR16, PAR30, T5/T8 LED tubes etc., see fig.4), remote controls and Ethernet-to-IEEE802.15.4 gateways. A dedicated wireless module is available for brick ballasts with industry standard

*Fig. 4: NXP smart lighting module for 230V GU10 MR16 LED lamp*

0-10V analog dimming input. Reference designs for high power lamps as used in street, high bay and parking lot lighting use very high efficiency lamp drivers like the SSL4101/4120 with efficiencies up to 94%.

The networking software stacks supported include among others ZigBee LightLink and JenNet-IP (fig.5) which can both run on exactly the same hardware. Both are mesh networking stacks whereby all individual lamps act as repeaters. Messages destined for a distant part of the network can discover a route by hopping from lamp to lamp until they reach the desired destination. If an individual lamp fails, then a new route would be discovered using a different combination of lamps. JenNet-IP makes use of IPv6 messages based on the IETF 6LoWPAN standard, allowing direct control of a lamp anywhere on the Internet.

## LED LAMPS THAT ARE INDISTINGUISHABLE FROM INCANDESCENT BULBS

The microcontroller in the smart lighting system makes it very simple to control RGB multicolor lamps and tunable white lamps. Together with NXP's sensor-less sensing technology that enables accurate, yet low cost, control/monitoring of the LED's temperature, this allows it to closely mimic the traditional incandescent light bulb to produce warmer, cozier white light when dimmed (fig.6).

This removes one of the most important barriers consumers perceive when considering buying a LED lamp.

The future of both residential and commercial LED lighting lies in leveraging the intrinsic benefits of LED technology and wireless communication technologies. The future starts today!

*Fig. 6: Tunable white LED lamp following incandescent black-body-curve while dimming*

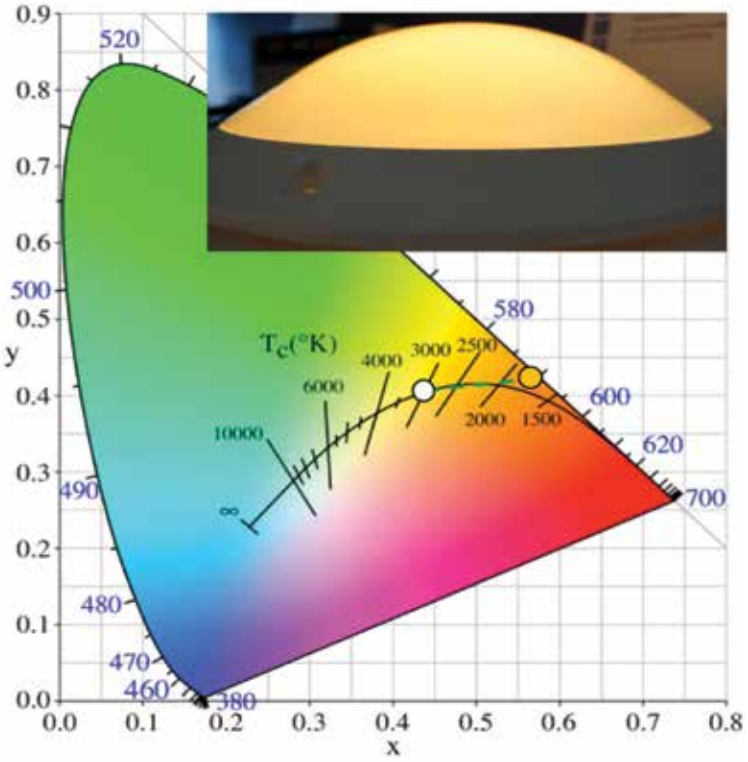
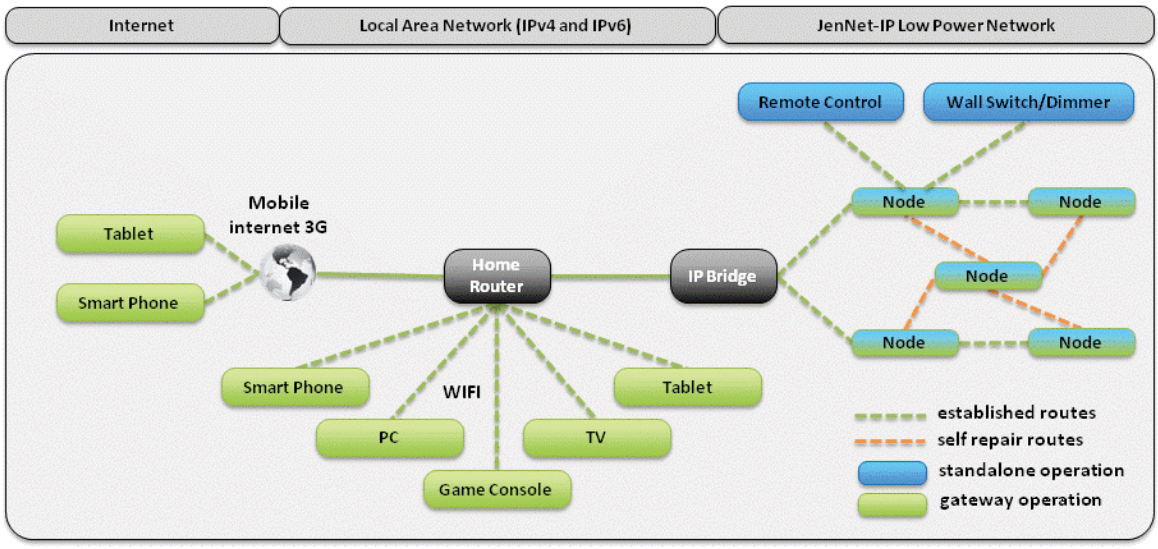



*Fig. 5: JenNet-IP based Smart lighting network*



# Winners and Losers of LED Lighting: It's A Buyer's Market

*LEDs have taken a small share of the general lighting market already – sooner or later, they will take over entirely. The lighting revolution is good news for some, and bad news for others.*

## THE WINNERS

The first winner is going to be the consumer – whether private or commercial. They will have more choice, longer lasting products and, over time, increasingly good quality light. The higher efficiency of LED light bulbs will translate into energy bill reductions, while the huge competition of LED manufacturers will ultimate translate into lower pricing. €20 and €30 bulbs do not excite many customers today, but in some years we will see excellent €5 and €10 products available with high lumens.

Secondly, governments are going to win. Just by passing a few regulations and then watching the market largely fend for itself, they are going to preside over an era of notable energy usage reduction, just what they need to meet EU and other targets.

Thirdly, environmentalists should be happy. LED don't use mercury like fluorescent lights, and use much less energy (and hence less carbon emissions) than incandescent and halogens. A reduction in overall energy use in lighting might even assist those campaigning against the need for more nuclear power stations or coal plants.

Fourthly, vendors of things consumed by the LED industry such as phosphors, gas, chemicals and materials. Although revenue growth is more modest for LED, the actual unit and production growth is faster. Unlike equipment installations which have up and down years, actual consumption of things used in production is more even, and LED units shipped are rarely in decline. Perhaps over a month or a quarter but rarely if ever on an annual basis.

## THE LOSERS

Some lighting companies. According to a number of industry sources, many lighting players, both big and small, have rushed to join the LED revolution and, due to fierce competition or not having a good enough business plans, have ended up struggling with the new technology due to low margins on the products which have also led to job losses in some cases. As LEDs filter into the market, they face a secondary problem of less shipments each year due to the higher lifetime. The extent of this is a disputed point, with some people seeing a lot of proactive replacement as LEDs continually improve, or big growth from emerging economies. However IMS Research projects only half the number of lamps worldwide will be shipped at the end of the decade (9 billion in 2020) than at the start (17.7 billion in 2011).

Some LED companies. With over 100 LED companies in existence today, many more if small packagers are included, it is going to be difficult for all of them to have a good business. Most notably, the number of companies in China increased very rapidly as the government offered significant subsidies for entry into the LED market. Globally, there is currently more LED supply than demand, and this may persist for a while. It may be a >$US10 billion industry (as annual packaged LED revenue) but there are a lot of companies fighting for a share of that. Experience of other industries suggests there may simply be too many companies to survive independently. However, in the last two years, only a small number of second or third tier LED companies, mostly in China or elsewhere, have gone out of business. Many people expect to see this to increase. However we believe that top, well established suppliers such as Nichia, Osram Opto and Cree (just to name a few) are relatively less vulnerable. These companies, and others, pioneered the industry with tremendous technological advances and have retained a lot of knowhow and the intellectual property rights to protect this.

Some investors. Some LED companies were hot in 2009 and 2010. From under $20 at the start of 2009, Cree's share peaked at $83.38 during early 2010. However more recently, we are now operating in a more cautious

**Contact Details**
**Email:** Jamie.Fox@IHS.com
**Web:** www.LEDmarketresearch.com

environment. It was around $30 for much of 2012, before rebounding more recently to about $45. SemiLEDs' share price fell from about $30 in December 2010 to less than $1 by February 2013. Which shows that fast growing and exciting industries are not always an easy way to make money. Money can still be made, of course, with care and caution and careful analysis – or luck!

Some equipment manufacturers. As there is currently overcapacity, and as the industry growth is relatively less explosive than in 2010, a huge boom for manufacturers of equipment has passed. The opportunities for sales are not as high as before, and the cyclical nature of the LED market makes things difficult. These companies won big in 2010, but did not do so well in 2012. Longer term this is harder to say. Equipment manufacturers hope for another boom in general lighting, but lighting will come more gradually than the shift to TVs, and the shipment levels of 2010 might never be seen again.

It is worth pointing out that some lighting companies, some LED companies, some investors, and some equipment manufacturers will do very well – but others could suffer if they are not very careful in this extremely competitive market.

In short, it is a buyer's market at the moment and may continue to be so for quite some time.

*Jamie Fox, IHS (IMS Research)*


# LED professional Symposium +Expo

## Europe's central meeting point for LED lighting technologies

*Luger Research e.U. will present the third annual LED professional Symposium +Expo in Bregenz, Austria on September 24–26, 2013.*

The LED technology sector has been driven forward by numerous innovations and developments during the past year. The quality of light has been improved and power density markedly increased through augmented efficiency. This fast paced market promises much progress and many innovations during the coming year. GaN-on-Silicon technology, various nano-technologies and new production methodologies are now ready to enter the market.

In order to expedite development it is necessary to have a mutual exchange of scientific knowledge, discussions about promising solutions and a network that brings key players from the areas of science and industry together. This is the central idea behind the annual LED professional Symposium +Expo (LpS) in Bregenz (Austria), which has established itself as the leading LED lighting technology event in Europe. Apart from the numerous presentations in the fields of component, measuring and production technologies, the important topic of decreasing costs of research & development will be discussed by Menno Treffers, Secretary-General of Zhaga.

Over 80 exhibitors from all over the world are expected in the Festspielhaus Bregenz to present their product innovations in the field of LED technology. Based on the increasing number of visitors (+20%), the event organizer is expecting more than 1,000 international guests this year. Visitors to the LpS 2013 will be able to glean information about the latest developments and advances in technology as well as see state-of-the-art products ready for the market.

### QUALITY HAS THE HIGHEST PRIORITY

An extraordinary amount of positive feedback from exhibitors, visitors and speakers, confirms the exceptionally high quality of the event: "The range of topics was well chosen and the organization throughout the event was exemplary. RECOM Electronic will definitely be back in 2013!", said Stephan Wegstein, Marketing Director Lighting, RECOM Electronic GmbH.

One of the main objectives of the event organizer is to exceed the expectations of the participants again this year. "Our goal is to present the latest technologies, innovations and methodologies for LED lighting every year. People visiting Bregenz will have the most current information available and the network necessary to make the right strategic decisions for the coming year", said Siegfried Luger, Event Director and publisher of LED professional.

**Info + Registration:**
www.LpS2013.com
www.LpS2013.com/call
info@LpS2013.com

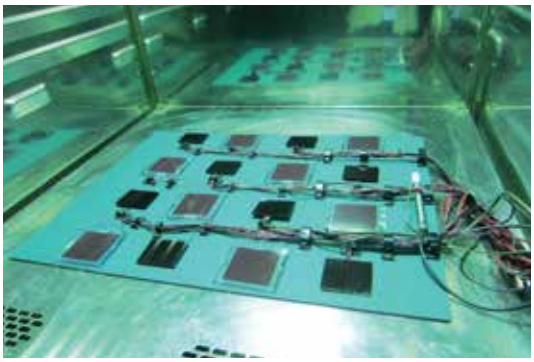
**Luger Research e.U.**
Moosmahdstrasse 30,
6850 Dornbirn, Austria, Europe
**T** +43 5572 39 44 89
**F** +43 5572 39 44 89 90

**Press Contact**
*Katharina Fink*
**T** +43 (0) 5572 39 44 89 43
**M** +43 (0) 699 11 33 43 43
**F** +43 (0) 5572 20 60 70
katharina.fink@led-professional.com
www.led-professional.com
www.lugerresearch.com

# How stable is your emerging solar cell?

This is a common question when novel solar cells want to enter the PV market. Presently, silicon based solar cells have more than 90% market share, while OPV and DSSC seem to be forever stuck in the starting blocks. This is not only due to their efficiency, which we can confidently expect to increase over time through better production and materials (as amorphous silicon solar cells have in the past); their stability is key.

The European research project "Energy for a Green Society" (ERG) aims to achieve substantial advances in the solar energy supply chain, from sustainable harvesting to smart distribution. Major objectives include pushing novel solar cell efficiency towards 25% and reducing power conversion losses by 20%. One of the project's activities is the demonstration of commercial viability of Dye Sensitized Solar Cells (DSSC) which represent a promising low-cost alternative to silicon PV technology, and are ideally suited to indoor applications. Nowadays, photovoltaic standards for organic or hybrid cells including DSSC do not exist, and there are no low light tests to evaluate the performance of cells in non-standard lighting conditions.



Leitat Technological Center
R&D Department, Renewable Energies Division
Dr. Monica Della Pirriera
e-mail:mdella@leitat.org
Tel.: +34 93 788 23 00

Currently, Leitat are able to perform pre-homologation solar tests, including execution of critical stages of UNE-EN61215 (c-Si) UNE-EN 61646 (a-Si) and IEC 62108 (CPV) standards among others. Leitat's know how in the field of climatic chamber aging tests allows the design of specific and adapted tests for new applications. These tests permit us to evaluate existing and novel PV cells in desired environment (temperature, humidity, and incident radiation). In Leitat, we also search out correlation between total hours in accelerated aging test and number of hours in real conditions hours.

**The European ERG project consortium, includes 27 partners from 10 different countries: Italy, Belgium, Germany, Spain, Ireland, the Netherlands, Slovak Republic and United Kingdom. For more information, please visit *http://www.eniac-erg.org/***

Within the scope of the ERG project and to perform benchmarking between DSSC and a-Si under low incident radiation, Leitat have performed ageing tests in their climatic chamber under 100 W $m^{-2}$, 25 °C and 35 % humidity for up to 1000 hours. Two types of modules have been used: Sanyo a-Si modules and DSSC modules from SolarPrint. In the test, 8 solar cells of each type were aged, with half of each group given UV protection. The modules were continually operating close to maximum power output, and their efficiency, open circuit voltage, short circuit current, fill factor and power output were monitored without stopping the test.

In this environment, aging test's results suggest that:

- For stability under 100 W $m^{-2}$, DSSC PV modules should be protected with a UV blocking layer
- a-Si modules do not require UV protection; moreover the protection slightly reduces power output
- With protection, DSSC modules are slightly more stable than a-Si modules when their efficiency under standard solar conditions was measured after the test
- With UV protection, DSSC modules were significantly more stable than a-Si when their performance under indoor light was considered
- The energy produced by both technologies was benchmarked.

*The research leading to these results has received funding from the European Union's ENIAC-JU ERG project (http://www.eniac-erg.org) under grant agreement n°270722-2 and from the national authorities of Belgium, Germany, Ireland, Italy, Slovakia, Spain, The Netherlands and United Kingdom.*

# Smart Specialization: Education meets Automotive

*Lambert van Nistelrooij, Member of the European Parliament*

*The EU 2020 Agenda for Europe is to result in a smarter and greener Europe that creates jobs. Europe performs well in fundamental and applied research. Yet the challenge is to get beyond the crisis and make focused investments. Europe has to be more successful in converting its knowledge into growth and jobs. Europe must deliver top performances. The new buzzword in this regard is 'Smart Specialisation'. What is it and why is it so important? How do we accomplish this? I would like to present the smart specialization principle by way of an example: the AutomotiveCampusNL. A unique hotspot in Helmond, the Netherlands, where companies, knowledge institutes and government bundle their activities for sustainable transport. Electric Vehicle Technology has become one of the most important topics at the Campus and is one of the smart specializations of the region.*

## CAMPUS AS HOME FOR THE TRIPLE-HELIX

The Campus in itself is a home for companies, education institutes as well as public and private research centres and test facilities in the field of automotive technology and smart mobility. It offers a challenging and inspiring ecosystem where knowledge and business come together. Residents conduct research, development, designing, modelling, engineering, testing and assembly of vehicle and systems technology here. AutomotiveCampusNL accommodates numerous test and expertise centres for among others crash testing, active safety and handling, advanced driver assistance, power train testing, emission and performance measurement and wind tunnel testing. In 2013, an Automotive Facilities Brainport (AFB) Center will be set up at the Campus. This will offer an electric vehicle and battery centre, driving guidance centre, manufacturing process unit, educational test facilities and an incubator and accelerator centre.

## ELECTRIFICATION AS SOLUTION FOR MOBILITY

At the AutomotiveCampusNL, attention is paid on hybrid and electric vehicles. Electrification is the future solution for increasing vehicle energy efficiency and thereby sustainability. Electric driving is nowadays established as the new kid on the block in transport. Discussions about global warming, increasing prices of fossil fuels and charging stations are rapidly speeding up the penetration of sustainable and energy efficient forms of transportation worldwide. However there is a lot to explore and optimize in electric and hybrid vehicles. A new facility is already launched in Helmond: European Electric Mobility Centre (EEMC). This facility centre offers a worldwide unique combination of facilities, expertise and services for the hybrid and electric vehicle related industry. This portfolio stretches out over all product development stages, for heavy and light duty vehicles, on battery, power train and vehicle level. Hybrid and electric vehicles cover all kind of applications, from passenger cars to heavy-duty commercial vehicles, niche and in between. The EEMC has internationally acknowledged expertise in the field of vehicle safety in combination with vehicle performance and the corresponding certification. At the Campus there is also a possibility to a full-scale crash testing in a crash lab accredited for homologation against worldwide standards.

## DRIVING TOGETHER

AutomotiveCampusNL aims to provide a context-rich learning environment for automotive students. Annexes of automotive education institutes on all different levels (vocational, bachelor and university of applied sciences) have already been established on the Campus, which strongly supports vertical integration of the different education levels. For example, some students worked together in the EEMC on different projects. Students can start their automotive education on a medium level and flawlessly continue until they have reached their PhD.

*Official opening EEMC at AutomotiveCampusNL in Helmond, the Netherlands.*

Photo credited to: Pressvisual

The combination of education, student presence, opportunities for on-the-job training, knowledge exchange and specific enabling projects within the Campus innovation programme ensures a high quality automotive curriculum that radiates continuity and confidence. Education meets automotive on the Campus.

## EU SILICON VALLEYS?

Is it still possible to create regional initiatives in Europe? EU 'Silicon Valleys'? I believe so; the European Parliament believes so. Greater collaboration between regions, companies and knowledge institutes is key for achieving that goal. Regions will determine the areas in which they want to excel and will look for partners within Europe. The AutomotiveCampusNL will also embark on this path. Moreover, excellent clusters as these are the ones who have a major role in assisting regions will have the opportunity to eventually attain excellence. Through its revised architecture, strategic programming and delivery mechanisms the cohesion policy for 2014-2020 creates a more balanced Europe and directly enhances the regional investments. The dictum is 'use it, or lose it!' More innovation improves future levels of competitiveness, creates new jobs and enables us to maintain our prosperity.

## AUTOMOTIVENL

AutomotiveNL represents the Dutch automotive sector and promotes its interests as a strong opportunity area, with the ambition of growing to:

- a turnover of 24 billion euros in 2020 (at present 17 billion)
- employment of 55,000 FTEs in 2020 (at present 45,000)
- a doubling of the number of automotive students at all educational levels in 2020

To achieve these aims, AutomotiveNL works on developing innovations into marketable products, achieving an optimally functioning ecosystem and creating competitive production facilities in the Netherlands. One of the locations where such an ecosystem is being built is the AutomotiveCampusNL in Helmond, part of AutomotiveNL, which brings together companies, knowledge institutes and education; an optimum environment to promote partnerships in open innovation and the 'Triple Helix' (industry, knowledge institutes and government).

# Oil Refining: A fresh perspective?

*An interview with EUROPIA*

EEI recently spoke to Ms Isabelle Muller about the significance of refined petroleum products and about the future role in Europe's energy mix. Mr Chris Beddoes has since succeeded her at Europia, and we took the opportunity to hear his views.

**A recent priority for Europia has been to raise the profile of the downstream oil industry. How successful has this been?**
I believe that Europia is well known and highly respected for its constructive advocacy in the dialogue about the future of Europe's energy supply and the role of oil and EU refining in this future - even if its views are not always shared.

There were, I think, three particular developments during 2012 that indicate the recognition of the issues faced by the refining sector. The first was precipitated by the news in January that Petroplus, which was Europe's largest independent oil refiner, had filed for bankruptcy, citing "very tight and difficult European credit and refining markets." I shall return to this in a moment, but the news generated quite a reaction within the Commission and Member States, and made real some of the concerns that EUROPIA had been highlighting over the past 2-3 years. Secondly, and as a result of this, Energy Commissioner Oettinger convened a Refining Round Table in May, which was attended by the many Member States, the Refining Industry, MEPs, Trades Unions and the International Energy Agency. The Round Table concluded that EU policies and legislation were contributing factors to the competitiveness problems faced by the industry. There were no doubt many other factors, but as a result of these discussions, Commissioner Oettinger inaugurated a follow up Refining Conference, and has now established a refining Forum, a biannual opportunity for the Industry, the Institutions and Member States to exchange information and views on the status of the industry and the implications to the EU economy.

**So it seems as if the potential threat to the European refining Industry is being taken a little more seriously.**
It would certainly be true to say that the attention being paid to the petroleum sector is no longer confined to environmental aspects, though these remain fundamentally important. In fact, the Commission under the lead of DG Enterprise proposed last October to undertake an assessment of the impact of EU legislation upon the competitiveness of certain European Industries; in particular whether the cumulative effects of a series of relatively small measures together represent too heavy a legislative burden. The DG Enterprise so-called "fitness checks" will first examine


*Chris Beddoes*

the Refining Industry and the Aluminium Industry. As regards the refining industry, we would expect this review to include all relevant legislation, but two particular items on the table now that may have a major bearing are the implementation measures for the Fuels Quality Directive Art 7A and the Industry Emissions Directive through the BREF.

It however seems likely that publication of any findings resulting from the "Fitness Check" may take until 2014. The point is that refining takes place in a global marketplace, and the global benefits of European-only environmental legislation may not be fully realised if it simply makes European Industry uncompetitive. Global demand for petroleum products will continue to increase and so refining will simply continue elsewhere. The net effect will be to export European jobs while increasing European fuel imports to European consumers and making little contribution to global climate objectives.

**In other words, there is a growing focus upon the industry's competitiveness in the global marketplace**
Yes. This is bolstered by another EU initiative, this time a technical one, supported by the EU's Joint Research Centre [JRC]. Their role is providing the scientific advice and know-how to support EU policies. In this case, The JRC has created a European Forum for Science and Industry which has started to look at the refining industry to assess the scientific and technical needs of the industry in the light of the clean transport legislation, with a particular emphasis on modelling and foresight.

**Might the failure of Petroplus therefore lead to a reappraisal of the role of refining in the EU?**
The world's energy demands are growing (by at least 25% by 2030 versus 2008 according to the IEA), and it is not simply a question of "Green" energy versus "Black" energy: to meet this growth, the world needs a secure, balanced energy supply generated as efficiently as possible from the widest possible range of sources. Broadly speaking, everyone acknowledges the need for greater efficiency and cleaner energy, and I think the refining industry has responded well to previous legislation, such as that to do with the elimination of sulphur and lead in automotive fuels, allowing much cleaner and more efficient vehicle engines. The industry will also adapt to falling demand for refined petroleum products in the EU: this is simply a function of good business. However, I believe our concerns about the industry's competitiveness are now receiving better recognition as it grapples with the commercial, legislative, environmental and political environments in which it operates in the EU, which in turn has to operate in a global economy and environment.

**Mr.Beddoes, thank you very much for your time today**

# Green Energy Technologies –

## luxury or the logical future of power industry?

*Forum and Exhibition for South-East Europe (29-31 May, 2013)*

Today we are witnessing a dynamic competition between green, brown and nuclear energy and most of us are asking whether the youngest of them will win this competition and meet the high expectations.

In February this year, the Committee of the Regions (CoR) called on the EU to set a long-term strategy that enables renewable energy to become a key energy source for the years to come and it also suggests that the EU should consider "the possibility" of becoming 100 % reliant on renewable energy by 2050.

What is happening in South-East Europe? Despite the intensive development of green energy sector during the last years, Bulgaria still faces a number of challenges. Some new trends will drive the market of the green technologies in the country and will open new attractive niches. The experts forecast a boom of installations of small integrated photovoltaic systems in the next years. Legal changes ensuring the simplification of administrative procedures for the installation of PV panels on roofs and facades will be approved in the next few months. Small biomass and hydro installations will be of a priority for the Bulgarian government. In February, the Parliament accepted amendments to the Energy Efficiency Act, which foresee working out of a national plan for the increase of the number of nearly Zero Energy Buildings (nZEB) and introduction of certificates for energy performance. The country has a significant potential to cut the energy consumption levels and related carbon emissions through the implementation of 'smart buildings' conception.

From 29th to 31st May, 2013 in Sofia (Bulgaria), the SE European Eco Forum and Exhibition will bring together again top industry professionals from whole Europe. The event will transfer the most advanced technologies and know-how to the regional market and speed up its development. The Organizer Via Expo has upgraded the format of the 2013 edition which incorporates some hot topics: energy efficiency and renewable energy, smart buildings, elevators and escalators and waste management.

### THE EXHIBITION

The strong international presence of well-known companies clearly demonstrates the interest in the Region. There will be an Austrian Pavilion for the 4th year in a row. Polytechnik will showcase boilers and firing systems for biogenic fuels. A debut on the Bulgarian market will make Global Hydro Energy which plans to expand its position in South-East Europe. It offers small hydropower plants with a capacity of 15 MW. Alternative fuels and recycling technologies will be presented by Vecoplan.

Argentina is one of the largest exporters of biofuels in the world and the bioethanol production will set a record 400 million liters in 2013, as the sector continues to expand due to the existing processing infrastructure, favorable policies and the ample supply of feedstocks. Visitors will learn about the Argentinean know-how at the stand of the *Embassy of Argentina*. In the field of biomass *K.A. Technology* will show *Richard Kablitz & Mitthof's* solutions. *Costruzioni Nazzareno* from Italy will demonstrate technologies for the production of pellets, briquette presses and crushers for wood waste. For the first time there will be an Italian Pavilion at the Exhibition.The solar technologies will catch again the spotlight. This year the focus will be on building integrated PV roofing-, facade- and window systems which are identified as an attractive niche for the renewable energy market.

Swiss leader Sputnik Engineering (SolarMax) will make a premiere of its new series string inverters SolarMax P, specifically designed for small solar farms to 6 kWp. Krannich Solar (Germany), a distributor of world renowned


manufacturers of solar technologies and components, is also among the exhibitors.

Repeated participants are well-known Bulgarian companies like Filkab, Kris 94, EC 3, Sky Solar, Elprom Trafo, Motto Engineering, etc. According to experts from these companies the forthcoming changes in the sector will be related to consolidation and transition from subsidized to real market model, the interest in photovoltaics will be provoked also by economic and environmental benefits.

Energy storage is seen as a key technology to support the future development of renewable energy, as feed-in tariffs decline in many parts of the world. Heliocentris Energy Solutions specializes in autonomous energy supply and energy efficiency solutions with the aim of replacing diesel generators with "zero-emission" products.

Weiss A / S will acquaint visitors with its waste-to-energy technology which is being applied in small communities and remote areas.

During the last years the conception of smart buildings has made a notable progress in Bulgaria and several buildings with BREEAM, LEED and DGNB certifications have been realized. *The European Patent Office (EPO)*, working together with external experts, has designed a new information retrieval system, thanks to which, the public can search worldwide patents relating to sustainable buildings. EPO will also provide an overview of some patenting trends in the sustainable building sector.

Techem Smart System will be presented by Techem Bulgaria. It is designed for remote reporting, control of consumption and daily monitoring on the operation of the different kinds of equipment.

## THE FORUM

Via Expo has invited leading experts from the European Renewable Energies Federation (EREF), European Council for an Energy Efficient Economy (ECEEE), Pike Research, European Commission - DG Energy, European Patent Office, Energy Economics Group – EEG, etc.

Investors, architects, designers and representatives of the state administration will discuss a wide range of topics. Top 10 trends in smart buildings, financial models, energy storage with renewable energy systems and building integrated photovoltaics are the highlights in the program.

Mr. Rapf from the Buildings Performance Institute Europe (BPIE) will define the nZEB options according to the local conditions. BPIE researched and developed an ambitious roadmap for Poland, Romania and Bulgaria which will help these countries progress towards the implementation of nZEB and reduce the energy consumption levels. The presentation of Mr. Adrian M Joyce from EuroACE will put an accent on the financing models for smart energy buildings & ZEB.

A Workshop 'Practical approaches to controlling methane emissions and generating energy from landfill gas' will be organized by the Global Methane Initiative (GMI), U.S. Environmental Protection Agency and the Bulgarian Ministry of Environment and Water (MOEW). ●

**For more information:**
Via Expo - www.viaexpo.com

**European Innovation Magazine:**
Event media partner

# ENE FARM: Fuel Cells Technology in Action

*Mike Edmund, Editor*

We examined fuel cells little while ago. This interesting technology produces electricity from hydrogen and oxygen in a manner resembling electrolysis in reverse; now we explore its real-life application in Japan. This country possesses very little in the way of natural resources; and negligible oil reserves, so it is perhaps unsurprising that the Japanese people is a resourceful and innovative one. Neither is it much of a surprise that Japan had developed of the most advanced nuclear energy programmes in the world - including the Kashiwazaki-Kariwa Nuclear Power Plant, rated at almost 8GW and the largest in the world. Until, that is, geology played its part; and put the word Fukushima on everyone's lips.

But even before the 2011 earthquake, a Japanese project was underway to develop fuel cell technology for domestic use. Conceived in the 1990s, ENE FARM is a residential Combined Heat and Power (CHP) system in which a fuel cell provides the electricity for an individual dwelling. However, one of the many attractive features of the technology is the chemical reaction that generates this electricity also releases heat as a by-product; harnessing this otherwise wasted heat raises the overall efficiency of the system to between 70 and 80%.

Early systems were based upon a 1 kW unit fuelled by city-gas-derived hydrogen. Once the feasibility of the concept was demonstrated, larger-scale demonstrations and then full commercialisation followed, encouraged by subsidies from the Japanese government. In the last three years more than 20,000 units have been installed; and government subsidies are steadily reducing as uptake and economies of manufacturing both increase. The technology is evolving, too: the latest system needs to produce less power, offers improvements in electrical efficiency and occupies about half the floor space; it is also 20% cheaper.

It has been calculated that one family switching to an ENE FARM fuel cell could reduce its $CO_2$ output by about 1,100kg per year, or about 20 times the saving that would made by switching from incandescent light bulbs to compact fluorescent ones. It has also been calculated that when the Tohoku earthquake unleashed the tsunami that flooded Fukushima, it released enough surface energy to power Los Angeles for a year. Sadly, harnessing such colossal forces is beyond our technology, but they may have provided the spur towards a clean technology that might help save the planet.

*ENE FARM Fuel Cell Production Line | Japan Times*

# Micro CHP and Fuel Cells systems in buildings

*Dr Yannick Mermond, Project manager – Micro CHP systems, EIFER*

Europe's energy markets and infrastructures have been facing important evolutions and challenges for several decades, especially since the Fukushima disaster. Some examples of these challenges are:

- the target on CO2 emissions reduction,
- the phase out of nuclear energy in Germany by 2022,
- the financial and economic crisis resulting in fewer investments in large electricity production means,
- the targets on renewable energy leading to the connection of intermittent energy sources to the grids and requiring more flexibility from other production means or storage technologies.

An important challenge is also the target of 20% energy savings by 2020 in the total EU energy consumption.

According to European experts, combined heat and power systems (CHP) are part of the solution to relieve the pressure on electricity grids and to achieve primary energy savings for the industrial sector. CHP systems can do the same for the residential sector which is responsible for almost 30% of the total EU energy consumption. The residential sector could be a significant source of energy savings, and is associated with a large market for low energy technologies. Annual sales of natural gas boilers in the EU have reached more than 3 million units per year. Micro CHP systems are developed to compete with natural gas boilers (classical or condensing technology) for space heating and domestic hot water preparation in dwellings. Micro CHP technologies are designed to generate electric power in the range from 0.7kW to 3kW.

Several types of Micro CHP technology are available, at different level of maturity. Internal combustion engines (ICEs) have been commercially available since the middle of the 90's. Pre-commercial Stirling engines (integrated in condensing boilers) started to appear in 2003 (official commercial launch occurred in 2011), mainly in Germany. Another very promising technology, Fuel Cells (FC), has been commercially available since 2009 in Japan.

The main difference between these technologies is the ratio between the heat and the electricity generated by the systems. This heat to power ratio, generally ranging from 5 (Stirling engines) to 0.8 (high temperature FC) is not only a characteristic of the technology, it also determines the type of building in which Micro CHP systems can be installed. Internal combustion engines and Stirling based Micro CHP systems target the refurbished buildings market and boiler replacement market. Fuel Cells are installed in new buildings in Japan, and will target the market of future new buildings in Europe (Positive Energy buildings) where they are expected not before 2015.

Fuel Cells Micro CHP systems are at the demonstration level in Germany with the project CALLUX that aims to field test 800 hundred systems by 2015. The European project "eneField" involving more than 50 partners (heating industry, energy suppliers, developers) was launched in 2012 and intends to field test thousand FC based Micro CHP across 12 EU members states.

Whatever their core technology, it is still difficult for Micro CHP systems to reach economic viability because this depends on several parameters such as gas and electricity prices, investment costs, feed-in tariffs, and on additional costs linked to the connection of the systems to the grid. The success of Micro CHP in Germany and in Japan currently relies on generous government subsidies and support mechanisms. Nevertheless, opportunities for the commercial development of this technology exist because:

- Europe is an important market for natural gas heating technologies,
- the integration of renewable energy solutions in existing buildings remains generally difficult,
- Micro CHP products are high energy performance systems,
- new national rules and European Directives are favourable to Micro CHP,
- European industry needs new technologies.

New business models are also expected to push Fuel Cell products to market. Because of their lower production of heat, these systems can be more easily operated. A remote (or local) management of these systems could also contribute to optimizing the use of electricity in buildings or could even enable Micro CHP systems to participate to the electricity generation markets.

SANDVIK

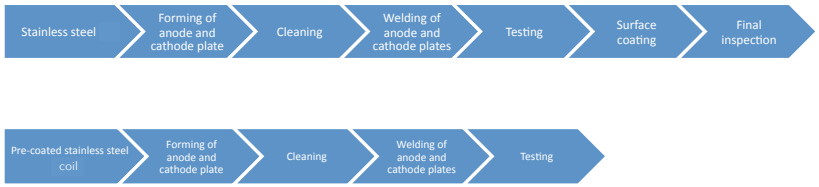
# Bridging the Gap

## *Pre-coated strip steel for an industrialised production of the bipolar plates in fuel cells*

Fuel cells offer an exceptional potential for a clean, efficient, and reliable power source. They generate electricity by an electrochemical reaction in which oxygen and a hydrogen-rich fuel combine to form water.

Nonetheless, one of the remaining obstacles for a broad mass market introduction of fuel cells is the high system cost. A significant contributor to the high cost is the bipolar plate that separates the cells in the stack acting as anode for one cell and cathode for the next cell. The bipolar plate should be a good electrical conductor, resist corrosion and provide uniform flow for the reaction gases in the cell. Further, it is generally understood that the bipolar plates have to be light, compact and inexpensive. Stainless steel is a good candidate material for the bipolar plates due to availability, cost and formability. However, stainless steels suffer from oxidation in the fuel cell environment resulting in degradation of cell performance over time. Thus, coatings are required for adequate plate performance.

*Figure 1. Fabrication steps for bipolar plates. Top: conventional fabrication, bottom: pre-coated concept.*




Sandvik has developed an environmentally friendly coating technology that enables large scale coil to coil production of ready-to-stamp coated foil for the mass fabrication of bipolar plates.

By applying the coating on a coil prior to the forming process significant cost savings in bipolar plate production can be achieved. Figure 1 illustrates the reduced number of production steps that will not only reduce lead time, improve yield and simplify logistics, but also eliminate the costly individual coating process of each bipolar plate.

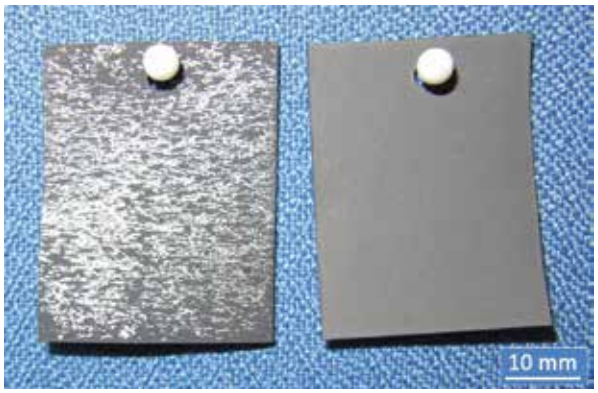
Using tailor made coatings for different types of fuel cells, such as PEMFC (proton exchange membrane fuel cells) and SOFC (solid oxide fuel cells), it is possible to use low-cost stainless steel as substrate material. Figure 2 shows an example of improvement in oxidation resistance in air at 800°C (1470°F) by coating a ferritic steel of EN 1.4509 type with a cobalt-based coating. This type of coating does not only reduce oxidation but also minimizes chromium evaporation from the bipolar plate that may poison the SOFC.

The upcoming mass market for fuel cells will unquestionably require a supply chain designed for the production of several millions of bipolar plates in a rational way. Pre-coated coils offer this possibility combined with an excellent performance of the bipolar plates in the fuel cell. ●

*Continuous coating line. Process control room.*

**Contact details:**
Hakan Holmberg
Manager Strategic Business Development Surface Technology
Sandvik Materials Technology
hakan.holmberg@sandvik.com
+4626263482
www.smt.sandvik.com

*Figure 2. Stainless steel type EN 1.4509 exposed to 800°C (1470°F) for 1000h. Left: uncoated, right: cobalt- based coating*



# Planning for a new Energy Paradigm

**Is it significant when one of the largest international oil and gas companies takes a majority stake in a high-tech renewable solar company? EEI recently caught up with Mr Arnaud Chaperon, Senior Vice President Prospective Analysis, Institutional Relations & Communications for Total New Energies.**

*An interview with TOTAL*

*Arnaud Chaperon*

**Good Morning. I wonder if we might begin by hearing a little about Total's thinking behind the acquisition of Sunpower.**
The acquisition was the result of a deliberate process that began a few years ago.

Total believes all kind of energies will be needed to meet growing energy demand in the long term. Even if we estimate that around 74% of world requirements for energy will be met by fossil energies in 2035, we also see strong growth of new energies, notably solar and wind. Thus renewables have a promising future and must play their full role in the energy mix. Some diversification of energy production is therefore essential. And Total has chosen to focus on solar energy through SunPower. Solar electricity seems intrinsically attractive: the photovoltaic sector represents clean power with a bright long-term outlook and is technology-driven, and you might almost say that Technology, along with Marketing and Services, runs right through our DNA.

**So what was particularly attractive about Sunpower?**
It has much to do with the technology itself. Sunpower is an excellent company with a consistently clear technological leadership in solar panel manufacture. With a cell record at 24.2% rated efficiency, its cells and panels are the most efficient available today. The second attraction is the clear prospect of downstream synergies between our own marketing and service expertise - Total is present in more than 130 countries, and welcomes 3 million customers per day in its 15,000 gas stations - and Sunpower's technological excellence.

**And is that attraction only a short- term one?**
Total commitment in solar energy is a long-term one. The recent economic situation has been stormy, to say the least, and we believe that our sheer size is one factor that will help weather that storm. The solar manufacturing market is likely to consolidate. And Total, via Sunpower and its world record breaking solar technology, will be a leading player. To succeed in the long-term, we'll develop new business models generating more value and keep investing in solar R&D, partnering with leading science and research organisations to maintain our technological superiority.

**The present PV-based dispute between the EU and China cannot have helped calm that economic storm.**

*Sunpower-manufactured PV cells keep Solar Impulse aloft.*

© Solar Impulse | Fred Merz

What we all hope for is a sustainable industry, based upon fair competition. Low-quality, low-priced photovoltaic products, wherever they be manufactured, are likely to have a negative effect upon the image of solar products in general. This is likely to speed up the consolidation of the market, ultimately leading to a greater focus on product excellence.

**So you are naturally optimistic about the future?**

Solar energy is going towards competitiveness versus other conventional energy sources. We can already see grid parity for some solar applications in specific regions of the world such as Middle East, Africa, and now in Germany.

In the past, Grid Parity was seen as the Holy Grail of photovoltaic technology. Today, we understand the market to be more complex. We foresee the emergence of a new decentralised structure, with micro-generation of PV electricity on countless rooftops and the development of decentralised storage units, smart metering self-consumption; and many other developments. What will be the true price of electricity? Is it the price at which it is traded on the wholesale market? For the consumer, is it the price he is paid for any surplus he sells to the grid? Or the price paid by an aggregator who buys it, stores it and sells it back to the neighbourhood? The challenge is to devise economic models to explain this new market; and to devise appropriate regulation to manage the coexistence of the new model with the present structure for the benefit of utilities and customers alike. The electricity market is in Europe accelerating its evolution and has to tackle the integration of renewable and its intermittent nature into the grid, with quite a number of new challenges as well as opportunities.

**M. Chaperon, thank you for your time.**

# Renewable energy innovation receives funding injection through NER300

*Eleanor Smith, Communication and Policy Officer, EREC, smith@erec.org*

**At the end of 2012, the European Commission released details of which projects will be funded by the New Entrants Reserve (NER300) fund, one of the world's largest funding programmes for innovative low-carbon energy demonstration projects.**

This move will see 23 broad ranging technologies in the bioenergy, geothermal power, solar thermal electricity, ocean and wind energy sectors as well as distributed renewable management (smart grids) awarded funds totalling over €1.2 billion. The increase in annual renewable energy production in Europe that these projects will incur is equivalent to the annual fuel consumption of more than a million passenger cars, not a negligible amount.

The NER300 fund was originally created by a Commission Decision in 2010. Originally, its raison d'être was to help finance demonstration projects in "environmentally safe capture and geological storage of CO2" as well as "innovative renewable energy technologies" – in that order. The fund awards CCS (Carbon Capture and Storage) and RES (Renewable Energy Sources) projects funding under the Commission Decision over two rounds, the first of which concluded on 18th December 2012.

The fund aims to reduce our impact on climate change and improve living conditions for society at large by reallocating funds from polluters to developers of low-carbon technologies. It does this by using revenue from the EU's ETS (Emission Tradings Scheme), prompting Climate Action Commissioner, Connie Hedegaard to refer to the programme as a 'Robin Hood mechanism', as it takes from carbon-intensive and gives to low-carbon technologies.

This will undoubtedly be money well spent. Historically, investment in innovation in the renewable technology sector has yielded great results, with costs steadily decreasing across the board.

Interestingly, the technology this fund was primarily created to support is absent from this round of funding: CCS. The rules of this particular funding programme stipulate that the European Commission can fund no more than 50% of a given project and the rest must be covered by Member States. Since no CCS projects met this requirement, the European Investment Bank (EIB) and European Commission made the decision to award all the funding for this round to renewable technologies.



# Europe's energy challenge: The role of renewables

Since the adoption of the Renewable Energy Directive , the EU has come a long way in establishing a stable and market-oriented framework for increasing the share of renewable energy. This not only contributes to the reduction of greenhouse gas emissions, it also helps maintain and increase European competitiveness, by reducing import dependency and triggering technology innovation and the creation of new products for a rapidly growing global market.

The growth rate of renewables in Europe has continuously accelerated under the current regime of binding targets. From 4.5% p.a. in the last decade it should reach 6.3% in the period 2010-2020. The overall share of renewable energy in gross final energy consumption has already reached 12.4%. So far we are on track to reach the target of 20% in 2020. Importantly, the 20% target is based on total energy consumption, including the heating and cooling sector for the first time.

At present, almost 50% of the total energy consumed in Europe is used for the generation of heat and for cooling for either domestic or industrial purposes. In households this figure even reaches around 80%. Today we manage to source 14% of this demand from renewable energy. But the potential is much higher. Renewable heating is still dominated by the use of biomass a fuel used since ancient times but nowadays increasingly efficient thanks to new heating and cooling technologies. Other technologies such as geothermal heat, heat pumps and solar thermal heat collection currently only provide a small fraction of the heat from renewable sources.

This leads to two main challenges. We will have to enable the production of high quality biofuels from secure and sustainable supplies and delivered by optimally-integrated solutions for households, industry and district heating and cooling. With regard to other technologies like solar thermal heating or geothermal energy, deployment needs to be further accelerated. Ongoing activities such as the Renewable Heating and Cooling Technology Platform under the European Strategic Energy Technology (SET) Plan aim to help this by bringing together all stakeholders concerned.

Also we need to ensure that these technologies and their specificities are taken into account when national and local authorities plan, build and renovate industrial or residential areas. This issue is explicitly addressed by several pieces of European legislation, in particular the Renewable Energy Directive , the Energy Performance of Buildings Directive , and the Energy Efficiency Directive . The third, which entered into force in December last year, also requests Member States to establish a long-term national strategy for national building stocks an exercise which will include a comprehensive assessment of the potential for high efficiency cogeneration and efficient district heating, e.g. through heat production from renewable energy sources. Based on this, Member States will then be requested to lay out strategies, policies and measures that may be adopted up to 2020 and up to 2030.

*Philip Lowe*

Recent policy measures in the UK follow a similar rationale and represent a good example of how to approach the greening of the heating sector: the UK set out a clear national strategy, the "Strategic framework for low carbon heat in the UK" which was published last March, and aims to stimulate the market through a robust legislative framework, such as the Renewables Heat Incentive for non-domestic applications and its extension to householders, which is currently under discussion. These measures were desperately needed, as the UK still trails far behind other Member States with the share of renewables for heating and cooling amounting to less than two per cent.

With the European legislation recently adopted, the creation of a comprehensive European framework for an efficient and sustainable heating and cooling sector is now complete. These policies are designed to give the market the attention it deserves.

# Energy Efficiency: Huge Potential for Industries through own power production

*Author: Paul Rubig*

The heating and cooling sectors are key actors in the European energy system, responsible for more than 40% of total final domestic or industrial energy consumption and a significant share of European greenhouse gas emissions. To achieve the 2020 renewable energy targets and Europe's target for the Reduction of Greenhouse gas emissions, efficiency gains are required in both residential heating and industrial processes. A better use of thermal energy is becoming crucial for achieving the common visions target. Also, cooling demand is expected to rise significantly in the next years in spite of greater use of energy-saving measures like insulation. Still this sector often remains overlooked by European and national policies.

District heating and Cooling can and does already substantially contribute to the overall energy system, including lowering $CO_2$ emissions, integration of renewables, reduction of primary energy input, but also stable and economic energy supply. In particular in urban environments with high density energy demands it is an ideal infrastructure solution. Nevertheless it is a huge challenge how to economically realize this potential and

**1** PR376a_Anwederbericht Vattenfall

set the right incentives to further develop this extremely important sector.

Moreover industries can benefit from renewable heating and cooling and many industrial processes already make use of cogeneration and combined heat and power plants (CHP) in order to reduce costs, environmental impact of power generation and discharge the grid. In particular they are used for heating and drying or alternatively for absorption of chillers to cool industrial processes or warehousing facilities. A CHP system is a very efficient way of converting fuel into useful energy. You can expect a conversion efficiency of up to 80% from a well designed scheme.

Even though the evidence shows potentials in the usage of process heat there are no major investments in this sector at the moment. Unfortunately the current economic and institutional conditions for the use of CHP are not favorable to any investments in this technology. In order to reach the full potential we would need to ensure basic conditions in the area of legislation, economics and infrastructure and more importantly a better incentive framework.

In many industrial Processes heat and warmth are an important basis for a manufacturing process. In Austria for example the final energy consumption of industrial furnaces makes up for 14% of overall energy consumption. No doubt that the produced heat could be used for further economic processes, instead of just emitting it to the atmosphere or cooling it down. There are of course several limitations and challenges to the use of waste heat such as the different temperature levels in the different processes, the availability of heat sink as well as the availability of connections to the local district heating grid. Given the constraints, using waste heat for processes in the own firm area is the most valid possibility. In the headquarters of Vattenfall for example this new technology was implemented with success. The industrial heat pumps use the thermal discharge of the computer centre to heat the building and cool the EDP systems. The system reaches impressing Coefficient of Performance values and therefore allows for a reduction of 500 Tons $CO_2$ per year.

To seize these opportunities we should try and think about possible incentives such as reductions in the taxation of energy especially for firms producing there own power with cogeneration and combined heat and power as well as for green energy plants.

The loss of this tax-income can be compensated for the state by the generated additional economic activity. From this additional activity of course the public could profit in terms of turnover tax as well. Furthermore it would have positive effects on our trade balance, since Europe would be able to reduce its energy imports.

Overall we should be careful, when imposing evermore constraints and burdens on the manufacturing industries by for example changing the set up of the emission trading system and impose evermore conflicting environmental legislation, since the most important motivation for and to the innovation processes in the manufacturing sector is still the cost factor. Despite some contrary opinions Europe has already the most rigorous environmental legislation and the highest energy prices in the world. In the light of this and the newly announced Re-industrializing strategy by the European commission, we should start to think about how we can incentivize green growth instead of penalizing European industries at every possible stage.

# Renewable Heating and Cooling: a new SRA to supply 25% of energy demand by 2020

*By Simone Landolina, EUREC / European Technology Platform on Renewable Heating and Cooling*

Accounting for over half of EU energy demand, the heating and cooling sector is the Cinderella of the energy debate, essential yet largely neglected. According to Eurostat, 84% of energy supplied for heating and cooling in 2011 was still produced by burning fossil fuels such as oil, gas and coal – with a severe environmental impact arising from the associated greenhouse gas emissions and posing a risk in terms of energy security.

Renewable energy technologies offer a safe, reliable, clean and increasingly efficient solution to Europe's heating and cooling needs. Cost effective decarbonisation of the heating and cooling market is achievable, however public and private resources must be mobilised around a clear Vision and Strategic Research Agenda.

It is against this background that in 2008 the **European Technology Platform on Renewable Heating and Cooling (RHC-Platform)** was established with the aim to provide a common framework for European industry and research stakeholders to define technological research needs and strategic priorities to increase the use of renewable energy sources (RES) for heating and cooling and to consolidate EU technological leadership.

With the publication of the Common Vision for the Renewable Heating & Cooling sector in Europe in 2011, the RHC-Platform proved that the theoretical and technical potential of renewable energy sources could cover a quarter of EU energy consumption by 2020. However, the report also pointed out that discovering how to make such a potential economically viable remains an outstanding challenge.

In order to realise the Common Vision, the RHC-Platform has produced a new **Strategic Research Agenda for Renewable Heating and Cooling (RHC-SRA)**, a key document which addresses the short, medium and longer term R&D needs in the field of renewable heating and cooling technologies and puts together the strategic research priorities identified for Biomass, Geothermal, Solar Thermal and Cross Cutting Technologies.

The SRA sets out the likely directions of technological and organisational changes that will need to be converted into specific research activities over the next years, starting from Horizon 2020, the next EU framework programme for research and innovation (2014-2020). Furthermore, it aims to facilitate the coordination of other research programmes in and between EU Member States.

As market growth to a great extent depends on major technological advances, the implementation of the SRA, along with appropriate market conditions, will be crucial to realise the shift to a renewable energy system in which European citizens can enjoy affordable and sustainable heating and cooling services.

The RHC-SRA is set to be launched at the **4th European Conference on Renewable Heating and Cooling**, taking place in **Dublin on the 22-23 April 2013**. The event is organised by the RHC-Platform in association with the Irish Presidency of the Council of the EU, and it is co-financed by the European Commission. With over 200 participants expected from all over Europe, the event has become the biggest annual gathering of its kind and it provides a unique opportunity for learning, knowledge sharing networking and discussion surrounding RHC technologies.

Over the course of three plenary and seven parallel sessions, conference delegates will participate in defining which

**Contact details:**
Simone Landolina
Coordinator of the Secretariat of the RHC-Platform
**T:** +32 2 546 1943
**E:** info@rhc-platform.org
**W:** www.rhc-platform.org

research, development and demonstration projects are best suited to the implementation of the SRA until 2020, and therefore are recommended to receive support under the coming framework programme "Horizon 2020" of the European Commission.

However enormous the challenge ahead of us is, it is not only technological. Tomorrow's energy systems are defined by the policy and legal framework we adopt today, which must **provide the right conditions to attract large scale public and private investments**. Public support will increase as the full potential of social benefits, such as green jobs, is realised. Successful deployment of renewable energy technologies also has to take into account the needs of end-users and industry investors need the right signals today – from the EU and national governments – to make Europe a resource efficient and renewable energy economy by 2050.

The next European Budget (2014-2020) is being decided in troubled economic times, however this ought not to divert the ambition of European policy makers to secure enough resources for the research and innovation of renewable heating and cooling technology.

# Heat Roadmap Europe 2050

## Focus on heat and bottom-up approach reveals considerable energy benefits for Europe

*By Birger Lauersen, Manager international affairs, Danish District Heating Association*

- *Save €14 billion/year,*
- *Reduce heating costs with 11%,*
- *Create 200.000 jobs,*
- *Increase energy efficiency,*
- *Reduce energy imports and emissions*
- *And improve the electricity grid.*

*All in one package, using simple and proven technology!*

The European Commission's Energy Roadmap 2050 foresees only a very modest growth in the future for district heating. Due to low geographical resolution, traditional energy modelling based on national energy balances excludes specific local possibilities, and favours generic possibilities available everywhere, such as electric and gas.

In this pre-study, commissioned by the European organisation for district heating and cooling - Euroheat & Power, ambitious but realistic growth rates are assessed for district heating in the EU27 until 2050. The methodology is a combination of hour-by-hour energy modelling of the EU27 energy system and mapping of local conditions. The study finds that deliveries from district heating in the EU can grow by a factor of 2.1 until 2030 and by a factor of 3.3 until 2050.

### SAVE MONEY

More district heating in Europe will reduce the energy system costs considerably since local heat recycling and renewable energy use will reduce expensive energy imports, while also increasing the efficiency of both electricity and heat sectors. The overall annual cost reduction in the heating sector can be about €14 billion by 2050. This corresponds to a relative cost decrease of 11%. Socio-economic payback time is estimated to be two to three years for heat distribution pipes put into the ground to recycle more heat.

### GET MORE JOBS

More district heating will generate local jobs since investments will replace expensive imports of fossil fuels to Europe. Approximately 200-220.000 jobs will be created in Europe due to local investments in heat recycling, renewable energy supply, and extended or new heat grids.

### REDUCE EMISSIONS

Since fossil fuels are substituted with local resources, the reduced primary energy supply from fossil fuels will also reduce emissions of carbon dioxide for all heat demands served by district heating systems, with up to 13-17 %.

### SECURE ENERGY SUPPLY

The reduced energy import will also increase the future security of supply and give more positive balances of foreign exchange.

### SMARTER ENERGY SYSTEMS

With a high proportion of intermittent renewable electricity supply, a smart energy system is crucial so that all sectors can contribute to a balance supply and demand. One of the proven flexible partners is district heating systems which can provide balancing power in both directions, with electric boilers and large heat pumps together with thermal storages absorbing excess electricity generation, while combined heat and power plants actively supporting the electricity supply system during power deficits.

### EXPAND WHAT WE ALREADY HAVE

60 million EU citizens today are served by district heating systems. But cities with at least one system have a total population of 140 million inhabitants, and approximately 57% of the EU population lives in regions that

have at least one district heating system. Hence, more sustainable heat can be easily delivered in the future by expanding existing district heating systems.

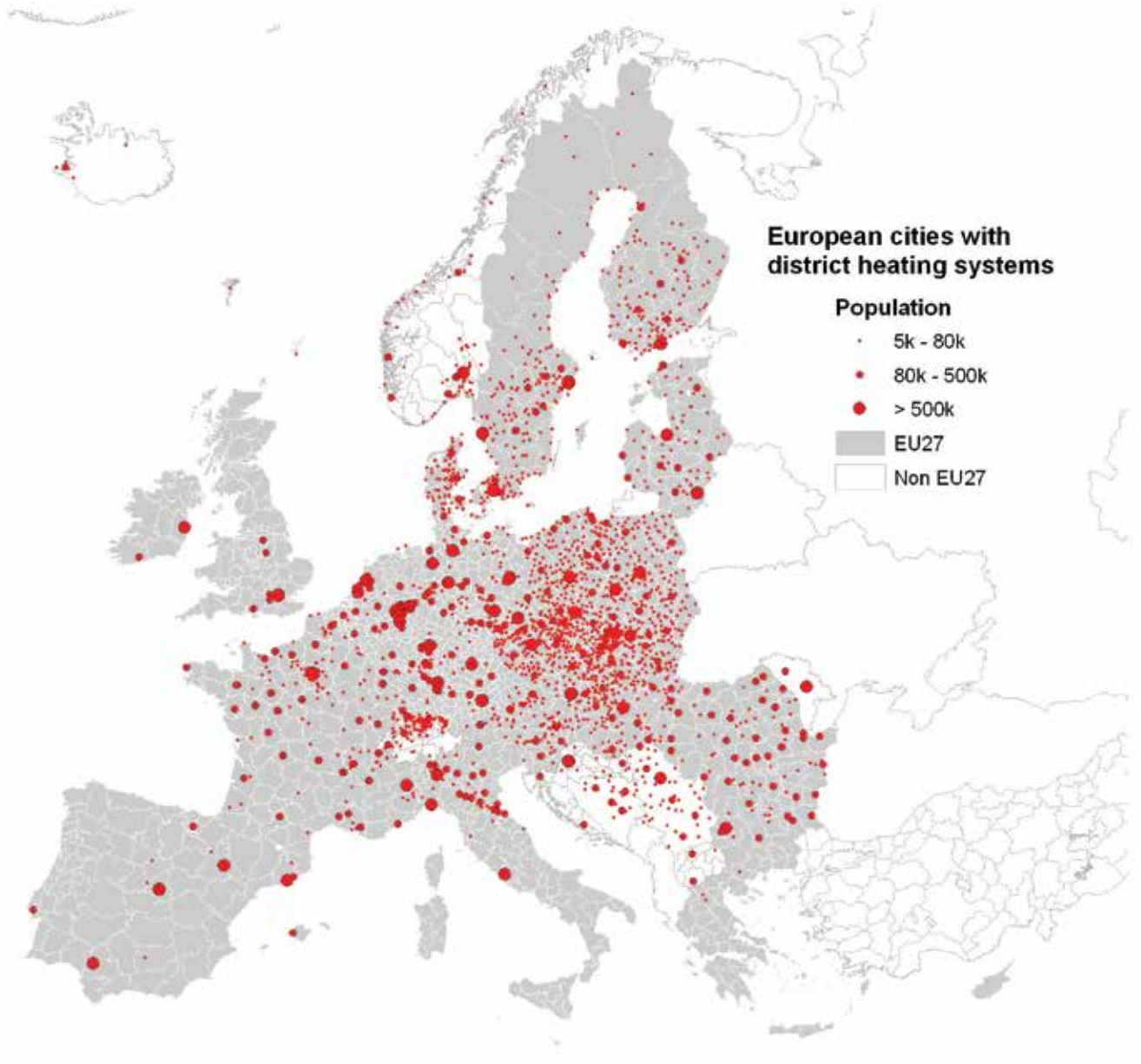
## RECOMMENDATIONS

The study stresses the need to communicate the local possibilities for district heating to urban and regional planners.

The methodology applied in this pre-study, which is a combination of energy modelling and mapping of the local conditions using a high geographical resolution, is crucial for district heating analysis, since the potential for expansion is dependent on local heat resources and demands.

There is a need for recognition and increased details of the heat sector in energy policy analysis and the energy balances employed, so that specific local possibilities are included and policy focus only on generic possibilities (electricity and gas) is avoided. ●

*See full study: http://www.heatroadmap.eu*

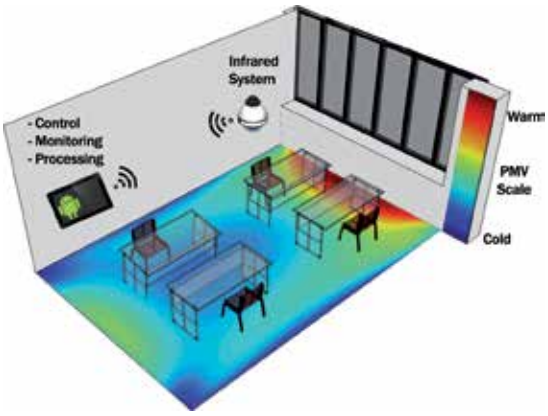


# Universita' Politecnica delle Marche:
## advances in monitoring energy and comfort in buildings

Monitoring and testing energy and comfort performances is one of the key issues for improving efficiency in buildings. The Measurement Group at Università Politecnica delle Marche from many years is specialized in the development and application of innovative monitoring systems, sensor networks and test protocols to accurately determine thermal and energy performances of buildings and to characterize materials behavior during both production and use. The focus is on low-cost technologies suitable for in-field and industrial applicability. This activity is mostly developed in the framework of industrial and EU projects cooperating with most advanced high-tech companies and research centers.

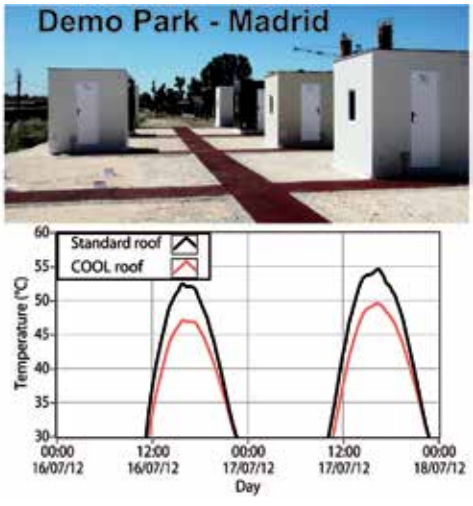
### MONITORING INDOOR COMFORT

One example is the innovative low-cost real-time tool for monitoring indoor thermal comfort currently developed by the Group within the EU funded project CETIEB – Cost-Effective Tools for Better Indoor Environment in Retrofitted Energy Efficient Buildings. The heart of the device is an infrared imaging device to be installed on the ceiling of the occupied room. The system scans indoor surfaces and then, using algorithms provided by ISO 7730, comfort parameters (as Predictive Mean Vote - PMV) can be estimated for several positions in the environment The system is accompanied by a software tool based on Android platform for remote control and data processing and is able to communicate with commercial BEMS (Building Energy Management System). The results can be given in terms of real-time PMV maps, as shown in the picture, suitable to provide feedbacks for modular control not achievable by standard thermostats.




### TESTING MATERIAL PERFORMANCES

The EU project COOL-Coverings aims at developing innovative nanobased coatings for the building envelope (both façades and roof) with enhanced reflective properties in order to reduce cooling energy consumption and indoor comfort. Colored ceramic tiles, paints and roof membranes with increased reflectance in the NIR (Near Infrared) range have been developed and their performances are now under evaluation in a dedicated demo park in Madrid. Mid-scale demos covered with standard and cool coatings have been realized and instrumented for the continuous monitoring of thermal parameters. Together with the design of the monitoring system, the Group focused on the measurement of the durability of NIR properties by developing dedicated accelerated procedures to reproduce outdoor ageing mechanisms (both weathering and soiling) while drastically shortening the time required for testing.




**Contact Details:**
Prof. Gian Marco Revel
Università Politecnica delle Marche
Dipartimento di Ingegneria Industriale e Scienze Matematiche
Via Brecce Bianche
60131, Ancona, Italy.
Phone: +39 071 2204518
E-mail: gm.revel@univpm.it

# Italy: Five Key Facts

| | |
|---|---|
| Size: | 301,230 sq km |
| Population: | 61,261,254 [1] |
| Total primary energy supply (Mtoe): | 165.1 [2] |
| Total $CO_2$ Production: | 416.4 Mt [3] |
| Proportion of electricity from renewables: | 35% [4] |

[1] IndexMundi (July 2011 estimate)

[2] OECD (2011)

[3] US EIA (2010)

[4] CIA World Factbook

# Paving the way to sustainable living in marche region

*"Wind of Change", author: Tamás Párkányi (Hu)*

*"Veduta aerea" , author: Cristina Patuelli (IT)*

Marche region energy sustainability strategy stems from the strong belief that social and economic development of the territory, especially in periods of economic constraints, can't be based but on a smarter and efficient use of energy and on a wide deployment of all renewable energy sources.

SVIM - Sviluppo Marche SpA, as development agency of Marche region, is in charge of supporting the regional institutions to achieve the best results in terms of socio economic and balanced growth of the territory, through the design of European co-funded projects and implementation of innovative interventions in energy, environment and innovation sectors, consistent with regional and European strategic priorities.

The recent Energy 202020 targets and the indication to become a competitive low carbon economy by 2050, set by the European Commission, are posing further challenges to the action of SVIM, that since 2003 has been engaged to promote the shift to a sustainable living model in regional territory through the mobilisation of local communities. Municipalities and local authorities are central to SVIM priorities, somehow anticipating the vision of Covenant of Mayors initiative. Sustainable Energy Communities, composed of municipal policy makers, technicians, private actors and associations, have been set up at regional level, involving so far 68 municipalities for more than 800.000 inhabitants, aiming to exploit synergies, create common ground for cooperation, share best practices, and contribute to drive the implementation of regional policies with a bottom up and systemic approach. Thus, particular effort has been dedicated to inform, sensitize and train municipal policy makers and technicians to improve their skills and competences as crucial actors to deliver at local level the energy targets set by EU.

SVIM supported local municipalities also by drafting energy baseline assessments, feasibility studies and actions plans, paving the way for the adoption of new, efficient and

sustainable approaches in the shaping of local development policies. SVIM strategy also contributes to the creation of regional public-private partnerships, strengthening the competitiveness and innovation of many regional SMEs operating in green economy sector and interested to provide the best technological and scientific services and products.

The main challenge for the next programming period, is to improve public procurement procedures of regional and municipal authorities with regard to the integration of energy efficient criteria. This would serve as a leverage of the public sector to promote private energy investments, fostering economic recovery and new and better green jobs in our territory.

Such activities have been realized in the framework of several projects co-funded by different Eu cooperation programme, most of them conceived and coordinated by SVIM: **Bioforenergy** (NPPA INTERREG IIIA CARDS/PHARE 2004 – 2006), **Radar, Setcom,** (IEE programme 2007-2013), **MMove** (IVC programme) **Effect** (SEE 2007 – 2013 programme), **Powered** (IPA Adriatic CBC Programme), **Alterenergy** (strategic project of IPA Adriatic CBC Programme).

**City_SEC project** (IEE programme), conceived and coordinated by SVIM, is an excellent example of the key role played by our regional development agency to deliver energy targets at local level in the framework of IEE programme.

**"City_SEC – Regional development and energy agencies supporting muniCIpaliTY_SEC to jointly become active energy actors in Europe",** through the cooperation of 8 partners, mainly Regional Development Agency and Regional Energy Agencies from Italy, Croatia, Greece, Poland, Hungary and Sweden, has supported 50 Municipalities involved in SEC- Sustainable Energy Communities - to undertake a long-term energy planning strategy, and go beyond the 20-20-20 EU energy targets.

In the first phase of project implementation, training and capacity building activities addressed to local policy makers and citizens were realized: study visits to more experienced cities in Sweden, Italy and in each partner country were organized with great impact on improved knowledge and skills of local policy makers.

These activities constituted the first steps by which the 50 City_SEC municipalities were able to join the of Covenant of Mayors initiative, which happened in May 2010; and of the drafting of Sustainable Energy Actions Plans for their formal submission to the CoM.

Regional development and energy agencies role was to **facilitate the cooperation among all local public and private stakeholders interested by the SEAP contents, to ensure a bottom up and participative approach for the definition of this long term plan, strategic for the effective implementation of energy actions at municipal level.**

In this context, CITY_SEC has contributed to remove social, administrative and legal barriers to the uptake of renewable energy use especially in those European regions with less experience in energy planning.

Among different types of communication activities organized in these years, the two photo-competitions realized with SETCOM and City_SEC projects, resulted as the most attractive and direct way to raise awareness of all citizens about the importance to foster a shift to more sustainable and environmentally friendly living throughout Europe.

The winning photos have been exhibited at national level, in Italy and in all projects countries, and in Bruxelles, during the European Sustainable Energy Week 2012.

**Contact details:**
sbozzi@svimpa.it – Sole Administrator
lcatalani@svimspa.it – Team Leader
emontironi@svimspa.it
fdimaggio@svimspa.it

# Italy's new Energy Strategy: focusing on competitiveness and on sustainability

*Leonardo Senni, Head of Energy Department, Ministry of Economic Development*

Reducing energy costs, surpassing all the "20-20-20" environmental targets, greater security of supply and industrial development in the energy sector. These are the objectives set out in the new National Energy Strategy document just approved by the Italian Government.

The reform of the energy sector is a key element in the government's Sustainable Growth Agenda. More than 20 years on since the adoption of the last National Energy Plan, the industry had been eagerly awaiting this policy document.

It is the result of a wide-ranging public debate on a consultation document that was presented last October. The debate involved more than 100 stakeholders (institutions, sector associations, trade unions), as well as the general public, through an on-line feedback mechanism.

The document defines objectives, key policies and priority measures in the energy sector. The measures defined in the new energy strategy, which has a double time horizon (2020 and 2050) aim at significantly improving cost competitiveness of the key energy sources (electricity, gas and fuels), which today tend to be more expensive than in other European countries. At the same time, the strategy make it possible to move decidedly towards the de-carbonization of the economy, while improving security of supply.

The results expected by 2020 are as follows:

- Wholesale prices of all energy sources will be aligned with average European average price levels, thanks to the liberalization measures foreseen and already undertaken, resulting in savings of about €9 billion/year in the overall power and gas bill (from current 70 billion – assuming same commodity prices). This is already happening, thanks to the measure already implemented: gas wholesale prices have aligned in the past few months (from an historical gap of about 20%), and electricity prices are coming closer to those of central Europe.

- Expenditure on energy imports will be reduced by about €14 billion/year (from the present €62 billion), and dependency on foreign supplies from 84% to 67%, thanks to energy efficiency, increased production from renewables, lower electricity imports and increased production from national resources.

- €180 billion will be invested between now and 2020 in the green and the white economies (renewables and energy efficiency) and in traditional sectors (electricity and gas networks, re-gasification plants, storage, hydrocarbon development). These will be private investments, partly supported by incentives, and are expected to generate positive economic returns for the Country.

- Greenhouse gas emissions will fall by about 21% vs. The 2005 level, exceeding the European 20-20-20 targets for Italy.

- Renewable energy sources will account for 19-20% of gross final consumption (compared with about 10% in 2010). This is equivalent to 22-23% of primary energy consumption, while fossil fuel use will fall from 86% to 76%. Furthermore, it is expected that renewables will become the primary source in the electricity sector together with gas, accounting for 34-38% of consumption (compared with 23% in 2010).

- Primary consumption will fall by about 24% by 2020 compared with the reference scenario (an estimated 4% below 2010 levels); this exceeds the European 20-20-20 targets of -20%, thanks mainly to energy efficiency measures.

To attain these results, the strategy has been articulated into seven priorities, each with specific supporting measures that have already been set in motion or are currently being defined:

1. Fostering Energy Efficiency, which is expected to exceed the European targets, as the most appropriate means of pursuing all the aforementioned objectives.

2. Promoting a competitive gas market, integrated with the other European markets and with aligned prices. Italy has the opportunity to also become the main Southern European Hub.

3. Developing renewable in a sustainable way, in order to exceed the European targets ("20-20-20"), while at the same time keeping energy bills competitive.

4. Developing an electricity market fully integrated with the European market; the market should be efficient (with prices competitive with the rest of Europe) and see the gradual integration of renewable power production.

5. Restructuring the refining industry and the fuel distribution network, to achieve a more sustainable system, with European levels of competitiveness and service quality.

6. Sustainably raising national hydrocarbons production, which will bring major economic and employment benefits, while observing the highest international standards in terms of security and environmental protection.

7. Modernising the system of governance of the energy sector, with the aim of making decision-making processes more effective and more efficient.

In addition, research and development will play a key role in developing technologies that allow for a more competitive and sustainable energy system.

The Italian Energy Strategy document is now publicly available on the website of the Ministry of Economic Development.

# The Green Revolution

**Proesa® process, from Beta Renewables: cost-competitive use of non-food biomass for biofuels and bio-chemicals**

Today world runs on oil and this creates substantial greenhouse gas emissions. The world is taking action to reduce these emissions and biofuels are a key part of the solution: for example in the European Union, 10% of all fuels must by biofuels by 2020. But we need to find alternatives to making biofuels from food crops; the future is second generation biofuels from cellulose, straw and agricultural waste. These are the basis from which Beta Renewables started to develop its Proesa® process, a second-generation cellulosic biomass technology that is the result of over €150 million invested in Research and Development since 2006. It takes inedible biomass, like energy crops or agricultural waste (such as sugarcane bagasse and straws) and turns them into high-quality, low-cost, fermentable C5 and C6 sugars. These sugars can then be used to cost-competitively produce ethanol and bio-products with a smaller environmental footprint than fuels and chemicals made from oil or natural gas. The Proesa® process is covered by 21 pending patents.

## THE SCIENCE BEHIND PROESA

The Proesa® process starts with a chemical-free pre-treatment phase. "Smart cooking" of the biomass minimizes the formation of inhibitors and increases overall efficiency. The parameters of our viscosity reduction technology and enzymatic hydrolysis can be tailored to optimize use of different feedstocks, transforming glucans and xylans into monomeric sugars best-suited for a target bio-product, while using low enzyme dosages and power consumption. Proesa® technology includes a strain engineered to convert both C5 and C6 sugars to

ethanol. In addition, unsulfonated, unchlorinated lignin byproduct can be sold to make chemicals or valorized into steam and power to provide energy for the plant.

Our science and engineering includes extensive research into feedstocks to optimize the process for specific geographies, climates and soil types. This demonstrates our commitment to enabling a sustainable biomass-to-products value chain, which includes profitable farming of the chosen biomass feedstock.

Our current Proesa® process is tuned for producing output streams in proportions most useful for the production of bio-ethanol and bio-chemicals. Over 1000 plants are projected to be needed by 2025 to meet global demand for these products. In addition, we are working with partners to develop additional advanced processes, including for renewable diesel and jet fuel production.

## WHO WE ARE

Beta Renewables, the company responsible for ongoing Proesa® process development and licensing, is a Joint Venture formed by Chemtex, the engineering division of the Italian Gruppo Mossi & Ghisolfi along with capital investment firm TPG. Recently Novozymes, the world leader in bio-innovation, has acquired a 10% share in Beta Renewables.

Beta Renewables' technology comes from an R&D complex in Rivalta Scrivia, Northern Italy, with over 150 researcher where it has run a demonstration-scale biomass plant continuously since mid-2009, with dedicated areas for partners that integrate Proesa® with their downstream conversions. Within an hour of this R&D center, Beta Renewables is building the world's first commercial-scale cellulosic ethanol plant in Crescentino, Italy. This plant started production at the end of 2012, with a design capacity of 60,000 metric tons per year, ramping up from an initial 40,000 tons. The technology is readily scalable to plant sizes exceeding 100,000 tons per year, and may also be cost-effectively implemented at more modest scale.

Beta Renewables builds upon over 60 years of success at its parent company, Chemtex, in process development and in commercializing hundreds of plants worldwide. This experience provides a uniquely pragmatic approach to technology development and deployment, with a keen focus on the cost to build and operate plants with market-leading economics.

BETA RENEWABLES S.p.A.

**Contact details:**
**Beta Renewables S.p.A.**
Strada Ribrocca,11
15057 Tortona (AL)
**Tel:** +39 0131 810.1
**E-mail:** info@betarenewables.com

# End of life of solar panel: e-waste or opportunity?

*Matteo Del Buono, European Academy of Bolzano/Bozen, Institute for Renewable Energy, South Tirol, Italy*

The photovoltaic industry can be described as a very dynamic industry. The amount of photovoltaic panels placed on market around the world has been rising sharply in the recent years and is expected to strongly grow in the coming years. At the end of 2009, the world's PV cumulative installed capacity was approaching 23 GW. One year later it was 40 GW. In 2011, more than 69 GW are installed globally and could produce 85 TWh of electricity every year: in some countries this amount already covers up to 5% of the gross national electricity consumption. In terms of global cumulative installed capacity, Europe still leads the way with more than 51 GW installed as of 2011. This represents about 75% of the world's total PV cumulative capacity. Next in the ranking are Japan (5 GW) and the USA (4.4 GW), followed by China (3.1 GW) which reached its first GW in 2011. Nonetheless, the future is uncertain as PV enters the competitiveness era because of the potential early phase-out or drastic decrease of some feed-in tariffs (FiT) programmes. This is especially noticeable in Europe where the PV market is undergoing a transformation due to changes in feed-in tariffs in key countries (Spain, Italy, etc), credit crunch and financial crisis.

Fig. 1 shows the outlook until 2016 of the cumulative capacity in EU-countries among the two scenarios considered by EPIA. To be noted that the 2020 PV potential of Europe varies from 240 GW for EU 27 countries which is much larger than the 110 GW estimated using a conservative forecast.

## BUT WHAT ABOUT THE END-OF-LIFE OF PV PANELS?

In December 2008 The European Commission has proposed to recast the Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Concerning the scope of the Directive within the recast procedure, the Commission intended to clarify the scope without changing it. A potential extension of the Directive to include photovoltaic panels was for that reason not addressed by the supporting impact assessment SEC(2008)2934. The discussions in the co-decision procedure and the negative evaluation of an environmental agreement submitted by the photovoltaic industry have shown that the option of including photovoltaic panels in the scope of the WEEE Directive should be analysed, in order to provide a solid ground for the on-going discussions between the legislators on this specific issue. The environmental impact of PV waste in the next decades could be foreseen assuming the scenarios for future cumulative installed PV capacity (as shown in Fig. 1) and considering a 25 year life time for panels. Mentionable quantities of photovoltaic panel waste will occur around 2050: 9.57 million tonnes of solar panels (Fig. 2).

PV recycling is currently not economically viable because waste volumes generated are too small, significant volumes of end-of-life photovoltaic panels will only begin to appear in 2025 or 2030. Nevertheless two treatment and recycling methods are yet operative: Deutsche Solar treatment as recycling process for crystalline silicon panels and First Solar treatment as recycling process for cadmium telluride panels. The main environmental problems linked with photovoltaic panels, if not properly disposed to a landfill are mainly leaching of lead and cadmium. Loss of conventional resources (primarily aluminium and glass for crystalline panels) and loss of rare metals (silver, indium, gallium and germanium for thin film panels) could be recovered by a high value recycling treatment. While it is cheaper to use virgin silicon in photovoltaic panel production, more potential economic incentives exist for CIS, CIGS, and CdTe panels due to the rarity of indium, tellurium, and other rare

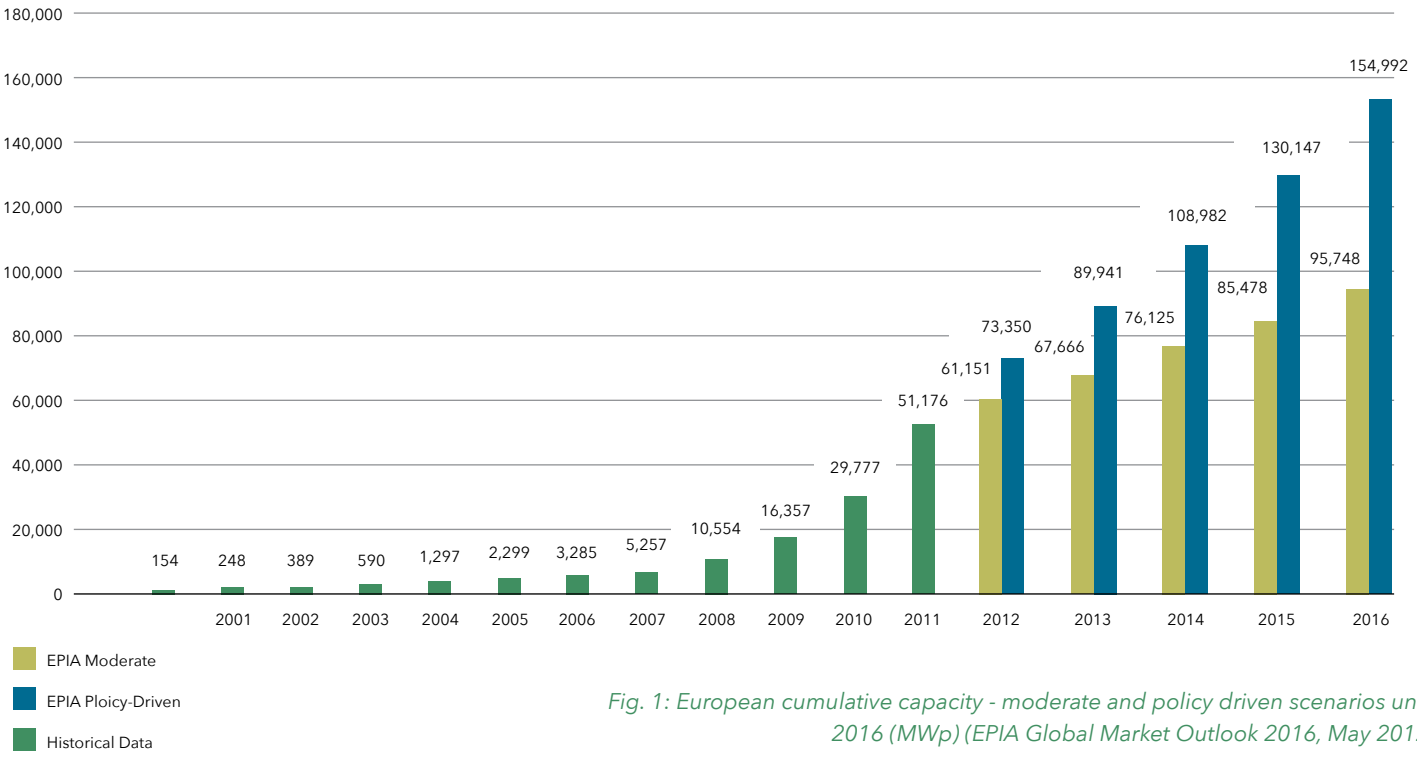



*Fig. 1: European cumulative capacity - moderate and policy driven scenarios until 2016 (MWp) (EPIA Global Market Outlook 2016, May 2012)*

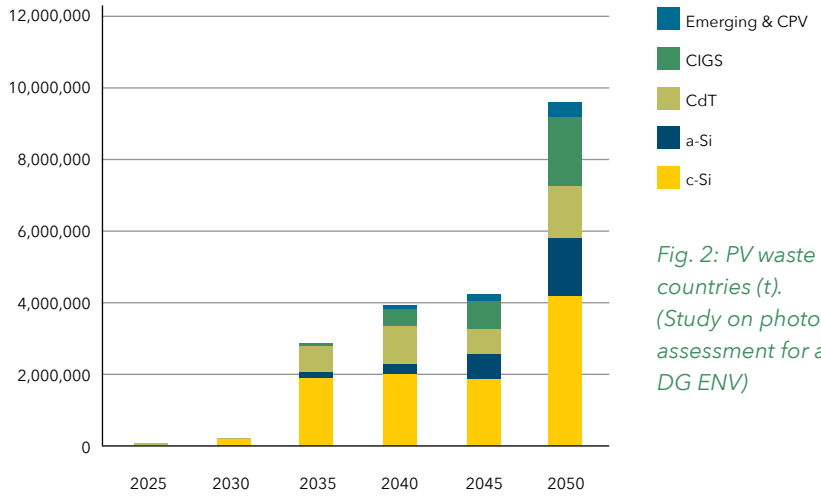



*Fig. 2: PV waste generated by different technology in the EU countries (t).*
*(Study on photovoltaic panels supplementing the impact assessment for a recast of the wee directive, Final report 2011, EC DG ENV)*

metals, particularly in comparison to expected future growth in the photovoltaic industry and the resulting exponential increase in raw material demand.

## RECYCLING IN ITALY AND ROLES OF EURAC

The Italian FiT system (Conto Energia, Decree of May 5th, 2011) required a certificate issued by the manufacturer of photovoltaic modules, confirming that the PV manufacturer or importer is a member in a take-back and recycling system/ association. In December 2012 the Italian institution responsible for the FiT (GSE - Gestore Servizi Energetici) released the technical specification to define and verify the technical prerequisite for associations in charge to recovery and recycling of end-of-life PV panels in Italy: PV Cycle, Cobat; Remedia, Ecolight, etc... As applied research institution Eurac – Institute for renewable energy –will collect all the necessary information to support public institution, associations and PV manufacturer defining methodology and procedures to handle in a proper way the end-of-life PV panels. Eurac, in cooperation with a local waste service company (Santini Servizi srl), has already concluded a preliminary study collecting the recovery and recycling experience in Italy. Considering the Italian PV installation of the last four years, about 1,1 million tonnes of PV waste in 2036 are expected in Italy. The recycling technology and market have huge potential for future developing.

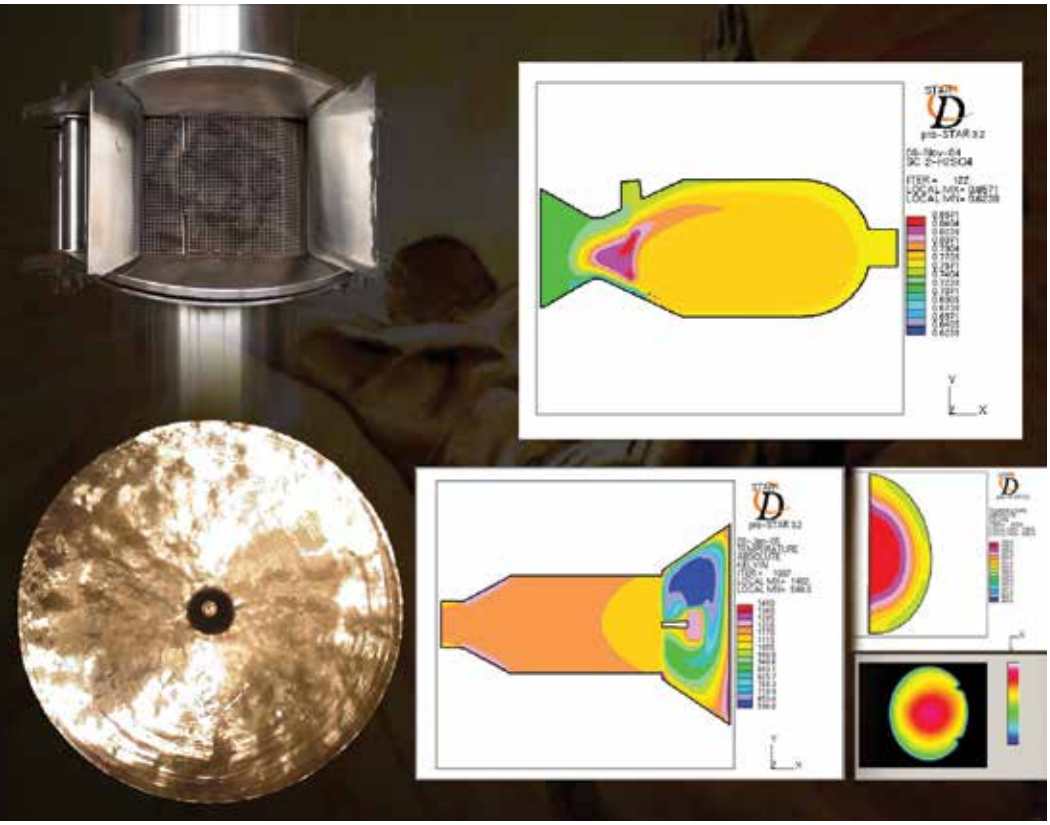
# RO3 EC & FMG Energy Saving Related Research Activities

*Prof. Giovanni Cerri*

Roma Tre University Energy Conversion and Fluid Machinery Group (RO3 EC&FMG), depicted in Figure 1, is continuously working in the field of Renewable Energy and Energy Saving collaborating in many European and National Projects as partner and coordinator. In the last decade, an hardware Solar Simulator has been developed to investigate innovative sun energy receivers, absorbers and storage concepts. Figure n.2 shows one of the ellipsoidal reflector under light concentration test and details of three high temperature receivers. In this field, the RO3 EC&FMG has been working with CEA - Commissariat à l'Energie Atomique (F), DLR (D) and ENEA (I) for the development of Hydrogen production by means of thermochemical plants fed by Nuclear and Solar Energy under HYTHEC EU Project and TEPSI Italian Project. The Solar Simulator is going to be used to develop innovative devices to be adopted for the Mini-Gas Turbine Solar Thermodynamic EU funded OMSOP Project that has been launched in February.

*Figure 1*

*Figure 2*



Presently, the RO3 EC&FMG is also working on the assessment of innovative small concentrated solar energy plants for electricity production. Unconventional cycles and innovative storage systems are going to be investigated. Such Thermodynamic Plants have to meet the Italian rules with the main goals of receiving incentives and being economically convenient.

Moreover, the RO3 EC&FMG is focusing their attention on the energy saving concepts applied to industrial cryogenic plants. In particular, in collaboration with Angelantoni Industrie S.p.A and SETEL S.r.l., under the national Cold-Energy project, the RO3 EC&FMG is developing a system (shown in Figure 3) that allows plant internal recovery expecting a power consumption decrease of some 15-20%.

The RO3 EC&FMG is also involved in the preparation of water and ethanol in liquid fuel (like vegetable oils) emulsions to improve atomization and

combustion performance in terms of energy saving and emissions in furnaces, reciprocating engines and gas turbines. Figure 4 shows an innovative automatic mixer that allows the installation of the system on board of the engine. The produced emulsion is of engine customized quality and can bring to disperse up to 25%-30% of ethanol in the fuel without the addition of chemicals for the mixture stabilization.

Finally, the RO3 EC&FMG has been working in the field of education and lifelong learning. A personalized "Green training programme" has been developed under the EU funded GoGreen Project. The programme is aimed at improving knowledge and skills of entrepreneurs and professionals to promote the Green Business practices in SME's.

*Figure 4*

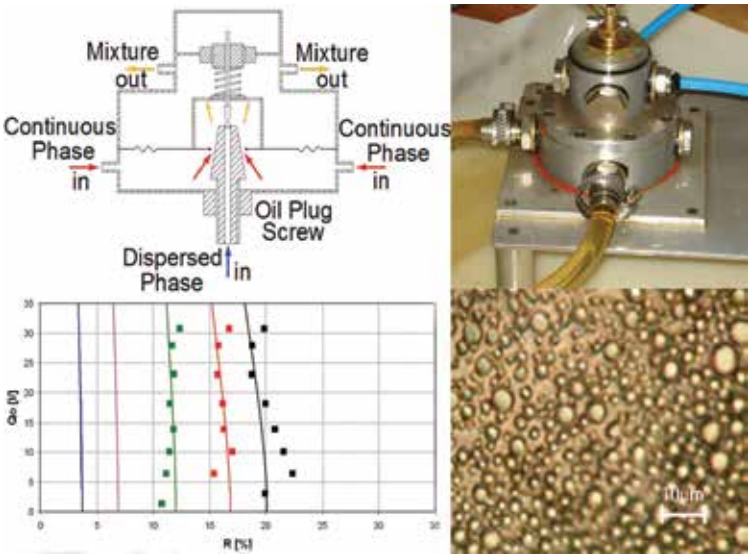
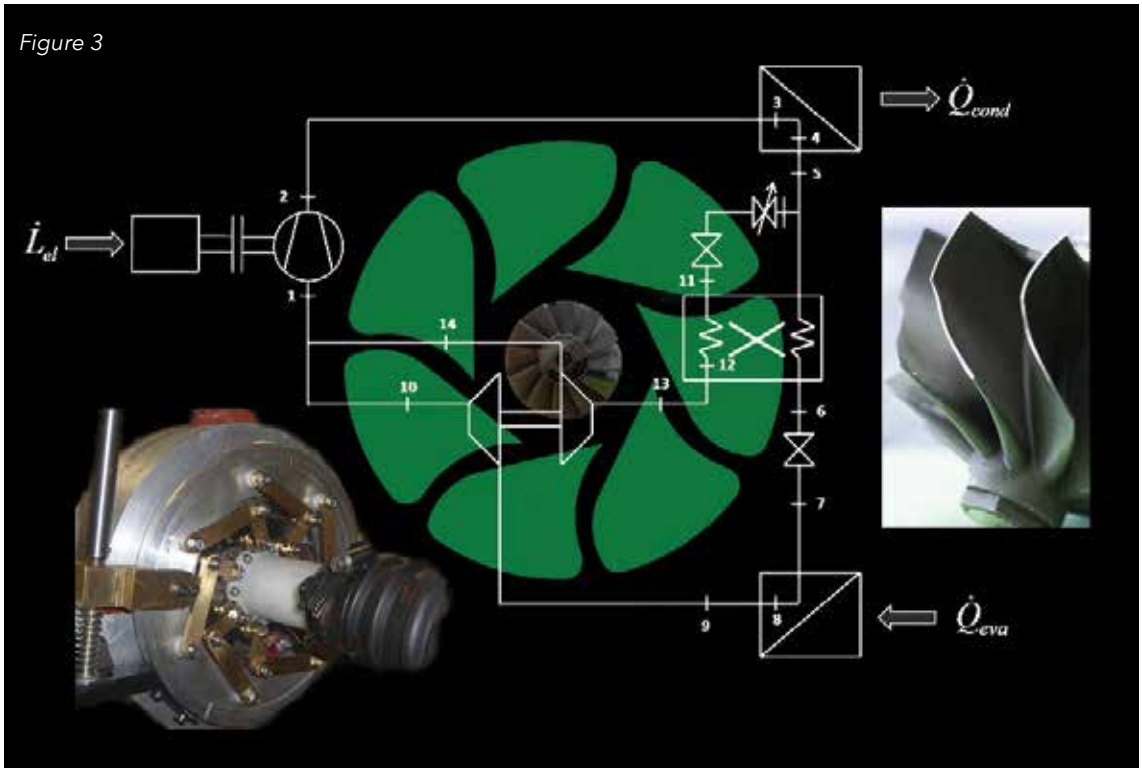



*Figure 3*



# "The secret of getting things done is to act."

*- Dante Alighieri*

*Mike Edmund, Editor*

It would be easy to devote this article to the glamorous international brands for which Italy is well known; and to fill it with seductive images of the Amalfi Coast; or of a beautiful supercar snaking its way across the evening countryside in Tuscany. It will nevertheless review instead some of the country's more significant renewable energy technology (RET) initiatives. Indeed according to Eurostat, Italy is making impressive progress towards its 20-20-20 RE target of 17% of energy production. Leaving aside how any component of a 20-20-20 target can be expressed by a figure of 17, the four years since 2006 have seen the proportion of RE rise by very nearly three quarters, to stand at a shade over 10% of the total: more than half way to the goal.

Italy's approach is perhaps typified by its partially-nationalised €79.5 billion multinational energy giant Enel. According to the company, about 42% of its 98 GW of net installed generating capacity last year was carbon-free. Enel also claims to be the first utility in the world to replace the traditional electromechanical meters of its 33 million domestic retail customers with smart meters. Enel also plans to instal an additional 13 million smart meters among its customer base in Spain. [*Enel, 2011 figures*] As readers will already know, Smart Meters are fundamental to smart grids and hence smart cities.

The photovoltaic (PV) sector has historically been the dominant RET in Italy: installed capacity has been growing spectacularly year-on-year, from 87 MW in 2007 to 12.75 GW in 2011. [*Data: GSE; Eurobserv'er*]

*Figure 1*

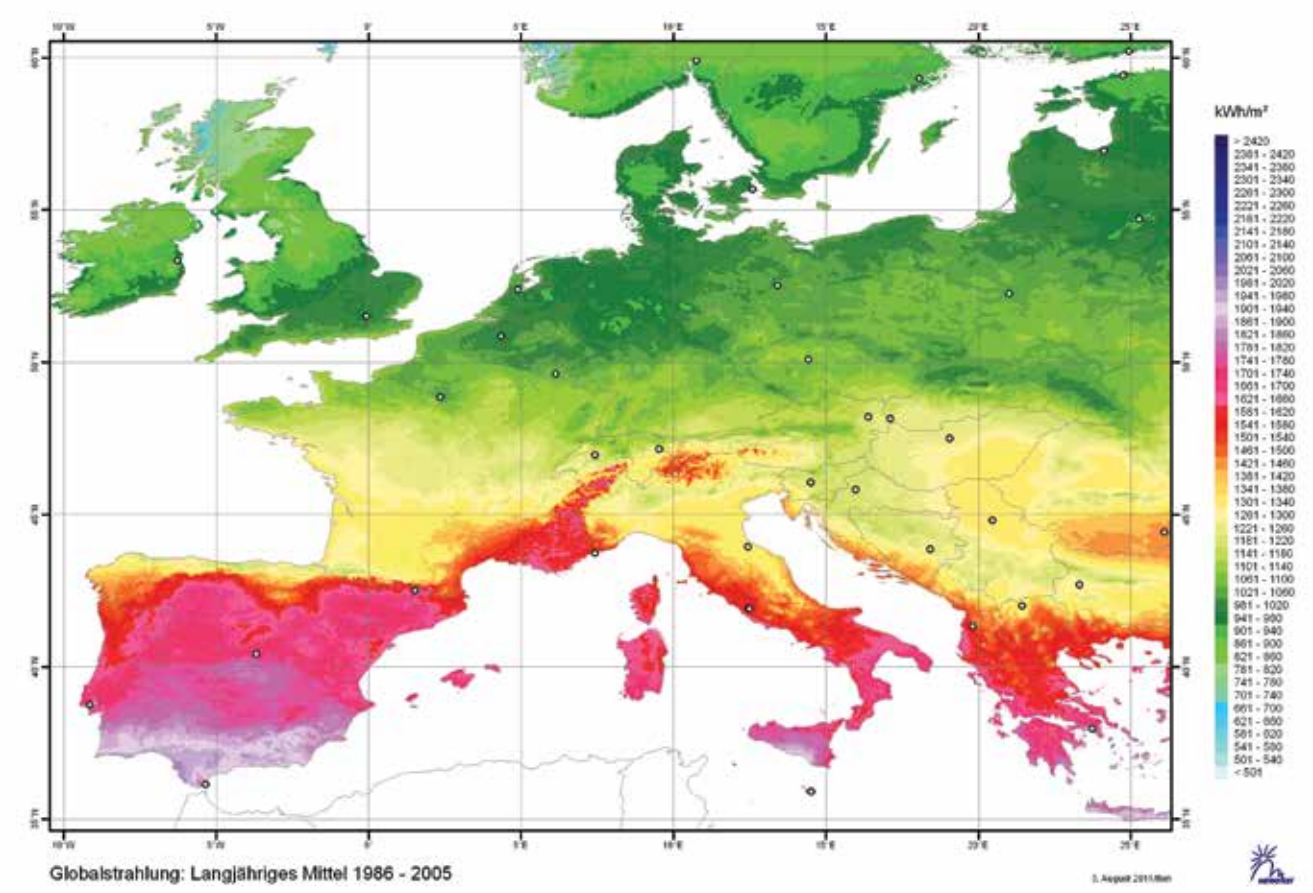


*Figure 2*

A glance at a map of solar irradiation [*Figure 1*] shows clearly why this is so; it also illustrates the apparent differences between northern and southern european countries, with the Alps seeming to represent something of a 'solar frontier'. Two of the largest PV installations in Italy are the Montalto di Castro power station in Viterbo province (rated at 85 MW) and the 48 MW Serenissima Solar Park in the northeast of the country. The solar panels at Montalto di Castro are supplied by SunPower, a company that features in an interview elsewhere in this issue and, though impressive, these figures should be placed in context. Recent months have seen reduced emphasis upon ground-mounted solar PV, mainly because of cuts in public incentives announced in 2012. Meanwhile, that emphasis is increasing in other countries. In the USA, the Agua Caliente facility is rated at 250 MW, a figure that is dwarfed by the Greek Project Helios, which is scheduled to come online in 2015 and is rated at 10 GW.

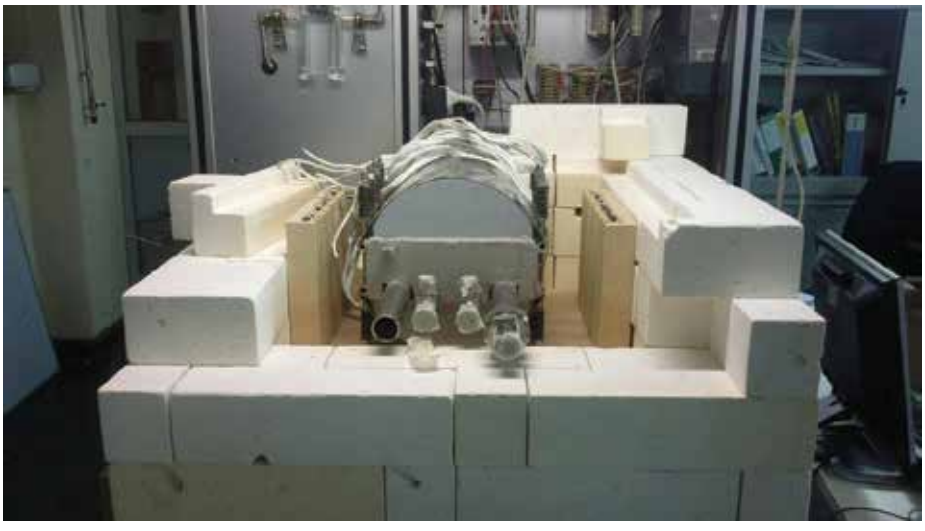
Conversely, Italy's legislative regime has generating increased interest in other RETs such as wind, geothermal, wave and tidal power, biomass, biogas, landfill gas and sewage treatment gas. In practice, Enel subsidiary Enel Green Power [*EGP*] was responsible last year for a total of around 7.6 GW of installed renewable capacity [*Enel, 2011 figures*]. The considerable technological knowhow and expertise in the fields of hydropower and geothermal energy so acquired form the basis of potentially valuable exports. Meanwhile, according to Gestori Servizi Energetici [*GSE*], Italian bioenergy production of electricity rose 20% in 2011 to 2.8 MW [*GSE's sole shareholder is the Italian Ministry of Economy and Finance: Editor*].

Perhaps it was inevitable after all that an article featuring Italy would mention Ferrari. As it goes to press, the Maranello-based firm has just announced LaFerrari [*Figure2*], which powered in part by a 161bhp electric motor. It is perhaps beyond the scope of these pages to discuss whether the world needs a car capable of speeds of over 350km/h, but there is a long history of automotive innovations in high-performance vehicles finding their way into mass-market cars. St Francis of Assisi offers encouragement: "Start by doing what's necessary; then do what's possible; and suddenly you are doing the impossible." His words were given added poignancy last November, when Pope Benedict XVI addressed the Pontifical Academy of Sciences just a few months before he resigned the papacy. On that occasion, he spoke of "the urgent need for continued dialogue and cooperation between the worlds of science and of faith in the building of a culture of respect for man, for human dignity and freedom, for the future of our human family and for the long-term sustainable development of our planet." Clearly, Rome has had its 20-20-20 commitments at the heart of domestic energy policy during what can only be described as difficult economic and political conditions. It remains to be seen how the recent election result will affect progress.

# SOFC CCHP with poly-fuel: operation and management (SOFCOM)


*Plant site of the Demonstration in SMAT (Torino. Italy)*

*Test bench for lab test on effects of contaminant on SOFC stacks*



**SUMMARY/OVERVIEW:**
The research activity is devoted to the scientific, technical and economic management of two demonstration of complete energy systems based on SOFCs.

A first proof-of-concept SOFC system (Torino, Italy) will be able to operate with biogas produced in an industrial waste water treatment unit (WWTU). The plant will be in operation as CCHP plant, with heat recovery from the exhaust for the production of hot services (e.g. hot water) and conditioning services (through an adsorption chiller). Also, the plant will be completed with a $CO_2$ separation from the anode exhaust and with a section of $CO_2$ management (and disposal) integrated with the primary fuel processing system.

A second proof-of-concept SOFC system (Helsinki, Finland) will be demonstrated considering a SOFC stack operating with a syngas from biomass gasification. This second demonstration plant will be concentrated on the operation of a SOFC stack with a lean gasification fuel; all the concerns related to a proper fuel gas cleaning for fuelling the fuel cell system.

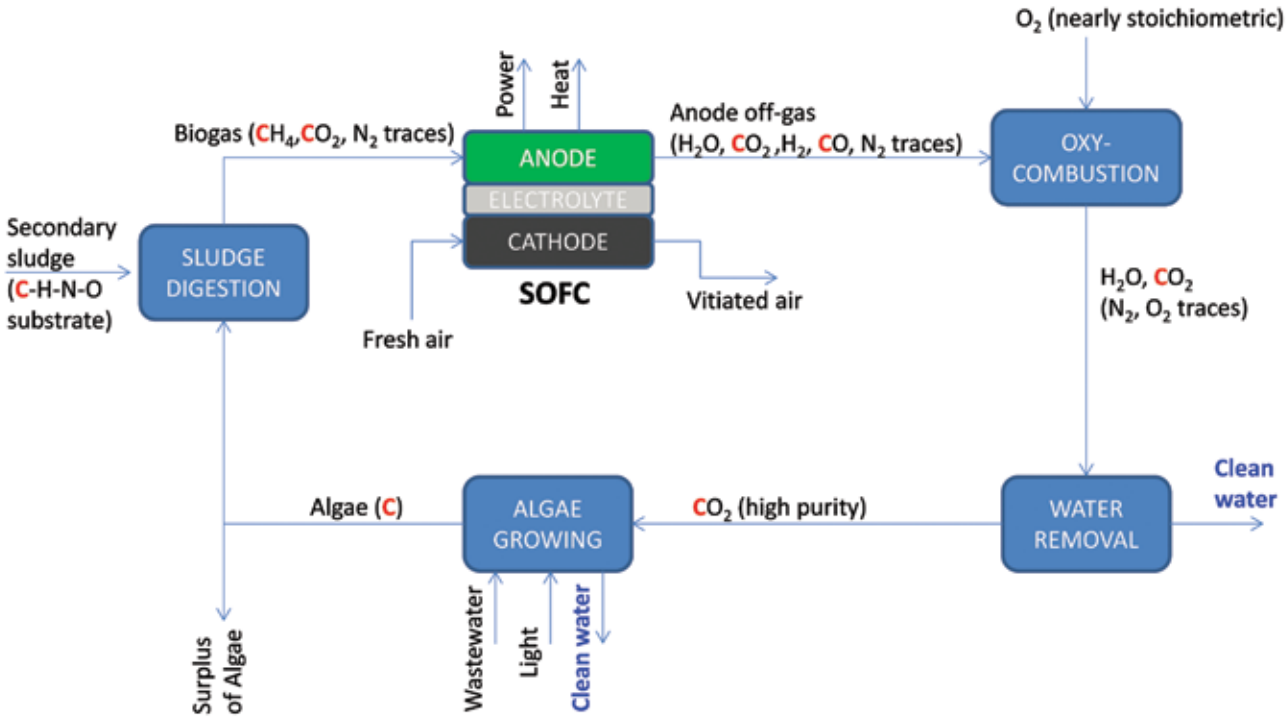
The Demonstration Axes will be implemented in the context of other 2 axes:

- Lab-scale Experimental Analysis Axis, developed on every section of the whole system at laboratory-scale: fuel section; cleaning section; fuel processing section; SOFC CCHP section, for the production of electrical and thermal (cooling and heating) power; carbon capturing module.

- Macro-scale Analysis Axis (Energy-Environmental analysis, Industrial Scale-Up analysis, repair strategies): preparatory to the Demonstration Axis: modelling of the complete system, devoted to the energy, economic, environmental analysis of the option SOFC-based CCHP plants as distributed systems using local energy sources; validation of the plants, with the subsequent development of guidelines for the scale-up and industrialisation of such plants, and the definition and redaction of repair strategies, the monitoring analysis on the long run, and the development of pre-normative results leading to recommended practices for those plants.

**OBJECTIVES**
The proposal is an applied research project devoted to demonstrate

sofcom
FCH-JU project




*Carbon Cycle in the SOFCOM Process*

the technical feasibility, the efficiency and environmental advantages of CCHP based on SOFC fed by different typologies of biogenous primary fuels (biogas and bio-syngas, locally produced), integrated with a process for the $CO_2$ separation from the exhaust gases.

- scientific improvement of SOFC fed by biofuels;
- technical and economic management of two demonstration based on SOFCs with carbon sequestration-management modules;
- pre-normative issues and scale-up analysis of this typology of integrated plants.

## EXPECTED IMPACT

- The main impact of the project will be the 'proof-of-concept' demonstration of two SOFC units integrated with biogas or bio-syngas, respectively.
- Such fuels have a wide potential in terms of availability and diffusion over the territory. The fuels considered are not only of interest because of their carbon neutrality, but also for their market interest.
- Another relevant impact accomplished by the project is represented by the CCS capability of the integrated systems studied and tested during the project.

**Contact details:**
**Coordinator:**
Politecnico di Torino

**Contact:** Mr Massimo SANTARELLI
E-mail: Massimo.santarelli@polito.it
Tel: +39 011 0904487

**Other participating organisations:**
TEKNOLOGIAN TUTKIMUSKESKUS VTT
TOPSOE FUEL CELL A/S
SOCIETA METROPOLITANA ACQUE TORINO SPA
MATGAS 2000 A.I.E
CONSIGLIO NAZIONALE DELLE RICERCHE
INSTYTUT ENERGETYKI
ECOLE POLYTEC
LAUSANNE
TECHNISCHE UNIVERSITAET MUENCHEN
UNIVERSITA DEGLI STUDI DI TORINO

**www.sofcom.eu**

# Peculiarities of the Italian Energy System

*Ugo Farinelli , AIEE - Italian Association of Energy Economists*

*Ugo Farinelli*

The Italian energy system differs markedly in many respects from those of the other major member countries of the EU as concerns both energy supply and energy demand.

The most striking difference is perhaps the relevance of natural gas as an energy source, in particular for electricity generation. Having renounced since 1987 to exploit nuclear power, having only marginal coal deposits and meeting with strong local opposition to coal power stations, Italy has turned first to fuel oil and then progressively to natural gas, which at present accounts for 70% of thermo-electric production and over 50% of total electricity production. Modern, highly efficient (nearly 60%) gas turbine combined cycle power stations are prevalent. In addition, (another distinctive feature in the EU panorama), Italy has been importing large quantities of electricity (up to 15%), now being reduced. Italy's dependence on import for about 84% of its energy sources is also a record in the EU.

Renewable energy (RES) was traditionally present as hydroelectricity, especially in the Alps. A number of these plants can also be used for electricity storage. The last years have seen accelerated introduction of new RES, mainly wind and PV, especially in the electricity sector – a programme generally considered somewhat over-expensive, which brought Italy to the 2nd place (after Germany) in EU for RES; also worth mentioning is the relevant presence of geothermal energy, which Italy was the first to use for large scale power generation starting from 1905, and for which it is still by far the leader in the EU.

Peculiarities can be found also on the demand side. Italy is one of the most "virtuous" countries in the world in terms of low energy intensity of the GDP: this derives mostly from the high energy efficiency in the industrial sector (efficient processes, high presence of industrial combined heat and power production); and on the product mix, based on medium, small and very small industries, often clustered in industrial districts, and on high-quality, high value-added products which characterise the "made in Italy mark; and also, in the transport sector deriving from traditionally high prices of petrol (record in Europe) which prompted the diffusion of efficient and small-size cars. This does not apply to the building sector, where for a number of reasons (particularly the bad quality of buildings erected in the post-war boom) insulation and other "passive" characteristics are markedly below the EU standards.

Peak demand for electricity is now in summer rather than winter, due to the increasing load of air-conditioning. The rapidly increasing contribution of RES to electricity production (the dispatch of which is compulsory) is creating some criticality in balancing for the transport and distribution system, which has stimulated the interest for "smart grids". In this direction, Italy is a fore-runner in "smart meters" for electricity (smart gas meters are on the way) having installed 30 millions digital meters (a world first) allowing (at least in principle) exchange of information between distributor and clients.

The Italian government has recently issued a "National Energy Strategy" document (in the frame of an ample consultation of all stake-holders) which sets objectives and proposes actions from now to 2020. Main priorities include: increasing the efficiency of energy utilisation beyond the 20% required by the EU; promoting an integrated gas market, allowing Italy to become the main South-European gas hub; further promoting renewable energy (to supply 20% of total energy consumption and 37% of electricity), with a re-balancing in favour of thermal applications; sustaining the national production of hydrocarbons. The strategy aims at reducing the price of energy to the European average level, particularly for the productive system, which has to face international competition.

fiper
FEDERAZIONE ITALIANA PRODUTTORI DI ENERGIA DA FONTI RINNOVABILI

# Biomass to energy in Italy:

## is it a real and cost effective opportunity?

*By Dr. Vanessa Gallo – National Secretary of FIPER*

### BIOMASS POWER PLANTS

The latest Ministerial Decree 6 July 2012 represents a turning point for the energy biomass use. For the first time, the Italian Government has promoted efficient biomass use by creating an additional incentivef for co-generation (combined heat and power) systems. In fact, previous incentives rewarded exclusively energy production, distorting the woody biomass market chain. Another important decree concerns the promotion of byproducts derived from wood, agricultural or agro-industrial chain in full compliance with the Waste Directive. This decree previews an additional incentive for the energy production by byproducts (table 1).

### INCENTIVE FOR ENERGY PRODUCED BY BIOMASS

On the other hand, the use of byproducts permits the energy producers to diversify biomass sources and to reduce the impact on energy crops. Italy has an interesting potential of byproducts deriving from the agriculture sector: vineyards, fruits and olive tree grove pruning, etc., as well as woody residues produced by forest management, river cleaning , public woody pruning, or the residues from wood processing industries.

### BIOMASS HEATING PLANTS

There is a structural delay in the Italian production of heat from renewable sources. Before the enforcement of the 20 20 20

*Table 1*

| | Power (kWe) | Life Time (years) | Base Tariff (€/MWh) | Increase CHP (€/MWh) | Increase CAR for nitrogen (€/MWh) | increase for nitrogen (€/MWh) | MAX CAR Tariff (€/MWh) | Max Tariff without CAR (€/MWh) |
|---|---|---|---|---|---|---|---|---|
| Biomass products | 1<P≤300 | 20 | 180 | 40 | 30 | 20 | 250 | 200 |
| | 300<P≤600 | 20 | 160 | 40 | 30 | 20 | 230 | 180 |
| | 600<P≤1000 | 20 | 140 | 40 | 30 | | 210 | 140 |
| | 1000<P≤5000 | 20 | 104 | 40 | 30 | | 174 | 104 |
| | P>5000 | 20 | 91 | 40 | 30 | | 161 | 91 |
| Biomass Byproducts | 1<P≤300 | 20 | 236 | 10 | 30 | 20 | 276 | 256 |
| | 300<P≤600 | 20 | 206 | 10 | 30 | 20 | 246 | 226 |
| | 600<P≤1000 | 20 | 178 | 10 | 30 | | 218 | 178 |
| | 1000<P≤5000 | 20 | 125 | 10 | 30 | | 165 | 125 |
| | P>5000 | 20 | 101 | 10 | 30 | | 141 | 101 |
| Waste | 1<P≤1000 | 20 | 216 | 10 | 30 | 20 | 256 | 236 |
| | 1000<P≤5000 | 20 | 109 | 10 | 30 | | 149 | 109 |
| | P>5000 | 20 | 85 | 10 | 30 | | 125 | 85 |


Dr. Vanessa Gallo

*Table 2: Annex A Delibera 182/2012/I/FER:*
AEEG Evaluation of the system cost" for 1 Tep of energy production/yearly

| | |
|---|---|
| Electricity produced by FER | €930 |
| Electricity produced by photovoltaic | €3500 |
| Thermal energy produced by FER | €350 |
| Efficiency Measures | €100 |

Directive, policy was to promote renewable electricity production against efficiency measures and heat production, although the Directive does not distinguish between thermal and electrical KWh Recently The Authority of Electric Energy and Gas (AEEG) published a specific analysis regarding the global costs of 1 Tep of energy production. These results invite the Italian Government to promote both the thermal renewable sector and efficiency measures through the new National Energy Strategy (SEN).

A new incentive, the "conto energia termica", designated for domestic thermal production from renewables (biomass, pellet boiler and heater, heat pump, solar panel etc.) was introduced in Italy on the 1st January 2013. Nevertheless, Government has allocated only 900 million euro/ yearly for this measure.

In the industrial sector, a new decree concerning Efficiency Energy (the TEE) is in force; it concerns projects on energy saving. This decree previews an increase of 50% of TEE value for "big projects" able to guarantee energy saving above 35.000 Tep.

Stakeholders are still awaiting the ministerial decree concerning guaranteed funding criteria for promoting the realization of district heating plants. For this funding during 2011-2012, the AEEG collected about 100 million Euro in gas revenues.

District heating plants could play an important role to develop and consolidate the woody biomass chain.

In Italy, Fiper estimated that 801 municipalities could be heated by biomass district heating plants. If the Government decides to promote even only 400 of the 801 plants (of about 5-10 MWt – 0,5-1 MWe), the national power will be increased by 1000-1500 thermal MW and 200-400 electric MW produced by CHP, with a contribution estimated in 0,5-1 Mtep. This figure corresponds to an investment of about 2,5- 4 billion Euros allowing the use of 3-6 million of tons of woody biomass yearly, for an economic value estimated at 5-10 Billion Euros per year (at current biomass prices).

finally, the future of biomass to energy is in the hands of the new Government!

# 4th European Conference on Renewable Heating & Cooling 22-23 April 2013 Dublin Ireland

## Join us and shape the future of Renewable Heating & Cooling in Europe!

Highlights of the conference include:

- Launch of the new **Strategic Research Agenda for Renewable Heating and Cooling**
- Debate on the subsequent **Implementation Roadmaps for Solar Thermal, Geothermal and Biomass technologies**.
- Attend the conference and **contribute to identify the best ideas for research, development and demonstration projects**, which could receive support under the coming framework programme "Horizon 2020" of the European Union!

Register now online:

**www.rhc-platform.org/conference2013**

RHC Renewable Heating & Cooling European Technology Platform

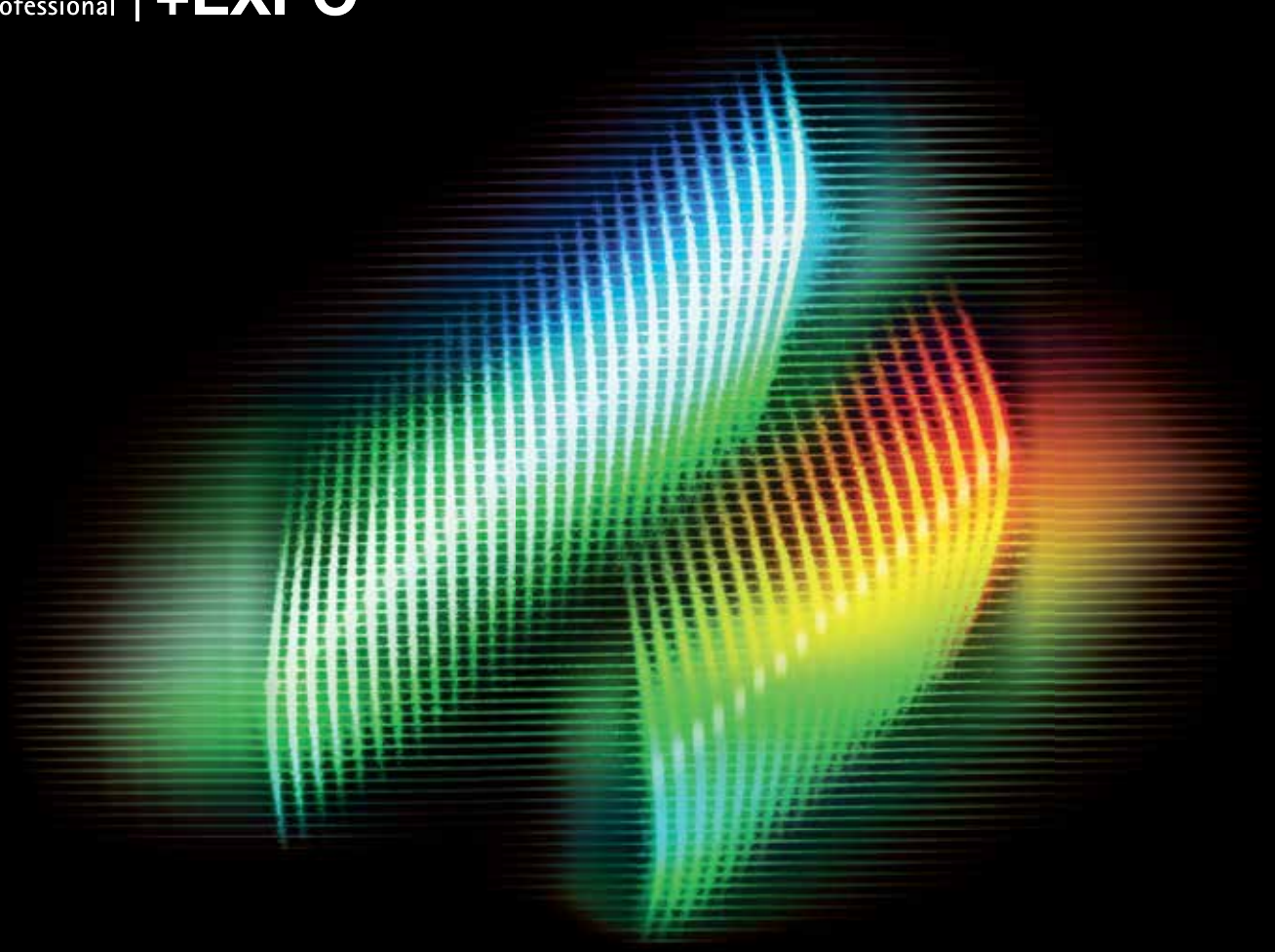
IN ASSOCIATION WITH eu2013.ie

With the support of

3rd annual LED professional Symposium & Exhibition

# LpS 2013

LED professional | SYMPOSIUM +EXPO



# LED Lighting Technologies

International Winning Approaches

## 24-26 SEPT 2013 | BREGENZ | AUSTRIA

**Europe's Foremost LED Lighting Technology Event**

LUGER RESEARCH | Moosmahdstrasse 30 | 6850 Dornbirn
T +43 5572 39 44 89 | F +43 5572 39 44 89 90

info@lps2013.com | www.lps2013.com