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Spokesman for Transport and Regional Policy, European Commission

Isabelle Ryckbost
Secretary General, ESPO

Diederik de Stoppelaar
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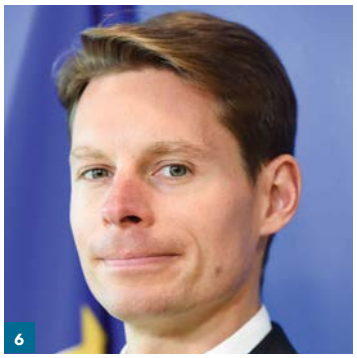
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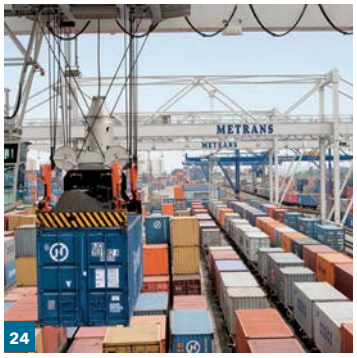

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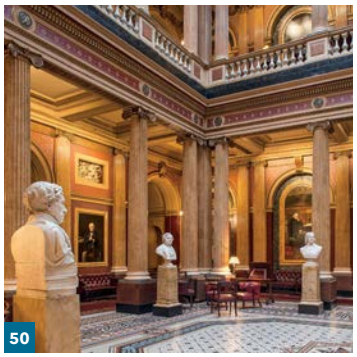
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Foreword

As we go to Press, Europe confronts many important and potentially dangerous issues, perhaps illustrated up by EU Commission President Juncker's comment: "We can't go on with business as usual". EEI is dedicated to innovative technologies, perhaps the means by which many of these problems may be surmounted.

In our Shipping feature in this issue, Jakub Adamowicz from the EU Commission discusses the potential role of LNG as a promising means of lowering the sulphur content of marine fuels, and so lowering emissions. Meanwhile, the Federation of European Private Port Operators (FEPORT), which speaks on behalf of more than 1200 large terminal operators and stevedoring companies, operating in over 400 seaports across the EU, reviews the role of the voluntary EEEG Guidelines in reducing the greenhouse gas emissions footprint for container terminals. Isabelle Ryckbost, Secretary General of the European Sea Ports Organisation (ESPO) emphasises the importance of Ports, which "supply, produce, use, store, import, transport, save, clean energy" Ms. Ryckbost goes on to explore the opportunities and challenges facing ports as they face up to climate change policy goals, geopolitical developments and volatility of energy prices.

In his excellent article, Dr.Arnulf Jäger-Waldau from the European Commission sounds note of caution about photovoltaic energy. Noting the rapid growth in installation, which appears set to continue as far as 2020, he nevertheless points to a future stagnation in the European market. Unrealistic FITs , a less than perfect legal framework point and variations in non-technical costs across the EU point to investment uncertainty. Nevertheless, he suggests that future reductions in the price of the technology might spur growth, particularly if both the legal and electricity distribution infrastructure are overhauled. Meanwhile, James Watson and Kristina Thoring of SolarPower Europe describe COP21 as an opportunity for global leaders to promote solar power. Climate change, they say, is "the urgent and defining issue of our time". They set out the rationale for photovoltaic energy in clear terms, which is based upon the falling cost of the technology and the high level of popular support.

In a time of increased global uncertainty, Angela Marlovits from Gas Infrastructure Europe (GIE) explains the rationale behind a methodology to increase security awareness (MEISA). Most companies, she points out, are conscious of the need to build a security awareness culture within their organizations, but better awareness among senior management and employees is needed. Identifying 23 methods to increase security and 11 methods to measure security awareness, she describes how MEISA has been developed for the gas network industry.

2015 is the International Year of Light: Carlos Lee and Louis Bonnefous review the history of lighting, from the candles and oil lamps of antiquity through arc lamps, incandescent filaments and fluorescents, to electroluminescence and LEDs. They discuss how important LED technology might become in preserving our cultural heritage, lighting buildings such as London's Reform Club, and protecting artwork from UV and IR irradiation. We may not be "in a good place." But innovation can take us to one.

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

Michael Edmund
Editor

LNG – promising solution for ships

By Jakub Adamowicz, Spokesman for Transport and Regional Policy, European Commission (pictured)

As of 1st January 2015, seagoing vessels sailing in Emission Control Areas (ECAs) must use fuels with maximum 0.1% sulphur content. ECAs comprise the Baltic and North Sea in Europe and most of the US and Canadian coasts as well as the US Caribbean Sea area. In all other waters across the globe, the sulphur cap will be lowered from the current 3.5% to 0.5% by either 2020 or 2025, depending on the results of a feasibility review planned for 2018. The new limits were set by the International Maritime Organisation (IMO) through Annex VI of the MARPOL Convention[1]. The Convention imposes also strict requirements on emissions of nitrogen oxides (NOx) in ECAs, which all marine diesel engines installed after 1 January 2016 must comply with. This will significantly reduce the total emission of nitrogen oxides in shipping.


Photo: © EU

The sulphur requirements of the MARPOL Convention were incorporated in EU law via the Sulphur Directive 2012/33/EU, which prescribes the use of fuels with a maximum 0,5% sulphur content in all EU waters (non-ECAs) as of 2020, independently of the results of the 2018 review.

Moreover, EU policy[2] is also targeting a reduction of greenhouse gas (GHG) emissions from the shipping sector of at least 40% by 2050. Currently, GHG emissions from global shipping amount to around 1 billion tonnes a year, which corresponds to 3% of the world's total. In the EU, the proportion of emissions from shipping stands higher at 4% of the total. If no measures are taken, CO_2 emissions from the shipping industry are expected to increase between 240% and 600% by 2050 according to the Transport Outlook 2015 published by the OECD International Transport Forum. In addition, the availability and cost of fossil fuels are matters of concern.

The use of LNG as propulsion fuel for shipping, the use of low sulphur fuels and the installation of exhaust gas scrubbers are the main alternatives for compliance with the more stringent air emission requirements for vessels.

Comparing the relative emissions for these various compliance options shows that LNG propulsion has the most environmental benefits. LNG propelled ships emit hardly any particulate matter, about 90% less sulphur oxides, up to 90% less NOx and 20-25% less CO_2, representing a good solution for the reduction of both relevant substances and GHG emissions. The use of LNG as an alternative fuel for shipping has therefore greater environmental potential than fuel oils and distillates, even taking into account the production and transport process.

There are however concerns regarding the methane release that can occur during all stages of the LNG life-cycle. Since methane is 20-25 times more powerful than CO_2 as a greenhouse gas during a 100 year time span, the issue requires careful handling. The specific case of methane emissions resulting from internal engine combustion has been extensively addressed and discussed. 'Methane slip'

results from the incomplete gas combustion leading to the emission of small amounts of methane to the atmosphere. Engine technology is the way to address this problem. Different engine concepts are available today for using LNG as a shipping fuel. Working on gas only or in dual fuel arrangements, four-stroke engines have gone through serious design improvements to minimize methane-slip, whilst in modern two-stroke engines this has already been practically eliminated during combustion.

To minimize methane slip, additional specific measures could be developed, like: methane emissions mitigation plans, optimisation of transport efficiency of LNG-fuelled ships and adequate design of the LNG supply chain.

LNG is also expected to be less costly than marine gas oil (MGO). Current low LNG prices in Europe and the USA suggest that a price – based on energy content – below that of heavy fuel oil (HFO) is possible, even when taking into account the small-scale distribution of LNG.

With the exception of Norway, the take-up of LNG as ship fuel in Europe is still at an early stage, and key stakeholders typically identify three main barriers: the lack of adequate bunker facilities for LNG, the gaps in the legislative or regulatory framework, and the lack of harmonized standards.

The recently adopted Directive 2014/94/EU on the deployment of alternative fuels infrastructure aims to solve the first problem by requiring Member States to provide an appropriate number of LNG refuelling points for maritime and inland waterway transport in the maritime ports of the TEN-T Core Network by 31 December 2025 and in the inland ports by 31 December 2030.

To address the next two barriers, the Commission launched at the end of 2014 the *Study on the completion of an EU framework on LNG-fuelled ships and its relevant fuel provision infrastructure*. The results should be available in the second half of 2015.

The overall aim of the study is to analyse the current legal and procedural situation, as well as trends and obstacles for the use of LNG as a fuel for ships in the EU. As a part of this study, an awareness campaign has been carried out, providing balanced information about LNG as an alternative fuel for shipping (cf. www.lngforshipping.eu). The website will be kept updated and enriched with new inputs.

At the same time, by means of its Connecting Europe Facility (CEF), the EU is providing financial support for the development and deployment of LNG-related technologies and facilities. Following the 2014 CEF call for proposals, about EUR 43.5 million has been allocated to projects promoting LNG deployment in the maritime sector. Additional funding will be made available in the CEF call to be launched in the fall 2015.

Various international organizations and relevant expert fora support the harmonization of standards and the overall promotion of LNG as a maritime fuel: IMO, EMSA, IACS, SIGGTO and SMGF just to name a few. Also the European Commission has established the European Sustainable Shipping Forum as a cooperation platform for Member States and maritime industry stakeholders, to enable a structural dialogue, exchange of best practices and coordination, thus providing the opportunity to discuss practical issues related to sustainability of maritime transport. LNG is one of the main topics. It is extremely important to develop clear directives, while leaving some margin for adaptation to local circumstances.

Summing-up, the main obstacles to the use of LNG in maritime transport are being removed and LNG is on its way to become a feasible and greener alternative to the use of fuel oils and distillates for ships.

1 International Convention for the Prevention of Pollution from Ships, Annex VI Prevention of Air Pollution from Ships
2 The EU White Paper - Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system /COM/2011/0144 final

Recycle your Steam and Save Energy

The potential of Mechanical Vapour Recompression (MVR) using Radiax® Technology

INTRODUCTION

Steam systems are a part of almost every major industrial process today. For various heating processes steam is used as heat carrier for evaporating solvents in distillation columns, drying processes, reactor columns, etc. Roughly a quarter of the oil and gas consumed in the process industry is used to generate steam. As steam production is in most cases one of the largest energy users and plant arrangements are often outdated, improvements can lead to significant energy savings. Besides saving costs, enterprises are taking more responsibility nowadays for their impact on society and therefore focus on improving energy efficiency. MVR can be a solution for reducing your energy costs and carbon footprint significantly.

The basic principle of MVR is recycling unused low-value steam, mechanically converted into high-value steam while preserving its latent energy, reaching COP values up to 10.

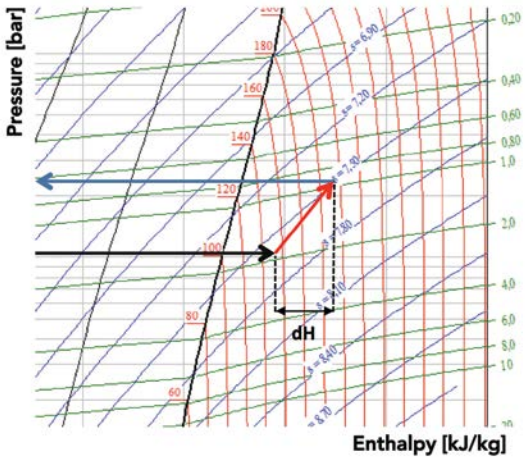
After a short introduction of MVR, this article describes the Radiax® compressor. This compressor has been developed by Bronswerk and has several advantages in comparison to conventional compressors. Many of these advantages are relevant for MVR.

THE PRINCIPLE OF MVR

During MVR, a mechanically driven compressor increases the pressure of a steam flow. The compressor operates as a heat pump by adding energy to the vapour. Contrary to the compression heat pump with its separate circulating fluid (closed system), MVR operates as an open system. In an open heat pump system the process fluid (in this case steam) is also acting as the circulating fluid. Due to the elimination of the evaporator, condenser and separate circulating fluid, high COPs, up to 10, can be obtained.

An example MVR cycle is illustrated in the log(p)-h water vapour diagram (figure 1). The mechanical work delivered by the compressor is depicted as dH. Steam leaving the compressors is slightly superheated due to the dissipated thermal and mechanical losses of the compressor. If favourable, the superheated steam can be tempered or de-superheated to its saturation point by injecting boiler feed water (BFW) in order to attain the required process conditions.

Figure 1: Log(p)-h diagram for water vapour



RADIAX® COMPRESSOR TECHNOLOGY

Different types of compressors such as centrifugal fans, turbo-compressors and rotary root blowers are suitable as mechanical vapour compressors if operating according to the principle of continuous flow machines. However, each compressor type has its limitations on pressure ratio, volume flow and operating flexibility. Bronswerk Heat Transfer has developed a new compressor which eliminates various limitations known from conventional compressors. Figure 2 illustrates a cross section of the Radiax® compressor. The specially designed inlet rotor ensures no-stall characteristics, which result in a smooth axial pressure rise. The divergent design of the rotor contains a large number of blades. The rotor is capable of reaching tip speeds close to the speed of sound while converting flow speed in dynamic pressure. The rotor is directly driven by the electric motor. Vapour leaving the rotor enters the stator-diffusor where dynamic pressure is converted into static pressure. Vapour enters the stator-diffusor tangential and is guided by 3D designed channels ensuring a perfect transition in axial direction. The rotor, electric motor and stator-diffusor are integrated in a single casing, which minimises the amount of components and leads to a compact design.

Advantages of the Radiax® compressors compared to

conventional compressors are:

- Completely variable with regard to pressure and flow without compromising on the overall compressor efficiency and offering maximum flexibility.
- High pressure ratio up to 2.0 per stage for steam, maximum two stages per Radiax® compressor.
- The Radiax® compressor is able of handling two phase fluids. This enables BFW injection upstream to temper the temperature of the compressed superheated steam without damaging the rotor.
- The Radiax® compressor is free of oil and oil seals due to the integrated electromotor in the compressor unit, eliminating the risk of contamination of steam caused by leakages.
- The Radiax® compressor is approximately 60% smaller in size and weight compared to conventional MVR compressors, thus saving plot space.

CASE STUDY

To illustrate the advantages of MVR using Radiax® technology, a case study is described. A chemical plant derives its product from a reactor column that requires 7,000 kg/hr of steam at 4 bar(a). Steam is derived from a steam boiler and directly injected in the reactor column. During this process 300,000 kg/hr of condensate is generated. For this case energy prices are €25 per ton of steam and €0.06 per kWh for electricity. Assuming this plant runs for 8,600 hour per year the total energy expenses are €1,505,000 per year.

This system can be easily optimised by adding a flash tank and Thermal Vapour Recompression (TVR) unit. By releasing the pressure of the 300,000 kg/h of condensate from 4 to 3.4 bar, 4,500 kg/hr of condensate flashes. This low-pressure steam will be upgraded by a steam ejector (acting as a thermal heat pump in this situation) where 2,500 kg/hr of high-pressure steam is necessary as driving steam. This configuration reduces the expenses on energy to €537,5000 per year.

Applying MVR using the Radiax® technology reduces the energy expenses further to only €103,200 per year. In this scenario, pressure of the 300,000 kg/h condensate is released to 2.85 bar, flashing 7,000 kg/h of condensate to low-pressure steam. Steam derived from the flash tank is compressed in a single compression stage to 4 bar, absorbing less than 200 kW electric energy. The MVR configuration with Radiax® compressor is illustrated in figure 3. This relatively simple modification saves €1,401,800 per year on energy compared to the conventional system.

CONCLUSION

MVR using Radiax® Technology is a simple and effective solution for reducing your energy costs and carbon footprint. The favourable characteristics of the Radiax® compressor create opportunities for a wide range of applications. Minor modifications are required, using only a small area of the available plot space. This solution will amortise within a very short period of approximately 2 years, despite the current fossil fuel prices. For more information please contact Geert ten Brink.

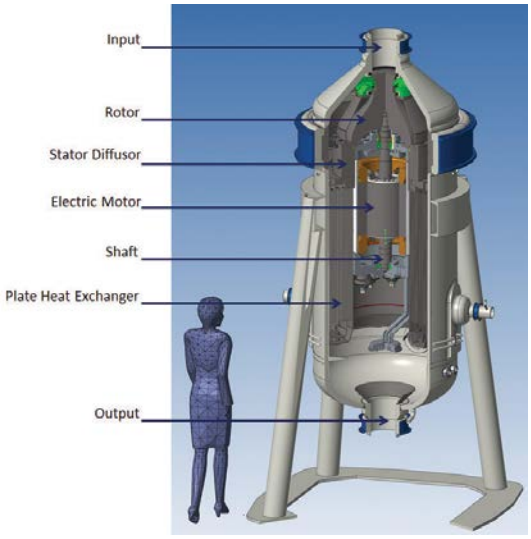


Figure 2: MVR configuration with Radiax® compressor (Patents applicable)

Figure 3: MVR configuration with Radiax® compressor

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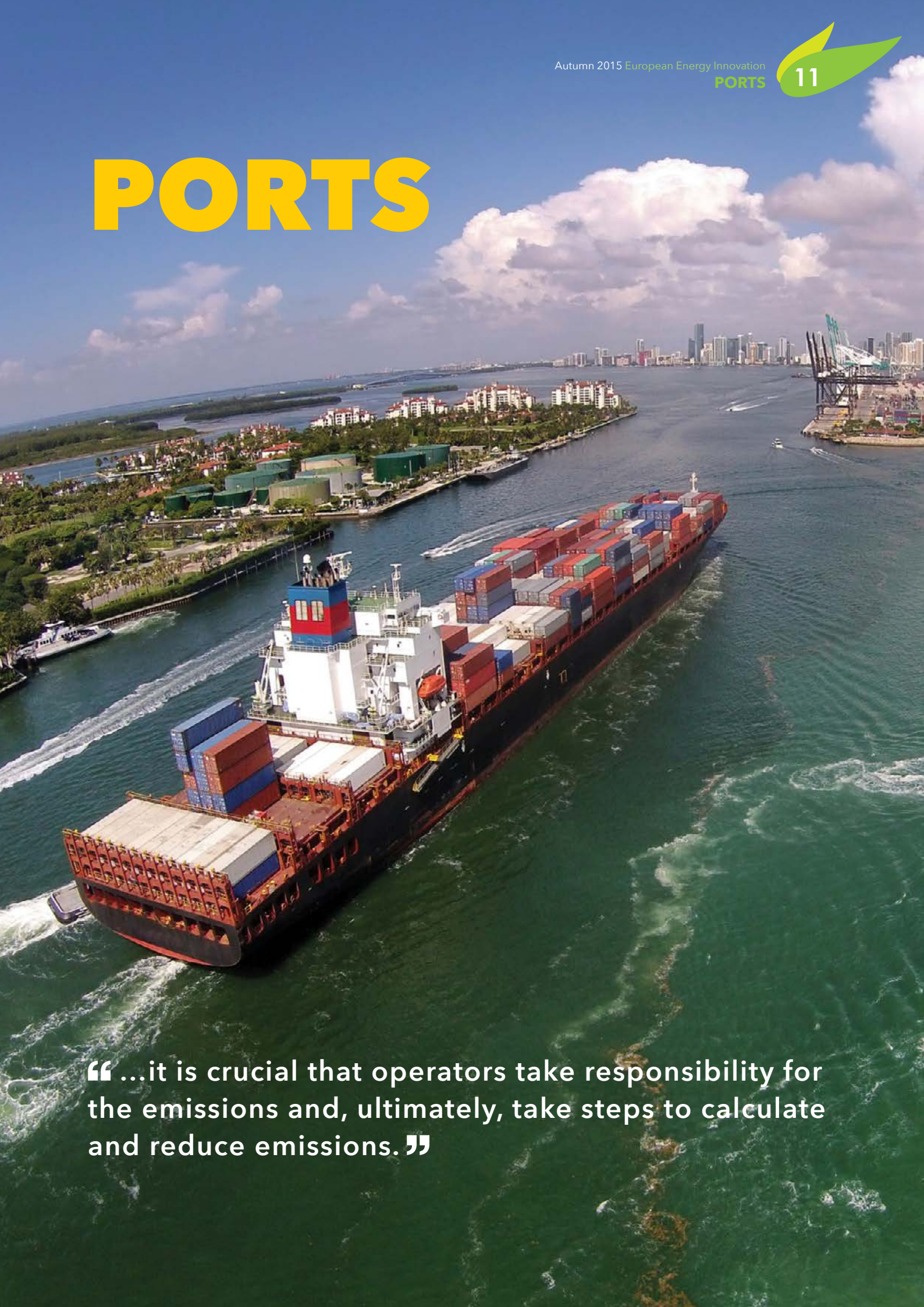

"...it is crucial that operators take responsibility for the emissions and, ultimately, take steps to calculate and reduce emissions."

Energy-efficiency, more than a buzz word for European ports

By Isabelle Ryckbost, Secretary General ESPO

"No ports, no energy; no energy, no ports". This was the title of our Annual Conference. And not without reason. Ports are of paramount importance for Europe's energy: they supply, produce, use, store, import, transport, save, clean energy.

So no need to say that ports have to be alert when climate change policy goals, geo-political developments and volatility of energy prices risk to drastically alter the world's energy landscape.

Since summer 2014, energy policy has been very high on Europe's political agenda with ambitious targets as starting point: 27% renewables by 2030, improve energy efficiency with 20% by 2020, with 30% ten years later. The aim is to secure energy provision, to enhance sustainability by using greener energy and last but not least, by doing more with less energy. Let us focus on this energy efficiency: how can European seaports improve their energy efficiency and contribute to more energy efficiency in the overall economy?

What is at stake? Around 40% of the commodities of European ports are sources of energy. Transport accounts for 30% of Europe's final energy consumption. The ITF Transport outlook 2015[1] sees international freight transport volumes growing more than fourfold by 2050. Overall, higher incomes and growth of world population will increase the demand for energy in the world.

The challenge is thus huge, also for ports, but there are opportunities. Let me present some:

- Ports are not only gateways to the world but they are transport nodes. They link sea transport with all land modes. And there something can happen. Everything has to be put in place to optimise hinterland links, to shift towards more sustainable modes of transport, to remove barriers and bottlenecks, in short to make hinterland links smoother and more sustainable.

- The expected growth in freight traffic volumes is of such an order of magnitude that creating additional transport and port infrastructure in itself will not be enough. A better use of the existing capacity is needed. According to the World Economic Forum, only about 40% of load capacity is effectively being used today. Moreover, increasing trade volumes will also make the supply chain as such more complex. To address this challenge, the European transport sector should seriously look into the untapped potential of further digitalisation, use the rapid proliferation of hand-held digital devices, big data, and the "internet of everything". The ultimate aim should be to develop port communities in the Union that function in a transparent way, with all stakeholders submitting digital information to the system, allowing a far more efficient and secure logistic chain and connecting industry. This would lead to a better utilisation of the existing capacity and infrastructure in ports, to more efficient planning regimes in the whole logistic chain and to a higher overall efficiency of the European Transport System. As key players in the operation of the logistics chains, linking maritime transport with all other transport modes and with external service and information providers, European ports can play a pivotal role in this process. For European policy makers, this development should be seen as a top priority and where possible be encouraged and facilitated.

- Ports will have to enhance the energy performance of their own operations. To do so, they have to learn from each other. Both within ESPO's Ecoports network as at the occasion of our annual Conference, ESPO is constantly facilitating the exchange of best practices.

- Ports are industrial hotspots and often cluster different industries. Port areas bring together different companies and industries, adequate infrastructure and logistics and often have a supportive business network. In that respect ports are an ideal place for exploiting the potential of circular economy and find ways for eliminating waste or using by-products in an efficient way. The port authority can be the perfect match maker in bringing together the different stakeholders in the port and can help paving the way for a circular economy in the port.

- Finally, ports can play an important role in enhancing the energy-efficiency of both the ships and the industries they accommodate. A growing amount of European ports are rewarding "green ships" and/ or are encouraging ships to use shore side electricity. In addition, port authorities can enhance the energy-efficiency of their port companies and industries by setting conditions in the land lease contracts or by just giving incentives, encourage and support port companies to work on energy-efficiency.

To conclude, there is an urgent need to work on energy efficiency. Ports have an active role to play and are also willing to do so. At our Conference, 90% of participants believed that ports should actively manage this change in the energy landscape of which working on energy efficiency is an important pillar.

We should also realise that Europe is not anymore the only one setting the bar high. Recently, the US president Barack Obama made his clean power plan public. Before summer the G7 engaged itself to achieve an economy without fossil fuels by the end of the century. Let us hope others follow. Energy like transport relies on a network and the alternative energy network can only work efficiently if there is a "network" and if many are using the network.

1 OECD/ITF (2015), ITF Transport Outlook 2015, OECD Publishing, Paris/ITF, Paris.

Isabelle Ryckbost, Secretary General ESPO

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EU initiatives to decarbonise maritime transport and port activities

By Rémi Mayet (pictured), Deputy Head of Unit, Ports and Inland Navigation, DG for Mobility and Transport, European Commission

As 74 pct. of all goods to or from the EU zone are carried by ship, the European ports are essential to Europe's growth. The impact assessment of the Commission's proposal for a regulation of the port sector – currently in the legislative procedure in the European Parliament and the Council – shows that for every additional one million tonnes of cargo handled in a port, an average of 300 new jobs are created in the port and its surrounding area.

According to the International Transport Forum, the amount of cargo handled in European ports is expected to nearly triple by 2050. In 2017, all main ports in North Europe and Far East will receive at least one megaship (>18,000 TEU) every day. These figures challenge not only port capacity but also our EU decarbonisation, environmental and air quality goals, ports being often – not only in close proximity to dense urban areas – but completely integrated in the city surrounding them.

The apparent trade-off between economy and environment is far from a one-to-one affair. Technologies that reduce the use of fossil fuels, for example, have the dual impact of promoting economic efficiency of ships, while reducing the sectors' environmental footprint. We need a strong focus on green innovation within the maritime sector, also in order for the sector to stay competitive in the long run.

Examples of such innovation can be found in the ability of cranes to store the energy released when lowering a container, or in the use of engine heat in vessels to regulate the temperature on board. Implied here is also the obvious fact, that when we talk about the greening of the maritime transport sector, it is important to look at not only the vessels actually moving the cargo but also at the port side. Intelligent port management must combine measures to reduce emissions, energy consumption and costs and develop innovative mobility concepts, renewable energies and the interlinking of energy-generating plants and consumer plants to promote efficient use of resources.

This approach is aptly illustrated by the current move to greener vessel fuels, such as LNG (Liquid Natural Gas). On the one side, it requires shipping lines to invest in the appropriate equipment, while on the other, comprehensive bunkering systems must be installed on-shore. The same can be said for other measures such as shore side electricity supply for moored vessels or efficient and environmentally safe disposal of scrubber residue.

At the level of the European Commission, we work concretely with the industry, port authorities,

experts and national governments on five fronts to green and decarbonise ports and shipping: governance, emissions regulation, infrastructure, innovation and financial incentives:

- **Governance:** If local initiatives are to be effective, it is important that not only the port authority or the managing body of the port is pulling in a greener direction. The port community as a whole – e.g. terminal operators, shipping companies etc. – need to be behind the project. With a view to underpin this kind of collaboration, the Commission, in the proposed ports regulation, has included provisions for regular consultation among the many stakeholders of a port. It is the ambition that these consultations will act as forums for, inter alia, the development of a shared green agenda for the port as a whole.

- **Emission regulations:** Technical regulations limiting emissions from marine fuels play a key role. The limit on the sulphur content of 0.1 pct. in marine fuel has entered into force since 2015 in the SECA areas (Sulphur Emission Control Areas), following from the implementation of the IMO's MARPOL-convention. To accompany these changes, the Commission has established the European Sustainable Shipping Forum (ESSF). It brings together Member States and maritime industry stakeholders in order to exchange best practices and coordinate, while providing the opportunity to discuss various issues that may arise as early in the implementation process as possible.

- **Infrastructure:** Regarding infrastructure – within ports and for hinterland connections – the Connecting Europe Facility (CEF) with a budget of €23 billion for transport projects towards 2020 provides tremendous opportunities to build a more sustainable Trans-European Transport Network (TEN-T). It can provide grants or financial instruments (debt or equity sharing instruments) for projects to transfer goods to greener transport modes, such as shipping, rail and inland waterways, and developing and implementing green technologies. The lack of appropriate infrastructure is a major market failure which prevents viable alternative fuels – the famous chicken and egg problem. To redress it we use CEF to fund LNG bunkering or on-shore power supply facilities. The goal of the Directive on alternative fuel infrastructure is that such facilities are available at all core TEN-T ports by 2025.

- **Innovation:** CEF can also support innovation. The next call for proposals due to be published in November 2015 provides opportunities to fund pilot deployment (real life trials) of innovative transport/energy solutions in ports and test the appetite for synergy actions between the transport and energy sector in ports – ports can be major actors of the transition towards more renewable energies (wind and tidal energies). This call comes on top of the Horizon 2020 programme, which is the EU's tool for financing research and demonstration and offer plenty of possibilities to promote the green innovation agenda in the ports and maritime sector. We have set up a 'port innovation contact group' to help define a common agenda and gather and disseminate results.

- **Financial incentives:** In addition to providing financial support, we also promote the application of differentiated charges by ports for environmentally friendly ships. We work with the port and shipping industry to draw up common guidelines identifying good practices. The aim is to enable ports to reward shipping lines implementing green technology, ahead of legislation, and encourage operators to opt for energy efficient short sea shipping, using common and well documented data, definitions, tools and methods.

The years to come hold great potential for the greening of a sector that is so economically important for Europe. Determination is needed from all actors involved. The Commission encourages the Member States and the investors to join this effort. The European Fund for Strategic Investments created last July at the initiative of President Juncker provides a crucial tool to boost and channel private investments to European projects contributing to growth and jobs but also to decarbonise transport.

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DockingMonitor

Development of automated combined berthing aid and drift monitoring system for large ships.

ABOUT THE DOCKINGMONITOR PROJECT

DockingMonitor is a two-year EU Research for the benefit of SMEs project ending autumn 2015. The project consortium has partners from Denmark, Italy, Germany and Norway. The project was initiated by Marimatech AS (DK) having extensive experience in innovation and technology development in port safety industry. Other industrial partners are S&F Systemtechnik GmbH (DE), Cortem SPA (IT), Westcontrol AS (NO) and Norske Shell AS (NO). R&D partners were Teknologisk Institutt as (NO) having the role as coordinator, Fraunhofer ILT (DE) and Labor srl (IT).

SAFE DOCKING WITH DOCKINGMONITOR

DockingMonitor is a combined berthing aid and drift monitoring system which eliminates the need for distributing more than one measurement unit at the jetty. Great risks are associated with the process of berthing and cargo transfer of large ships, particularly oil and LNG tankers. High speed upon approach to jetty and excessive ship movement when moored may cause damage to jetty structure, loading arms, fenders and ship hull, or result in oil spills during loading/unloading of oil and LNG tankers. The risk of mooring line breakages and consequent danger to cargo and jetty crew will be reduced.

DOCKINGMONITOR KEY FEATURES

The project has built a working prototype developed within machine vision, laser technology, control electronics, and mechanical design. The DockingMonitor berthing and drift monitoring system consist of two different measurement systems: Transversal Movement Monitor (TMM) and Longitudinal Movement Monitor (LMM). Longitudinal drift measurement is handled by an innovative machine vision system. The camera-based monitoring uses image processing algorithms to calculate the velocity and motion and alerts in case of critical displacements. Transversal movements of a ship are detected by a custom made 2D-laser scanner. The TMM is combined with a flexible control system that handles the message flow in and out the DockingMonitor system. EX-proof housings to fit the requirements at oil and gas terminals have been designed and constructed for the two subsystems.

DOCKINGMONITOR KEY BENEFITS

The solution will be energy and cost efficient. DockingMonitor is portable and easy to install on the jetty. The port operators will in addition benefit from robust technology having improved safety automation. Data from the system will be transmitted to displays, PCs and handheld devices. An alarm system will alert jetty and ship crew of potential danger. The system design shall ensure reliable and precise measurements in challenging light and weather conditions making DockingMonitor the perfect choice in exposed locations.

POTENTIAL MARKETS AND AREAS OF APPLICATION

The DockingMonitor system has successfully been subjected to testing in the lab and in container port environment. The target areas are national, EU and overseas small and large harbours receiving cargo vessels. Potential markets identified are the expanding oil and gas sector as well as the general maritime freight and cruise ship traffic. It is expected that the solution with using only one telemeter laser vs. two as in existing systems is attractive to existing as well as new customers. The DockingMonitor will be further improved to a smaller and lighter single-housed portable model before it is ready for the market.

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Project Partners

Fraunhofer ILT · WESTCONTROL · MARIMATECH · S&F Systemtechnik · LABOR · CORTEM GROUP

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 315423.

The elephant in the climate-talks room

By Sotiris Raptis, clean shipping officer at Transport & Environment (pictured)

The final countdown to the global climate summit in Paris just began – less than 100 days until the moment when humanity finally decides to save itself (we hope). 196 countries, all sovereign states, will be seated around the big UN table trying hard to live up to the expectations of the peoples of the world. This is as far as the official story goes; what very few know is that there will be two big players missing at the Paris table. Technically speaking they are not countries but, with as much emissions as Germany, they could each easily be one. These two sectors are: international shipping and aviation, the two elephants in the (Paris) room.

The international nature of shipping is undisputed: you can't get more international than a ship calling at the port of Antwerp with goods from China waving a Panama flag and manned by Filipinos. That's why, when the Kyoto Protocol was adopted in 1997, the implementation of measures to reduce greenhouse gas (GHG) emissions from international shipping was left to industrialised countries working through the UN's International Maritime Organisation (IMO).

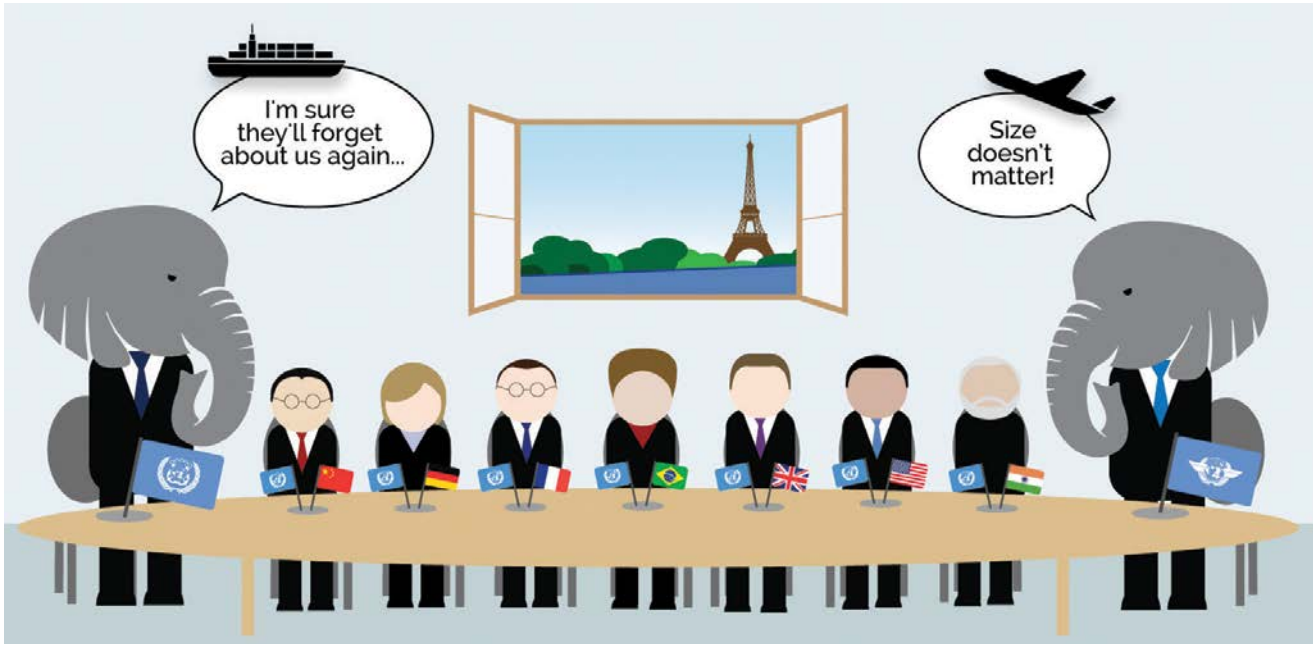
The problem is that the IMO has not been very successful (to say the least) in agreeing measures to limit carbon emissions from ships. As a matter of fact, shipping emissions have increased by approximately 70% since the Kyoto baseline year, 1990, and represented 2.7% of all emissions in the world in 2012. What is more worrying, scenarios of future shipping GHG emissions presented in the 2014 IMO study show that under current policies shipping emissions are expected to rise by up to 250% by 2050. The same IMO study finds that any efficiency gains will be offset by the growth in demand for shipping.

At Copenhagen in 2009 all the UN countries, both developed and developing, agreed to keep the increase in global temperature below 2°C, so as to stand a chance of avoiding catastrophic climate change. This means that in 2050 GHG emissions of all sectors of the economy need to be 40 to 70% below their 2010 levels in order to be consistent with the 2°C target. In this context, while the hope is

that emissions of all sectors of the economy will peak or decline by 2020, none of the "business as usual" IMO scenarios which include expected fleet efficiency improvements, foresee a decline in shipping emissions before 2050.

Like all the other sectors of the global economy, international shipping urgently requires an emissions reduction target. There is no reasonable or sensible excuse to continue exempting shipping from the global policy framework. Not even the economic argument stands up to proper scrutiny. The global GDP rebounded after the economic crisis and the shipping sector recovered to an extent. But, thanks to slow steaming, shipping emissions showed a decline. This indicates that there are options available and a great potential for new technologies to clean up without hampering progress. That's why a cap on emissions is not meant to limit the growth of the sector or global trade.

So far, the shipping industry and the IMO have failed dismally to cut their greenhouse gas emissions. Climate change is the greatest challenge that developed and developing counties face, a threat to our very existence on Earth. Any Paris deal must clearly state that international shipping will be subject to a carbon reduction target. The deal must also oblige the IMO to agree by 2016 the measures to implement these carbon reductions. Finally, all UN countries should also include domestic shipping GHG emissions in their own national emission reduction plans. Turning a blind eye to these two elephants in the room is no longer an option.



BoxReload

Joint effort of Hutchison Paris Optimal Planning division and Erasmus University Rotterdam shows potential for reducing empty kilometers, fuel use and emissions in maritime container trucking.

By Larissa van der Lugt (pictured), Erasmus University Rotterdam, RHV-BV

BACKGROUND

Road freight transporters of maritime containers often carry empty containers. The market is quite fragmented – both at supply as at demand side - and the destination for an import order of a haulier does not always match an origin location of its export orders. This means that containers need to be brought empty to the port or the inland destination, causing costs, fuel use and emissions that one preferably avoids.

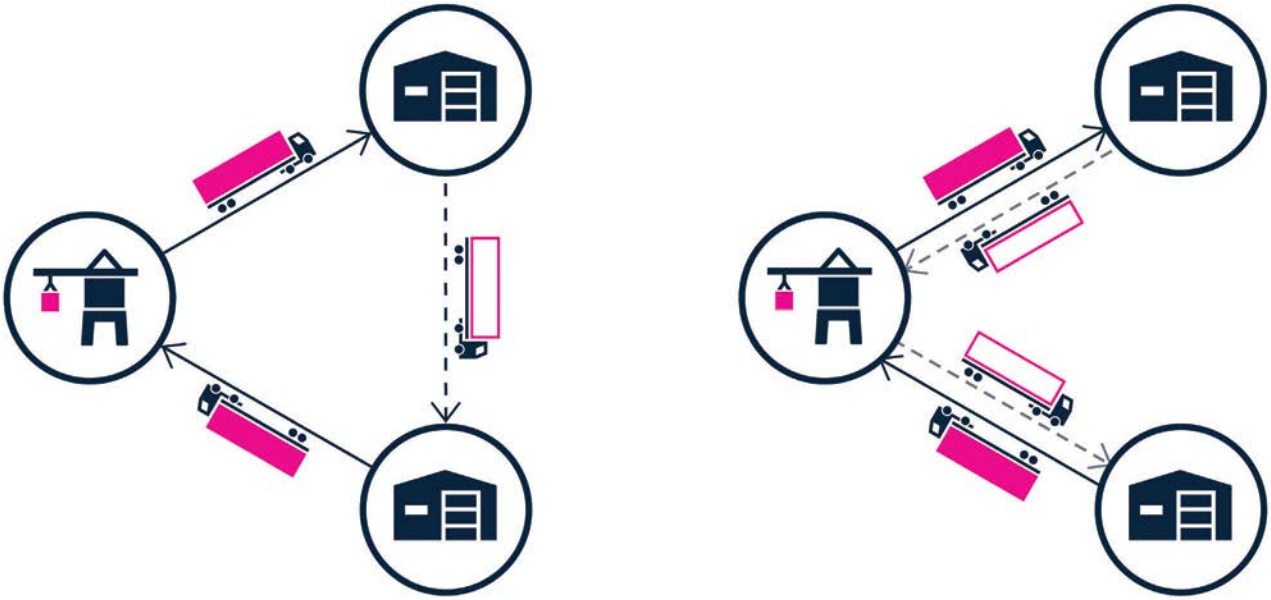
A solution can be found in increased collaboration between road hauliers for the transport of maritime containers. The idea is then to find collaboration opportunities between hauliers by identifying possibilities for triangulation, i.e., reloading an import with an export, or reloading via depot.

This idea is further developed under the name of Boxreload, initiated by PARIS Optimal Transport Planning division of Hutchison Ports, based on the PARIS planning system. The initiative has received support from the European Commission by a TEN-T grant for a pilot project and this is sponsored by the Dutch Ministry of Infrastructure and Environment. For the pilot, cooperation is established with the Erasmus University Rotterdam, that brings in its knowledge on ports, logistics and transport management.

BOXRELOAD'S KEY FEATURES

Boxreload finds opportunities where a container with import cargo that is being delivered by one haulier can be re-used ('reload') for the collection of an export cargo that is booked with another haulier. Typically, this would be two different hauliers with two trucks and two containers, each trip involving moving an empty container to/ from a congested port area.

The reloads are identified by a completely 'neutral transport planner': the PARIS real-time automated planning engine,



making the same kind of decisions normal human transport planners make, but in an optimal way. A key feature is the retained autonomy with the individual company's planner. Boxreload works in conjunction with hauliers' existing order and planning systems (TMS). Once connected to Boxreload, a haulier can request partnerships with other hauliers. As an analogy, consider accepting friends on Facebook: both users have to agree to be 'partners' before they can see each other's profile and reloading opportunities between each other. And whether or not to accept a solution generated by the system remains the planner's own decision. Sensitive customer information is never displayed in Boxreload.

JOINT RESEARCH ACTION WITH ERASMUS UNIVERSITY ROTTERDAM

Notwithstanding the quality of an underlying system, collaboration is not an easy process. Many initiatives in the past have failed and still there are not as many collaborative platforms as one would expect in the different transport sectors, considering the challenges and the potential benefits collaboration can deliver. Implementing such collaborative systems needs careful evaluation of market potential and improvements needed, as to fit the needs and preferences of the potential users and to remove potential barriers.

To succeed in this, Hutchison Ports has for the pilot project teamed up with Erasmus University Rotterdam. At the departments Urban Port and Transport Economics (RHV) and Supply Chain Management (RSM) academic knowledge on management and economics is translated into practical insights and business solutions for the port and logistics sectors. By combining the research skills of Erasmus with the transport planning and optimisation experience of the PARIS division, insights are gained on the specific benefits, barriers and potentialities of the Boxreload platform. These insights help the further refinement of the system and support the implementation. For the researchers of Erasmus University Boxreload enhances its knowledge base on business model innovation and new business network developments in the logistics sector, feeding into new research and educational materials. Such cooperation between industry and knowledge institutes enhances innovations and increases value for society, at the same time benefitting both parties.

NEXT STEPS

The aim is to further develop Boxreload into a commercial system, identify any further modifications that are required to meet the needs of a greater variety of users and increase the system's functionality. One example is the integration of the Boxreload system with the shipping lines to enable the use of nearby local empty depots, enhancing reloading possibilities; another is the potential to also include rail or inland barging, as is the case with PARIS. This not only gives more optimisation possibilities but could also result in further reductions in road freight kilometers per match. Furthermore, after some further initiatives already taken in Belgium and Spain, the aim is to explore the scope for further commercial deployments around other major (inland)ports in Europe.

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Carbon Emissions Reduction: a reality for European terminal operators

The reduction of carbon emissions is one of the major challenges facing the European transport chain. To ensure the sustainability of this vital supply chain, it is crucial that operators within the chain take responsibility for the emissions and, ultimately, take steps to calculate and reduce emissions.

To reduce emissions, operators must first be aware of their emissions and gauge them against a benchmark period (for instance; annual carbon emissions). When calculating emissions, it is important that operators only calculate emissions for which they are accountable for. For instance, in a seaport terminal, seaborne vessels are a large source of emissions (up to 75%), and ports and terminals have no control over their emissions.

Against this backdrop, the major container terminal operators in the European Union have created the EEEG Guidelines for greenhouse gas emissions footprint for container terminals. The guidelines are a voluntary methodology which allows container terminals to calculate their CO_2 emissions on a periodical basis (for example; annually). The EEEG guidelines are currently used by APM Terminals, Contship Italia, DP World, ECT, Eurogate, HHLA, Hutchison Port Holdings and PSA who collectively account for over 75% of container lifts in the European Union's seaports.

HOW DOES THE EEEG METHODOLOGY WORK?

The methodology is based on two key components, namely the total emissions of a terminal and the total number of containers that have moved in and out of the terminal.

The total emissions of a terminal are established by multiplying energy consumption (say 100 litres of diesel fuel) by its EF (emissions factor). By doing this, a terminal can establish its total emissions in line with the GHG (Greenhouse Gas) Protocol. The GHG protocol an internationally accepted standard for carbon footprint calculations. This methodology allows you to add up emissions from individual activities and combine them for a total picture.

Using the total number of containers that have moved in and out of a terminal is used as normalization factor to link the consumption to the core activity of the operation.

Measuring emissions at port level on an annual basis would be misleading as it does not take into consideration the amount of movements within a terminal.

The methodology is utilised by dividing the total terminal emissions by the total number of containers entering and exiting in a set period (for instance; annually). This gives the total figure for a terminals total emissions per container handled ($kgCO_2e$/box).

Benefits of EEEG Guidelines

The EEEG Guidelines allow a container terminal operator to compare their emissions on a periodical basis at a meaningful level, namely at container level. In a situation where there has been emission increases per container, the operator can identify the source of the increase easily be examining different fuel consumptions separately. A detailed, internal evaluation of emissions allows operators to focus on specific emissions problems and take meaningful actions to reduce emissions in the future.

Endorsement of the EEEG Guidelines by FEPORT*

During the FEPORT General Assembly meeting of June 12th, 2015, European terminal operators officially endorsed the EEEG Guidelines as an agreed upon EU methodology for calculating carbon emissions within container terminals. FEPORT is currently working on the expansion of the methodology to cater for the specific needs of other cargo types. FEPORT has strongly recommended that all container terminal operators look to incorporate the EEEG guidelines into their internal energy plans.

How can the EU help?

One of the major questions facing European policy makers is how can they assist in the reduction of carbon emissions. The creation of the EEEG guidelines testifies to the proactive attitude that terminal operators have towards carbon emissions reduction and their willingness to take action to monitor the emissions resulting from their operations. All operators using the EEEG Guidelines have noted this as being a useful tool in this regard.

Strong dialogue between the EU institutions and industry can ensure that there is not a duplication of work in this regard. The promotion of industry led methodologies, which have been tailor made for accuracy, will give operators the clearest picture of their emissions, and will allow them to take the necessary steps to reduce their respective emissions. The EU can assist operators by promoting and supporting industry good practices.

* Since 1993, FEPORT represents the interests of large variety of terminal operators and stevedoring companies performing operations and carrying out activities over 400 terminals in the seaports of the European Union. FEPORT speaks on behalf more than 1200 companies.

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CO_2 reduction in port development: solutions come from the sea

The main objective of the Nereidas project is to offer a solution to make ports more efficient and to raise environmental awareness.

The implementation of this project in the port of Melilla can be summarised in the following actions:

- Placement of roughness structures and techniques for the development of *Elisolandia elongata* growth;
- Placement of degradable structure and the planting of *Cymodocea nodosa*;
- Development of An EWS for the control and safeguarding of the plantations;
- .The elaboration of a protocol that standardises its use in other locations.

The CO_2 emissions produced by maritime traffic and port activities can be compensated through the ecological process of planting and developing marine organisms. This has been done in the **Pilot in Melilla** scheme. The seagrass *Cymodocea nodosa* and the seaweed *Ellisolandia Elongata* were used. They are widely spread in the Mediterranean Sea. This compensation mechanism can be described as an innovation in the marine field, and it is an efficient tool for the capture of CO_2, and for increasing biodiversity. In contrast, currently used methods rely on preventive measures for reducing fuel consumption.

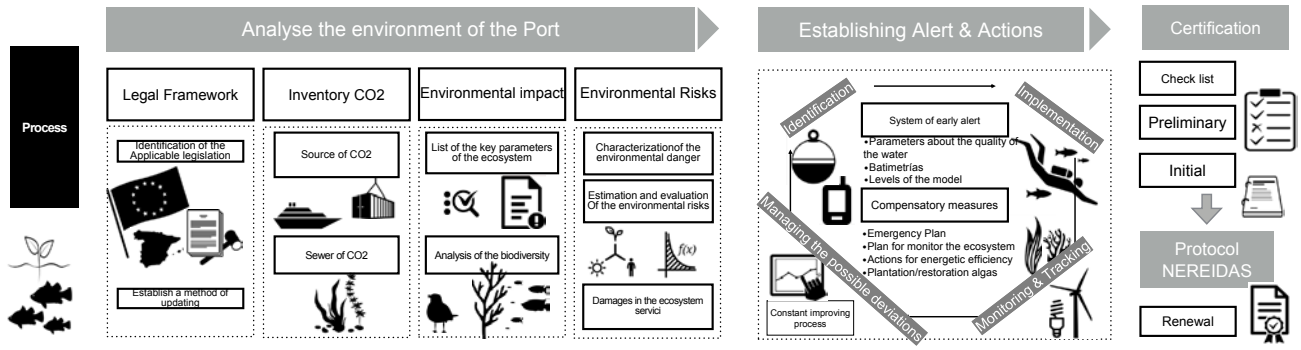
In order to identify diffuse pollution and to safeguard the biological structure, the **Early Warning System (EWS)** has been developed. It is a tool which can monitor the parameters in the sea and to distinguish normal variations, contamination occurrences and differences in quality caused by biochemical interactions. It has the ability to analyse and interpret results in real time and include water analysis data from other sources. The Nereidas module can send information about risks via email and SMS to cell phones as well as web alerts in near or real time.

For example: an increase in the concentration of nutrients dissolved in water can accelerate the microalgae eutrophication process. Abundance of the algae leads to a significant reduction of dissolved oxygen in the water. The absence of photosynthesis affects the microalgae respiration process and consumes all the

Arnaldo Marin - University of Murcia

Francesc Campá - CIMNE

Irene Huguet - ATISAE



Nereidas flow chart

available dissolved oxygen. The generation of anoxic conditions reduce the PH and consequently dissolve the CO2. **The EWS forecasts the danger and helps to prepare ad hoc measures before this happens.**

The ultimate aim of the Nereidas project is the design of a protocol to implement preventive and compensatory measures concerning environmental damage to maritime transport and port activities. Today the market hosts many rules and guidelines with the same denominator: "contribute to the mitigation of climate change". Each addresses different challenges of varying magnitude, but none have the purpose of this project. As it is widely known, who pollutes pays and repairs, but is still polluting. With this Protocol we add another turn of the screw and propose to compensate for this pollution.

The uniqueness of this Protocol, for good environmental practices in Mediterranean ports, is the new approach and its special attention to biodiversity for the survival of living beings and to offset pollution in ports. Furthermore it is self-assessed and issued for the first time, so that it can be developed and tested before going to market. ●

Jaime Bustillo - Port of Melilla

Pedro Martinez - C&C

NEREIDAS

UNIVERSIDAD DE MURCIA

CIMNE

ATISAE
ASISTENCIA TÉCNICA INDUSTRIAL, S.A.E.

Puerto de Melilla
Autoridad Portuaria de Melilla

C&C Medio Ambiente

Cofinanciado por la Unión Europea
Red Transeuropea de Transporte (RTE-T)

PEMA: Pooling expertise for more efficient ports

Virtually everything we see, use, eat or otherwise consume has, at some point, been transported in a shipping container – a shipping container that has been carried by a container ship, often across vast distances.

As container ships become ever larger – the biggest now hold more than 19,000 Twenty-foot Equivalent Units (TEU), and several vessels capable of carrying more than 20,000 TEU are currently on order – how these jumbo-sized vessels are loaded and off-loaded is increasingly becoming a pressing issue for decision makers, along with the logistics infrastructure needed to subsequently handle the huge amount of containers these vessels transport.

The Port Equipment manufacturers Association, (PEMA), works to pool the expertise of its members to, in turn, improve the efficiency with which ports operate. It provides a forum and public voice for the global ports and terminals equipment and technology sectors, and publishes independent data, produces recommendations on common standards and represents stakeholders' interests in three key areas: safety, technology and the environment, thereby taking steps to make the global ports sector not only more efficient, but also safer and more environmentally sustainable. Here, we take a closer look at PEMA's broadening range of activities.

PEMA, headquartered in Brussels, celebrated its 10th anniversary in 2014, and its membership, which has grown rapidly in recent years, now stands at nearly 90 companies – from niche equipment suppliers to major conglomerates – representing key players in all areas of the ports and terminals sector, including crane, equipment and component manufacturers, automation, software and technology providers, and consultants and other experts. The Association's scope is genuinely global, with members based in Asia, the Americas, Europe and the Middle East, and many companies with operations worldwide.

PEMA divides its activities into three main committees: its Safety & Environment Committee, Automation & Control Technologies Committee, and Equipment Design & Infrastructure Committee.

"PEMA strives to improve safety, operational efficiency and reduce environmental impact at ports and terminals worldwide," explains PEMA President, Ottonel Popesco.

The Association regularly publishes White Papers, recommendations and independent reports on port equipment use, characteristics and sales, as well as hosting seminars and panel discussions at a variety of industry events. You can review PEMA's published material at: pema.org/publications/.

AUTOMATION AND EFFICIENCY

Since its first appearance in ports and terminals in the 1990s, automation has become increasingly widely accepted as an effective way for ports and terminals to improve the handling of large container vessels.

Driverless yard cranes, commonly known as automated stacking cranes, (ASCs), are the most mature and widely deployed of the robotic container handling equipment so far developed. However, unmanned automated guided vehicles, (AGVs), and shuttle carriers to move containers between the quayside and yard stack are also gaining ground. The industry has also recently seen the first deployment of remotely controlled ship-toshore quay cranes, relocating the operator from a cabin in the crane to a central control room. Alongside the development of robotic equipment, a growing array of automated locating, identification and sensor technology is being developed to help ports improve the safety and efficiency of their operations by automating manual logistics processes.

PEMA is helping ports and port authorities in this process by providing data and best practice guidance on how these systems can improve efficiency.

In July, PEMA published a paper on laser technologies, highlighting how collaboration between terminal operators and laser technology manufacturers has resulted in rapid

improvements in performance at a growing variety of port and terminal applications. And it is not only heavy-duty equipment that can be automated. Another area where automation can improve efficiency and reduce costs is lighting. The introduction of LED lighting with, for example, 'Instant-on' technologies, reduces energy consumption as well light pollution.

SAFER AND GREENER PORTS

Safety remains a key issue in the ports and terminals sector, and PEMA has been active in this area for a number of years, publishing information papers and recommendations for ports and terminal operators.

PEMA's activities in this field focus primarily on reducing risk to personnel, and also incorporate steps to reduce the likelihood of accidents that result in costly equipment and infrastructure damage. The Association also co-operates with other bodies such as the TT Club and ICHCA International, to publish guidance on safety standards.

PEMA has highlighted the need for advanced safety systems to be fitted to vehicles that provide a high degree of diagnostic coverage to detect people and other vehicles.

Automatic collision prevention devices, driver assistance systems, automatic laser-based reach stacker assistance system and container weighing technologies all support the safe and secure handling of containers.

As well as improving safety and security, these sorts of container-tracking technologies also make an important contribution to improved operational efficiency.

PEMA also plays a role in supporting the ports and terminals sector in discussing and meeting legislative requirements related to environmental issues. Key areas here are shore side electricity, also known as 'cold ironing', and the electrification of equipment such as cranes, trains, and trucks.

Shore side electricity involves ships in port switching off their engines and connecting to the electrical grid. This results in substantial reductions in emissions of sulphur and nitrogen oxides and particulate matter from ships.

Shore power technologies have been around for many years and are becomingly increasingly widely used. In the EU, funding is available for ports to introduce shore power technologies, and the 28-member bloc introduced the Deployment of Alternative Fuel Infrastructures directive in October 2014 that makes shore side electricity mandatory (in most cases) for European ports by 2025.

While issues over common standards for shore side electricity between Europe, the US and Asia had impacted implementation, an international shore side connection standard for larger vessels, (ISO/IEC/IEEE 80005-1), such as cruise and container ships, tankers, bulk vessels, passenger ferries, (Ro/Ro and Ro/Pax), has been in place since 2012. This is also part of the European directive, under which all ports will have to offer shore side electricity.

The International Electrotechnical Commission Standardisation Committee continues to work to broaden the application of this specification, and is also working on a standard for smaller ships, (80005-3), such as offshore supply vessels, river cruisers, and larger fisheries vessels.

"A large set of shore power technologies is now available to meet the all types of port applications. Furthermore, an increasing number of companies involved in the shore side electricity sector are joining PEMA," says PEMA's Safety & Environment Committee Vice Chair, Loréne Grandidier.

PEMA is currently working on a technical paper on the application of shore side electricity, which will highlight best practice in the application of these technologies.

"PEMA continues to support efforts of the global ports sector to improve operational efficiency – so the behemoths of the oceans enabling world trade are handled effectively– as well as improving safety and reducing environmental impact," concludes Popesco.

For more information on this material, please contact Rachael White, PEMA Secretary General at: Tel +44 20 8279 9403 | rachael.white@pema.org. You can learn more about PEMA at pema.org.

GAS

“ ...improved market implementation – supported by cross-border infrastructure and a regional, cooperative approach – offers the most efficient way to enhance supply security. ”

There is new energy in the heart of the Mediterranean

OLT Offshore LNG Toscana S.p.A., mainly owned by E.ON and Iren Group, is the company which operates the floating regasification terminal 'FSRU Toscana'. The terminal is technologically innovative and well-advanced. It guarantees the maximum standards in terms of environmental sustainability and safety. "FSRU Toscana" is permanently moored off the Italian coast - between Livorno and Pisa - in the heart of the Mediterranean Sea. The terminal has a regasification capacity of 3.75 billion cubic meters per year and an LNG storage capacity of 137.500 cubic meters. The terminal is versatile in design and operation which allows the possibility for future LNG bunkering and distribution.

oltoffshore.it

OLT Offshore LNG Toscana

Heating our homes: gas innovation now and in the future

Only one generation ago, heating in my home-place of Ireland meant cutting peat in the bog and drying it under the sun, before transporting it to the shed for storing until wintertime. This "turf" could then be used in an open fire or range, with the temperature "controlled" by simply putting less or more on the fire.

In today's Ireland, as in most of Europe, most people just "flick a switch" for instant heat! The introduction of fuels like natural gas into the heating system has dramatically changed how consumers acquire heat and their comfort level (including better air quality), often in a cost-competitive manner.

Noel Regan, EU Affairs Director, Eurogas

From the consumer's point of view, the two experiences above are worlds apart, yet behind the scenes, the same four steps play out. In both cases, one needs access to an energy source, a way to transport and store the energy until needed, a means to convert the stored energy to heat and, finally, the ability to control the temperature.

Physics dictates that these four steps will remain fundamental to home heating. But the need to heat homes while producing less greenhouse gas (GHG) emissions is expected to drive innovation in all four areas.

The gas industry is continuously exploring how it can contribute to this challenge, while also meeting consumer expectations for affordable heating and high quality customer service. Recent innovations in gas have delivered multiple benefits; a look into the future reveals even more possibilities.

Gas as an energy source

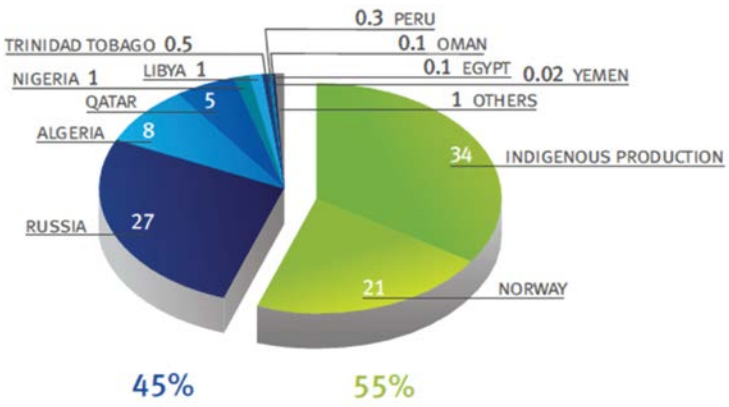
Natural gas provides almost half of home heating in Europe, with 55% of the demand met by supply produced in Europe and Norway. For most Member States in the European Union (EU), having a diverse network of gas suppliers contributes to national energy security. Eurogas firmly believes improved market implementation – supported by cross-border infrastructure and a regional, cooperative approach – offers the most efficient way to enhance supply security.

Renewable gas, in the form of biogas, is starting to contribute to diversity of supply. With 15 billion cubic metres (bcm) produced in 2013, it supplied enough gas to heat the equivalent of approximately 4.5 million households. Continued innovation is expected to improve the means of production and production efficiencies.

Transportation and storage of energy

The ability to deliver gas as needed is very important to satisfy consumer heating demand: a typical northern European household will require over eight times more heat in

Figure 1. Natural gas supply in Europe, 2013



Source: Eurogas Statistical Report 2014

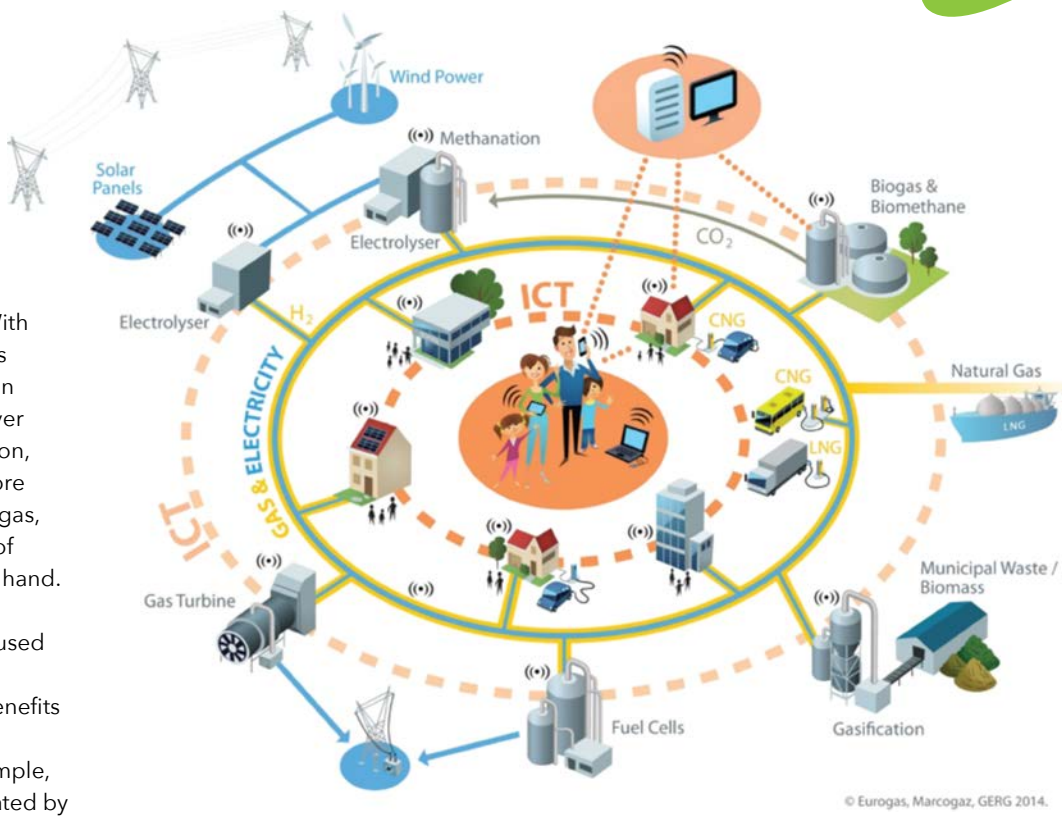


Figure 2. A smart gas grid, contributing to a smart energy system

January than in August. With over 2.2 million kilometres of pipelines, Europe has an extensive network to deliver gas to the home. In addition, some 150 facilities can store approximately 97 bcm of gas, ensuring that about 20% of annual demand can be at hand.

Increasingly, gas is being used with other energy carriers, another innovation that benefits consumers. Power-to-gas (P2G) technology, for example, converts electricity generated by renewables to gas, which can be stored for much longer periods (i.e. seasonally, rather than for a few hours or days). P2G could offer a long-term solution to using intermittent renewable energy for heating homes. Several Eurogas members are investing in P2G and advancing its technological development. For example, a recent installation in Germany features an impressive system efficiency of 86% with heat recovery.

Conversion of energy to heat

The efficiency of heating appliances – that is, the rate at which they transform the energy supply (gas) into the energy service (heat) – influences the cost of heat and the GHG emissions created during conversion, as low efficiency requires more supply to be converted for the desired comfort. Approximately 85% of European households are using old, inefficient boilers.

Switching to efficient, condensing boilers boosts energy efficiency, in some cases by more than 20%. While it requires an upfront investment, replacing old boilers makes financial sense; in most cases, gas bill savings will "pay back" the cost within seven years. Higher efficiency also helps meet national and EU objectives to reduce energy demand and associated emissions.

Gas heat-pumps, which capture renewable heat from the air, ground or groundwater, reach conversion efficiencies of up to 165%. Combined heat and power (CHP) units, which produce both heating and electricity, are now available in smaller units suitable for individual homes.

An emerging trend is to install complete heating and cooling solutions in homes, which allow different energy carriers to work together to meet the consumer's needs. Such a system might combine, for example, a gas condensing boiler and solar thermal panels, or a hybrid unit of a gas condensing boiler with an electric heat-pump.

Controlling the heat

While each of the above steps show substantial potential to reduce the volume of energy that needs to be generated, stored and converted to deliver heat comfort, innovation in heating control can go a step further. Increasingly, appliances and technologies are being connected in ways that integrate gas into "smart" energy systems. For example, customers can control their home heating remotely, through applications on their smart phones.

A smart gas grid

Considering all these innovations occurred in just one generation, it's safe to assume that more dramatic changes are in store. Eurogas will help ensure that the gas industry continues to evolve to meet both consumer needs and environmental challenges, and to collaborate across energy sectors to create smarter energy systems – as shown in the Eurogas vision of a smart gas grid.

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Natural Gas: Catalyst of the European Energy Union

Gerald Linke

The five pillars of the planned European energy union – energy security, the single energy market, energy efficiency, the decarbonisation of the economy, and research and innovation – are in line with the central fields of action of the German energy transition. With its infrastructure, natural gas is a fuel that provides efficient, cost-effective opportunities for using innovative gas technologies to ensure sustainable energy supplies. The potential of gas technologies for storing renewable energies and making them available as and when needed is becoming increasingly evident.

In order to guide gas into the transition process towards a future renewable-based energy system, seven leading European research and development organizations*, DVGW among them, have recently established an innovative network named European Research Institute for Gas and Energy Innovation (ERIG). This network will be promoting joint innovation and development work in order to develop the role of gas by improving the efficiency of gas-related energy conversion processes in the domestic, commercial and industrial sectors. Furthermore, ERIG aims to enhance the safety, reliability and economic sustainability of the European gas infrastructure system and gas storage facilities, including LNG as a fuel for long distance transport by land and sea. Besides increasing the share of renewable and synthetic gases, such as biogas, bioSNG, hydrogen or methane, in the gas system, a key objective is to support the integration of volatile renewable power in the energy system by flexible gas options (power-to-gas) with a view to balancing the power grid through the combination of demand and supply flexibility and storage.

Natural gas is the fossil fuel with by far the lowest carbon dioxide emissions. Compared with the use of petrol and diesel, emissions of the greenhouse gas, which is detrimental to the climate, could be reduced by up to 24 percent by using natural gas as a fuel.

In the field of the transportation of goods, natural gas is an environmentally compatible, cost-effective alternative in the form of liquefied natural gas (LNG). The use of LNG in shipping is especially significant. The carbon dioxide emissions of natural gas, based on energy equivalent, are 45 percent lower than with coal and 27 percent lower than with oil. Established natural gas technologies combine the highest efficiency with the lowest CO_2 emissions of any fossil fuel. For this reason, it is necessary to give strong support to a higher share of gas in the international energy mix for climate protection and energy efficiency reasons.

In addition to the integration of renewable energies into the energy system, the linking of gas and power grids is also a pioneering achievement of German industry with potential effects for the worldwide energy supply market. Communications between gas and power infrastructure in Germany are becoming increasingly intensive as a result of the energy transition, and innovative gas-based storage technologies are becoming increasingly important. These can make a key contribution to compensating for fluctuations in wind and solar power generation and making power generation independent of power demand.

One solution with considerable potential is power-to-gas technology. The excess power from renewable sources can be used to produce hydrogen and then synthetic methane by electrolysis and that this could be fed directly to the existing gas grid. This will transform gas and power infrastructure into an overall energy system. "We need to think more strongly in terms of system integration and to work harder on the points of contact between gas and power. The considerable climate protection and energy efficiency potential of coupling these two energy sources should be given more prominence in the process of shaping political opinions. In this case the convergence of gas and power grids will be the key element in the success of the energy transition". ●

**French Gas Association AFG, Danish Gas Technology Centre, German Technical and Scientific Association for Gas and Water DVGW, Energy Delta Gas Research EDGaR, Netherlands, Energiforsk – Swedish Energy Research Centre, Swiss Gas and Water Industry Association SVGW and the Swiss Association of Gas Industry VSG*

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A methodology to increase the level of security awareness (MEISA Tool)

By Angela Marlovits (pictured), Chair of the GIE Security Study Group, Gas Infrastructure Europe (GIE)

Security awareness is the knowledge and attitude members of an organization possess regarding the protection of the physical and especially, information assets of that organization.

Most companies are conscious of the need to build a security awareness culture within their organizations. However, the efficiency of the chosen programs is not clear as the majority of the companies has not implemented specific initiatives to measure the concrete effects on the employees.

Therefore, GIE identified the most common methods adopted to increase and to measure the level of security awareness of the employees working within complex organizations.

Additionally, to support the security management in the selection of the best method for increasing or measuring the security awareness, the software tool MEISA (Methodologies to Increase the level of Security Awareness) has been developed. According to the parameters selected by the user, the tool automatically provides the best five methods that meet the requirements.

A METHODOLOGY BUILT ON COMPREHENSIVE SOURCES

In 2013 the GIE Security Study Group performed a Survey on Security Standards and Practices of Gas Infrastructure companies. One of the main results is a widespread perception that embedding "security awareness" into organization's culture is the primary key driver for improving the level of security.

From the benchmark results it can be noticed that

- End-user security awareness training is included in most of the organization's security policy;
- Awareness-raising activities is one of the relevant priority in security governance;
- Better awareness on security among senior management and employees would help to improve the level of security in every organization.

Therefore, the GIE Security SG agreed to perform a study on Increasing Security Awareness. The elaboration of the study is based on an extensive literature overview and policy review, and on the use of ad hoc questionnaires and interviews with the active involvement of several security managers from organizations operating in critical sectors. The collected data emphasize that most of the companies have a specific program to increase

Screenshots from the MEISA tool

the security awareness of the employees. An unexpected result revealed by this study is that the measurement of the actual level of security awareness inside the organizations is less common.

METHODS TO INCREASE AND MEASURE SECURITY AWARENESS

To provide a concrete support to the design of security awareness campaigns, 23 methods to increase (e.g. desktop message and screen saver, poster, security day etc.) and 11 methods to measure security awareness (e.g. interview, post-training test, walkabout etc.) have been analysed.

All these methods cover a complete description of each method, its advantages and disadvantages, best practices and – if available – examples. Moreover, a set of assessment indicators and descriptors has been utilized to yield a quantitative evaluation of the method's performance.

These indicators are used to summarize information related to the cost and time necessary to design and implement the method, the extension of the transmitted message, the active involvement of the end-user, the time horizon effectiveness, etc. This analysis has shown that some methods, even if very popular, result to have little effectiveness. Other ones are easy and cheap to design and implement, but they are able to transmit very limited contents or their effects tend to vanish in a relatively short time. Conversely, there are initiatives that require a strong involvement for the design and the implementation, but are able to effectively increase the security awareness in the organization.

THE MEISA TOOL

The MEISA Tool software has been developed in order to support practitioners. Once chosen requirements through a set of parameters, the tool searches the best-fitting methods among those illustrated in the study report. For each method the tool shows a short description, advantages, disadvantages and the comparison between the numerical values corresponding to the query and method's assessment indicators.

The methodology and tool is not necessarily addressed to Gas Infrastructure only. However, it has been developed exclusively for the members of GIE. Therefore, for the time being, it is available to members only.

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Developments in biogas/ biomethane industry

By Dr. Attila Kovacs, Board Member European Biogas Association & Dr. Kornel L. Kovacs, President, Hungarian Biogas Association

There is a question people engaged in biogas dislike to hear: "Can you replace Russian gas with domestic biogas, yes or no?" The short "no" corresponds to the present circumstances but does not reflect the real potential. On the other hand, the simple "long-term yes" would be meaningless without formulating the conditions attached to it. The fact is that the huge potential of biogas cannot be realised without continued, stable, long-term political support. Much to our regret "long-term" is far beyond the horizon of the next general elections…

A better question in our view is the following: "Can you replace a new major natural gas import pipeline project (like NABUCCO or South Stream) with biogas produced in Europe?" The answer is straightforward: yes, subject to political determination and directing the pipeline money to biogas investments.

At any rate, the direct comparison with imported natural gas is not sufficient. Biogas is much more, than a renewable, domestic energy carrier, biogas is to be fully integrated into waste management; processing agricultural wastes and by-products belongs to up-to-date agricultural practice; biogas is about GHG emission reduction, landscape maintenance, rural development, decentralised energy supply, local jobs etc. The broad range and complexity of benefits offered by biogas technologies make it difficult to operate adequate support systems. The experience shows that limiting the support to the issue of renewable energy supply is not sufficient: the solid environmental benefits should also be honoured. By other words: placing biogas into the same basket with other renewable energy sources (when it comes to competing for support funds) is a very narrow-minded approach.


Dr. Attila Kovacs


Dr. Kornel L. Kovacs

The difficulty to evaluate the multifaceted positive impact of biogas might be one of the reasons for frequent changes in the related government policies. These revisions are sometimes unexpected, drastic and even retroactive. They seem to be driven by short term political considerations rather than consequent long-term strategies. The unreliability of political support discourages companies from investing into research and development of an industry with unsecure future.

Nevertheless, the development in biogas/biomethane technologies has been substantial, although it may be not as spectacular as with wind and solar. The leading biogas/biomethane companies continue their efforts towards

increasing the technical efficacy and economic feasibility of the operations.

The key areas of research and development are the following:

a) Deeper understanding of the biological processes for identifying possibilities of intensification

The decomposition of organic materials by a microbial community is carried out under anaerobic conditions. The great variety of diverse microbes that participate in the microbial food chain gradually degrade the complex molecules essentially to a mixture of CH_4 and CO_2. The composition of this microbial consortium depends on various factors, such as feedstock ingredients, temperature, pH, mixing, or the geometry of the anaerobic digester. A clear understanding of the organization and behavior of this multifarious community is crucial for optimization of their performance and attainment of the stable operation of the process. The research work has resulted in developing a number of biological and chemical additives assisting the creation of better conditions in the digesters.

Classical microbiological methods are principally based on studies of isolated pure strains of microbes, and hence are of little help when the goal is elucidation of the relationships among members of a complex microbial consortium in order to improve the overall performance. The development of high-throughput sequencing technologies has opened up new avenues for such investigations. The metagenomic analysis of biogas-producing microbial communities is a novel approach by which to study the complex interaction among microbes in real-life environment that is important for both basic research and the practical aspects of improvement of renewable energy production from biomass.

b) pre-treatment of feedstock before the digesters for broadening the substrate base and improving conversion rates

The pre-treatment of substrates with poorly accessible molecular structures (i.e. lignocellulosic materials), which include many agricultural residues (such as maize straw), some industrial residues (such as brewers' spent grains) and some crops (such as switchgrass) is necessary for enabling the decomposition of these materials in the biogas digesters.

The research and development activities focused on this area have resulted in a number of different technologies: physical (mechanical, thermal, ultrasound, electrochemical), chemical (alkali. acid, oxidative), biological (microbiological, enzymatic), combined processes (steam explosion, extrusion, thermochemical).

The results from practical application of some of these developments are encouraging and biogas technology companies continue working on further improvements.

c) developments in biogas upgrading technologies

The cleaning of raw biogas from CO_2 and other components is shortly called "upgrading". The resulting product is highly concentrated (96 – 99,5%) "biomethane", which can be injected into the natural gas network and used for electricity generation, heating, or as vehicle fuel. The development in biogas upgrading technologies in the last 10 years has been remarkable.

About 50 companies are offering upgrading solutions based on different approaches (physical scrubber, chemical scrubber, adsorption, membrane separation, cryogenic and combined processes). The development efforts are focused on minimising the methane loss (in this regard the improvement in 10 years is above 80%), reducing the power consumption (50% improvement has been achieved) and making smaller capacity plants economically viable. It is expected that in the coming 15 years the bulk of the new biogas plants will be equipped with upgrading installations and will produce biomethane as final product instead of electricity.

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Perceptions versus real change

Is the building market ready to value energy efficiency?

By Cosmina Marian, Buildings Performance Institute Europe (BPIE)

In the mist of European and national legislation for energy efficiency improvements in buildings, there is an unavoidable discrepancy created by the readjustment of the market and all concerned actors. These requirements are supposed to motivate designers, developers, real-estate managers and users to integrate considerations related to energy savings into their way of doing business. But exactly how successful have these endeavours been?

The example of Energy Performance Certificates (EPCs) can point to a market trend. The main aim of an EPC is to act as an information tool for building owners, occupiers and real-estate actors, displaying the building level of energy consumption. Arguably this makes the EPC a powerful market tool to drive up demand for energy efficiency in buildings by targeting such improvements as a decision-making criterion in real-estate transactions, and by providing recommendations for a cost-effective upgrading of the energy performance. But there are still some gaps in fulfilling the full potential of the EPC scheme.

A recent survey[1], conducted among real-estate agents from 8 Member States[2] and with over 610 respondents, points to a difficult time for the proper use of EPCs as instruments that create market demand. Real-estate agents were asked to share their opinion on energy certification and its influence on the real-estate market. More specifically, agents were asked for their professional opinion on the main factors that households consider when selecting properties to rent or buy.

The main issues covered by the survey touched upon the following aspects: the level of knowledge about EPCs as well as on the EPBD[3]; factors considered whilst purchasing or letting a property; evaluating the usefulness and credibility of EPCs; connection between the EPC and the exposure time of a property on the market and barriers to a comprehensive implementation of the EPC system.

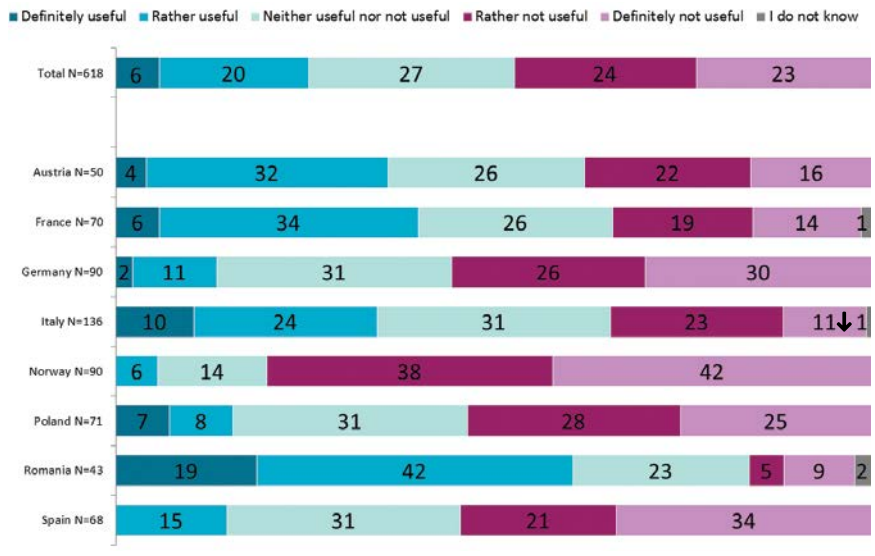
The analysis of the survey answers points to a set of significant findings. While energy performance certification is compulsory in most of the surveyed countries, there are still exceptions to the rule. Moreover, while EPCs are compulsory, 6% of the respondents indicated they were never necessary when making a transaction in Poland.

Real-estate agents rate quite low the usefulness of EPCs, only slightly above one fourth of them saying otherwise (Figure 1). This is not surprising since there is no distinguishable connection between the exposure time of a property on the market and its EPC class (Figure 2). In the opinion of those questioned, a higher indicator of energy performance for a building doesn't translate into greater interest in its acquisition (Figure 3).

Most of the answers confirm that there is a lack of knowledge about the usefulness of an EPC. Thus, the main elements taken into account when purchasing or letting a property remain the location, price and size. Though, agents are aware of the benefits of having a high class EPC pointing to lower energy costs and a better technical condition of the building.

It is important to note that most people can make rational

Figure 1. Real estate agents' rating of the general usefulness of EPCs



% answers ↑↓ Significantly higher/ lower score - total vs the country

economic choices, like choosing a property with a high EPC class, if they have the means to do so. The benefits of choosing a property that in the long run will save on the energy bills have to be made more obvious to the general customer. This way a good EPC can be another instrument in the tool box of real-estate agents to inform their clients about the characteristics of a property.

But the issue remains the lack of confidence in the reliability of EPC data which many respondents to the survey noted. It seems that perception on this matter makes all the difference. People will only adjust their behaviour rationally when confronted with credible information. The lack of a monitoring and compliance system decreases, and rightly so, the credibility of the EPC scheme. When confronted with unreliable data, the market will not welcome a failing instrument with open arms.

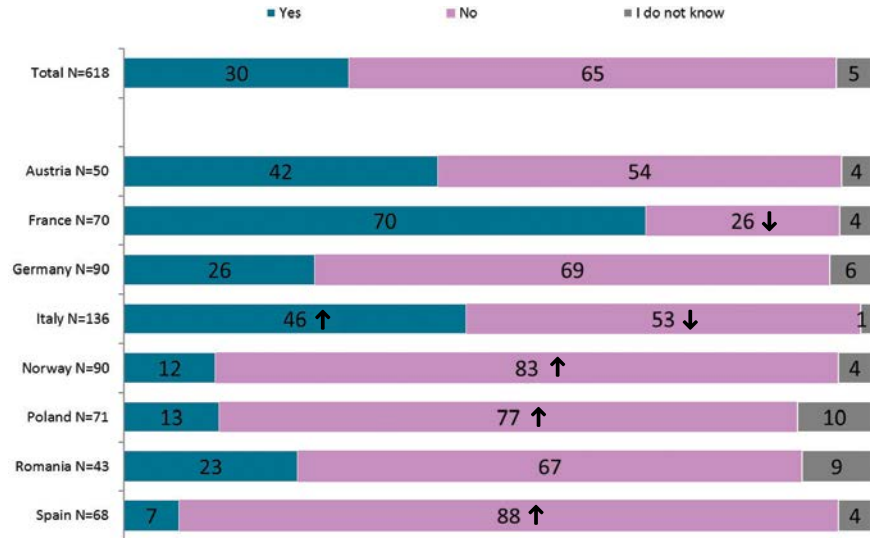
In order to ensure a high quality of energy performance certifications, an independent control system was introduced through the EPBD recast (Art. 18). This EU measure seems to suffer some delays before being properly implemented on the ground. The level of awareness of these relevant EU Directives is quite low among the survey participants.

Considering the example of the EPC scheme there is ample reason to argue for an inconsistency in the pace in which the market is integrating tools that are supposed to encourage energy performance improvements in buildings. The survey hinted to a larger issue – we have proven technology, financial schemes and the tools to encourage investments in energy efficiency in buildings, but a large-scale uptake of these approaches is missing.

Maybe a next step to ensure proper market uptake could be to set up a more reliable EPC quality check system and raise awareness among stakeholders about the benefits of using EPCs. A good EPC rating can lead to the increase of the property value and to reduced energy bills.

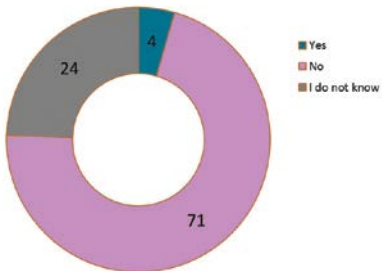
It seems that a major problem on the ground is the lack of trustworthy EPCs. This shows once more the need for stricter requirements for the qualification and/or accreditation of experts as well as for a system that monitors compliance.

Figure 3. Is there more interest shown in properties with a higher EPC rating?



% answers ↑↓ Significantly higher/ lower score - total vs the country

Figure 2. Connection between the EPC and the exposure time on the market



% answers

N=45 Voluntary certification and other form of certification – without legal requirement for EPC

Contact the coordinator of the ZEBRA2020 project:

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1 The survey was conducted within the framework of the EU funded project ZEBRA2020. The survey analysis is available at www.zebra2020.eu
2 Austria, France, Germany, Italy, Norway, Poland, Romania and Spain
3 Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast)

Lighting

“ ...one of the quickest, most practical and most cost-effective ways for Europe to save energy. ”

Polycarbonate line from Covestro enables efficient lighting

Smart lighting for smart cities

Electricity for lighting accounts for approximately 15 percent of global power consumption and 5 percent of worldwide greenhouse gas emissions. The Global Efficient Lighting Forum, co-organized by the United Nation's Environment Programme's (UNEP) en.lighten initiative and its collaborating centre in China, estimates that a global shift to energy-efficient lighting would low-er electricity demand for lighting by more than 1,000 terawatt-hours (twh) and reduce CO_2 emis-sions by 530 million tons per year[1]. LED lighting technology offers an energy- and cost-efficient solution here and is becoming increasingly common. LEDS have a long service life of up to 50,000 hours. Depending on requirements, their light can be focused or scattered to improve light quality and reduce light pollution.

Covestro (formerly Bayer MaterialScience) has developed a complete line of Makrolon® brand polycarbonates for the production of LED luminaires. These polycarbonates are available as granules, sheets and films.

MANY FUNCTIONS AND APPLICATIONS

They are used in lenses and optics, light guides, diffusers, reflectors, cooling elements and housings. The range of applications is just as broad, ranging from interior and exterior building lighting to streetlights, headlights and traffic signals to billboards and displays. These products make LED lamps a smart lighting technology solution for cities.

"The Makrolon® LED product line includes highly transparent and robust grades that offer good flame retardance compared with other transparent materials," says Dr. Klaus Reinartz, Head of Marketing for LED Applications in the Europe, Middle East and Africa Region at Covestro. As lenses or reflectors, they bundle or direct the LED light as desired. "The good heat resistance of the plastic prevents transmission from altering the lens and thus its optical behavior," says Reinartz.

In certain applications, such as headlights, lenses can have very complex shapes in order to achieve the desired redirection of the light. Covestro has developed innovative and efficient in-jection molding processes for the production of such lenses with free-form surfaces, and helps customers to implement them.

COOLING ELEMENTS WITH A COOL DESIGN

Even if LEDs do not get as hot as the conventional light bulb, they do generate heat that needs to be dissipated. Thermally conductive Makrolon® TC8030 offers several advantages over cast aluminum for the production of cooling elements. The plastic offers tremendous freedom during shaping, such as for the design of the cooling ribs. The material also weighs less and electronic components can be integrated into it directly in the mold.

An extraordinary application of LEDs can be found in a recently redesigned Covestro office in Shanghai, where over 4,000 LED tube lights made of Makrolon® were installed. Despite their great number, the tube lights from Skyworth use roughly 25 percent less electricity than conventional lighting and require less maintenance. ●

Skyworth LED lighting using Makrolon® polycarbonate makes the new offices of Covestro in Shanghai a brighter place. Source: Covestro

1 http://www.unep.org/NEWSCENTRE/default.aspx?DocumentId=2812&ArticleId=11067; www.enlighten-initiative.org

Smart lighting as a stepping stone towards smart cities

By dr.ir. Elke den Ouden. TU/e Fellow New Business Development in Public-Private Value Networks, Eindhoven University of Technology

Cities strive to improve quality of life for their citizens and see opportunities in new ICT-based technologies. Public lighting and public lighting infrastructure can play a significant role as a stepping stone to achieve the ambitions of cities to become 'smart cities'. New technologies, like LED lighting and data science, do not only contribute to energy saving, but at the same time provide opportunities for value adding services. The industry is in transition from a hardware and product-driven industry to a full solution and data based service-driven industry.

Moving beyond the functionality of products to meaningful applications providing value for citizens and society requires a change in paradigm that affects all participants in the quadruple helix (government, businesses, knowledge institutes and citizens). In this article we will highlight two of the prominent changes in the innovation process.

OPEN DATA AND OPEN PLATFORMS

The ultimate goal of urban solutions is to provide value for societal stakeholders by creating a healthy, liveable city with a vibrant economy. Many of the smart city solutions exist of a variety of sensors (weather, movements, energy consumption, camera's etc.) and mash up the gathered data with freely available open data to gain insights in emerging patterns that can be used for various software applications. For example, in Stratumseind, the pub street in the city of Eindhoven, a smart lighting solution aims to influence the atmosphere in the street and reduce the number of aggressive incidents that are inherent to entertainment districts (see Figure 1). With dynamic lighting scenarios the mood, stress level and behaviour of the visitors is influenced. Data from various sources is collected

Figure 1 - Dynamic lighting scenarios to influence people's mood and behaviour in a pub district (more info: www.de-escalate.nl)

Figure 2 - Adaptive lighting that creates the right ambiance for any moment (designed by Philips)

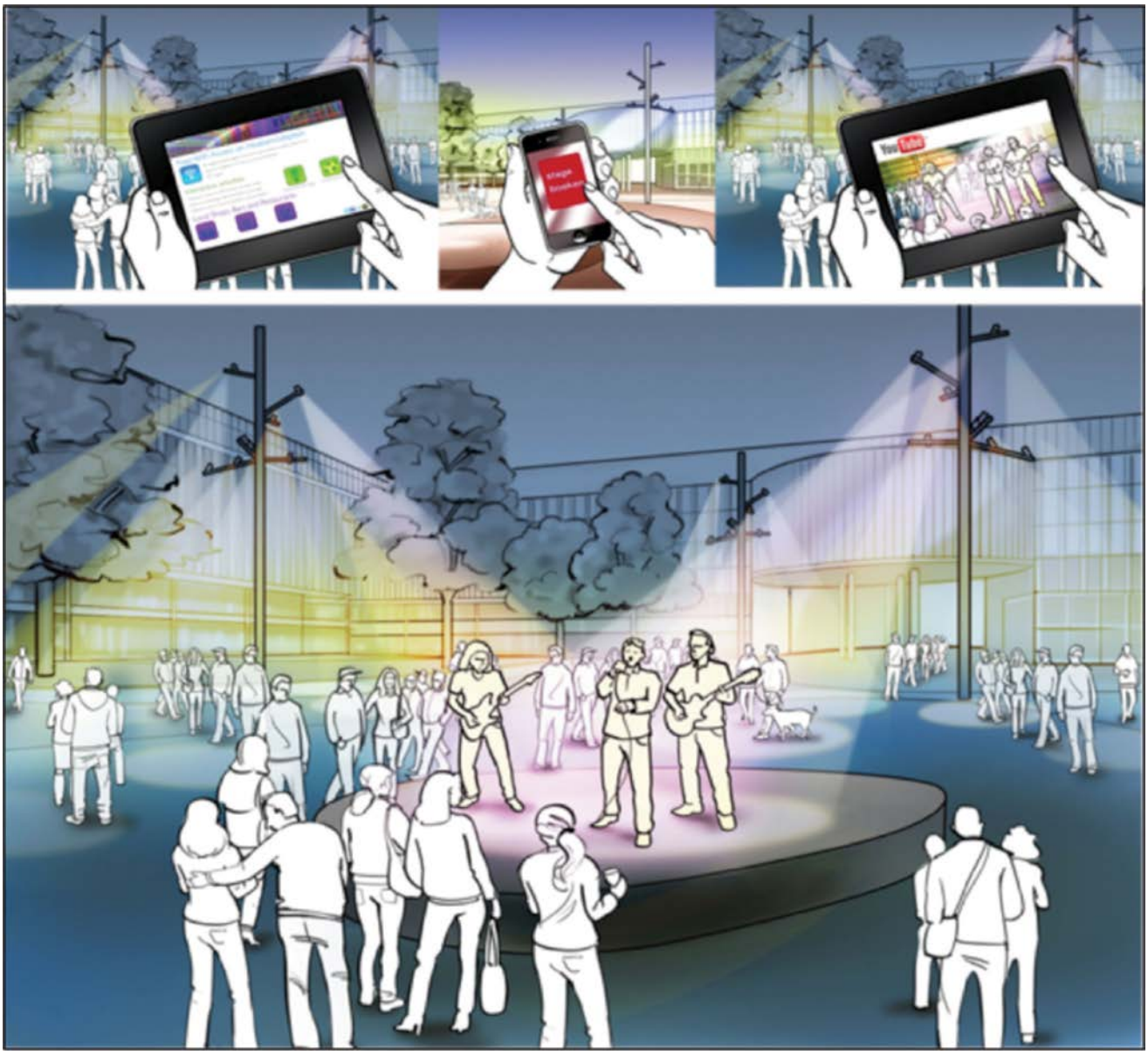
to determine in real time the risk of escalation and apply the appropriate lighting scenario. Real time measurements, such as 3D sound, social media watching, people counting, as well as open data on e.g. weather, events in the area or results of important soccer matches, and data that becomes available with a delay, e.g. police reports on incidents, determination of origin of mobile devices, waste collection or the amount beverages consumed. Historical data from past incidents is used to find correlations and parameters to predict risk levels of escalation. One of the challenges in such projects lies in integrating all information collected and analysing data of different nature to establish the risk for escalation in real-time. Another challenge is the realisation of an adaptive open platform that connects the devices and services from different providers and is able to anticipate on continuous developments in technologies and services, so it is upgradable to also meet future needs. An open platform enables the integration of forthcoming innovations. To guard public interest it is necessary to ensure the privacy and security of the users of the platform, especially for urban public systems. In the innovation process not only the different parts of the system need to be designed, but the open platform that ensures privacy and security by design as well.

NEW BUSINESS MODELS

The shift from products to services addressing societal needs and to the creation of open platforms that enable continuous innovation also invokes new business models. The business models should generate a recurring revenue stream that enable continuous investment in upgrades of the hardware, as well as the development of new scenarios and applications as part of the service. New hardware and software will become available over time, allowing new functionalities, and the context and use of the urban space will change and lead to new needs. To ensure that the system has a sufficiently long economic lifetime it will need to be able to include new and at present unknowable modules. For example, at Hoekenrodeplein, a square in Amsterdam near the ArenA stadium, an adaptive lighting system is installed to increase not only sustainability and safety – by providing a light-on-demand solution – but also hospitality by creating different ambiances that fit to different activities on the square (see Figure 2). This has value for the owners of shops, pubs and restaurants near the square as they benefit from a more lively square, but traditionally they are not included in the business models for public lighting. Moreover, with such an adaptive system it becomes possible to further enhance the hospitality by turning part of the square into a virtual street performer's music stage (see Figure 3). The concept re-uses the lighting by creating a spotlight and the camera's and wifi for the adaptive system can be used to stream video's to internet. The only investment needed is in the software app to book the stage and stream the content. This service could generate a stream of recurring revenues, but the question is who is willing to exploit it, as it is significantly different from the traditional business models in the sector.

Enabling continuous innovation based on progressive insights, changing contexts and new opportunities requires a business model that includes value creation

Figure 3 - The concept of a street performer's music stage (designed by Philips)



for existing as well as new participants on the platform and enables on-going investments.

These examples show the challenges in creating and implementing smart solutions that are truly serving the needs of people and making the city an attractive place to live. ●

More information can be found in the Open Innovation Yearbook 2014 and 2015 (open access):

- Ouden, P.H. den, Valkenburg, A.C., Schreurs, M. & Aarts, E.H.L. (2015). Smart lighting solutions as a catalyst for smart cities: Practical challenges of ambitious innovation partners. Open Innovation 2.0 Yearbook 2015. (pp. 83-94) European Commission, Directorate-General for Communications Networks, Content and Technology.
- Ouden, P.H. den, Valkenburg, A.C. & Aarts, E.H.L. (2014). Service design based on smart urban lighting. Open Innovation 2.0 Yearbook 2014. (pp. 120-124) Luxemburg: European Commission.

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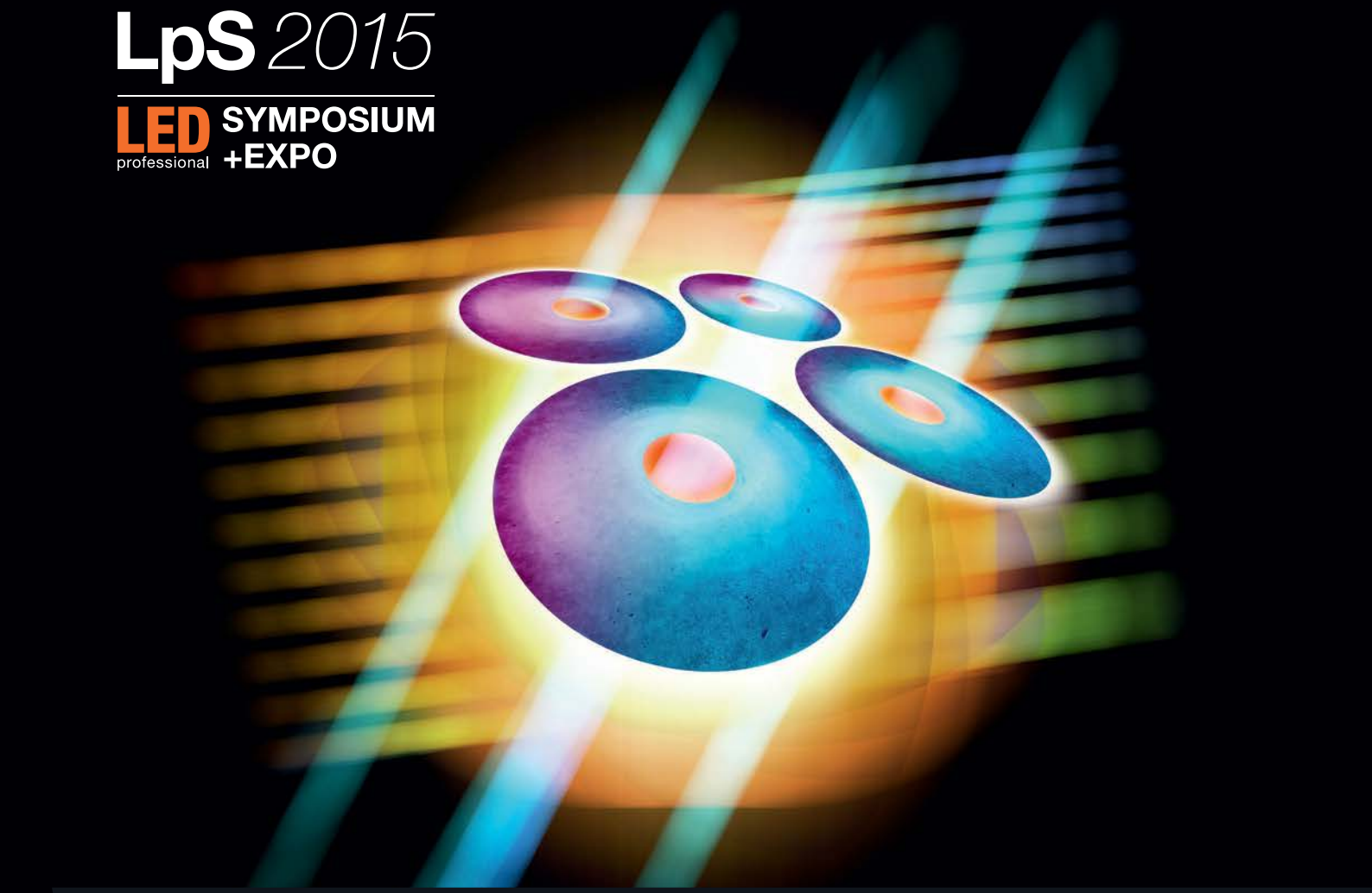

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Lighting in Cultural Heritage

By Carlos Lee (pictured), Director General of EPIC (European Photonics Industry Consortium) and Louis Bonnefous, IOGS (Institut d'Optique Graduate School).

2015 is proclaimed international year of light by UNESCO to emphasize the importance of light and light-based technologies. Lighting technologies, and more generally photonic technologies, are gaining increased attention as they are technologies that will deeply impact our lifestyle because they are pervasive and enabling. Photonics technologies create, use, modify, or detect light. We encounter photonics in applications as diverse as transport, environment, manufacturing, life science, and also lighting is one of main products.

In cultural heritage, leading-edge technologies are required: there is no place for something that could alter a priceless artwork. Thanks to innovative technologies, museum conservators are now relieved, lighting is no longer a threat for their pieces of artwork. And in addition, the new lighting technologies will enhance the best perception of artworks.

Ensuring that artworks reflect their true charms: a view of the Aachen Cathedral Treasury museum. The illumination needs to meet the stringent conservation issues for the lighting of historic exhibits.

A LOOK BACK ON LIGHTING TECHNOLOGIES

The first 'fuel lamps'

Long time before the advent of semiconductors, during the Antiquity, candles and oil lamps were first used as lighting sources and we still use them today on special occasions. During the 18th century, Aimé Argand used another type of fuel to produce light by inventing the kerosene lamp which was later replaced by gas lamps.

Towards electronics

At the end of the 19th century, new types of lamps were widely used for street and building lighting. Humphry Davy was the first to seize the possibility of

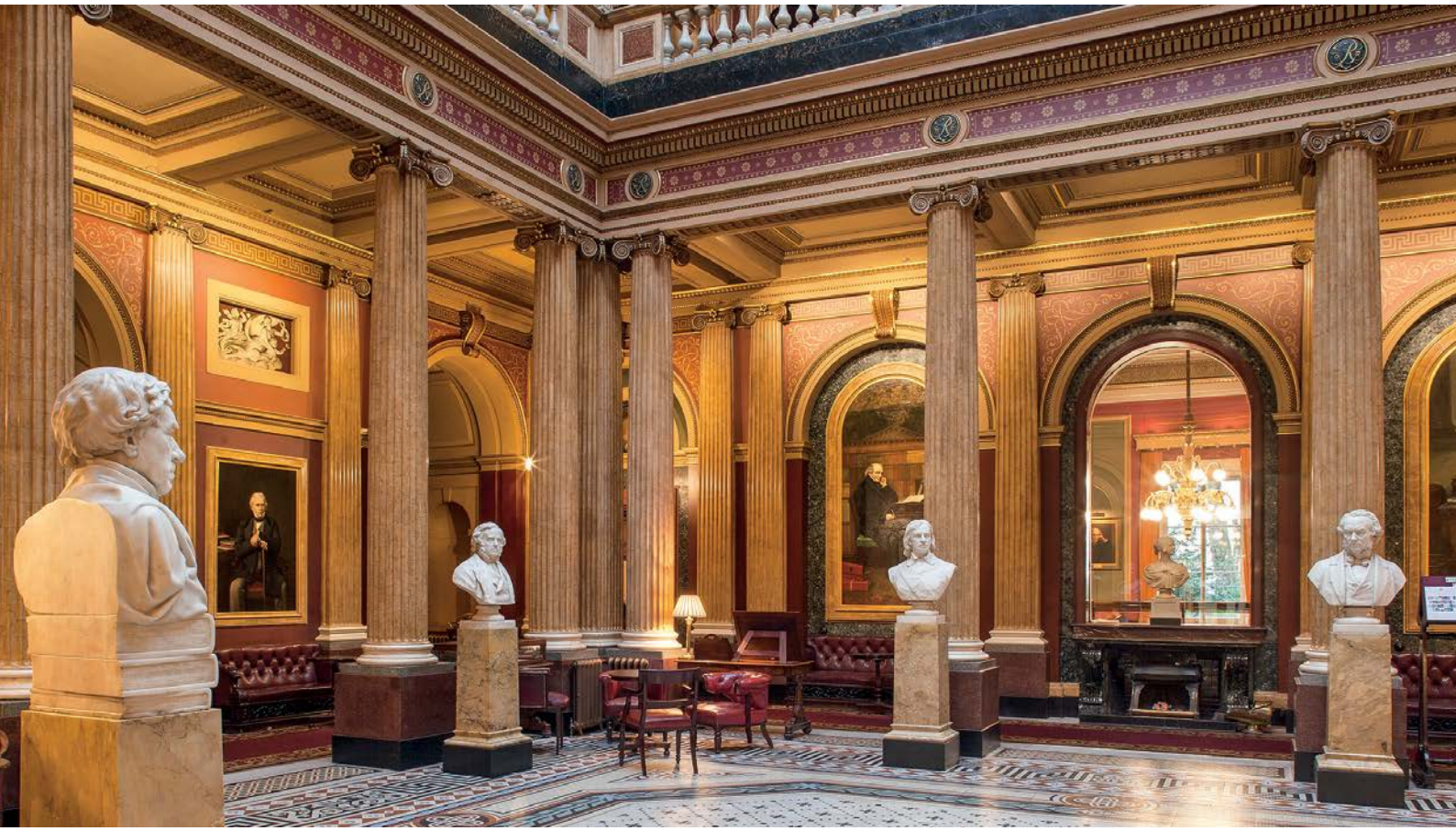
electric technologies to produce light. His 'arc lamp' produces light thanks to an electric arc which is a discharge that occurs when a gas is ionized. In the early 1920, the long lasting incandescent light bulbs superseded the arc lamps thanks to successful inventor Thomas Edison. Light is emitted by incandescence thanks to a wire filament heated by an electric current and protected from oxidation with a glass bulb filled with inert gas. Incandescent lamps correspond to our traditional lighting. Of low manufacturing costs, incandescent lamps are produced in a wide range of size and luminosity. At the middle of the 20st century, fluorescent lamps appeared. More costly, they have the benefit to convert more efficiently energy into useful light than incandescent lamps. Eventually, the first LED technologies appeared thanks to Nick Holonyak in 1962 which predicted that LEDs would later replace every incandescent lamps of old Thomas Edison.

The advent of LED technology

LED which stands for Light-Emitting Diode is composed of two semiconductor materials that emit light thanks to an opto-electrical phenomenon discovered in the early 20st century called 'electroluminescence'. The first LEDs were quite useless for lighting purposes as they emitted low-intensity infrared light. It's only in 1962 that Nick Holonyak build a first visible-light LED. Also of low intensity, the LED was limited to red colour but already replaced most of small incandescent bulbs in electronic devices.

Today, LEDs offer very high

The Reform Club is both internally and externally of one period and is one of the most important buildings in London dating back to the Victorian period. A visit to the Reform Club is a special experience even today. The primary goal of the lighting solution was to add life, excitement and vitality and provide the 'eyes' through which to the Victorian-age building's charisma and provide a pleasant and unforgettable atmosphere for both visitors and staff, while at the same time meeting conservation and energy requirements.



brightness in colours that encounter the visible spectrum. It's only recently that high-brightness blue LEDs were invented by the Japanese Shuji Nakamura, Hiroshi Amano and Isamu Akasaki, recipient of the Physics Nobel Prize in 2014. The semiconductor materials used determines the colour of the LED.

LED IS PRECIOUS FOR CULTURAL HERITAGE

LED light is harmless for artworks

LED is the only source that offers a light free of UV and IR radiations. Even when LED luminaires are placed in direct close contact to the object, the lighting is less harmful than with a traditional system. The decolouration or deterioration risks are thus avoided and the colour temperature variation of controllable LED systems is also with no risks for the artworks.

LED systems are intelligent, controllable systems

In buildings dedicated to arts, smart lighting control systems are essentials to dose with precision the quantity of artificial light needed to be combined with daylight. LED systems have the advantage to be notably easy to mount on electronic integrated circuits. This great benefit allows LED technologies to be 'smart': in museums and galleries, lighting systems are autonomous and adjust to the current luminosity to offer 'soft' light. The company Zumtobel, world leading supplier of lighting systems headquartered in Austria, has a very innovative lighting management system in its LEDs which let them simulate an overall soft and highly realistic natural lighting as well as providing an increased light

The multifunctional SUPERSYSTEM from Zumtobel forms a unifying light element in the successful renovation of the listed arcades at the LWL Museum in the city of Muenster, Germany.

A view from the Museo del Duomo. Targeted accent lighting help present the exhibits in their natural beauty, taking visitors to the exhibition on an authentic journey through time.

flow on specific directions so as to highlight details and objects exposed. Light's staging can be considered as an art by itself and thanks to LED systems it has never been so convenient to create 'ambiences' in museums.

LED systems are economical

LED systems are economical first because they are controllable. Each system adapts to the current luminosity and offers a natural brighter lighting than incandescent or fluorescent lamps. Compared to a typical 60-watts incandescent lamp, an LED of the same brightness will consume 5 times less energy. One of the most relevant example of an energy effectiveness art building is the Wilhelm-Hack-Museum, a modern art museum based in Ludwigshafen in Germany. LED systems have now replaced former traditional incandescent light bulbs and the museum's energy costs have been reduced by as much as 70%. The numbers are even more relevant for outdoor lighting where powerful LED are used to illuminate monumental building facades. LED systems are also economical as they are very long lasting. With a bulb lifetime of over 50.000 hours, their life span is more than 60 times longer than the one of incandescent lamps (750 hours). Lastly, LED systems are economical because they hardly require any maintenance. The yearly operating cost for a 60-watt traditional lamp is about 13$ compared to the less than 3$ needed for an LED of the same brightness. When we know how expensive maintenance costs can be in museums, LED systems have become very welcome alternatives.

A good museum lighting system answers the needs of both conservators and users which ask for an atmosphere that can create emotions, visual comfort without impacting artworks, and be energy-efficient. Thanks to LED technologies, these needs are now satisfied and LED systems are set to replace traditional lighting in most museums.

About the author:

Carlos Lee is Director General at EPIC, European Photonics Industry Consortium, the association promoting the sustainable development of organisations working in the field of photonics. Photonics encompasses technologies that use, create, modify, or detect light, such as photovoltaic, lighting, lasers for medical/military/industrial applications, optics and fibers for optical communication, and many more. Photonics is one of the six key enabling technologies recognized by the European Commission.

Refurbishment rates are barriers to lighting quality and efficiency

By Diederik de Stoppelaar (pictured)

Efficient lighting products will become increasingly available due to the Energy Related Products Directive. But can they sufficiently contribute to improving the lighting quality and efficiency in indoor and outdoor applications? And will these products come in time for EU energy saving targets?

Lighting is responsible for 14% of all the electricity consumption within the EU (source: IEA 2002). When these efficient lighting products are put into existing installations, they can yield some 15% improvements in energy efficiency. Looking at professional lighting, around 80% of the possible energy saving with existing products will come from the office and industry lighting application. With a refurbishment rate of 7% per year however it will take 15 years to realize full benefits. Even worse is the outlook in street lighting which represents about 20% of possible energy savings. 33% of installations are older than 40 years. But with a refurbishment rate of 3% per year, it will take around 30 years to realize full benefits from using efficient lighting products.

In addition these products are all too often put into service in poorly designed and operated lighting installations that will lead to bad lighting conditions and waste in energy.

A discussion about modern lighting goes beyond the aspect of energy saving.

Light and lighting is essential for mankind to perform many visual tasks efficiently, effectively, in comfort and at places providing safety and security. The required illumination for both quantity and quality for the tertiary lighting sector is well defined in the CEN lighting applications standards. These standards describe and define how illumination can be provided by daylight, electric light or the combination of the two sources in well designed, installed and operated lighting schemes.

A lighting scheme is the key leverage for energy saving and quality in lighting. Planning, installing and maintaining a properly designed lighting scheme will improve the effectiveness of lighting in terms of quality and quantity and can result in up to 70% reduction in the energy used, changing from conventional light sources to LED.

The European Union has a carbon reduction commitment and plans to reduce by 27% European greenhouse gas levels and energy consumption by the year 2030.

It has been demonstrated that energy efficient lighting is one of the quickest, most practical and most cost-effective ways for Europe to save energy. A range of measures have been introduced throughout the European Union. These measures range from consumer information initiatives, such as the Energy Labelling of Products Directive, legislation to remove energy inefficient product from the European market using the Energy Related Products Directive, or efficient construction measures as given in the Energy Performance of Buildings Directive.

It is however predicted that Europe is falling behind its energy saving targets for 2030 and additional measures are needed.

The lighting industry welcomes and has already contributed to the initial stages of ENER Lot 37 Study on Lighting Systems, which are considered as holistic systems: light sources, ballasts, luminaires, multiple luminaires in a system with sensors and controls and also the design and installation of the system.

The scope of the study is "….to carry out a limited preparatory study on lighting systems for the exploration of the feasibility of EcoDesign, energy labelling, and/or energy performance

Lighting system: process of implementation

of building requirements. The options of where to go next include a basic idea on how to implement possible measures, without going into detail. The energy saving potential of the options is considered, but not the political feasibility. The options can be further addressed in a possible full preparatory study."

The lighting industry recommends formalising in a lighting system the process of design through to operation in a manner that allows transparency and is therefore open to monitoring or regulation. This process should have 5 main stages.

DESIGN

To ensure that the design is performed according to best practice, both for energy efficiency and lighting quality, certain criteria are needed like

- the designed system shall include suitable controls to minimise the energy usage
- the designer shall provide a maintenance schedule for the system to be operated to ensure optimum operation of the system through life

BENCHMARK

Before the design can be implemented there should be a check to ensure that the design conforms to best practice and to energy performance requirements.

INSTALLATION

Designing a system that provides a quality environment in an energy efficient manner is not enough unless the system is implemented correctly. This means that the system needs to be installed as designed and therefore

- the installer shall install the system in accordance with the specification and plans provided by the designer

- the installer shall not make changes to the system and products specified without the approval of the designer

COMMISSIONING AND SIGN-OFF

Building systems are no longer products operating in isolation but potentially complex interlinked components producing a controlled, efficient system. Commissioning of the system is essential to ensure all functions are operating correctly to the product specification and to the system design and therefore

- the installer shall complete and commission the system for handover

- the installer and building owner shall confirm the correct operation of the system and formally sign-off the commissioning

OPERATION AND MAINTENANCE

Unless users understand how to correctly operate the system, and maintenance engineers understand how to maintain the system to ensure optimal efficiency through life, the energy savings potential of the system will degrade through life and only realise a fraction of its potential. This requires that

- the installer shall instruct the owner/user in the energy efficient operation of the system
- the installer shall instruct maintenance personnel in the correct and timely maintenance of the system

The challenge is to move beyond product regulation, start using metrics that measure energy use and not installed load, and define requirements on commissioning and maintenance. This will require a higher level of expertise from legislative bodies, market surveillance, planning control authorities, lighting design and electrical installation professionals.

It has been demonstrated that energy efficient lighting systems are one of the quickest, most practical and most cost-effective ways for Europe to save energy. With LED technology we are really at the beginning of a new era. The chances of lighting go beyond the vision aspect and energy saving. New areas such as human centric lighting and smart lighting are currently explored intensively with new results expected for autumn this year.

The European lighting industry fully embraces these innovative opportunities, strongly supports a full study on lighting systems, and for the study to make concrete legislative proposals.

Mr. Diederik de Stoppelaar, a seasoned lighting veteran, brings over 25 years of experience in the lighting industry to LightingEurope, including being instrumental in the founding of LightingEurope and serving as Treasurer from 2011-2013. Previously he was the global General Manager for the Vertical Outdoor within GE Lighting. Prior to his work at GE, Mr. de Stoppelaar has served in various management roles within Philips Lighting, as Chief Marketing Officer of Thorn Lighting, Regional Commercial Director of Zumtobel, and Vice President for Sales, Europe and Africa, of Lutron.

Adaptive indoor LED lighting and user comfort

Spatial light distribution of daylit situations as a reference for user preference

By Martine Knoop, Technische Universität Berlin, June 2015

Light Emitting Diodes have shown a rapid evolution in the last few years and are replacing conventional light sources in luminaires for general, functional, lighting in indoor applications. In combination with appropriate controls, these directed light sources can offer task lighting where and when needed. The resulting adaptive, demand responsive, LED lighting solutions can realize highly efficient task illumination. However, in comparison to illumination with conventional light sources, the proportion of diffused and directional light in room changes and the resulting lighting conditions are not always rated positively by the users. Too directional lighting could lead to harsh shadows and interfere with task performance, lead to unpleasant appearances of people in the room or be distracting or confusing for some users. Additionally to that, the illumination of vertical room surfaces can decrease, which subsequently may affect room appearance.

In order to provide comfortable lighting conditions the light distribution in a room should be considered. This lighting quality aspect seems to be of specific importance in situations with smart, adaptive, LED lighting solutions, as they might realize an inhomogeneous light distribution in the room.

Most existing quality measures for indoor lighting are derived from research with and referring to the use of diffuse light sources. The International Commission on Illumination (CIE 2013) looked into the applicability of existing lighting quality measures in the assessment of the quality of interior lighting with LED lighting systems. This review states that preferred luminance levels for the vertical surfaces within the field of view can be found in literature (e.g. Loe et al. 1994, Van Ooyen et al. 1987, Newsham et al. 2004, Newsham et al. 2005, Kirsch 2015). However, further research is required for the diffuseness – directionality of the lighting within the room, the spatial light distribution, which affects shadows and appearance of people and objects.

Using daylight as a reference, being the chosen light source from a user's point of view (e.g. Heerwagen and Heerwagen 1986, Boyce et al. 2003), the preferred directionality and diffuseness could be derived from daylighting conditions. Schofield and colleagues indicate that most people prefer diffuse lighting with a directional component, which can be found "on a cloudy day, in the illumination field of a typical room with an overhead light and light-coloured walls, or from the sun embedded in a diffusing sky" (Schofield et al. 2011, p. 2330).

Research is needed to look into the preferred conditions and set the minimum requirements for an acceptable balance between diffuseness and directionality for room appearance, modelling and shadows. Research at the Technische Universität Berlin looks into user acceptance, measurement and specification of the spatial light distribution of both daylit and artificially lit situations. For this purpose, a mock-up room at the Technical University of Berlin is used, that allows for separation of a large number of variables that could affect the subjective evaluation of spatial light distribution (Figure 1). The mock up has self-illuminating room surfaces of which areas of approximately 20 x 20 cm² can be dimmed up and down (Kirsch and Völker 2013). In Fall 2015, the room will be equipped with an artificial sky as shown in Figure 1. Spatial light distribution is described and evaluated by means of light incidence solids (Liedtke et al. 2013). Through quantifying spatial light distribution and analysis of user responses, guidelines for lighting design and product development will be drawn up.

In summary, adaptive, demand responsive, lighting has a great energy savings potential. Nonetheless, user comfort needs to be considered in designing these solutions. Lighting of room surfaces is required for an appropriate room appearance. Additionally to that, localized,

Figure 1: Experimental set-up Technische Universität Berlin. Left: test room with backlit walls and ceiling, middle: artificial sky with artificial view, right: light sources realising 'daylighting' conditions of the artificial sky (Pictures: Raphael Kirsch and Stefan Gramm, TU Berlin)

demand related, lighting around the user needs to include a diffuse component, next to its directional one, to guarantee pleasant appearances of people and to realize moderate and task supporting shadows. Whereas recommended surfaces luminances can be found in literature, research needs to look into appropriate diffuseness – directionality ratios.

References

Boyce, P., Hunter, C., Howlett, O. (2003). The benefits of daylight through windows. Troy, New York: Rensselaer Polytechnic Institute.

CIE. 2013. CIE 205-2013 Review of Lighting Quality Measures for Interior Lighting with LED Lighting Systems. Vienna. Commission Internationale de l'Eclairage.

Heerwagen, J. H., and D. R. Heerwagen. "Lighting and psychological comfort." Lighting Design and Application 16.4 (1986): 47-51.

Kirsch, R., Völker, S. 2013. Lighting Quality versus Energy Efficiency. In: Proceedings of CIE Centenary Conference "Towards a New Century of Light". Paris, France, April 15/16, 2013.

Kirsch R.M (2015) Lighting quality and energy efficiency in office spaces. PhD Thesis Technische Universität Berlin. urn:nbn:de:kobv:83-opus4-65760

Liedtke,C., Völker, S., Knoop, M. (2013) The light direction and directional light - towards a new quantification of an essential lighting quality criterion. In: CIE (Hrsg.) Proceedings of CIE Centenary Conference „Towards a New Century of Light" April 15/16, 2013 Paris, 542-551

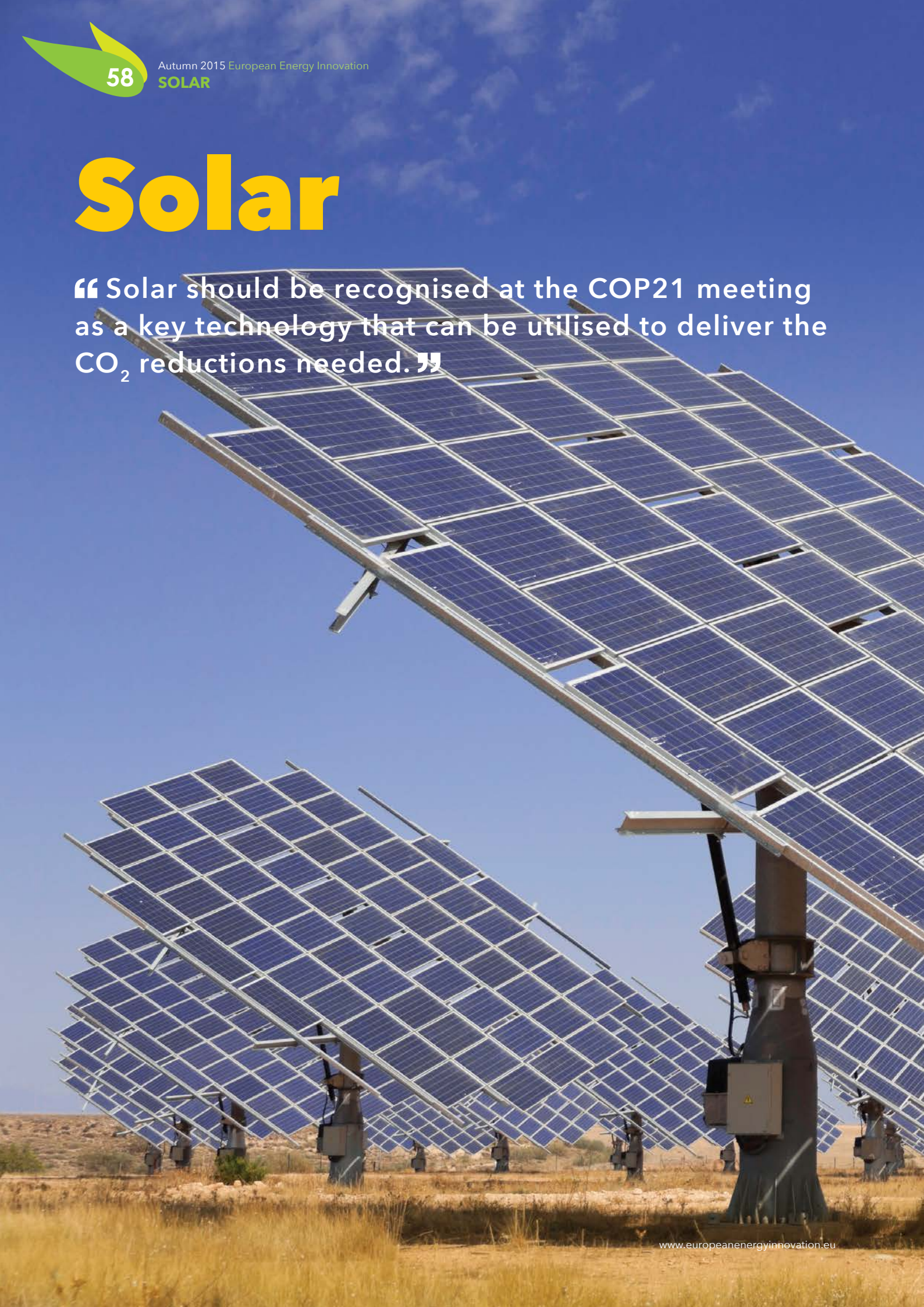
Loe, L.; Mansfield, K.P.; Rowlands, E. 1994. Appearance of lit environment and its relevance in lighting design: Experimental study. Lighting Research and Technology. 26. pp. 119–133.

Newsham, G.R.; Marchand, R.G.; Veitch, J.A. 2004. Preferred surface luminances in offices, by evolution. Journal of the Illuminating Engineering Society. 33. pp. 14–29.

Newsham, G.R., Arsenault, C., Veitch, J.A., Tosco, A.M., Duval, C. (2005) Task lighting effects on office worker satisfaction and performance, and energy efficiency. Leukos 1(4):7-26.Schofield

Solar

“Solar should be recognised at the COP21 meeting as a key technology that can be utilised to deliver the CO_2 reductions needed.”



Does Europe abandon photovoltaics?

By Arnulf Jäger-Waldau, European Commission, Joint Research Centre; Institute for Energy and Transport, Renewables and Energy Efficiency Unit

During the last 15 years, solar photovoltaic electricity generation has grown from a niche market to provide about 250 TWh electricity in 2015, roughly 1% of the world electricity production. The IEA *Medium-Term Renewable Energy Market Report 2014* published in August 2014 estimates, that cumulative installed capacity of solar photovoltaic electricity systems will more than triple by 2020 compared to 2013.

After the world-wide photovoltaic market more than doubled in 2010[1], the market continued to grow steadily and has more than doubled to about 42.3 GW[2] in 2014. For 2015, an increase to more than 50 GW is expected (Fig. 1). This represents mostly the grid connected photovoltaic market. To what extent the off-grid and consumer product markets are included is not clear, but it is believed that a substantial part of these markets are not accounted for as it is very difficult to track them. The rapid growing markets in China, Japan and the USA more than compensated the stronger than expected market contraction in Europe which fell from a record of 18.5GW in 2011 to less than 7 GW in 2014 (Fig.2).

capacity of about 88 GW, the European Union is still leading in PV installations with 49% of the total world-wide 178 GW of solar photovoltaic electricity generation capacity at the end of 2014, but down from the 70% at the end of 2012. According to the IEA *Medium-Term Renewable Energy Market Report 2014* this share will drop below 30% by 2020 due to a stagnant market of 7 to 8 GW between 2014 and 2020.

What are the reasons and main consequences of this development?

Some Member States had introduced support schemes, which were not designed to react fast enough to the very rapid growing market and this led to unsustainable local market growth rates. To counteract, unpredictable and frequent changes of the support schemes as well as legal requirements led to installation peaks before announced deadlines as well as high uncertainty for potential investors. A number of retroactive changes have further decreased investment confidence.

The legal framework for the overall increase of renewable energy sources in the European Union was set with the Directive 2009/28/EC, and in the mandatory National Renewable Energy Action Plans (NREAPs), the

Figure 1 Cumulative Photovoltaic Installations from 2005 to 2015 (data source: EPIA[3], Eurobserver[4], JRC PV Status Reports[5] and JRC analysis)

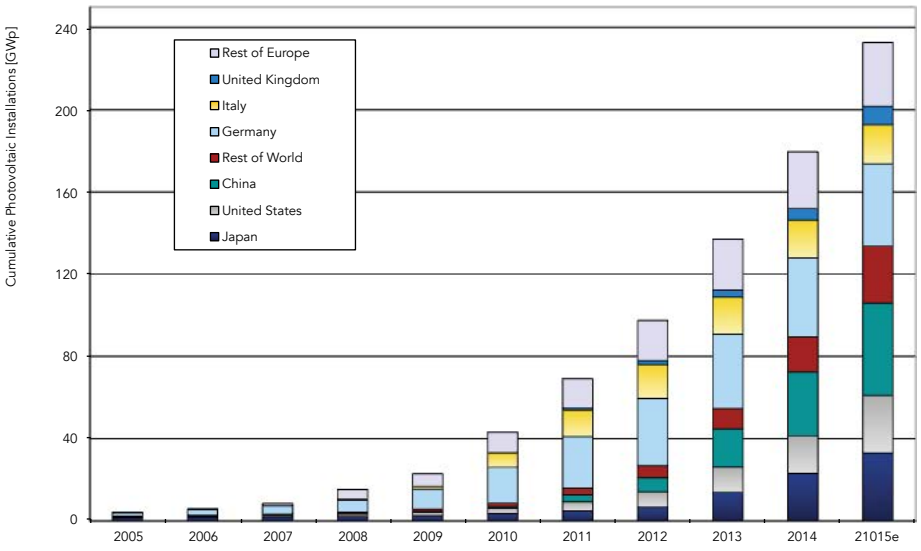


Figure 2 Annual Photovoltaic Installations in the European Union from 2005 to 2015 (data source: EPIA[3], Eurobserver[4] and JRC analysis)

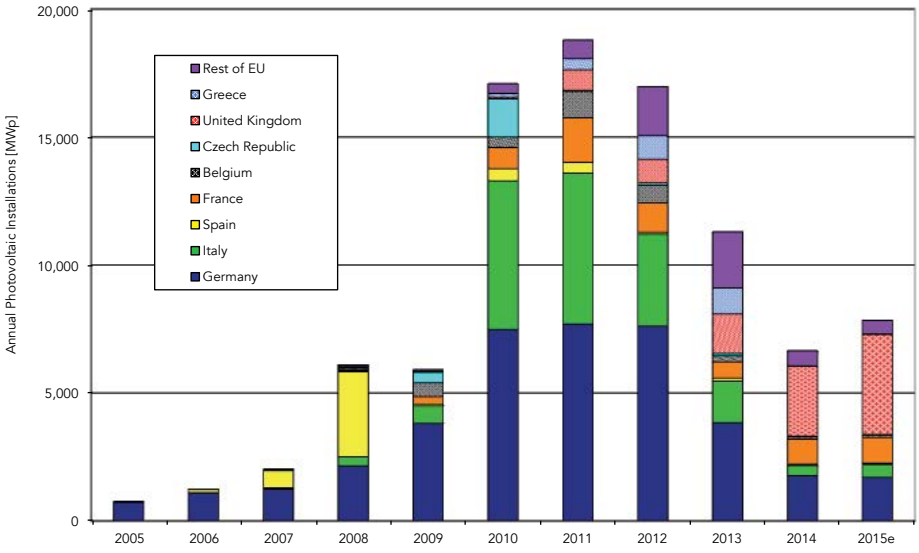
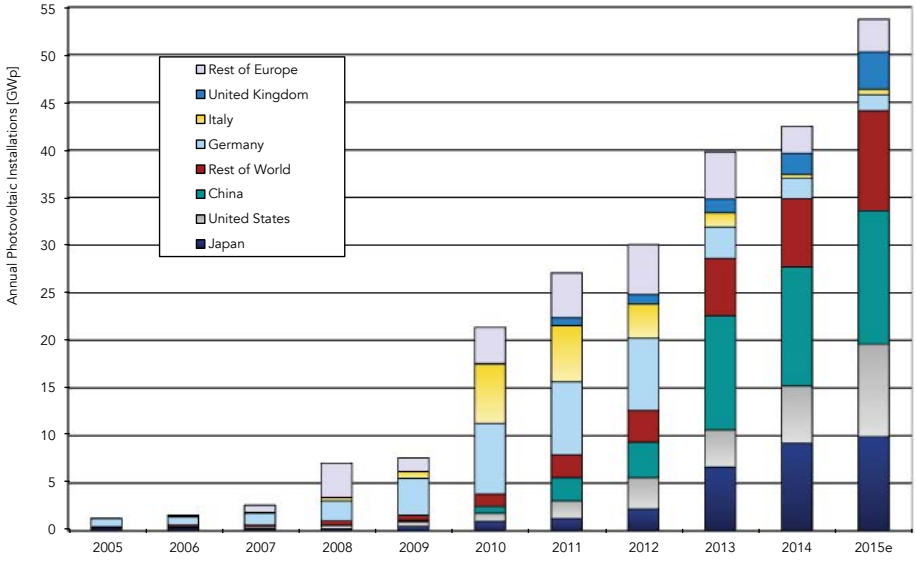


Figure 3 Annual Photovoltaic Installations from 2005 to 2015 (data source: EPIA[2], Eurobserver[3] and JRC analysis)



Member States have set specific photovoltaic solar energy targets, adding up to 84.5 GW in 2020. At the end of 2014, this target had been exceeded in the European Union as a whole (Fig. 4). The absence of mandatory national renewable energy targets for the period beyond 2020, as well as the ongoing changes in the regulatory frameworks give no investment security to potential investors. In addition, some of the European Member States introduced levies on electricity, which the consumer generates and consumes itself instantly at the time of generation.

One of the consequences/are the effects on local jobs and the local economy as already described in last year's edition[6]. Between 2011 and 2013 the PV jobs in Europe halved from over 260 000 in 2011 and this trend continued in 2014 and early 2015.

More than 75% of the 260,000 jobs were related to operating and installing solar photovoltaic electricity systems. Almost all of these jobs were local European jobs contributing to the European gross national product. The steep drop in new installations since then has led to a dramatic reduction of these local jobs and with it the positive effect on the local European economy.

The second main consequence of the decreasing solar photovoltaic electricity system market in Europe is the fact, that European citizens are not harvesting the fruits of electricity below the residential retail price, which is now available for a large number of them[7].

For over 40 years, governments all over the world have spent billions of Euros on R&D to lower the hardware costs of photovoltaic systems. The increasing market has enabled the industry to follow the price-experience or "learning" curve with an average learning rate for solar modules of about 80%, i.e. the average selling price (ASP) of solar modules fell by 20% for each doubling of the production volume. PV system prices have followed the lowering of module prices but at a slower pace. The reason for this is that non-technical costs have not

decreased at the same pace or sometimes even increased.

Despite the fact that a global market exists for the hardware components of a PV system, e.g. modules, inverters, cables, etc., and prices are very similar worldwide, the prices for installed PV systems still vary significantly. The reasons for these differences are manifold and range from the different legal requirements for permitting, licensing and connection to the grid to the different maturity of the local PV market, with impacts on competition between system developers and installers.

In July 2015 the European average price of a residential system was 1.25 €/Wp[8] including installation but without tax and administrative and connection costs. However, there is a wide spread in the costs of PV systems for home owners. A price survey showed that prices for installed PV systems between 1 and 10 kWp in the European Union varied from quotes as low as EUR 1000 per kWp to more than EUR 2600 per kWp. At the same time different VAT rates between 0% and 25% applied throughout the Union. Administrative and connection costs as well as fiscal and financing conditions are a further source of huge differences in the European Union. These non-technical costs vary much more within in the European Union than the solar radiation and can make PV use in sun-rich countries less attractive than in countries with an average solar radiation, but low non-technical costs.

Already at 5 % return on investment (ROI) the financing costs are the largest single cost factor. Together with fees and permit costs, they comprise about one-third of the electricity-generation costs from a residential PV system for the first 20 years. The influence of financing costs is shown in Figure 5. Therefore, reasonable financing is key to low-cost photovoltaic electricity.

The introduction of fixed network charges or levies to be paid on electricity generated with a PV system and self-consumed at the place and time of generation further add to a diversification of the attractiveness to install

Figure 4 Cumulative Photovoltaic Installations in the European Union from 2005 to 2015 (data source: EPIA[3], Eurobserver[r4] and JRC analysis)

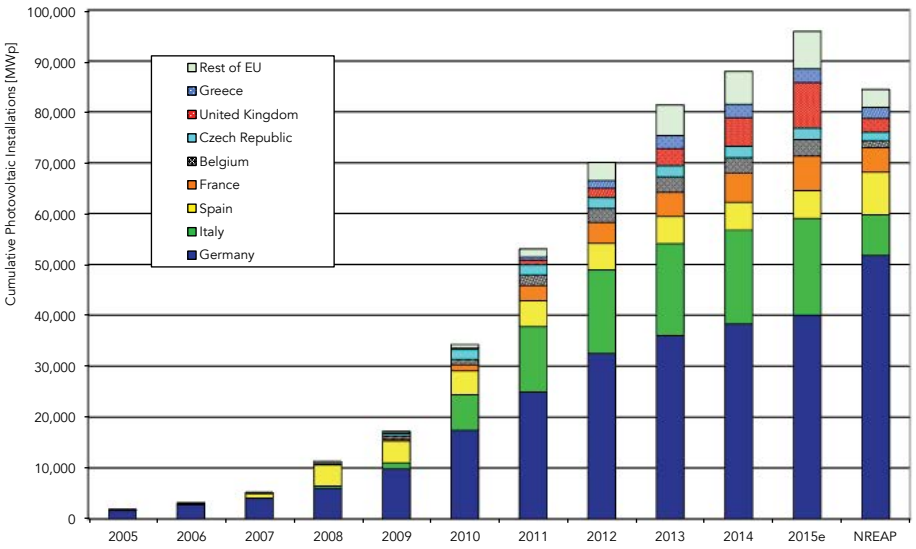
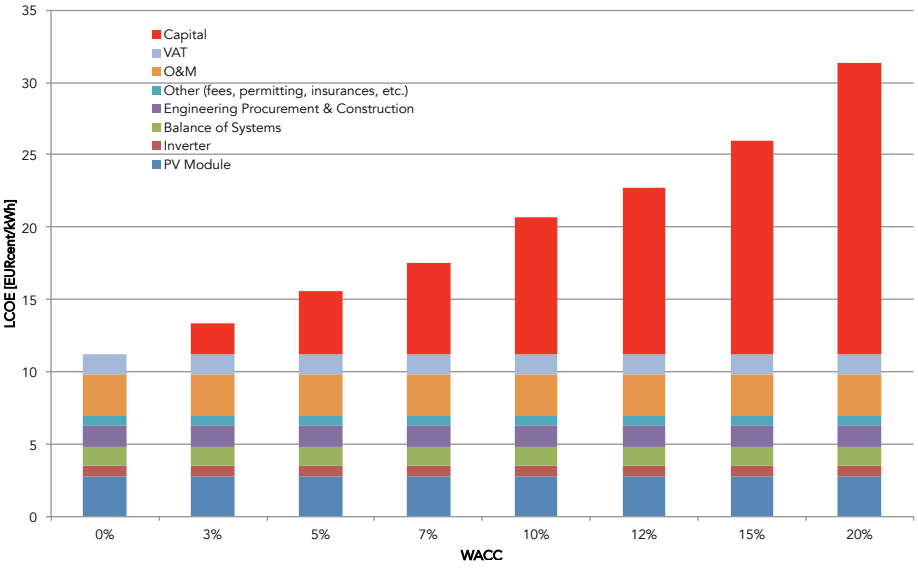


Figure 5 Influence of WACC on LCOE (LCOE of PV-generated electricity for residential systems with a system price of 1 400 EUR/kW, 20% VAT, 2% O&M cost, an annual generation of 1 000 kWh/kWp/year and a financial lifetime of 20 years.)



Dr. Arnulf Jäger–Waldau is a Scientific Officer and Senior Scientist at the Renewables and Energy Efficiency Unit, Institute for Energy and Transport of the European Commission's Joint Research Centre since 2001. He works on the assessment of renewable energy technologies, the effectiveness of their implementation, their integration into energy infrastructures and the role of renewable energy for climate change mitigation.

Since 1987 he works in the field of material research for solar cells and holds patents on semiconductor material deposition for thin film solar cells and solar module design.

He has more than 200 publications in peer reviewed journals and conference proceedings ranging from materials research for PV and solar cell development to market studies and policy evaluations for Renewable Energies. He is the author of the European Commission's annual "Photovoltaic Status Report", which is published annually since 2002.

From 2011 to 2014 he was the Technical Chairman of the European Photovoltaic Solar Energy Conference (EUPVSEC) and the European Co-Chair of the 6th World Conference on Photovoltaic Energy Conversion Kyoto, Japan in November 2014.

Dr. Jäger-Waldau was a Lead Author for Solar Energy of the Special Report of the IPCC on Renewable Energy and Climate Change Mitigation published in 2011. He served as a reviewer of the Global Energy Assessment Report (GEA) published in 2012 and of the 5th Assessment Report (AR5) of IPCC.

He serves as Academic Committee Vice Chairman member of the Asian Photovoltaic Industry Association (APVIA), member of the International Advisory Board of the Warsaw University Photovoltaic Centre and member of the Scientific Advisory Board of the Solar Research Centre of the Bulgarian Academy of Science. From 2005 to 2013 he was a member of the Executive Committee of the European Materials Research society (E-MRS).

a PV system. The European Commission in a recently published document is advocating the use of "Best practices on renewable Energy Self-consumption"[9]. Amongst other best practices, the paper is calling for an *"Avoidance of discriminatory charges for self-consumption projects" and "Acknowledging the different national conditions, ensuring that possible future grid tariff reforms promote both renewable energy and energy efficiency objectives, are based on objective and non-discriminatory criteria and reflect the impact of the consumer on the electricity grid, while guaranteeing sufficient funding for grid and system costs"*.

As further price reductions for PV systems and rising electricity prices can be expected over the coming years, solar photovoltaic electricity generation offers an interesting option for European citizens if the non-technical costs are minimized. A 30% self-generation of solar photovoltaic electricity of the more than 210 million European households would correspond to 220 TWh or about 8% of the current electricity demand. This would require more than double the current installed capacity and thus could revitalize the European market.

As not all households have the possibility to install a PV system directly on their roof, either because they are tenants, live in multi-family or high rise buildings, or in other buildings which are not suitable, new regulations and legal framework conditions are needed to unlock this potential and revitalize the European PV market. Possible solutions could be the possibility of local electricity co-operatives or other business models, where a number of users would generate the electricity behind one substation, without feeding electricity back to the main grid. To make such a vision come true, a new design of the electricity as well as the distribution of electricity infrastructure costs has to be realized. As long as Europe blocks such new developments and continues to impose new non-technical costs its PV market will remain weak.

1. The 2010 market volume of 20.9 GW includes those systems in Italy, which were reported under the second "conto energia" and installed, but connected only in 2011.
2. The 2014 market volume includes those systems in China, which were installed in 2014 but only connected in 2015. The Chinese New Energy Administration reported over 5GW of new installations for Q1 2015, but it is estimated that between 40 to 50% of this capacity was already installed, but not connected at the end of 2014.
3. European Photovoltaic Market Contracts in a Rapid Expanding Global Market, Arnulf Jäger-Waldau, European Energy Innovation, Autumn 2014, 52 – 56
4. Cost Maps for Unsubsidised Photovoltaic Electricity, T. Huld, A. Jäger Waldau, H. Ossenbrink, S. Szabo, E. Dunlop, N. Taylor, JRC Technical Report 2014
5. PVinsight, 21 July 2015, http://pvinsights.com/SolarSystem/SolarSystemPrice.php
6. Commission Staff Working Document, Best practices on renewable Energy Self-consumption, Brussels, 15.7.2015 SWD(2015) 141 final, Accompanying the document: Communication from the European Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Delivering a New Deal for Energy Consumer, {COM(2015) 339 final}
7. Cost Maps for Unsubsidised Photovoltaic Electricity, T. Huld, A. Jäger Waldau, H. Ossenbrink, S. Szabo, E. Dunlop, N. Taylor, JRC Technical Report 2014
8. PVinsight, 21 July 2015, http://pvinsights.com/SolarSystem/SolarSystemPrice.php
9. Commission Staff Working Document, Best practices on renewable Energy Self-consumption, Brussels, 15.7.2015 SWD(2015) 141 final, Accompanying the document: Communication from the European Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Delivering a New Deal for Energy Consumer, {COM(2015) 339 final}

An opportunity for global leaders: Promote solar power at the COP21

In December this year, close to 200 governments will arrive in Paris, aiming to negotiate a global treaty to tackle climate change. The objective is to keep global temperatures from r ising by a maximum of 2°C in comparison to pre-industrial temperature levels. This is highly ambitious, because to do this the biggest emitters must reduce carbon emissions to at least 80 per cent below 1990 levels by 2050.

Climate change is the urgent and defining issue of our time and policy makers must address this existential threat now. There is no room to delay action any further. The effects of climate change are already being felt by many; with longer and hotter heatwaves, rising sea levels, species extinctions and acidifying oceans all being recorded. As UN General Secretary Ban Ki –

Hanau Energies Concept's 6.8MW solar park in Sallèles-Cabardes, south-west France © Hanau Energies Concept.

Moon stated, "There is No Plan B, Because There is No Planet B".

COP21, hailed as the most important environmental meeting in history, represents an immense opportunity to change the way the world is powered. Turning away from non-sustainable fossil fuels and nuclear. The conference can play a major role in securing a long-term clean future for generations to come. The outcome of COP21 must be a major contribution to creating an energy system that addresses climate change, with renewable energy, such as solar power, at its core.

The world urgently needs to reduce its dependence on polluting fossil fuels and costly nuclear power. Fortunately there are real solutions already available from renewable sources, and embracing these will offer the solution to climate change and its associated misery. As a leading renewable power, solar is a real viable solution for decarbonizing the power sector and fighting climate change at a global level. The versatility and predictability of solar means that it can be an effective power source from Norway to New Zealand.

Solar really is a carbon reducing technology. In 2014 alone, the use of the world's installed solar power arrays saved over 110 million tonnes of CO_2 emissions, which is the equivalent of Greece's annual CO_2 emissions. In 2050 solar is forecast to save 4 billion tonnes of CO_2, the equivalent of taking 1.7 billion cars off the road. We have at our disposal a technology that really can address the twin needs of expanding global energy consumption and decarbonisation.

For policymakers it gets even better, as solar power is also becoming the cheapest form of electricity generation in the world. It therefore provides a cost-effective means of fighting climate change, with the levelised cost of solar electricity production in parts of Europe already today, being cheaper than any other technology. Solar system price declines of around 75% have been recorded in less than 10 years. This is a trend that will only continue, so that by 2025 solar will be the cheapest form of electricity production for most of Europe.

Secondly for policy makers it's a political no-brainer. Solar continues to enjoy the largest popular support of any power technology. In Europe, 94% of respondents to a Eurobarometer survey supported the deployment of solar power in 2014. This is a trend reflected globally, offering politicians of all political hues a solution to the energy transition and maintaining political support.

With popular support and decreasing costs, solar is the opportunity for the leaders at COP21. Solar deployment has experienced worldwide growth, with 2014 being a record year for solar deployment – some 40 GW have been connected worldwide. The total of solar installations now stands at 180GW and it is global – from the Americas to Australia. It supports developed and developing countries alike. In this sense solar power is also a democratic form of power supply anyone, anywhere can generate their own power with solar. You don't need a grid, so solar can really help to unleash the potential of countries in the developing world.

But it's not all plain sailing, there are indeed large interests that still pose potential barriers to seeing the successful deployment of solar at the global scale. Bloomberg New Energy Finance estimated that coal is set to attract US$1.6 trillion of investment over the next 25 years, more than any other fossil fuel or nuclear power. If this is set to be the case, analysis suggests that as a result, emissions from power generation will continue to grow until 2029, making the goal of limiting temperature increases to 2 degrees virtually impossible.

This would be the opposite of the outcome that is needed from world leaders in Paris in December. Coal fired power plants remain the biggest source of man-made CO_2 emissions, it is therefore crucial that action is taken in COP21 to ensure that the future of coal does not come to pass. Instead of protecting the technologies of the past, COP21 must forge the future of energy by providing the right signal for investments in solar and other renewable power sources.

The question of nuclear power is also important, and in this regard it as a question of cost. Many governments consider nuclear power as a key part in their decarbonisation strategy. However, the cost of new build nuclear power stations is considerable, with the proposed Hinckley Point C plant in the UK able to deliver at

Plenary Overview at Bonn Climate Change Conference ©UNclimatechange CC BY 2.0

a cost of Euro112/MwH in 2023, when the cost of solar is 34 per cent cheaper today.

You would also need to spend trillions of Euros on nuclear to gain the same level of CO_2 reduction as provided by renewables for a fraction of the cost. It therefore makes no sense to invest public money in a costly power source. Already in 2014 renewables produced more electricity than nuclear power in Europe, so again political leaders should be looking to invest in the renewable technologies of the future, rather than supporting a technology of the past.

So this leaves the question of what should happen in COP21. We need more ambitious pledges to come in from the key countries, responsible for CO_2 emissions. The European Union is putting a 40% reduction on the table, China will cut its CO_2 emissions per unit of gross domestic product by 60-65% from 2005 levels and the US has offered 28% reductions in CO_2 emissions on 2005 levels by 2025. Now all these pledges have to be turned into a legally binding global agreement in Paris, to lock in the opportunities of a carbon free power system and to offer any prospect of avoiding the worst consequences of climate change. The International Energy Agency has called for a credible emissions reduction target to make sure that investments are driven into technologies like solar.

While it may be difficult to gain a legally binding agreement, the solutions are available to the global leaders. Grasping these solutions will allow global leaders to succeed in Paris. Solar should be recognised at the COP21 meeting as a key technology that can be utilised to deliver the CO_2 reductions needed. Providing a platform for the technologies of the future will give the people of the world an opportunity to beat climate change, without incurring huge cost. It would also trigger an energy transition which could provide for new jobs in clean industries. The sustainability of solar is clear and action in Paris in December will go a long way to making sure that we can create a sustainable future for us all.

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The BIPV breakthrough: where and how?

The idea sounds simple: buildings may be made of structural components exposed to the sun, so why not build a PV-generating capability into them? If a PV-enabled building element looks better than a non-PV-enabled one, architects will adopt it and it will fetch a premium. Equally, the electricity it produces has a value that should also be taken into account in the price of the component.

But although 70% of the PV in Europe is installed in buildings (residential, commercial or industrial), this has very largely been in the form of BAPV ("Building-applied photovoltaics"), i.e. mass-produced, efficient, low-cost modules manufactured to standard dimensions.

Consensus on the BIPV early market: façades

BIPV is in search of its killer app. Analysis performed by the European PV Technology Platform[1] and presented by Gaëtan Masson (Director of PV consultancy Becquerel Institute) at its conference, *Energy Efficiency in Buildings and Building-integrated Photovoltaics: Where Sustainability meets Aesthetics*[2] has shown that the early markets for BIPV are more likely to be found in glass façades than in roof tiles.

The typical cost of a BIPV glass façade is 220 EUR/m^2 façade, while a non-PV double glazing façade may cost 180 EUR/m^2. The 40 EUR/m^2 difference is greatly exceeded by the income of 175 EUR/m^2 that might be generated by PV-façade over 20 years, under reasonable assumptions. With roof tiles, the conventional, non-PV variety cost 50-100 EUR/m^2. PV tiles cost 3-9 times more, opening up a difference of 200-400 EUR/m^2. The value of produced electricity, at 300 EUR/m^2, may not be enough to bridge the gap.

The two other speakers to comment on BIPV's best prospects for near-term growth also tipped PV façades as their choice.


Photo: Courtesy of Belectric OPV

Larry Malcic, Design Principal at the architecture, engineering and urban planning firm HOK, gave two reasons why the BIPV industry ought to work more closely with the curtain wall[3] industry, no part of which, so far as he was aware, was "doing anything with PV". Firstly, some curtain walls are made of large, prefabricated elements often produced in standard sizes. "Frankly, they already look like PV panels, so it's a natural fit," he said. Secondly, production is concentrated in "half a dozen players around the world". Malcic is confident that if they took the plunge to manufacture PV-enabled ones, design teams would understand them as familiar components, readily and relatively effortlessly including them in their designs.

Neil Pennell, Head of Engineering and Design at Land Securities, a company that owns, develops and manages offices, shops and housing in the UK, noted a preference among his potential customers for glassy buildings: "They afford daylight, good views and a feeling of space". He identified BIPV as a way to continue to meet this demand while complying with ever more stringent energy performance regulations.

Barriers to BIPV deployment

If the potentials are so self-evident, why have they not been exploited? One reason could be the unsettled question of the relative importance of electricity generation and aesthetic quality in BIPV elements and another, related to the first, is conservatism in the building industry and in the financial community.

Aesthetic appeal

Paul Cartuyvels of the construction company Bouygues underlined the importance of aesthetics: "When I talked to the people in my company, the first thing they said was that BIPV has to be beautiful." The CEO of Issol[4], Laurent Quittre said, "The primary objective of a company like mine is to make very beautiful projects. Our customers care about their image. They want beautiful façades and buildings. The second thing they want is a sustainable image – to be associated with companies doing the right thing for the environment. Thirdly, the façade has to work and to produce electricity." But Frédéric Bonnefoy, Product Manager Active Glass at AGC, a large glass manufacturer supplying many different industries, said, "For us aesthetics is not the main driver of BIPV. [A few stylish buildings] do not constitute a market. The market will only come with affordable, efficient and durable solutions. Return on investment is important."

Conservativism

"There's an inbuilt conservatism in the construction industry," said Pennell. "BAPV has a track record that BIPV does not yet have. Elements that serve an aesthetic function need to prove that they retain their original appearance as well as maintain a decent level of electricity generation." Speaking from the perspective of the UK, he said commercial buildings are valued on the income stream they will produce. "Premature obsolescence, for example in a component on the building, is a risk that reduces a building's value." Attitudes to PV are, however, softening. While there are only "a few instances" to date of the presence of a PV system on a building adding to the building's value when sold, this is becoming more common.

1 EU PV TP: a group of researchers from industry, academia and research centres advising the European Commission on PV technology policy: www.eupvplatform.org
2 8 July 2015 – RIBA (Royal Institute of British Architects), London
3 Curtain walls: non-load-bearing exterior walls of buildings, sometimes known as a building's 'skin'
4 Issol: a "solar glass manufacturer and a project developer of active glazing solutions" - http://www.issol.eu/en/about-us

Greg Arrowsmith

Technology trends

Malcic challenged the BIPV industry to "provide architects with BIPV elements that come in a variety of colours, sizes and types." Jef Poortmans, co-Chair of the BIPV group in EU PV TP, reacted by pointing out that "a balance must be struck between, on the one hand, embracing uniformity in BIPV building elements, which will allow cost reduction through economies of scale in manufacturing; and on the other hand, making available elements in a variety of sizes, forms and colour," which could make them more popular with designers.

New products are appearing that could inspire those designers. Laure-Emmanuelle Perret-Aebi, Section Head at CSEM, presented a film developed by her research centre that can be applied to any crystalline silicon PV module to give it a white appearance. Grown on a micro-structured surface, the film scatters light in the visible part of the spectrum while allowing infrared light to pass to the cells beneath. 10% module efficiency is typical. In the lab, 11.4% was achieved using a module made of HIT cells, which are particularly responsive to infrared light. A company, Solaxess, was created at the start of 2015 to commercialise the technology.

While CSEM made a deliberate choice to work with the "cheap, standard and mature" crystalline silicon platform, and to "touch it as little as possible", other companies are betting on OPV (organic photovoltaics) for some of their BIPV products. The glass company AGC, noting that spandrels make up 25-70% of the total surface area of a façade in tall, architecturally significant buildings, and can reach 70-95 degrees Celsius in summer and autumn, considers OPV to be better suited to this widely used building element. It has signed a development agreement to integrate organic PV films from the company Heliatek in its glass.

Merck also promotes OPV technology. It was a proud partner in the EU-funded project ROTROT that successfully demonstrated roll-to-roll manufacturing for OPV modules on flexible substrates like plastic films. Merck produces active material for OPV modules. Its product comes in a range of darker colours: blues, greys, greens and browns. "The production process is very cheap, and lamination is a well-established and standardized process, so the technology definitely has the potential to be cost-effective at some point," said David Müller, Global Head of Strategic Marketing PV at that company. "If you have a 20-storey building, the area of the roof relative to the walls is very small, making BIPV the strongest choice."

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Denmark's Energy Policy: Winds of change?

BY Morten Helveg Petersen, MEP: Vice Chair, ITRE committee (pictured)

Denmark has long been known as a frontrunner on environmental issues, but with the recent change of government, that position seems threatened.

Denmark has a lot to be proud of with regards to its energy policy: We are self-sufficient, on average 40% of our energy comes from windmills - recently, a strong wind meant that wind-energy accounted for 140% percent of the Danish energy consumption.

None of this has happened by chance: When the oil crisis hit Denmark in 1973, the government made a bold move to ensure Denmark's energy independence, imposing strict requirements on energy efficiency and boosting our efforts in the then relatively unknown energy source of windmills. It paid off! Not only is Denmark's housing stock now among the most energy efficient in the world; we also host some of the world biggest companies within the fields of heating, insulation and wind energy.

I say this, not to boast about our achievements, but because there is an important point to this: Denmark's example illustrates perfectly that there is no contradiction between economic growth and high ambitions on energy and the environment. In fact, Denmark's growth over the last 20-30 years, to a wide extent happened not in spite but because of our green ambitions - a point that is often forgotten in today's debate on the climate.

Although it is still the goal that the turbines should provide 84% of Denmark's energy consumption

by 2035, there is reason to believe that the winds of change that brought Denmark to the position it is in now have died out. With the recent electoral victory of the Danish centre-right, the energy ambitions have been toned down. Rather than investing in renewable energy, the newly appointed Climate Minister Lars Christian Lilleholt, has reopened the plans for Fracking that the previous government had seek to close, and Eva Kjer Hansen, the new Minister for the Environment, wants to allow the agricultural industry to emit even more ammonia, again in stark contrast to the previous governments ambitions to reduce it by 24% by 2020.

Whereas Denmark's renewable energy industry has enjoyed many years of political tailwind, it now seems to have the wind in its face, and that is worrying for a number of reasons.

Firstly because the momentum Danish policy-makers have been building up over decades could be lost. It has taken more than 40 years to arrive at the position Denmark is in, and if we deviate from the course, and return to non-renewable energy sources, we could arrive in the situation that caused the transition in the first place, namely one in which energy prices skyrocket, forcing us, once again, to return to renewables. I cannot help but wonder: Why slow down in the period where speed is of the essence, and why not just resume the course that has contributed to making Denmark both richer, and greener?

For me, it is in itself an important goal that Denmark's energy consumption will one day become 100% sustainable, but there are also important economic, structural and geopolitical considerations that my Danish colleagues tend to forget.

Firstly, the fundamental law of economics that a restriction in supply will lead to gradually higher prices. Sure, the failures of the Emission Trading System has resulted in a situation where coal often remains cheaper than renewable energy sources - not least because of a lacking internalisation the negative externalities associated with its production - but it is also a fact that the prices on fossil fuels have increased and will continue to increase in the future. Renewable energy, however, is becoming cheaper and cheaper, with wind energy, for instance, experiencing a ten-fold decrease in price in the United States in the course of the last 30 years. When we know that non-renewable energy sources will become more expensive in the future, and that renewables will experience the opposite trend, it makes no sense, either in environmental or economic terms, to invest in the former.

It is of great importance that Denmark stay on the track it has laid. We need more renewable energy, more wind-turbines, and higher degrees of connectivity with our neighbours, through focused investment in inter-connections and storage facilities. But it's not all about supply: We must also embrace the visions of the circular economy, and make sure that we limit waste and inefficiencies to bring down the energy demand. The cheapest energy is the one we don't use, and nothing is lost from taxi drivers driving electric cars, factories wasting less energy in their production or people living in more insulated houses. We have come a long way, but if Denmark is to retain its strong position on energy, our focus should be on eliminating energy inefficiencies before turning our attention to exploring new non-renewable energy sources, whose energy we might not even need in the first place.

For Denmark, the future must therefore be a return to the past. We need more investment in renewable energy, more research, and higher ambitions for our climate. We have shown that a strong focus on energy efficiency can reduce energy waste, drive down energy bills for our citizens and create thousands of jobs, and we must therefore not be distracted by the prospect of exploring energy sources that are both environmentally and economically unsustainable. Wind is not a closed chapter in Denmark's energy policy, but very much its future. The winds of change that once placed Denmark in the world's energy elite must blow once more, and put Denmark's energy policy back on track.

Renewable Energy: a heady cocktail of fact and faith; of

Bad is never good – until worse happens –*Danish Proverb*

By Mike Edmund, Editor

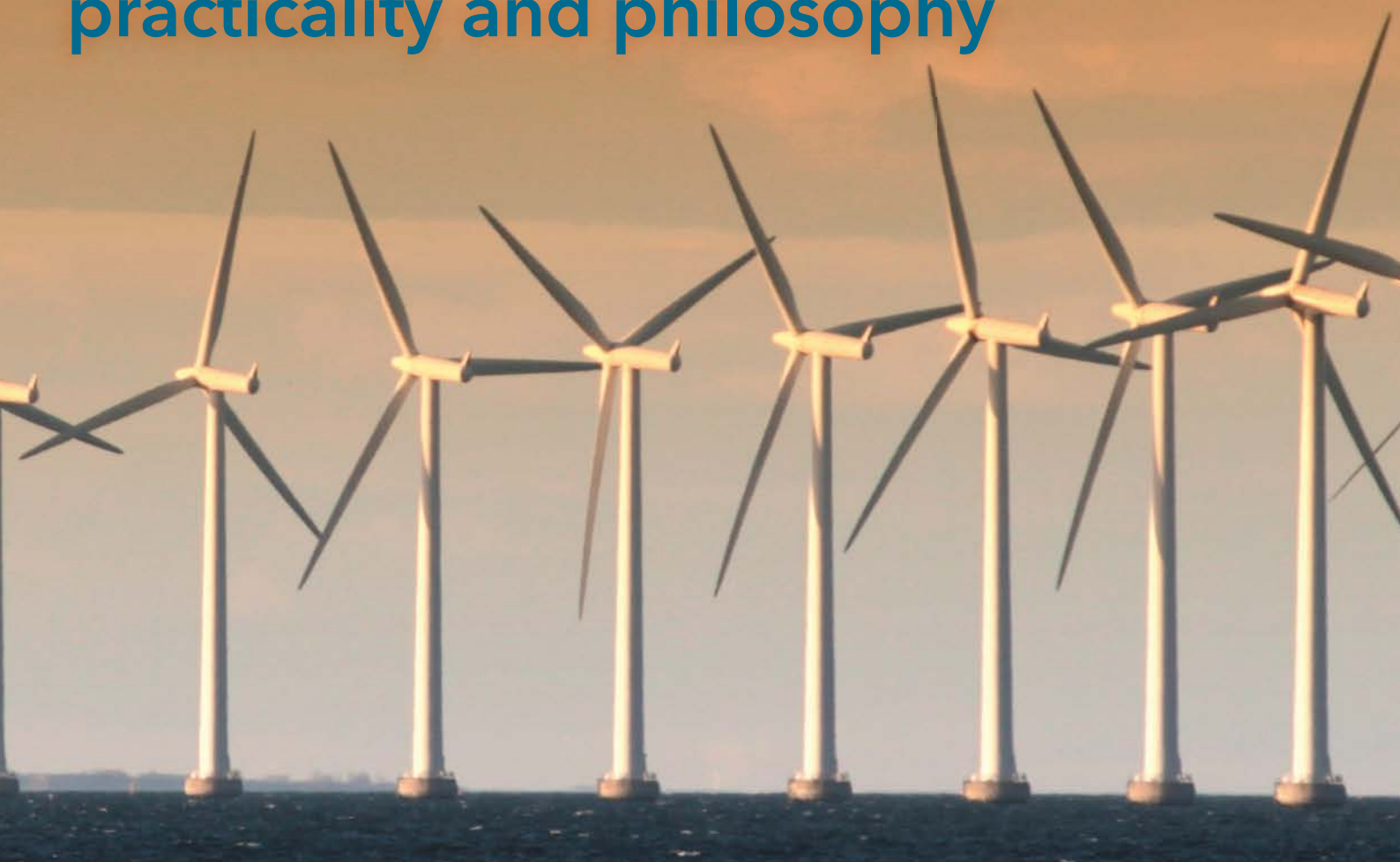
Ever-higher global temperatures, ever-smaller icecaps and ever-greater concentrations of atmospheric CO_2: measurement of climate-related parameters might tell us the facts, but what are we to make of them: is the situation bad? How bad?

One answer may be found in the words of Danish industrialist Jakob Askou Bøss. Commenting upon the forthcoming COP21 Meeting in Paris, he observed that "We need a global climate agreement". Climate change is surely a global issue, and in those six letters word surely lies the key to progress in Paris.

Jakob Askou Bøss is Senior Vice President at Danish State-owned Energy Company DONG Energy, and it is salutary to examine how Danish energy policy is confronting the issue of climate change. According to Eurostat, the share of renewable energy produced in Denmark rose from 23.8% to 43.1% in the ten years 2004 - 2013. By the way, comparable figures, for the EU28 are substantially lower: a rise from 14.32% to 25.37% over that period. The Danes would appear to be taking something of a lead in renewables, which in part arises from The Danish Energy Agency's National Allocation Plan (NAP), a "central element in Denmark's commitments to reducing its greenhouse gas emissions". According to the Agency, the NAP documents a country's climate efforts meticulously, and a part of this meticulousness surely involves public awareness. To this end, national energy consumption data is available online in almost real-time.

Meanwhile, The Danish Energy Agency attributes much of the country's progress to the wind: Denmark, it says, has more than 5000 wind turbines, which in 2013 supplied almost 30 per cent of the country's domestic electricity. It was therefore no surprise to read one windy day in July this year that the turbines had briefly generated 140% of national electricity demand, with the excess being taken up through interconnections into neighbouring Germany, Norway and Sweden. Interestingly, 40% of this surplus 'free' electricity went to Norway, which is able to store it in hydropower systems for use later. These events raise interesting questions about European

practicality and philosophy



interconnectivity, about managing the peaks and troughs of renewable energy production; and the prospect of a trans-European grid. But for the moment, continuing growth in wind farm installations means that Denmark could be producing half of its electricity from renewable sources well before 2020. Nowhere is this approach more typical than on the province of Samsø, whose story we have featured before. Today, Samsø island derives 100% of its electricity from wind power and 75% of its heat from solar power and biomass energy.

Climate change is self-evidently a global phenomenon that affects everyone on the planet, albeit perhaps in different ways. Meanwhile, there is an inevitable tension between the objectives of the developed nations and those of the developing ones; and whether total emissions or those measured *per capita* should feature in the dialogue. The near thirty-year journey of the IPCC is testament to the fact that Jakob Askou Bøss' simple call for global solution to a global problem will prove anything but simple to achieve.

Danish philosopher Søren Kierkegaard observed that although life can only be understood backwards it must be nevertheless lived forwards, and climatic events are indeed moving forwards - perhaps to the extent that time itself is now pressing. For Bøss also observed that, even with emissions at current levels, the UN Intergovernmental Panel on Climate Change (IPCC) expects that global warming will reach two degrees *before* 2040. The Carbon Brief has charted the long history of that two degree limit, first mooted by Nordhaus in 1975. The figure has been critically reviewed, but it has also been concluded that "working toward a 2° target provides as good a focus as is currently needed." And so, from Paris to Samsø; and Brussels to Kyoto, many efforts and much expense is directed at limiting the rise in global temperatures to 2 celsius degrees from its long-term (pre Industrial Revolution) average. Overshooting this 2 degree target makes the forecast increasingly alarming with each incremental one degree rise. In that context, and to put it bluntly, the situation does indeed appear bad. Let us all work to ensure that worse does not happen. ●

Danish offshore on the move

With nearly 50 years experience from complex offshore oil and gas fields, more than 20 years' offshore wind expertise and the synergy between the two sectors Denmark has a unique position. Innovation continues to move the sector forward.

The development of the Danish offshore sector is a success story. During nearly 50 years, the Danish oil & gas industry has gathered a wealth of outstanding experience from the complex oil and gas fields in the North Sea. Denmark was the first nation to go offshore in 1981 with wind energy and is now the market leader in technology, development, design, installation, operations and maintenance.

So the two sectors have had a head start but are both well aware that constant movement and innovation is inevitable to stay competitive. Several factors push this process.

"The lowest hanging fruits in the Danish part of the North Sea has been picked. The Danish companies are working on developing new and innovative methods to get most out of the oil fields already in production and to find new ones," says Johannes Kromann Bie.

He is Director of oil & gas at Offshoreenergy.dk, Denmark's official knowledge center and innovation network for the offshore industry. In connection with the industry's future he mentions the importance of the Danish Underground Consortium (DUC) which last year donated 134,000,000 EUR to the Technical University of Denmark (DTU) in order to help to increase the recovery factor by innovative thinking.

"DTU is gathering the world's best scientists who will cooperate with the sector to implement new technologies – that is an important step for Danish offshore oil & gas," says Johannes Kromann Bie.

The world's offshore wind lab

Looking at offshore wind the Danish companies have had unique conditions: The Danish offshore wind industry has benefitted from stable political support and unique framework conditions put in place for the industry at an early stage. At the same time the Danish Energy Agency functions as one-stop-shop and the Transmission System Operator (TSO), Energinet.dk, has the responsibility for the grid connection which has made offshore wind projects less complicated for the companies.

"This stability and procedures have contributed to help the sector so it could concentrate on testing and optimising the products and services which have contributed to strengthening Denmark's first mover position. You could say that Denmark is the world's offshore wind lab – we test the offshore projects in small scale and adjust them to the foreign markets," says CEO Morten Basse from Offshoreenergy.dk.

Another boost to innovation comes from an external force. The oil & gas industry faces low oil prices and Danish offshore wind has set a goal to reduce costs by 40% in 2020 compared to 2012.

"As an innovation network we see the situation as a possibility for the sector to optimise products and processes which can lower cost of energy and we see that the companies focus on this area," says Morten Basse and adds.

"We have taken the initiative to establish Cost Reduction Forum which gathers the major players in both offshore wind and offshore oil & gas to find new and better solutions that can reduce costs. There is great backing from


BOLD TERN

Morten Basse

Johannes Kromann Bie

all players to work together and agree on standards and procedures," says the CEO.

Exchange of knowledge

He considers the synergy between the two industries as a strength for the Danish offshore sector.

"Denmark is one of the few countries in the world to have a strong offshore oil & gas and offshore wind sector. Many companies work in both sectors and it is beneficial that they can transfer knowledge - we also focus on synergies in our work," Morten Basse explains.

He is pleased to represent an industry with a good reputation.

"Danish oil & gas companies are known to be innovative and react fast to change, deliver good quality and have rapid response times and Danish offshore wind expertise is demanded by all countries interested in renewable energy. We receive many delegations from abroad. So it is a pleasure to build the bridge between the industry and the world markets," he says.

About Offshoreenergy.dk

Offshoreenergy.dk is the official national knowledge center and innovation network for the Danish offshore industry. On behalf of its member companies and institutions Offshoreenergy.dk initiates development with the aim of growth within the Danish offshore industry.

More than 270 companies and knowledge institutions from Denmark and abroad have joined the organisation.

Cluster management excellence

In 2012, the EU awarded Offshoreenergy.dk with the distinction Cluster Management Excellence Label GOLD as an innovation network of the highest international calibre. In 2014, the prestigious label was renewed.

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- **Yves Vercammen**, General Manager, **Eni Shipping & Trading**

CONFERENCE DAY ONE
18th November 2015

- European Commission Keynote Address: The Outlook for European Security of Supply
- Focus on Supply/Demand/Consumer Part 1: Beyond the Borders of the European Union
- New Supplies + New Routes + New Infrastructure + New Investment = Is this Really Going to Happen?!

Speakers include:
- **Maroš Šefčovič**, Vice-President for Energy Union, **European Commission**
- **Julio Castro**, Chief Regulatory Officer, **Iberdrola**
- **Azizollah Ramazani,** Chairman, **National Iranian Gas Export Company (NIGEC)**

CONFERENCE DAY TWO
19th November 2015

- The Executive Energy Leadership Panel
- Focus on Oil Volatility and the Future Opportunities for Gas in Europe
- Coal, Renewables & Nuclear – the Faustian Bargain for Europe?

Speakers include:
- **Laurent Vivier,** President Gas, **Total Gas & Power**
- **Gertjan Lankhorst**, CEO, **GasTerra**
- **Jan Chadam**, CEO & President of the Board, **Gaz-System SA**

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