AUTUMN 2014

european energyinnovation

Gas
Green ports
Lighting
Photovoltaics

Country profile
POLAND

Includes editorial contributions from:

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Margot Loudon Deputy Secretary General, Eurogas

Dr James Watson CEO, European Photovoltaic Industry Association (EPIA)

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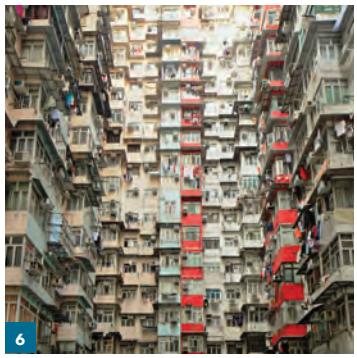
Contents


6


15


48


58

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Foreword

When considered against a backdrop of the brutality and horror in the Middle East, the renewed confrontation in Ukraine and the apparently growing threat of ebola in Africa, the negotiations attending the constitution and composition of the new EU Commission might have seemed rather less than exciting this Summer. But that would be to overlook the significance of M. Juncker's term of office to the energy situation that confronts Europe. Perhaps the acid test will be how it learns to deal with Russia over the next five years, as the 20-20-20 climate objectives come to the natural end of their something, and the 2030 Framework (still only a framework, you note), assumes more substance. Perhaps it will come to be how the single energy market and trans-european energy grids can be made to operate in the wake of the nationalist debate in Scotland, which has of course been watched with keen interest from Cataluña to Bayern.

So a warm welcome to the Autumn issue of the magazine, which features an excellent complement of stimulating articles from a range of distinguished contributors. From the Directorate-General for Mobility and Transport, José Fernandez Garcia explores the significant role played by liquefied natural gas in the development of an alternative fuels infrastructure. James Watson discusses the importance of private funding in the development of renewable energy technologies, highlighting the potential $50 Billion USD available from the so-called green funds. Dr Watson questions whether Europe's proposed renewable energy target is a sufficient incentive to drive private capital into the renewables sector, and cites the new Commission as an opportunity for new ideas and renewed optimism, particularly in the key area of energy efficiency. He calls for "an ambitious, stable and predictable regulatory framework" to support Europe's leading position in RE technology. Meanwhile, as if to make us all think a little harder, Dr. Arnulf Jäger-Waldau from the European Commission explores the contraction in the European Photovoltaic Market, something that is in marked contrast to the global expansion of solar technology. And as if to make us think harder still, the BPIE contribute to the debate about fuel poverty, which, it says, affects between 50 and 125 million Europeans.

Meanwhile, almost unnoticed amid the more dramatic news, the World Meteorological Organisation recently announced that atmospheric CO_2 levels rose last year to 396 parts per million, the largest annual increase since 1984. We wish the new Commission and the new Parliament every success, for there is much work for them to do.

And there is a lot more for you to read inside…

Michael Edmund
Editor

Alleviating fuel poverty in Europe

By the Buildings Performance Institute Europe (BPIE)

Between 50 and 125 million Europeans are affected by fuel poverty, with high numbers in Central and Eastern EU countries such as Bulgaria, Romania, Latvia, Lithuania, and Hungary. The European population is ageing, consequently increasing the number of vulnerable people. To add, between 2010 and 2012 the employment rate in the EU remained stagnant at 68.4%.

Since the economic crisis and the increase of energy prices affecting all European households, fuel poverty has been steadily pushed higher up on the European political agenda. It is not only a major problem for the so called 'new' Member States but is gaining momentum in historically stronger economies like the UK, France and Germany.

While there is no commonly agreed definition of fuel poverty, analyses show that it is linked with financial vulnerability as they share the same drivers. Among the main causes of fuel poverty are low household income, high energy costs and the poor energy efficiency state of the home. In terms of indicators used to describe and measure fuel poverty, several have been identified: the inability to keep a home adequately warm; the presence of a leaking roof, damp walls, floors or foundation, or a rot in window frames or floor; as well as arrears in utility bills. In 2012, 10.8% of the total European population were unable to keep their home adequately warm, increasing to 24.4% when referring to low-income people. For a more general overview, in Bulgaria, Hungary, Greece and Latvia, people at risk of poverty have the highest rates for all three fuel poverty indicators.

Fuel poverty is not only an important economic and social issue; it has severe health impacts as supported by many medical studies. Consequences are excess winter deaths, mental disability, respiratory and circulatory problems. Excess winter deaths (EWD) are defined as the difference between the number of deaths which occurred in winter (December to March) and the average number of deaths during the preceding four months and the subsequent four months. Their number is increasingly worrisome as between 30% and 50% are actually attributed to poor housing conditions. Moreover, EWD is not a problem characteristic only to northern European countries, but it also affects the South of the continent, where winters are supposedly warmer.

Fuel poverty is mainly a problem of low income households unable to make energy efficiency investments and which are therefore strongly affected by fuel prices increase. There is also evidence that energy costs are growing faster than household income. Eurostat data points to a strong correlation between risk of poverty and arrears on energy bills.

In many European countries the state offers support to low income households by providing energy subsidies or direct financial support for heating. However, this is not a long-term solution to the problem because energy price regulation and direct financial support to fuel poor people require continuous public budget allocation without generating

added value or economic growth. In contrast, energy renovations could create an economic lever and be a long-term answer to fuel poverty by reducing energy costs and ensuring improved thermal comfort. Larger scale energy efficiency measures can create or maintain jobs, reduce illness, rehabilitate poor districts and therefore contribute to social inclusion. Results from implemented energy renovation programmes targeting the fuel poor highlight these positive effects. But even if energy efficiency measures have proven their worth and sustainability, they continue to receive lower funding compared to income and fuel price support schemes.

In the UK, the total budget allocated to fuel poverty measures dropped by 20% from 2008 to 2014 adding to this gap in funding. Income support programmes receive the highest share of the budget (70%) while only a small percentage is allocated to energy efficiency measures. The same case about funding priorities can be made for Ireland and Greece.

In order to achieve the social, environmental and energy goals set by the EU for 2020, BPIE's latest report on the issue recommends to allocate a bigger share of European funds and national budgets for renovation programmes targeting social housing and neighbourhoods of fuel poor households. One way of sustaining measures intended to alleviate fuel poverty and protect vulnerable consumers are EU Cohesion Funds. Thus, energy efficiency in buildings can be supported by all three Cohesion

Country	Arrears on utility bills (%)	Inability to keep home adequately warm (%)	Dwellings with leakages & damp walls (%)	Country	Arrears on utility bills (%)	Inability to keep home adequately warm (%)	Dwellings with leakages & damp walls (%)
Bulgaria	50.7	70	29.5	Estonia	20	9.6	30.3
Hungary	58.8	33.9	53	Belgium	14	18.8	26.2
Greece	54.4	47.6	21	Ireland*	27.5	12.5	16.2
Latvia	39.5	35.1	43.3	France	17.8	15.2	22.1
Cyprus	25.9	50.6	34.6	Czech Rep.	19.4	15.3	20
Slovenia	37.5	17.3	46.1	Spain	17.9	18.2	17.9
Italy	24.5	44.1	30.1	Slovakia	18.3	13.6	19.7
Romania	41.5	25.4	30	Netherlands	8.6	8.7	27.4
Lithuania	22.8	38.2	28.6	Germany	8.6	14.8	21
Portugal	14.5	43	28.4	Denmark	5.5	7.1	25.3
Croatia	40.9	21.8	19.9	Luxembourg	6.6	2.2	28.9
Poland	30.1	27.6	20	Austria	11.3	7.7	15.2
Malta	19.4	32.1	12.4	Finland	13.7	3.8	8.6
UK	20.3	19.4	21.4	Sweden	10.3	3.5	11

*Fuel poverty indicators of people at risk of poverty (2012), Source: BPIE, based on Eurostat data *Data from 2011*

Policy financial instruments, especially since most of these funds are distributed in countries with the highest number of people affected by fuel poverty. It is estimated that €1 euro of subsidy in energy efficiency projects can leverage €9 to €12.50 euros of private funding. Therefore, on top of the €23 billion foreseen in the Cohesion Policy 2014-2020 for low carbon schemes, an additional €207-287.5 billion of private funds could be invested in energy efficiency projects.

A key priority at Member State level should be shifting price control mechanism and fuel subsidies to more active and effective public expenditure on renovation measures. But to create a reliable basis for policy making in this field and to provide additional evidence on the scale and impact of fuel poverty in the EU, it is also recommended to improve the availability of statistical data.

Indeed, the data available thus far proves the existence of patterns and trends such as the continuous increase of energy prices concurrent with a lack of growing household net incomes and a marginal decrease of energy consumption per dwelling. All these factors signal that Europe is moving deeper into fuel poverty. This alone should raise concerns about the lack of a long-term strategy for fuel poverty alleviation in the EU.

The Buildings Performance Institute Europe (BPIE) is a European not-for-profit think-tank with a focus on knowledge creation and dissemination for evidence-based policy making in the field of energy performance in buildings. BPIE delivers policy and advice as well as implementation support. The Brussels-based institute is the European partner of the Global Buildings Performance Network (GBPN).

To read the full report Alleviating Fuel Poverty in the EU, consult BPIE's website: bpie.eu

Three options for ultra low shaft power of air-driven heat exchangers in the LNG field

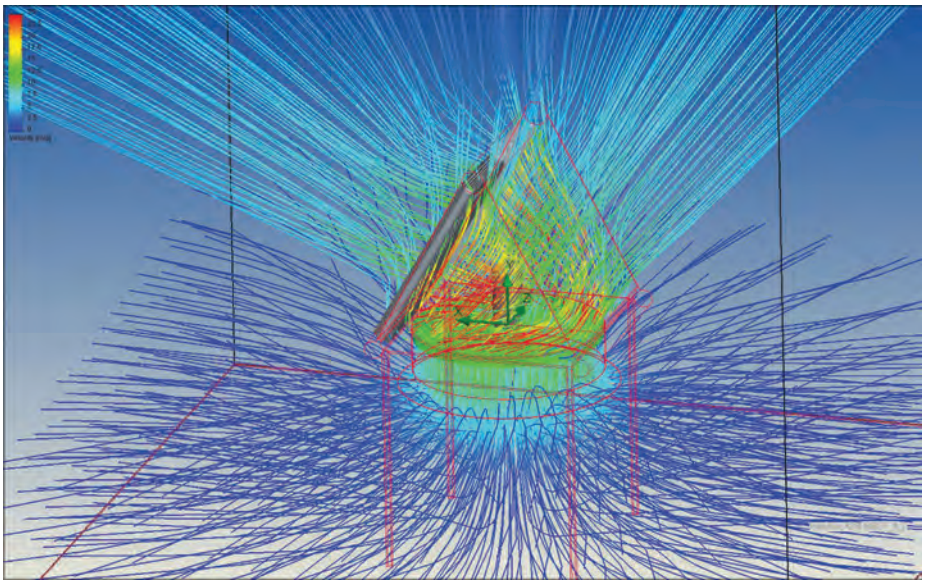
ENERGY CONSUMPTION IN LNG PLANTS

LNG air-driven systems are characterised by their enormous size and their substantial use of ventilation energy. Although the energy consumed by driving such large numbers of fans is small, compared to the energy throughput of the plants, it is attracting increasing negative attention for environmental reasons. On average, worldwide around 25 to 30 % of the generated electric power is used for ventilation. Nowadays, fans are used everywhere, from refrigerators to computers to air-conditioning systems. For the absorbed electric power of LNG fans, it is no exception to have 3 to 6 MWatt of air-driven cooling. It clearly is high time to look more closely at this very substantial energy consumption and find out how this field of activity can be made more efficient.

BRONSWERK HIGHEST-EFFICIENCY ULTRA LOW-NOISE COOLING

Using very advanced flow simulations, "in house developed" performance prediction software and exhaustive measured confirmations, Bronswerk has developed a fan system that consumes less than half the energy currently absorbed by the best fans. Also Bronswerk's fan is very quiet, even making far less noise than the E-motor drivers it uses. This is important, given that air-driven cooling of industrial processes always take place in open air and the systems cannot be screened off without blocking the air supply and the cooling effect. The sound-pressure difference between the Bronswerk fan and the quietest conventional fan on the market is 5 to 6 dB(A). The following example best illustrates this difference: Imagine you are talking to a friend in the street. A cyclist passes and you continue your conversation undisturbed. Then a moped passes and you have to stop talking because you can't hear each other properly anymore; a striking difference and that is why the Whizz-Wheel® fan, as the Bronswerk fan is called, is raising performance qualities of air-driven cooling to a new high level: 'Highest efficiency, ultra low noise cooling'.

Fig 1. A-frame air flow



SUPERIOR FEATURES PROVIDE NEW OPPORTUNITIES

The market initially reacted with disbelief, but now that large numbers of systems are using Whizz-Wheel® fans from diameters of a few centimetres to >> Ø 10 metres, the new systems have become well accepted. People also have realised that the superior features of high-efficiency cooling are providing new opportunities for the design of the systems. In situations where noise levels are very important – for example, in nature reserves – high-efficiency cooling causes minimal disturbance. In situations where plot space or weight is important, such as on floating platforms, the use of coolers with Whizz-Wheel® fans, because of substantial reductions, results in major financial benefits for the customer. In situations where energy savings are important, Whizz-Wheels® can realise

BRONSWERK®
HEAT TRANSFER
Dynamic Heat Exchange Solutions

savings of around 50 percent. Also and equally important – Whizz-Wheel® fans are much less sensitive to crosswind. Efficiency levels remain excellent even at higher wind speeds. To illustrate this, the effects of wind on the performances of a steam turbine condenser are described. Clearly shown is the difference in the electric power generated when the condenser is equipped with conventional fans or with Whizz-Wheel® fans.

IMPACT AND SCOPE OF NEW DESIGN OPPORTUNITIES

Noise: In the following example, the difference in the noise load of an LNG plant with 100 fans of 60 KW is calculated. In the calculation, it is important to not just take the noise of the fan into account but also the noise of the motor and transmission. In standard situations, fans and transmission each produce approximately the same amount of noise (sound pressure approximately 65 dB(A)). Because they combine, this results in a final load of 68 dB(A). The use of Whizz-Wheel® fans can achieve a noise load of just 50 dB(A) because only the motors and transmissions generate noise. In order to realise the full benefit of the fans, however, noise attenuation measures will have to be taken so that the noise of the motors is less than the noise of the fans. In this way, an ultimate noise load from 100 fans of 100 x 65 ≈ 80 dB(A) would be realised in the old situation and only 60 dB(A) in the new situation.

Plot space reduction and/ or savings in weight: For this consideration, the gas evaporation towers are taken as an example (see photograph). These are actually gas heating towers using the temperatures of gas (-80) and outside air (+20). These temperature differences being so far apart that Whizz-Wheel® fans can generate twice as much air with the same shaft power with a much better air speed distribution. That means that the entire cross section of the evaporation tower is adequately supplied with heating air, thus doubling the heat exchange. Twice as much gas can then be evaporated per tower requiring approximately half the number of gas evaporation towers. The results is a 50 % reduction in the costs for connecting motors and manifolds and, most importantly, it reduces the total weight by approximately 50 %, yielding sustainable solutions, both directly and indirectly. On a floating platform, it will result in savings on the underlying steel constructions, which now can be much lighter. The savings on steel constructions will be comparable to the amount invested in the total system. Such a saving on steel is not only good for the customer's finances, it also benefits the environment. Because even the 'big players' want to act responsibly and protect the environment.

Fig. 2: Gas evaporation towers with Whizz-Wheel® fans; 50 percent of the number of towers

Energy Savings: Whizz-Wheel® systems therefore make it possible to be environmentally-friendly and earn money at the same time. The extra investments in these fans can be recovered in 3 to 10 years. A recovery time of 7 years, for example, means a yield of approximately 14 percent on the invested capital. Currently there are very few investments

	Air quantity in % at:		
Wind speed	< 3 m/s	5 m/s	7 m/s
Conventional design	100	77.5	49.2
Bronswerk Whizz-Wheel®	100	91.6	79.2

Table 1. Wind effect on electric yield.

that produce such a high yield. Moreover, LNG plants very often have their own electric power plant. By using the Whizz-Wheel® fans the client only needs to install 50% of the capacity compared to conventional fans. This is an enormous economic benefit.

REDUCED SIDE WIND SENSITIVITY

Vacuum steam turbines used in power generation employ air-driven cooling (A-frame) condensers to create better steam condensation. Due to the fan and inlet shapes and the specific design parameters, conventional performance generally is very dependent on wind speeds. The VGB R131M (guide for performance testing or air-cooled condensers) stipulates that during capacity measurements the average wind speed should remain under 3 m/s.

At higher wind speeds, the manufacturer can no longer guarantee the performances of the (A-frame) condensers. This is a very convenient standard for the manufacturers because it means they do not have to take disadvantageous wind effects into account in their designs!

For the operator of the system, the cooling capacity of the (A-Frame) condensers is not so much a concern at wind speeds of less than 3 m/s. Fans have to deliver their cooling capacity also at much higher wind speeds all year round. Particularly in windy (coastal) locations, this can lead to an enormous discrepancy between the desired and realised cooling effect. If owners of (A-frame) condensers want to conserve electricity, this discrepancy becomes even greater. This is because air-cooled condensers are more and more designed to be increasingly economical with driver energy. There are two ways of realising this lower energy consumption:

1. Less air with a lower resistance level for the fans compensated by more condenser surface area (roughly a larger cooler with low-powered fans)

2. Fans with much higher efficiency (more air), an optimal aerodynamic design and yet lower electricity consumption

In the first case however, the resistance level for the fans is reduced so much that even a slight breeze can have a negative effect on the operation of the fans and therefore also a negative effect on the condenser vacuum. The system will therefore become even more sensitive to crosswind, which means it will generate even less electricity to the power grid. However, the client won't notice this until after the start-up of the equipment when higher winds are present.

With its Whizz-Wheel® fans, Bronswerk is purposely opting for the better, more efficient second scenario. With this compact design, Bronswerk can realise a higher air-side fan resistance level and thus reduce the effect of crosswind. Thanks to the ultra-high performance quality of Whizz-Wheel® fans, lower absorbed electric power for the condensers can be realised under all operating conditions and in all seasons. The following table displays the wind effect on the performance.

The loss of cooling air progressively results in a shallower vacuum. This leads proportionally to a lower generated power and to approximately as much as 10 percent less electricity! For flat air-cooled heat exchangers similar effects have been observed by Bronswerk. If you would like to know more about this subject or if you wish to receive a copy of the study report, please email to femke@bronswerk.com.

DE-BOTTLENECKING

In view of the above, people often ask: "What does this mean for my plant?" and more specifically: "My plant is currently producing too little capacity. Can this be improved with the Whizz-Wheel®?" The short answer is that Bronswerk should be capable of improving the operation of your equipment (in order to be more specific, more customer information is required) in combination with adequate cleaning of "old" equipment. In extreme situations considering to build a new plant at times can be more economical. When the plot space is limited and/or the

system must comply with strict noise requirements, the Whizz-Wheel® provides unprecedented (sustainable and financial) options for de-bottlenecking.

HOW DO WHIZZ-WHEEL® FAN SYSTEMS REALISE THESE IMPROVED PERFORMANCES FOR NOISE AND POWER

Winglets: Noise and drag of fans are generated to a large extent at both wing ends (tips and conventionally at the hubs). Modern aircraft wing design shows the winglets at the wingtips. Our blades (wings) have no end in the sense that they are mounted in a co-rotating ring(rim) so the air experiences effectively "endless" wings; No tip vortices and hence, minimized drag and noise!

Number of blades (wings): Increasing the number of blades decreases the aerodynamic and the mechanical load on individual blades. Slender blades, with a geometry set for optimal aerodynamic profiling from hub to tip, show very low drag minimizing power use and noise generation. Hence, radialy highly twisted blades. Furthermore, a higher number of such blades decreases the power level of the audible frequencies. Whizz-Wheel®: 16 blades vs. 4- 6 conventional.

New air-inlet called the fan housing or fan ring: A major result of the development is the insight gained by considering and analyzing the air flow through the integral cooler. Advanced geometrical intake flow design, called quasi-ellipsoid, eliminates crucial deceleration of the incoming air along the fan ring towards the blade-tips, thereby maximizing efficiency. The inlet dimensions are up to 50 percent smaller in height than conventional bell-shaped inlet shapes.

Hub size: As the hub would create a wake in the airflow, it is shaped integrally for minimizing flow disturbances and reduce vortices on the wake side. Thus, reducing hub generated power-loss and noise generation and above all providing better flow coverage at the centre of the heat exchanger pipe bundles.

Total weight and dimensioning: The monolithically shaped, ultra stiff but slender, Whizz-Wheel® structure, the quasi-ellipsoid compacted inlet and the ultra low power driving system, could reduce the weight of the total functional Whizz-Wheel® assembly up to ca. 50 %.

INNOVATION AND THE FUTURE

Bronswerk roots its long term continuity policy strongly in innovation. The innovation activities have led to a number of remarkable, patented technologies and products, such as the Whizz-Wheel® fan, bringing substantial advantages for our customers. In this article the three ways in which the Whizz-Wheel® can contribute in using energy much more efficiently in the LNG field have been highlighted.

For the LNG field this means improved sustainability with economic benefits in terms of noise level reduction, plot space and/or weight reduction, energy savings, and production enhancement through de-bottlenecking.

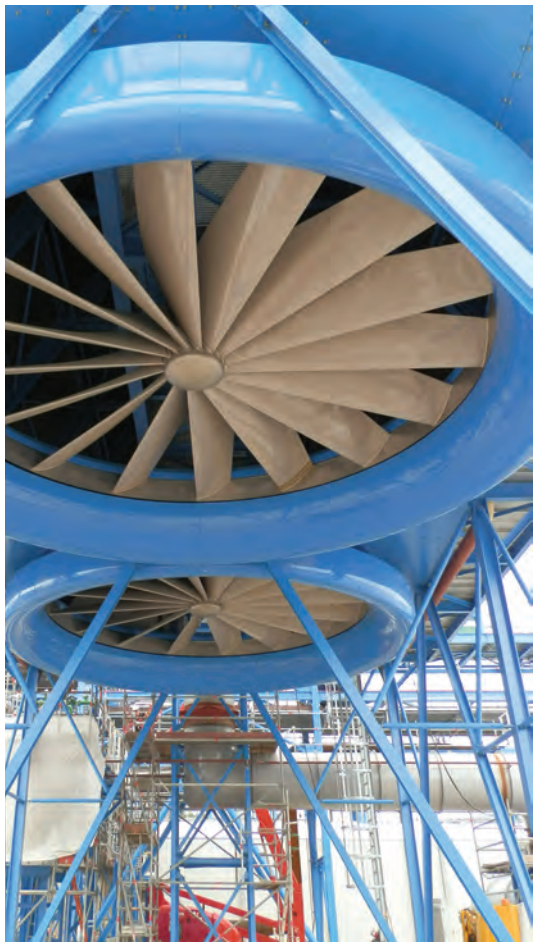


Fig 3. Whizz-Wheel® installation in Lyon

Contact details:

For more information or to find out what this can mean for your system, send an email to femke@bronswerk.com.

The role of LNG in the directive on the deployment of alternative fuels infrastructure

By Mr José Fernandez Garcia, Policy Officer, Directorate-General for Mobility and Transport, European Commission

Europe relies heavily on imported oil for its mobility and transport. The share of oil-based fuels in transport energy demand stands at around 94%. We spend up to 1 billion euros per day on oil imports and burn more than half of it in our vehicles, aircrafts and vessels. This equals approximately 2.5% of GDP and 7% of average household expenditures.[1]

The EU's strategy to reduce the oil dependency of transport builds on a number of complementary initiatives, including (1) the introduction of alternative fuels, (2) encouraging greener and more sustainable urban transport, (3) making the best possible use of intelligent transport systems, (4) encouraging the use of a combination of different modes of transport (multimodality) (5) investing in research and innovation as well as (6) a charging policy.

INTRODUCING ALTERNATIVE FUELS

The transport sector has a high priority for the introduction of alternative fuels substituting oil based products, as motorised transport highly depends on oil as an energy source and fuel at present. The 2011 White Paper on Transport specifically requested a sustainable alternative fuels strategy including also the appropriate infrastructure. Following this request, the Commission has set out a series of measures to reduce greenhouse gas emissions and consumption of transport fuels, including an alternative fuels strategy.

The objectives of introducing alternative fuels in the EU are primarily:

- Improvement in security of energy supply by source diversification and oil substitution;
- Reduction of greenhouse gas emissions on the grounds of climate change concerns.

Energy savings, low emissions, better air quality, reduced congestion and technological leadership can all go hand in hand; and alternative fuels, together with increased transport efficiency, are an indispensable tool.

In early 2013, the European Commission adopted a package entitled "Clean Power for Transport". The cornerstone of the package is a proposal for a Directive on the deployment of alternative fuels infrastructure which addresses the currently missing link to reach a sustainable transport sector: putting in place a standardized recharging and refuelling infrastructure to allow EU-wide mobility with alternative fuel vehicles.

EU Member States will have to take measures so that the Directive can start taking effect from 2020. The Directive mandates the build-up of infrastructure for the alternative fuels that are most promising in reducing both oil dependence and emissions: electricity, natural gas and hydrogen.

Natural gas is a mature and readily available technology for both road and waterborne applications. There are a number of cars and vans available on the market right now and it is the most promising alternative fuel for trucks, as well as maritime and

inland waterway vessels. Natural gas offers today a technology with performances equivalent to petrol or diesel units and with very clean exhaust emissions. Natural gas use in buses and trucks can substitute diesel fuel.

Natural gas – both as CNG and as LNG – figures among the alternative fuels for which the Directive mandates the deployment of infrastructure.

LIQUEFIED NATURAL GAS (LNG)

For heavy duty vehicles LNG, including liquefied bio-methane, can offer a cost-efficient technology to meet the stringent pollutant emission limits of Euro VI standards. The TEN-T Core Network should be the basis for the deployment of LNG infrastructure as it covers the main traffic flows. Member States should ensure that refuelling points are put in place by the end of 2025 and within adequate distances taking into account the minimum range of LNG heavy-duty motor vehicles. As an indication, the necessary average distance between refuelling points could be approximately 400 km.

In this context it is worth mentioning the European Commission's co-funded LNG Blue Corridors project.[2] The project aims at improving knowledge and awareness of LNG as an alternative fuel for medium and long distance road transport. The core of the project is the deployment and demonstration of four LNG Blue Corridors. This will include building 14 new LNG stations and building up a fleet of about 100 LNG Heavy Duty Vehicles which will operate along the corridors. The project will run for 4 years and will connect over 12 Member States and align itself with existing demonstrations running at national level.

LNG is an attractive fuel alternative for vessels to meet the requirements for decreasing the sulphur content in marine fuels in the Sulphur Emission Control Areas, affecting half of the ships sailing in European Short Sea Shipping. LNG is therefore an important element in the effort to comply with sulphur emission reduction legislation: 0.1% in Sulphur Emission Control Areas as of 1 January 2015 and 0.5% in all EU waters as of 1 January 2020. According to the Directive LNG refuelling points at maritime and inland ports should be available at least by the end of 2025 and 2030 respectively to allow circulation in the TEN-T Core Network.

In this context it is worth mentioning the Costa project[3], which aims at developing the framework conditions for the use of LNG for ships in the Mediterranean, Atlantic Ocean and Black Sea areas. If Costa's policy recommendations are implemented, it is expected that CO_2 emissions from shipping could drop by 25% in 2020 and by 50% in 2050. Considering air pollutants, the use of LNG would eliminate SOx and reduce NOx by 90%.

CONCLUSION

The Directive on the deployment of alternative fuels infrastructure shows the political will at the European Commission, the European Parliament and EU Member States to go forward with reducing our dependence on oil for transport, whilst at the same time making our transport greener and more sustainable. The measures that we are taking create a favourable regulatory framework to provide manufacturers, investors and consumers with the necessary confidence that alternatives to oil are there not only to stay but will become increasingly important over the years and decades to come. In this context LNG will play a gradually important role both for road transport as well as for waterborne applications.

Disclaimer: The content of this article does not reflect the official opinion of the European Union. Responsibility for the information and views expressed in this article lies entirely with the author.

1. European Environmental Agency, Expenditure on personal mobility (TERM 024) - Assessment published Jan 2011, available at: http://www.eea.europa.eu/data-and-maps/indicators/expenditure-onpersonal-mobility-2/assessment
2. http://lngbc.eu/
3. http://www.onthemosway.eu/blog/green-ports-and-green-shipping/2012/12/28/costa-project-towards-a-masterplan-for-the-use-of-lng-on-ships-in-mediterranean-atlantic-ocean-and-black-sea/

FINANCIAL TIMES

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Gas: still a secure, flexible and clean option

By Margot Loudon, Deputy Secretary General, Eurogas

Recent developments in relations between Russia and Ukraine have led to a renewed debate on Europe's energy security. Therefore it is timely to review how the gas sector plays such an important part in securing Europe's energy needs and delivering reliable services to more than 250 million Europeans.

Security of supply is a core objective of the gas business, and the gas market can deal with supply disruptions over a significant period. Eurogas considers that security of supply is fundamentally linked with the development of a strong European market. This will help ensure that Europe continues to attract gas supplies, in an increasingly international market. Europe has a wide choice of supplies from neighbouring parts of the globe and further afield. These arrive in Europe by diverse routes, through pipelines and in tankers. Energy companies in Europe have broad business interests and global reach and large and increasingly flexible supply portfolios are aimed at security. Eurogas does not think that energy independence should be a goal in itself. Reducing import dependency, ignoring the potential of the global market, will not necessarily bring increased security of supply.

In a critical few days for gas supplies in January 2009 the gas industry showed that it was able to provide an effective, cost-efficient response by rerouting gas supplies and using commercial storage and other market responses. The system, however, was tested, and lessons were learned leading to construction of more pipelines, more possibilities for sending gas in directions different from prevailing flows, and other measures to enhance the responsive flexibility of the system in the event of disruptions. The revision of EU legislation on gas supply security (Regulation 994/2010) strengthened supply security requirements and mechanisms to improve co-operation if problems arise.

Eurogas considers that further improvements are needed to deliver a well-functioning market essential to security of supply at European level. To date results throughout the European Union are uneven. A more robust, more

resilient market, underpinned by a physical, commercial, and regulatory infrastructure that allows more gas to flow seamlessly over more borders, is a prerequisite for further progress. Investments are needed, and therefore it is necessary for policy makers to give clear signals about the important role of gas in the energy mix, to give confidence to future investors.

TECHNOLOGICAL INNOVATION IS KEY

An important dimension for securing energy supply, in the short as well as long term, lies in technological innovation and the development of innovative market-based products.

Exploitation of unconventional gas resources has improved supply prospects worldwide. In Europe, although assessment of whether unconventional gas meets the required high environmental standards is in its early stages, production could help to balance declining conventional resources.

Although current utilisation rates of liquefied natural gas (LNG) terminals in Europe are low, largely because of the appetite for gas on the global market, there is confidence in its future importance and new terminals are planned or under construction, including floating terminals. Operators are also developing new services and products, adapting their offer to market developments and new market needs.

This pallet of services includes reloading (transfer from the terminal's tanks into a vessel) and transhipment (direct transfer from one vessel to another). These services introduce even more flexibility in the LNG market. LNG services are also expanding to retail LNG or small-scale LNG, for road and maritime transportation and for delivery of gas to off-grid customers (industrials, power plants, local distributors). Rail loading, although not yet available in Europe, is also a future option for the retail LNG market delivering small quantities of LNG in rail tanks.

Other exciting developments in the chain include the introduction of biomethane from waste and farm products, which can be injected into the gas supply system. Furthermore, biogas is identified as an excellent alternative to oil products in transport. This not only introduces a renewable component into the gas mix, but means that demand for conventional fuels will be reduced.

Gas is also a perfect partner for other renewables. Notably gas-fired power stations can provide back-up for intermittent wind and solar power, and the design of the combined-cycle gas-turbine technology has improved significantly so that a plant is better able to cope with fast start-up and ramp rates. In addition, a new technology of power to gas would permit excess energy from renewables to be turned into hydrogen or synthetic gas. Such technological advances will help to integrate operational aspects of gas and electricity supply.

Gas has the lowest emissions of CO_2 compared with other fossil fuels. Nevertheless, carbon capture and storage, although currently hampered by high costs and lack of demonstration, is still an option on the way to zero or nearly zero emissions and will enable keeping a broad and competitive range of choices.

In the household and commercial sectors a changing appliance park, bringing more efficient use of gas potentially in combination also with renewables will reduce demand per capita. Technological development, coupled with the growing appetites for customers to engage more in the market and choose innovative products and services to meet their needs, should also contribute to a greater integration of the gas and electricity markets in a way that delivers a more sustainable and consequently more secure energy system.

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GERG – Marcogaz Gas Sensor Initiative

By Jean Schweitzer (Danish Gas Technology Centre), Daniel Hec (Marcogaz), Robert Judd (GERG)

On 27th February Marcogaz[1] and GERG[2] and jointly organized a workshop in Brussels on the subject of sensors in the gas industry, with a specific focus on Gas Quality sensing, measurement and control. The event was a great success with over 60 attendees from a broad range of industrial and academic concerns.

INTRODUCTION: CONTEXT

The evolution of the gas market has brought focus on gas sensors as a technology that could/ should help the Gas Industry to manage the requirements of the market (gas quality harmonization, enlargement of Wobbe range, More LNG, H2 mixed in NG, Biogas, etc..)

Some sensors are already on the market for some applications some more are in development phase. We are in a transient situation where the involved stakeholders do are not necessarily aware of what is happening

On one side we don't all know well what are the products (sensors) and technologies on the market or in development. On the other side the manufacturers of sensors are not necessarily aware of the most recent discussion regarding harmonization of gas quality, injection of H2 etc…

The objective of the workshop was therefore to:

- Inform shortly stakeholders about the expected future gas variations;
- Share knowledge about existing technologies, and projects in developments;
- Indicate to sensors manufacturers where we have need for sensors and what specifications we need.

So in other words we need to put all information on the table sharing information about what are the sensors on the market & their performances + what gas quality change we shall expect. This would be useful to identify further the needed action and also to set up a strategy within the Gas Industry.

A secondary objective is to demonstrate that technologies for solving the gas variation challenge do exist and that sensors can play an important role in the gas harmonisation discussions.

WHAT DO WE MEAN BY SENSOR?

A gas sensor is a device that is giving information about one or several characteristics of the gas they are measuring.

We are here primarily looking at sensors that will help to solve the challenges of gas quality changes and covering different applications. Known technologies today are very different and include correlative device, gas leakages detectors, GC detectors, spectroscopic device/detector, etc...

WORKSHOP PROGRAMME AND OUTCOMES

The workshop programme included:

1. Information about future gas quality;
2. Information by manufacturers on existing technologies & developments;
3. Existing reviews of technologies & comparisons;
4. On-going projects;

The context of the event was presented at the outset

with presentations from the European Commission and from the European gas industry. The European Commission emphasized the importance of gas quality for realizing the Single European Energy Market. Gas quality variation in Europe will be both more frequent and of higher amplitude due to the increase of diversification of delivery. It is vital to understand gas quality (and particularly Wobbe Index which is an important measure of combustion characteristics) in order to ensure safe combustion of natural gas. In turn cheap, fast and accurate sensors allied to effective measurement and control systems may be vital to ensure that safe combustion is taking place and can be appropriately managed.

Many options are already in operation, and even more options for the future. The relevant applications range from monitoring and control of distributed gas, through to control at the individual user level.

Transport is becoming a major application with the increasing success of natural gas (CNG and LNG) vehicles and ships. Collaborative efforts from OEMs and engine manufacturers to integrate sensors into a new fleet of heavy-duty vehicles were presented. This application may lead the way in creating a new market for mass production of small sensors, and new integrated chip based devices such as MEMS[3] are rising to the challenge.

For domestic users, integrating gas quality sensing and control into individual appliances, especially boilers and waters heaters is an ambition that has so far only been realized in very small numbers. One early need is a cheap Wobbe meter which can be used by gas installers to check gas quality at point of use. Pipeline solutions may move away from the expensive total gas analysis chromatography based systems towards cheaper correlative type devices. These can be installed at the increasing number of entry points, and give sufficient confidence in the main quality parameters. Here regulatory rather than technical hurdles need to be overcome to ensure their widest use.

The number of diverse technical approaches to sensor development, demonstrate that this is a field which is not short of possible technical solutions[4]. The workshop has shown that that there is an important need by the sensor industry for information from the gas industry on gas quality variations, and application specifications for sensors in the industry. Therefore it is important for the gas industry to convey the correct messages to potential developers, manufacturers and integrators, so that the solutions will meet the needs. With this in mind, the Workshop organisers will continue to work closely together in coming weeks to define next steps and an action plan and roadmap that can be communicated back to the sensor community.

Sensors seem to offer solutions to a number of challenges that gas quality variation will bring. The workshop a first step for a joint industrial effort toward solutions to manage these variations automatically and with increased confidence. ●

For more information please contact the authors[5]

or you may want to join the **group** "Gas sensors and gas quality" on Linkedin

1. The Technical Association of the European Gas Industry www.marcogaz.org
2. The European Gas Research Group www.gerg.eu
3. T Micro Electrical Mechanical Systems
4. Presentations available at http://www.marcogaz.org/index.php/gas-sensors-workshop-2014
5. robertjudd@gerg.eu, daniel.hec@marcogaz.org, jsc@dgc.dk

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Han Fenemma, Chief Executive Officer and Chairman of the Executive Board, ***Gasunie***

Edouard Neviaski Chief Executive Officer, ***GDF SUEZ Trading***

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A Security Risk Assessment Methodology for Gas Infrastructure Operators

By Thierry Deschuyteneer, Executive Secretary, Gas Infrastructure Europe (GIE)

The European gas infrastructure is a network of assets without national boundaries: a failure of one portion of the network could spread to other areas, potentially involving several countries. Thus the European Commission has identified gas Infrastructure as a critical infrastructure.

GIE fully acknowledges the strategic importance of the gas infrastructure system for Europe and the necessity to create standards to ensure a level-playing field. A sound security risk identification and mitigation methodology maintains the value of energy infrastructure.

The GIE Security Risk Assessment Methodology is a common and integrated approach amongst European energy infrastructure operators. With this methodology a next major and important step to increase security and resilience of the gas infrastructure network in Europe has been achieved. This is an example of the active contribution of gas infrastructure operators to the European Program for Critical Infrastructure Protection (EPCIP).

A METHODOLOGY BUILT ON BEST PRACTICES

The GIE Security Risk Assessment Methodology has been elaborated by security experts from all over Europe with many years of practical experience, using different national best practices, together with one of the world's leading strategic consultancy.

Other important inputs come from the risk assessment methodology standards ISO 31000:2009 and ISO/IEC 31010:2009, as well as the "Reference Security Management Plan for Energy Infrastructure" prepared for the European Commission in 2010.

The GIE Methodology is robust yet easily adaptable and flexible and can be used by different energy companies. It covers all areas of security within a company, irrespective of size and scale. It is already in use by several gas infrastructure operators in different countries.

The GIE Methodology is tailored to gas transmission: valve stations; pressure and metering stations; compression and blending stations; import/export stations; process control stations; data communication systems; emergency and call centres; and gas flow control centres.

It also deals with the gas distribution sector: emergency and call centres and blending stations. Finally, underground storage, peak-shaving and LNG terminal installations are covered as well.

RISK IDENTIFICATION, ANALYSIS, EVALUATION AND TREATMENT

The first part of the methodology concerns risk identification. Each asset is characterised according to its criticality and potential threats.

Then risks are analysed: the likelihood of risk scenarios is evaluated as well as the impact and consequences of these risk scenarios. Results are summarised in a risk matrix. A semi-quantitative methodology is applied, with 5 likelihood classes: "very low probability", "low probability", "medium probability", "high probability" or "very high probability". There are also 5 risk classes: "very low risk", "low risk", "medium risk", "high risk" and "very high risk". For each category, an order of magnitude of the likelihood or risk is provided.

The next step deals with the evaluation of risks: by comparing the risk findings with the risk criteria (without or with the existing security measures), the need for mitigation measures is identified. Decisions have to be made whether a risk needs treatment, what the priorities for treatment are, and whether an activity should be undertaken.

The last part of the methodology involves risk treatment. This covers: selection of the strategy for managing risk; evaluation of the effectiveness of the "as-is" security measures and the analysis of the gap with the desired outcome; identification of mitigation measures; evaluation of the residual risk; vulnerability analysis; and supplementary measures.

It is not possible to identify a fixed set of detailed security measures that have to be applied to all assets of gas infrastructure operators; the security measures have to be defined by every operator considering the national mandatory regulations and the specific environmental aspects.

This methodology supports operators in identifying the security measures and, in particular, the definition of its own security guidelines that can be adopted for all assets belonging to a specific type and/or risk level.

A FREELY AVAILABLE METHODOLOGY AND TOOL

The GIE Security Risk Assessment Methodology is complemented by a Risk Assessment Tool which covers the specific assessment phases as described in the methodology: asset classification (including criticality and environment); threat analysis; evaluation of likelihood and impact; and object classification.

The GIE Security Risk Assessment Methodology has been presented to representatives of the European Commission and introduced to the European Network of Transmission System Operators for Electricity (ENTSO-E). The official launch of the GIE Security Risk Assessment Methodology took place on 29 July 2014.

The GIE Methodology has been developed using best practices from GIE members and is already in use by some operators. GIE expects that its members will progressively apply it. Experience from implementation could also lead to improvements in the coming years.

The Methodology is accessible to all stakeholders interested in this field. It is published on the GIE website (http://www.gie.eu/index.php/publications/gie). The documentation consists of a detailed description; a Risk Assessment Tool and a summary of the Methodology in the form of a presentation.

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EU energy policy: Impact on European ports

By Isabelle Ryckbost, Secretary General ESPO

Energy is high on the agenda of Europe's decision makers. Half of the candidate Commissioners were claiming the Energy portfolio and the Energy committee in the Parliament was also first on the wish list of many incoming Members of the European Parliament.

Not without reason. First, there is climate change. We all know that to tackle the climate change phenomenon we need to "decarbonise", stop the burning of fossil fuels. This is achievable through shifting to renewable energy sources and pursuing energy efficiency.

Second, there are the delicate geopolitical relations with Russia, the biggest exporter of fossil energy sources in the world, which obliges us to reflect on our energy supply and indirectly also on our dependency of oil and gas.

Ports have an important role to play in the field of energy. First there is the maritime transport side. And since ports are more than transhipment platforms we should also look at the other transport modes connecting the maritime leg with the hinterland. How can all transport modes respond to the upcoming challenges? But there is more: ports traditionally play an important in importing, exporting, storing and distributing energy. Finally, ports are also home to vast industrial complexes. If those industries are faced with difficult targets as regards energy efficiency or decarbonisation, this will also affect the ports that host them.

So, it is without saying, that the challenges in the field of energy are, or, should be high on the radar of Europe's ports.

The designation of Sulphur Emission Control Areas (SECAS) in the North and the Baltic Sea will undoubtedly have a great influence on ship fuels. As of 1 January 2015 vessels that sail in SECAs will have to burn fuel with a maximum sulphur content of 0.1%. This will mean a shift from Heavy Fuel Oil (HFO) to compliant Marine Gas Oil (MGO) with an immediate increase in the fuel price of up to 40-45%. Moreover, it is still uncertain if Marine Gas Oil will be available in enough quantities to cover the demand. But there are alternatives. The first is to continue burning heavy fuel oil in combination with exhaust gas cleaning systems, the so called "scrubbers". Here as well it is yet unclear if scrubbers will be allowed in all ports given the impact on other EU environmental legislation, like the Water Framework directive. The other alternative is the use of low sulphur fuels with the most promising being Liquefied Natural Gas (LNG). It is widely expected that 2015 will see a combination of the three main compliance methods in the SECAs.

As a consequence of the new sulphur rules, bunkering facilities will have to adapt to mainly offer MGO and in certain limited cases in the short run LNG to vessels. Moreover, in accordance with the upcoming Directive on alternative fuels infrastructure, a sufficient amount of LNG refuelling points need to be foreseen in Europe's core ports by 2025. European ports will then have to study the most convenient locations for installing LNG bunkering facilities in their areas and to ensure the safety and efficiency of bunkering operations.

But apart from the fuel used in shipping, an overall "decarbonised energy policy" will also affect ports in a broader sense. As a matter of fact, more than 35% of all commodities handled in European ports are sources of energy. What if Europe is becoming less oil dependent? Are or can ports play an equally important role in the import, export, storage and distribution of alternative energy? I believe the new energy mix might breathe new life into many ports. Next to the important role ports can take up when it comes to LNG, biomass, European ports can also play an essential role in the development and maintenance of renewable energy sites such as on and off shore wind mill parks, wave energy and tidal energy.

Moreover, as hotspots for Europe's industrial activity, ports will need to monitor their industries and the challenges they are facing to respond to Europe's energy challenges and policy.

Last but not least, ports realise they have to contribute themselves to the decarbonisation process by improving their energy performance. Energy consumption has entered for the first time in the ESPO top-10 environmental priorities in 2009 and gained significance in the last review 2013. ESPO's green guide therefore dedicates a full chapter on energy conservation and climate change. 72% of European ports monitor their energy consumption while that more than half of European ports monitor their carbon footprint (EcoPorts SDM 2014). 57% of ports have a programme to increase energy efficiency (Port environmental review 2009).

To conclude, if energy and energy policy are a priority for the European decision makers, it is certainly also a top priority for European ports. For this reason ESPO will also dedicate its next annual Conference (21-22 May 2015 in Piraeus - Greece) to the theme of energy in ports.

Isabelle Ryckbost, Secretary General ESPO

High Performance Green Port Giurgiu

Co-financed by the European Union
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The EU-project „High Performance Green Port Giurgiu“ aims at upgrading the port of Giurgiu and turn it into a highly-performant terminal using **smart technology** but also applying specific **environmental measures**.

For maximum benefits brought to the region it is necessary not only to ensure that navigation can be performed under normal conditions all year long, but that there are also ports capable of operating large cargo volumes in the shortest time interval possible, while also having a reduced impact on the environment.

Giurgiu port will be re-shaped into an **intermodal hub** being able to handle **large cargo volumes**. This implies that instead of being transferred by road, freight volumes will be transported by inland navigation, an **environmentally-friendly transport mode** used to shift considerable volumes of cargo from road transport to the Danube. The long term effects of this change experienced by Giurgiu Port are: a lower pollution rate in the region and a constant increase in the promotion and use of inland navigation.

For more information about the project, please visit the following website:
www.ilr.com.ro/projects/high-performance-green-port-giurgiu.html

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Future energy mix used by shipping can reduce the oily waste significantly

By Guido VAN MEEL, secretary general of EUROSHORE INTERNATIONAL (a non-profit association of waste contractors specialised in ships' waste)

Heavy fuel oil (HFO) or residual oil is a by-product of crude oil refining process, and as such containing a lot of the contaminants removed from the lighter oils. That means that heavy metals, sulphur and other pollutants are present in heavy fuel oil. This makes it much cheaper than other lighter marine fuels and is the main reason it is used in marine engines.

HFO is very viscous and requires to be kept at a temperature above pour point in bunkers and storage tanks to ensure efficient transfer and combustion. This is achieved by use of steam for the bunker and storage tanks and a series of heaters between the tanks and the engine fuel pumps and injectors to keep the oil between 40°C in the main bunkers and 120°C at the main engine injectors.

As we have seen, heavy fuel oil is a residue from the crude oil refining process and as such is the dregs of the process. It is used as a marine engine fuel because of its cheapness, but it does contain a lot of impurities. As a result some parts of HFO will not suitable for burning in the engine and will be pumped to the sludge tank. The sludge production depends of course on the quality of the HFO that is produced in the refinery, which varies in function of the crude oil and the technology used. In literature some sources mention a sludge production between 1% and 2% of the fuel consumption. That means that a 14000TEU container vessel with an average daily consumption of 200t HFO will produce between 2 and 4ton sludge per 24h. On a voyage from Singapore to Western Europe this means that between 40 and 80m^3 of sludge (waste oil) is generated.

The MARPOL 73-78 Convention requires that port reception facilities should be available in ports in order to accommodate the discharge of oily waste, garbage and other types of waste. In the main ports around the globe, waste handling has created flourishing businesses especially in the field of oily waste. Due to the increase of the oil price, the recycling of oily waste became a booming business from collection, storage, pre-treatment and refining of oily waste.

Next to sludge, other sources of oily waste are: slops which are cargo residues (oily slops), and used lube oil after the change of lube oil. All types of oily waste generated by shipping in Europe generates a few million tons of waste oil. As normal refineries

are not interested in the recycling of waste oil, several small scale refineries are set up to recycle part of these waste streams.

Due to the increasing impact of the exhaust gasses of ships on air quality, acid rain, particular matter in sensitive or areas such as Northern Europe or areas with an existing air quality problem such as the North sea countries, the East and West Coast of North America; the International Maritime Organisation (IMO) has created special areas. In these special areas ships are not allowed to burn high sulphur fuels.

In order to meet the new international requirements set out for these so called ECA's

with a sulphur limit of 0,1% from 01.01.2015, ships are obliged to use distillates such as marine diesel oil (MDO) or marine gas oil (MGO). When we look at the market price of HFO and MDO we see that the price of MDO is almost twice the price of HFO. Taken into account that fuel cost represents almost 50% of the operational cost of shipping, shipowners are looking to cheaper alternatives.

One option could be the use of exhaust gas after treatment technology, in particularly the use of a scrubber to wash out the pollutants from the exhaust gasses. Due to some uncertainties linked with the implementation of scrubber technology, the success of scrubbers is at this moment limited. However with a performance of above 90% in washing out pollutants, a scrubber can be a valid alternative especially when in 2020 the worldwide sulphur cap for seagoing vessels will be 0.5%S.

Scrubbers can be divided in dry and wet scrubbers. Wet scrubbers use seawater to wash out the pollutants from the exhaust gasses. That results in the discharge of heavy metals which are present in the HFO and some other pollutants. On top the pH of the wash water is rather low 3-4. That means that the discharge of the wash water could be complicated in harbour areas, approach channels and close to sensitive areas.

Due to the fact that the scrubber technology is in full development and that scrubbers are tailor made taking into account the size of the vessel and the power of the engine, there are no series of "standard scrubbers" available. That means that test results on the wash waters can vary in function of the HFO that is used and the technology that is used by the manufacturer.

The duality of the system is that on the one hand IMO has approved the technology under certain circumstances, but that the standards for the quality of the wash waters is left to member state. Some of the EU Member states such as Sweden have meanwhile forbidden the use of so-called "open loop" scrubbers in coastal waters and harbours. Other countries are carrying out an environmental impact study, that can limit the use of scrubbers. This vagueness in legislation limits the success of scrubbers.

The fact that some scrubber manufacturers claim a payback time of up to 2 years if the ship is sailing in an ECA area, will give an incentive for shipowners to install a scrubber if some of the threats can be overcome such as the wash water criteria.

Another option could be the use of natural gas. Due to the high volumes of HFO bunkered by the big seagoing vessels (5000-10.000tons) only liquid natural gas (LNG) can be used. Due to the risk linked with the use of gas and the low temperature (-162°C), LNG needs already twice or three times as much storage space compared to HFO. On the other hand the forecast for LNG is very promising in terms of availability and price. Especially the developments of shale gas in the US had a significant impact on the price setting for natural gas.

Shale gas has become an increasingly important source of natural gas in the United States since the start of this century, and interest has spread to potential shale gas reserves in the rest of the world. In 2000 shale gas provided only 1% of U.S. natural gas production; by 2010 it was over 20% and the U.S.

government's Energy Information Administration predicts that by 2035, 46% of the United States' natural gas supply will come from shale gas

LNG is already many years used as a fuel on LNG carriers, where the boil off gasses are burned in the engine. The problem with LNG in shipping is on the one hand the need of high qualified crew members familiar with the threats and dangers of LNG and on the other hand the lack of a bunkering infrastructure on the main shipping routes. Due to the high investment cost in a LNG-terminal (storage tanks and jetties) together with a significant investment in LNG bunkering vessels the success of LNG is limited. For that reason the EU has worked out a programme to subsidize LNG projects to overcome the actual bottlenecks.

On top the shipowner is facing a relative high investment cost in retrofitting ships with a LNG engine (be it a dual fuel engine or a pure gas engine) and isolated storage tanks. LNG will need ca 2 times the space of HFO for an equivalent caloric value and due to the fact that LNG has to be stored at minus 160°C, the isolation and safety structure will increase further the volume.

But with the exploitation of shale gas, the gas price is under pressure. It may be expected that the USA will export LNG to Europe at very competitive prices. The low LNG price, on the long term, can be an extra argument to change to LNG. The challenge in this file will be the set up a bunkering infrastructure that allows shipping to buy LNG at such interesting price that it will overcome the handicaps of extra training for the crew and the higher investment cost combined with the lack of space for cargo.

The potential development of LNG as an environmental fuel for shipping is supported by a growing number of safety codes worked out on port level. These developments should be backed by an International Code for the bunkering of LNG. IMO has already published interim guidelines in this field but a real code is not yet adopted.

That ports believe in the LNG development is shown by the planned or realised LNG investments. In the Port of Rotterdam, the busiest bunkering port in Europe with ca 15million tons, a new LNG terminal was erected a few years ago and special jetties for small scale LNG bunker vessels are planned. Also in the Port of Antwerp a LNG bunker terminal will be constructed in the coming years and a LNG bunker vessel is under construction. In Northern Europe, a large scale LNG terminal is under construction in the port of Goteborg. In Central Europe the port of Zeebrugge has plans to increase the LNG capacity of its terminal together with a second LNG jetty suitable for small scale bunkering vessels. In France a large scale LNG terminal exists already in the port of Nantes and a new LNG terminal is under construction in the port of Dunkirk.

Under pressure of these developments other ports in Europe and Asia have to follow this development in order to supply ships with LNG on the main sea routes between the Far East and Europe. At this moment, Singapore and China are studying very carefully the file in order to satisfy the needs of their customers. They will announce similar investments in the years to come.

Alternatively ships can use methanol as an alternative for LNG. Methanol has more or less the same molecular structure, but doesn't need to be stored at -160°C. That means that all equipment for the storage and bunkering will be cheaper. On the other hand methanol is also toxic and needs to be handled with the necessary precautions.

Both LNG and methanol, can meet without any problem the more strict parameters for sulphur nitrogen and particular matter which have to be met by international conventions. In the case of LNG the emission of CO_2 is ca 20% lower than for HFO, which can be an advantage in the near future when reduced CO_2 targets have to be met.

From a waste contractor's point of view, alternative fuels such as LNG and methanol don't create oily sludge. That means that oily waste volumes, based on sludge, could reduce significantly in the coming decade(s). This could complicate decisions that have to be taken in case additional capacity for waste oil treatment is needed. On the other hand, if ships will equipped with scrubbers instead of using alternative fuels such as, LNG and methanol, the sludge production will remain more or less the same.

As the author doesn't possess a crystal ball we can only conclude "with time comes counsel". ●

Gas – the key to success for the energy transition!

The gas innovation campaign of DVGW (The German Technical and Scientific Association for Gas and Water)

With the energy transition, Germany has opted for a fundamental transformation of its energy system. Production, transport and demand structures face a comprehensive upheaval which will have an impact on all sectors of energy consumption. In the transformation of the energy system, gas is the key resource for integrating renewable sources of energy – it is safe, flexible, highly efficient and especially climate-friendly. Furthermore, Germany already has safe, high-performance gas infrastructure.

Prof. Dr. Gerald Linke
Managing Director of DVGW
The German Technical and Scientific Association for Gas and Water

Up to the year 2050, the share of renewables in German power supplies is to be gradually increased to 80 percent. To meet the ambitious climate protection and CO_2 emissions targets of Germany and Europe, much still remains to be done. On the one hand, power grids will need to be modernized and expanded. On the other hand, additional storage capacities and system services will be required in order to compensate for fluctuations in wind and solar power.

Of all the fossil fuels, natural gas has the best climate balance. In addition, there is still considerable untapped efficiency potential in the optimized utilization of natural gas. Combined-cycle power stations with gas and steam turbines are already the ideal supplement to volatile, renewable energy sources thanks to their high efficiency and flexibility. Gas-fired power stations allow rapid changes in output, generating power in an extremely flexible way and achieving constantly high energy efficiency.

The new technical challenges posed by the energy transition will create additional opportunities for the use of gas infrastructure – for example for the storage and transport of large quantities of energy resulting from surplus power generation from renewable sources. If surplus power from wind or solar power systems is used for electrolysis to produce hydrogen and oxygen, the hydrogen can be fed directly to the gas system or converted into methane in a second process step.

The conversion of power into a fuel (power-to-gas) can relieve the burden on power grids and reduce the need for the construction of additional power transmission systems. Energy is carried by the gas networks and can therefore be made available to 40 million people and a variety of stationary and mobile applications in Germany. Power-to-gas covers the entire range of efficient gas utilization technologies – from the classical space heating market through power generation including cogeneration to climate-friendly mobility and the use of gas as a feedstock in the chemical industry. Further opportunities can be accessed via the liquefaction of natural gas (LNG = liquefied natural gas). LNG can also be used for powering heavy trucks and ships.

Within the framework of the energy policy system defined

by climate protection, security of supplies and economics, gas can play a key role in reshaping energy supplies in Germany. This development will not be possible without technological innovations within the gas system. Apart from technical safety, the main emphasis will be on optimizing the energy efficiency of individual components and on the entire gas processing and utilization chain. The extended role that natural gas can assume within the energy system will call for technical and scientific preparations at an early stage. DVGW has worked intensively in this area since 2009 within the framework of its innovation campaign. Together with companies from the German gas industry, research institutes and manufacturers, DVGW is investigating gas technologies to make future energy systems safer, more efficient and more environmentally compatible. The campaign includes about 30 different projects, which were grouped together by topic into thematic research clusters:

- Gas in an integrated energy system
- Smart grids
- Power-to-gas
- Gas production and upgrading
- Cogeneration and utilization technologies.

Brief and concise information on the main results of this work you will find in the brochure "Mastering future challenges with gas innovations!" on the website: www.dvgw-innovation.de

Blue helps Green: The Commission's Green Ports agenda

By Dimitrios Theologitis and Caroline de Clock

The EU objectives from the 2008 Climate and Energy Package reaffirmed in the 2011 Transport White Paper towards a competitive and resource efficient transport system and the Roadmap for moving to a low-carbon economy in 2050 still resonate today.

The reduction of at least 60% of the greenhouse gases (GHGs) emissions from the transport sector by 2050 with respect to 1990 and the goal of a cut by 40% of EU CO_2 emissions from maritime transport by 2050 compared to 2005 levels should then be a major driver for actions in the maritime and the port sectors. The strategy outlined in the 2013 Commission's Communication "Ports: An engine for growth"[1] makes a contribution towards this end: one of its action aims at increasing the sustainability and green profile of ports. Other actions such as the development of a better connection of ports to their hinterland (for example through multimodal platforms) and the setting up of a necessary framework to attract investment can usefully supplement it.

Being a "green port" means acting "green" on two aspects: port operations and ships in the port. The Commission has contributed to the development of both. Besides already adopted legislation, the Commission has supported the drive to improve the sustainability of Europe's ports with measures taken to deploy alternative fuel infrastructure. The directive approved in April 2014 promotes, through Member States' national policy, the development of alternative fuels in the transport sector and corresponding facilities, with the development of LNG refuelling points in core ports by 2025, but also of shore-side electricity supply. It is a first step helping the industry to meet legal requirements regarding the sulphur content of marine fuels in Sulphur Emission Control areas (SECAs) as of 1 January 2015 and outside SECAs as of 1 January 2020.

Beyond legal obligations, ports also develop on a voluntary basis their own tools to limit damage to the environment. Some EU ports are indeed part of the EcoPorts network, status awarded to ports within the European Sea Ports Organisation (ESPO) membership that share the performance of their environmental management programme. ESPO also produced a "Green guide" providing guidelines towards excellence in port environmental management and sustainability. Acknowledging the merits of such initiatives, the Commission has recently launched a call for tender for a study aiming at developing guidance on environmentally differentiated port infrastructure charging in order that these practices benefit the largest number of ports. The ultimate goal is eventually to contribute and accelerate the greening of the shipping industry. It will give increased certainty to the ship-building and shipping community that needs some additional technical details to better target its investments.

The call for proposals under the Connecting Europe Facility (CEF) published on 11 September takes also into account this "greening" priority. Indeed through this funding instrument, the Commission will provide financial incentives to ports implementing good environmental practices.

1. http://ec.europa.eu/transport/modes/maritime/ports/ports_en.htm

Grants can be envisaged for projects such as those improving rail hinterland connections to the core network, increasing waste reception facilities and alternative fuel facilities in ports such as LNG or cold ironing for which an important funding gap exists. Interested parties will be able to apply until the end of February 2015.

As public funding is important for port development, transparency rules have to be better implemented in the sector. By reinforcing legal certainty, the adoption of the proposed port regulation on market access and port services will be a first step towards improved investment in ports. The Commission supports the efforts of the Italian Presidency of the Council to progress on that proposal. At the time when this article is being written, the objective is to reach a general approach at the next Transport Council of Ministers on 8 October.

The potential for greening a sector that is so economically important for Europe is there. In his Political Guidelines for the new European Commission which he presented to the European Parliament on July 15th, Mr Jean-Claude Junker, the elected president of the European Commission, put the stimulation of investment for growth and job creation amongst his top priorities and also outlined his plan to boost investment for transport infrastructure. Ports can be fully part of it if there is a clear engagement of the port community and the transport industry at large to speed up the implementation of the port policy described above.

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In the European Commission since 1984. Various Head of Unit posts including Road Safety, Maritime Security, Maritime Transport and, since 2008 Ports and Inland Navigation.

Main domains are the development and implementation of a new European ports policy to promote growth and the further development of the policy framework to support and optimise the functioning of inland waterway transport.

Growing and influencing: Port Equipment Manufacturers Association celebrates its 10th anniversary

The Port Equipment Manufacturers Association (PEMA) is marking its 10th birthday this year, and is increasingly seen as a valuable contributor to best practice in safety, technological development and environmental impact for the ports and terminals sector.

PEMA provides a forum and public voice for the global ports and terminals equipment and technology sectors. It publishes independently sourced data, produces recommendations on common standards and represents stakeholders' interests in three key areas: safety, technological development and the environment.

"Thanks to the energy and commitment of our members, PEMA has come a long way in its first ten years, and we're encouraged by the way the Association's membership and scope of activities have steadily expanded," said Ottonel Popesco, President of PEMA.

The Association has seen strong growth in recent years, and now counts more than 70 companies among its membership – from niche equipment suppliers to major conglomerates – representing many areas of the ports and terminals sector, including crane, equipment and component manufacturers, automation, software and technology providers, and consultants and other experts.

Its scope is genuinely global, with members from Asia, the Americas, Europe and the Middle East.

"To ensure PEMA membership is worthwhile, and acts with a global perspective – which it must in the globalised ports and terminals sector – we need to attract members from all over the world," explains Popesco.

Some 100 members, as well as guests from 15 countries, attended PEMA's 10th anniversary annual general meeting, held in February this year in Amsterdam. Several industry experts addressed delegates representing PEMA membership.

Rarely do terminal operators and others on the 'customer' side of the industry have the opportunity to talk with so many of their suppliers to outline their expectations and requirements for the years ahead.

Speakers included Christer Granskog, former CEO of Kalmar and a motivating force in the establishment of PEMA; Marc Desmons, Engineering Services Manager at terminal operating group TIL and responsible for all the company's equipment procurement, upgrades and repairs; Isabelle Ryckbost, Secretary General, European Sea Ports Organisation (ESPO) and Dr Khalid Bichou, a visiting professor at several universities and co-founder of the Port Operations, Research and Technology Centre (PORTec) at Imperial College, London. Representatives from the recently formed Global Port Research Alliance (GPRA) also attended.

All four speakers addressed the issue of how ports and terminals are likely to evolve in the decades ahead, and how operators can improve efficiency, maintain profitability and meet the increasing requirements of environmental protection.

Granskog, for example, identified a continued trend towards greater

automation, increased focus on the overall cost of equipment ownership and less on purely headline prices, improved energy efficiency and improved environmental protection.

Three focus areas: safety, technology and the environment

PEMA conducts much of its work in three committees – Safety, Technology and Environment. The committees are made up of industry figures drawn from PEMA member companies.

Safety remains an important issue in the ports and terminals sector, and PEMA has been active in this area for several years, providing information papers and recommendations for ports and terminal operators. The Association has also co-operated with other bodies such as the TT Club and ICHCA International, to publish recommendations on safety standards.

PEMA also plays a role in supporting the ports and terminals sector in discussing and meeting legislative requirements related to environmental issues. And it enables informed debate on technological developments, such as the growing application of automated systems.

"We seek to support members and non-members alike. To really effect genuine change in such a globalised sector as ports and terminals, stakeholders need a forum where they can meet each other, discuss their needs and concerns and help formulate best practice guidelines or recommendations that move us towards a cleaner, safer, more efficient industry," explains Popesco.

PEMA publications: valuable information for improved decision making

The Association also regularly publishes surveys, reports and recommendations on port and terminal equipment use and purchasing.

"Our market surveys provide unique insights of port equipment trends and deliveries. They are designed to inform decision making to make equipment acquisition more efficient and more effective," says Popesco.

PEMA surveys are conducted by independent experts and incorporate information from a large number of ports all over the world. Recent surveys include purchasing data on ship-to-shore container cranes, yard cranes, shipping container weighing and mobile port handling equipment deliveries.

PEMA EVENTS: FORUMS FOR INFORMED DEBATE

PEMA also regularly holds industry events and forums. In June this year, PEMA hosted a series of 'State of the Industry Forums' on developments in port equipment and technology at TOC Europe in London. Key figures from the port equipment and technology sectors attended to debate a variety of issues including automation and standard harmonisation.

During these sessions, PEMA announced its new Standard on TOS-Equipment Control Interfaces. This benchmark is the result of two years of development work and proposes an open, standardised interface between terminal operating systems (TOS) and equipment control systems (ECS) for container handling equipment (CHE).

PEMA also hosted the final of its 2nd Student Challenge, an initiative to foster strong relationships between the academic and business worlds, and give top students an opportunity to meet industry experts.

This year, the two finalists were Blekinge Institute of Technology (from Sweden), and the University of Hamburg, with the latter taking the top prize of €1,000 for their solution to this year's theme: "Optimising Landslide Container Traffic Flow and the Terminal Interchange".

The judging panel was comprised of three leading experts in the ports equipment industry: David Huck, Port Director at Peel Ports Group; Gavin van Marle, Editor of The Loadstar and a consultant on the sea freight industry; and Tom Ward, a Senior Maritime Planner at Parsons Brinkerhoff and expert in the planning, analysis and design of seaport cargo facilities.

"Growing interest in our events and publications suggests that PEMA is playing an important role in developing best practice in our sectors – something we hope will continue in the years ahead," concludes Popesco.

LNG has yet to prove it's in ship shape

By Bill Hemmings, Transport & Environment's clean shipping manager

The upcoming more stringent regulations for emission control areas (ECA), where the maximum sulphur content of marine fuel will be limited to 0.1 per cent, has put liquefied natural gas (LNG) to the forefront in the debate on improving the sustainability of international shipping.

LNG is a compelling option with lower carbon emissions and much lower air pollution than bunker fuels currently in use – which are basically refinery waste and the dirtiest of all transport fuels. But LNG is still a fossil fuel, which means it is not a long-term, sustainable solution. Also, in the short term, its leakage of methane (a powerful climate-warming gas) is a serious concern, raising questions about its claimed greenhouse-gas savings.

The largely bunker fuel-powered shipping sector is today responsible for 3 per cent of global CO_2 emissions. They have increased by more than 90% since 1990 and if no action is taken, shipping carbon emissions are expected to triple by 2050. Bunker fuel currently represents up to 70 per cent of the costs of operating an international shipping vessel. Overall costs are continuing to rise with the stricter sulphur rules being one example.

Air pollution from the sector is also a major concern, accounting for approximately 50,000 premature deaths per year in Europe, according to Denmark's Centre for Energy, Environment and Health, at an annual cost to society of more than €58 billion. Chemical reactions in the air convert sulphur dioxide (SOx) and nitrogen oxide (NOx) emissions into fine particles that can lead to heart and lung failure.

Given these environmental and health costs, as well as the financial burden, ship operators must weigh up the benefits of the alternatives to bunker fuel that are currently viable: bolt-on technology such as exhaust gas cleaning systems for meeting stricter NOx regulations and scrubbers for SOx, or LNG power. Here we will address the latter, the benefits of which include CO_2 emissions 20-25 per cent lower than those from bunker fuel – due to a higher hydrogen-to-carbon ratio.

LNG contains almost no sulphur, which results in almost no SOx and particulate matter emissions. It also emits 85 per cent less NOx than bunker fuel, ensuring compliance with the IMO's Tier III NOx regulation due to enter force

in 2016 for newly-built ships in North America.

LNG's capital costs are high. The Clean North Sea Shipping project cites investment costs for LNG-propelled ships of around €215 per kW, though it says LNG has proven to be 45 per cent cheaper than marine gas oil and 22 per cent cheaper than ships with a scrubber using heavy fuel. Maintenance costs, it says, are expected to be 50 per cent lower.

So it's easy to see why gas is heralded in some quarters as the future of marine propulsion, but there remain serious challenges – both environmental and logistical. In retrofitting for LNG use, for example, substantial modifications are needed including increased storage capacity – LNG requires 1.8 times more storage capacity compared to conventional fuel. The availability of LNG in ports is also still patchy; those keen to use LNG are waiting for supply to improve while those responsible for providing LNG bunkering cite weak demand as delaying progress. On safety, there is no international rule yet governing how LNG can be used, though the IMO is in the process of drafting an international code.

LNG's potential to reduce climate-changing emissions also remains contentious. Methane gas leakage or 'slip' from the engine and during production is potentially a serious problem as, like carbon dioxide, methane traps the sun's heat in the atmosphere. Scientists now estimate that the warming potential of methane is much greater than previously thought. Newer engines address some of the leakage but it remains a factor that requires constant monitoring during operations.

So use of LNG can significantly reduce air pollution from shipping. But it is no silver bullet to curb the growth of the sector's carbon emissions and there are other effective options, such as reducing a ship's speed, and better routing, planning and maintenance. According to some, in 25-30 years renewable energies (through sails or solar panels) may be in use, while others point to the possibility of zero-emissions fuel cells. But these are long-term solutions and the sector will look at all possibilities in the interim. LNG is one such possibility but all environmental, safety and logistical concerns – particularly its climate impact – will need to be resolved before it can be wholeheartedly embraced. ●

For more details, see
transportenvironment.org

Adoption of LEDs in Smart Lighting Systems

By Carlos Lee, Director General, EPIC – European Photonics Industry Consortium

Solid-state lighting (SSL) using LEDs is being adopted rapidly with double-digit growth in Europe and around the world. Commercial indoor lighting represents a major market sector. In Europe, as elsewhere, commercial lighting applications represent about 50% of lighting sales.

LED technology used for lighting leads to highly-efficient light sources that bring the benefits of both reductions in greenhouse gas emissions and reduced electricity consumption. However, indoor commercial lighting, based on fluorescent sources is already energy-efficient. Deploying SSL by itself is not going to change much from this point of view. Although SSL may enable some additional cost-reductions, there is a limit to the added-value that can be achieved through cost-cutting. On the other hand there is no upper limit on the added-value that can be gained by introducing new functionalities enabled by smart lighting systems. The major difference between LED and fluorescent lighting is the following: LED lighting is easily programmed by computer to vary the intensity, the color, and even to carry information. Fluorescent (and HID) light sources do not have this capability.

The deployment of smart light systems is the clear, single step that will unlock economic added-value for the commercial lighting sector. Success requires a better marketing effort with education and imaginative financing solutions, as well as imaginative technology and design innovations that respond to customer needs.

The opportunity for SSL applications in commercial buildings varies according to region. In Asia and Africa where urban growth is strong, the emphasis should be on incorporating smart lighting in new building design. In Europe, the focus is on refitting and updating existing infrastructure. The European situation requires innovative thinking on how to finance Smart Lighting systems in an existing building with little or no apparent cost to the owner, while creating a more valuable piece of real estate as a result of the intervention.

Like fluorescent lighting or HID, SSL brings benefits in energy efficiency. However these benefits are secondary when compared to the value-added by improved productivity from Smart Lighting.

EPIC
European Photonics Industry Consortium

1. LIGHTING IS ABOUT PEOPLE

Economic productivity is the result of people at work. People must have light in order to be productive. There are lighting conditions that optimise productivity.

Here is the proof:

- Productivity is zero in the dark
- Productivity is zero if the light intensity is blinding
- Between these 2 extremes, there are conditions where the productivity is optimized

Smart lighting is the concept that seeks lighting conditions that optimize human productivity, in the classroom, in the factory, in the hospital recovery room, on the stage, wherever people are living.

Although smart lighting is not a new idea, SSL is the first lighting technology that allows the full exploitation of Smart Lighting concepts. This is why SSL is different and better than other efficient lighting technologies like CFL or HID.

The key to capture and exploitation of the added-value is to measure these improvements.

The revolution brought on by SSL will cause lighting to be used in applications that no one can even imagine today. The simple idea that we will save energy by simply substituting a SSL light bulb for an incandescent bulb is erroneous and misleading. In fact, there will be more kinds of lighting applications, and there will be more people using lighting. As a result, it is possible that more electricity will be consumed, albeit more efficiently.

An important additional fact is that there is not an energy shortage. The sun radiates the earth every day with thousands of times more useable energy than people can consume. There may be a shortage of cheap and dirty energy, but not a shortage of energy. So the prospect of introducing a technology that may create more demand for energy than it saves through efficiency should not slow the adoption of SSL.

2. SMART LIGHTING

The concept of Smart Lighting is straightforward. The objective is to improve the productivity and performance of people. People need light in order to perform. With the right kind of light, they can feel better and perform better Students of all ages perform better; learn faster and more efficiently under the right lighting conditions. These conditions change according to the time of day and the number of students, and the type of activity. The class room will be lit differently in different areas according to these parameters.

Smart lighting parameters can be:

- Intensity
- Hue or colour temperature
- Diffuse and point source
- Information/communication

What is more, the optimum parameters are variable, depending on:

- Time of day
- Presence of others: What is the scene? What kinds of people and objects?
- Time of year
- Task: What kind of work is going on?
- Weather

Figure 1: Commercial lighting represents about 45% of the lighting market in Europe, and about 50% of the lighting market worldwide. Commercial and industrial lighting together represent 75% of the lighting market. Smart lighting can make a significant positive impact on commercial and industrial lighting applications

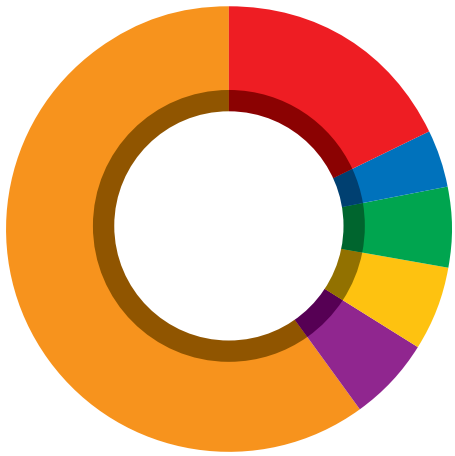

Figure 2: More than 90% of installed commercial lighting is already energy-efficient. Only halogen and incandescent lighting systems have poor efficacy.

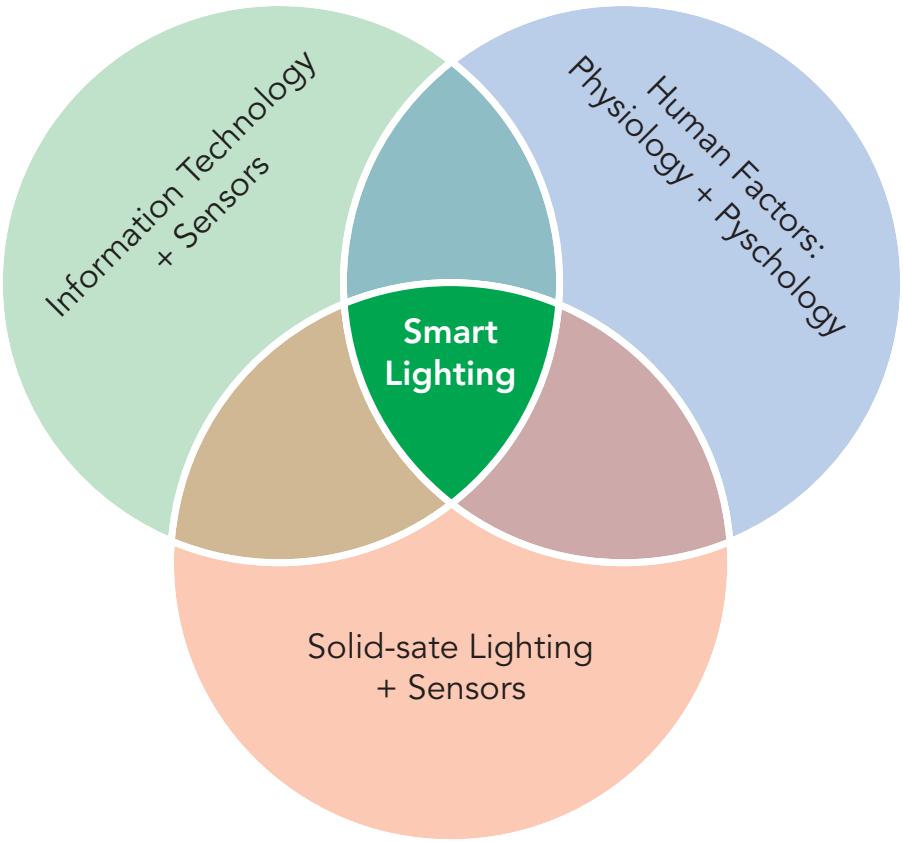

Figure 3: Smart Lighting is a combination of SSL, IT and Human factors

The added-value derived from smart lighting come from several sources:

- Higher productivity
- Greater security
- Lower energy consumption
- Lower maintenance costs
- Greater synergy between lighting, cooling, security

The energy efficiency of SSL is an important benefit, but it is one of a number of benefits, and not necessarily either the most important nor the most predictable.

The key to understanding why SSL is so revolutionary is to recognize that light-emitting diodes are programmable semiconductor devices, similar to transistors and integrated circuits. They are digital devices and they can be interfaced to computing systems. The possibilities are much greater: intensity, color, information transmission and detection.

To implement Smart Lighting successfully one combines LED light sources with sensors, knowledge about human perception, using information technologies to enable control of lighting in response to ambient conditions.

3. INVESTING IN SMART LIGHTING

The cost of residential lighting ranges between 10% to 20% of the monthly electric bill. In Germany today, a typical expenditure on electricity for lighting might be 20 euros per month. In France, because of lower rates, a typical expenditure might be 10 euros per month. By changing all lighting sources to LED a resident might realize a savings on electricity of 1-2 euros per month, or the equivalent of one extra cup of coffee per month. This potential savings is small compared to the cost of changeover. In addition, the residential user can rarely benefit in concrete terms from the additional functionality offered by Smart Lighting.

On the other hand, Smart Lighting will have a significant effect in commercial and industrial settings because the size of the building units is much larger than a single residence, resulting in economies of scale, but mostly because the additional functionality of Smart Lighting creates building units with added economic value, enabling higher rental revenues and resale value. These circumstances suggest that LED-based lighting will be adopted first by commercial/ industrial sectors and more slowly by individuals.

The installation of Smart Lighting requires planning and integration of building operating systems:

- Lighting, both electrical and passive solar
- Heating and air conditioning (HVAC)
- Security
- Information Technologies (IT)

The supplier is a lighting contractor with competence in all these areas. The customer is the building owner. Implementation of a revenue-sharing plan can be used to achieve the installation of a Smart-Lighting system at no additional cost to the building owner. We give a simplified illustration of such a plan.

The building owner:

- Pays the lighting contractor each year the entire budget for lighting (electrical consumption, replacements, maintenance based on the performance of the existing system. These payments continue, adjusted for inflation for a fixed period, such as 10 years.

The lighting contractor:

- Purchases and installs the Smart Lighting system.
- Pays the actual, but lower, costs for lighting consumption and maintenance with the Smart Lighting in place.
- Receives additional payments from the building owner based on the increased rental income stream of the property.

At the end of the agreed fixed period, the ownership of the Smart Lighting system reverts to the building owner who then pays for electrical consumption and maintenance.

The lighting contractor uses the margin between the revenues received from the building owner and his actual costs to pay for the purchase and installation of the Smart Lighting system. Obviously, a successful business negotiation requires a detailed knowledge of all the parameters of the opportunity. Basically, the building owner agrees to forego a portion of the added-value and revenue stream generated by Smart Lighting. In return, he can lower his perceived risk in the installation of a Smart Lighting system. He avoids capital expenditures financed by a bank loan, and does not have to wait for the payback time to recover the investment.

4. SUMMARY

LED lighting opens the way to higher efficiency lighting with greater functionality. No other existing lighting technology can offer all the advantages of LEDs. Adoption of LEDs in lighting applications depends on economics. Although greater efficiency offers costs savings to all users of LEDs, by far the most significant economic value comes from the additional functionality of LEDs, because they can be programmed and controlled by computer, and integrated into an intelligent building environment. This economic added value is most easily implemented in a commercial or industrial environment. It is generated by increased productivity of the people who use these buildings.

Solid State Lighting has the potential to re-invent the lighting market and industry, leading to a paradigmatic shift in lighting. For all European citizens – in fact for all mankind – the use of digitized light could bring a healthier, "natural" and more comfortable world, and, at the same time, a world where they could better fulfil their daily activities, at home, school and work. The needs of an ageing population could be served better, the cognitive development of the youth improved, and the alertness and performance of the working population raised, because smart use of light has positive effects on the well-being of men. For the Solid State Lighting owners the long lifetime and energy efficiency will save money and reduce hassle. Citizens will note that directly on their energy bill, the benefits of employers will be more indirectly such as in increased productivity. Find out more on http://ssl-erate.eu and http://lightingforpeople.eu

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Energy saving with smart lighting

On March 18th 2009 the European Commission adopted a regulation on non-directional household lamps which would replace inefficient incandescent bulbs by more efficient alternatives like LED lamps. Thanks to this regulation, EU citizens are expected to save close to 40 billion kWh (corresponding to the electricity consumption of 11 million European households or the equivalent of the yearly output of 10 power stations of 500 megawatts) and reduce CO_2 emission by about 15 million tons per year in 2020. The regulation is thus expected to reinject about 5-10 billion euros in to the EU economy.

This energy saving is even enhanced by the continuous improvement of the LED efficacy. However for physical reasons this efficacy increase cannot continue forever and it is expected that the limit will already be reached within the next ten years.

While the improvement of the light source will reach its physical limits, alternative possibilities for further energy savings will get into the focus and probably the most crucial one will be the use of light management systems. These systems not only allow for using the light when it is needed and where it is needed (and turning it off in all other cases) but they also allow to make proper use of the biological impact of light on the human body. Especially in office applications this gives the opportunity to increase the performance and well-being of the employees by simply adjusting the color temperature of the light.

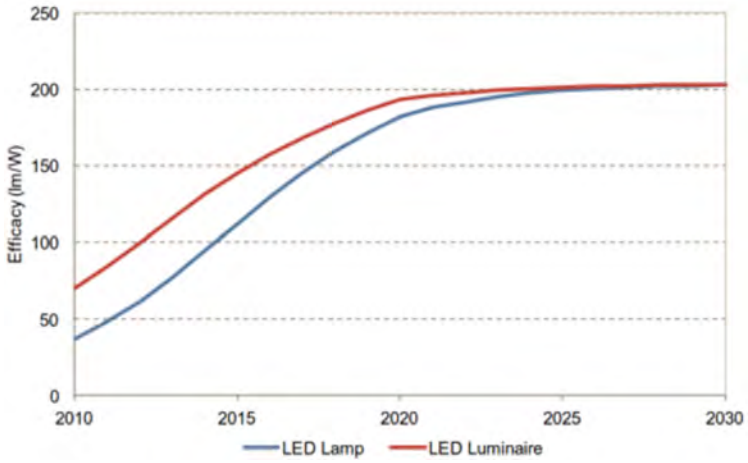

Fig.1: Efficacy increase as a function of time (Source: DOE-report "Energy Savings Potential of Solid-State Lighting in General Illumination Applications", 2012)

The energy saving potential of using light management systems is in the same order of magnitude as the energy saving potential of replacing classical light sources with LED light sources. According to a recent McKinsey report the lighting control system market is already mushrooming with a growth rate anticipated at almost 20 percent per year through to 2020 and while office is currently the largest market segment in this area, expansion is expected in residential and outdoor.

However the higher the energy saving potential of these light management systems are the higher tends to be their complexity. This can cause additional problems and mistakes in the initial commissioning of the system but it has an even more pronounced impact on the user and how he uses the system. Usually after a few weeks he has forgotten how to use most of the advanced features of the light management system and uses only some very basic functionalities which on the other hand have also very limited energy saving potential.

A good light management system should therefore be self-commissioning and although it should allow user control if desired it should do the light management by itself if the user doesn't give any input. In the ideal case a lot of the functionality should already be packed into the luminaire so that the user doesn't have to bother with separate server systems and network topologies.

Fig.2: corridor function with Sfera luminaires


Fig.3: light cloud with Sfera luminaires

An example of such a next generation luminaire is the Zumtobel Sfera which uses swarmControl. SwarmControl has two key functions – the corridor function and the presence-based function. The corridor function provides for safety and orientation. The luminaires are dimmed up successively thanks to a built-in presence detector, showing people their way to the workstation. At the workstation, the presence-based function ensures ideal lighting conditions with a mean illuminance level of up to 500 lx. Yet every staff member can adjust the lighting quantity at any time to suit his/her personal preferences. Via radio signals sent to the luminaire's neighboring luminaires, a positionally-independent "light cloud" that conjures up a pleasant atmosphere in the room is created. Over and above this, an ideal lighting situation is guaranteed that provides greater visual comfort for the various tasks to be fulfilled and has a positive impact on the staff members' performance. No additional software is required in order to configure the luminaires. Even if the arrangement of workstations in the office changes, swarmControl allows adjustment to cater for altered room layouts.

This type of additional intelligence in light management systems will be important for future lighting solutions to make sure that the energy is used optimally and that the persons using the lighting systems get the highest possible comfort and functionality from their systems.

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Intelligent lighting for people

By Reine Karlsson, Prof. EcoDesign, InsideLight, Lund University Open Innovation Center

The utilization of the new lighting can be made intelligent in several different ways. One obvious basis is that the selection of lighting system design and products can be more or less intelligent. Furthermore the use of the installed lighting can be more or less intelligent.

The rich variety of LED, sensors, user interfaces, hard- and software is enabling a new level of freedom of action. Smart dynamic lighting installations can be made ever more "intelligent", at a significantly lower cost than before. It has become possible to supervise what is happening in buildings and cities. Furthermore, it is possible to enable users to control the lighting in much more advanced ways than before. This has led to an increased interest in the character and quality of the light in our work and living environments. In addition, new research has shown that the variation of the amount of blue light is important for the synchronisation of our body's circadian clock, which is important for health and wellbeing. At a more basic level, we all know that the character and quality of our light environments are important for our wellbeing. The light is the carrier for the experiences we appreciate; e.g. the play of light at sunrise and sunset, in the forest and at the sea, and numerous people like to put candlelight's at the dinner table to create a nice atmosphere.

Solid State Lighting has come

of age and is able to deliver new benefits to the users and owners. SSL enable more dynamic, controllable and higher quality light, enhanced visual performance and improves the ambience and safety of urban environments. One aspect of the need for intelligent solutions is that the need for lighting is context dependent. There is quite a lot to gain, both individually and for society, when we have the right light, in the right place, at the right time, for each and everybody. This is the best solution from customer value point of view. It is also the solution that is best from sustainable development point of view, because it is not effective to use material and energy to produce disturbing or not wanted light.

The 7th Framework project SSL-erate, "Accelerate SSL Innovation for Europe" aims to accelerate innovative deployment of high-quality SSL solutions. One background is that Smart Lighting applications have so far only activated a minor part of the possible added user value and business development potential. The basic ambition with SSL-erate is to enhance the added user and business value of SSL by promotion of solutions that are better from health and wellbeing point of view and from intelligent green business development point of view. For example, the EU report Lighting the Cities mention that investments in innovative lighting infrastructures at the municipal level offer the potential to boost local innovation, growth and jobs. As a way to enable more renewal oriented business development, SSL-erate is promoting open-minded dialogue and open innovation by means of the innovation platform "Lighting for People", http://lightingforpeople.eu

SSL and ICT are enabling a very large freedom of action, which can be used or misused. With SSL there is great ability to tailor lighting systems to meet visual needs and wants, and also non-visual needs. At the other end of the customer value scale, there is a risk for sales and installation of poorly engineered products, including LEDs and poorly implemented lighting systems. When the requirements are unclear there is a risk that some suppliers will use their technical freedom of action to reduce their cost and still present their products with a new value enhancing "label", e.g. "LED". This risk is serious because, at the same time as it is difficult to make clear and widely understood specifications for the new lighting, the dominating goal for public procurement in Europe tends to be to minimize the investment cost. Consequently, the cheapest solutions tend to win and then there is a risk that people get disappointed with the new technology.

Smart SSL is enabling significantly better working and living environments, for example in schools and for elderly people. To be able to make optimum use of the potential to improve the quality-of-life there is a need to activate relevant knowledge as more clear guidance for the deployment of SSL.

Energy performance contracting bringing light to European streets

Christiane Egger – Streetlight-EPC project coordinator, OÖ Energiesparverband

Street lighting is an important contributor to traffic and public safety that requires a substantial amount of electricity and money. There are around 56 million streetlight luminaires in operation in Europe, with an estimated electricity consumption of 35 TWh. For municipalities with older, inefficient systems, street lighting can account for 30-50% of their total electricity consumption. However, the savings potential in this field is enormous – in many municipalities 30-70% with current technologies.

This high efficiency potential was recognised by European policies, which has led to phasing out requirements (between 2010 and 2017) for many lamp types. As a result, they will no longer be purchasable. Nearly 80 % of all streetlamps currently in operation will be affected by this. Municipalities are under strong pressure to act.

OPTIONS DURING THE PHASING-OUT

As non-compliant lamps become unavailable on the market, street lighting operators have the following options:

1. Replacement of lamps only ("re-lamping")
   Disadvantages: for most lamp types only possible until 2015, likely technical problems, low savings

2. Replacing both lamps and ballasts
   Disadvantages: lamps and luminaires often do not fit well, likely to result in a loss of warranty on the whole system

3. Reduction of street lighting services on an ad hoc basis (broken lamps are simply no longer replaced)
   Disadvantages: negative impacts on safety and risk of liability for accidents

4. Replacing luminaires (including lamps and ballasts) by efficient and long-lasting systems
   Challenge: high upfront investment costs

HIGH SAVINGS POTENTIAL OF LEDS

The recent market introduction of LED technology for street lighting offers high savings with comparatively short pay-back times (typically around 5-7 years). LED technology has been developing very rapidly over the past years. With cost reduction potentials of over 50%, it is already an economically very interesting option for street lighting refurbishment.

EXAMPLE: COST OF DIFFERENT LAMP TYPES

As shown in the table below, the reduction of maintenance costs resulting from streetlight refurbishment is often of the same order of magnitude as the reduction in electricity costs. It is the combination of both cost savings that make such refurbishment projects economically feasible. In addition to cost reductions, well-designed LED street lighting systems can bring significant improvements in terms of light pollution and protection of animal life.

Reaping the benefits of efficient street lighting technologies requires substantial upfront investments. That is the major market barrier for operators of street lighting. Additionally, the lack of trust in new technologies slows down market uptake. A functioning and trust-worthy financing model is needed to help municipalities overcome these barriers and succeed in carrying out refurbishment projects.

THE POTENTIAL OF ENERGY PERFORMANCE CONTRACTING (EPC)

Energy performance contracting is potentially a key instrument

Example: cost of different lamp types

	Costs in 5 years (Euro/lamp)				Costs in 15 years (Euro/lamp)			
Lamp type	Invest-ment	Elec-tricity	Mainte-nance	Total costs	Invest-ment	Elec-tricity	Mainte-nance	Total costs
HPM	4	321	230	555	12	964	690	1666
HPS	20	214	230	464	68	623	690	1401
LED	160	67	75	302	319	201	225	745

HPM: High Pressure Mercury, HPS: High Pressure Sodium

for financing and implementing economic energy efficiency investments. In the context of EPC, energy efficiency investments are pre-financed and carried out by an energy service company (ESCO). The annual energy and maintenance cost savings then cover the investment and capital costs.

Guaranteed energy services in the form of EPC work best in cases of high energy and cost saving potentials. In the case of LED street lighting refurbishment, pay-back time is often only around 5-7 years. Pioneer programmes in regions such as Upper Austria have already demonstrated the large potential of EPC as an interesting financing model.

"THE CHICKEN OR THE EGG"

Despite EPC's great potential, most European regions have not yet seen a significant development of EPC markets. Apart from legal barriers, this can be attributed to the lack of understanding and trust in EPC and the absence of experienced ESCOs and organisations facilitating the EPC market development. EPC often faces a "no demand, no supply" challenge.

Street lighting refurbishment with its low level of complexity (compared to building-related EPC) offers a good "learning ground" for the uptake of EPC. Pressure created by the phasing out of streetlamps presents a unique opportunity for the development of EPC markets!

STREETLIGHT-EPC – AN IEE PROJECT LEADS THE WAY

A project funded by the Intelligent Energy Europe programme was launched in April 2014 with the objective of triggering the market uptake of EPC through street lighting refurbishment projects. This project, called "Streetlight-EPC", will not only create demand and supply for EPC projects, but implement a market development process that will achieve critical mass.

The IEE project partners aim to implement 36 EPC street lighting projects over the project's 3-year lifetime, triggering up to 50 million Euro investments. The project's actions will also contribute to increasing energy efficient investments through EPC in other fields, bringing us one step closer to achieving European energy efficiency goals.

Energy agencies in 9 regions (Upper Austria, North-West Croatia, South Bohemia/Cz, Pomerania/Pol, Carlow-Kilkenny/Irl, Southeast Sweden, Podravje/Slo, Macedonia and North/Central Spain) will set up regional EPC facilitation services. These services will provide comprehensive support to municipalities and potential ESCOs.

Project partners also include 9 municipalities (cities of Wels, Trhové Sviny, Gdansk, Kalmar, Maribor, Skopje, Santander, Zagreb County and Kilkenny County) and a European network (FEDARENE). The project is coordinated by the OÖ Energiesparverband, the Energy Agency of Upper Austria, which has gathered vast experience in this field through the management of the region's EPC programme with over 150 EPC projects.

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In the forefront of lighting

Kai Piippo is the Chief designer in ÅF Lighting and Scandinavia's leading lighting designer. He has worked with architectural lighting design for more than 25 years and has many and grand visions. One of them is to "tame" daylight.

Functional and architectural lighting complement each other and creates an inviting and safe urban space at the town square in Visby, Sweden.

Photo: Åke Eson Lindman

Light is the energy that makes life on Earth possible. Light controls the human biological clock and is fundamental to our well-being. Daylight provides a tremendous amount of energy, and light is also the strongest link between human and architecture. I think there is much to gain if we learn to use daylight better.

Studies show that five hours of solar energy around the world is enough for a year's worth of energy consumption on Earth. By accurately analysing daylight, we can get a 24-hour design effect that uses natural light during the day and lets electric lights take over at night. If we learned to handle daylight better we could save energy and create pleasant environments that are beautiful and healthy to live in.

I want to make the world a more beautiful and a better place for people to live. Correctly used, light can create attractive, safe environments in cities, for example, that give social sustainability an entirely new status. We have the technology and the knowledge to do it. With LEDs and control systems we can fine tune all lighting and save up to 90 percent of the energy. Today we can program all light sources in a town square according to how it is used, how many people are usually there, and what day of the week or time of day it is. On Friday and Saturday nights we can have lighting that creates a completely different atmosphere than on a Monday night. A town square in northern Sweden should have totally different lighting than a town square in Naples. Different cultures with different social lives where the lighting is suited to the people who live and work at that particular location. Good lighting design and more efficient lighting systems would create a distinct profile for the square, letting the culture shine through.

Lighting has been in focus for the last ten years and has become a symbol for saving energy. Great progress has been made with the incandescent lamp phase-out on the European market and the introduction of new light sources. But how should these new light sources be applied in modern and old facilities? It's time to start talking about light as something life-giving and essential for human well-being. It's also time to start designing our environments with an understanding of these new light sources and how they are controlled.

A successful example of how good lighting design creates energy savings comes from ÅF Lighting's office in Malmö, designed by my colleague Jim Collin. With a brand new lighting solution where each light source is individually controllable and adjustable, he managed to reduce energy consumption by as much as 92 percent in a new office building. The lighting in the L-shaped office space uses the premise of creating many small rooms in the large one where each employee can control the lighting according to their needs and wishes. Along with several other well thought-out lighting solutions, this led to a happier, more energetic staff that has a greater zest for work.

Driving the energy savings is the new lighting system with its intelligent automatic control system, which accounts for about 80 percent of the energy reduction. The remaining 20 percent is due to the new fixtures, which are nearly twice as efficient as the old ones. Although the investment cost for the new lighting solution was relatively high, it's a one-time cost that can be recouped in a few years.

How then do we combine daylight with electric light in a new, optimal way? I envisage

Kai Piippo, Chief Designer in ÅF Lighting, Sweden

Photo: Ida Borg

The characteristic vaults of the Sölvesborg Bridge in Sweden can be seen from a long distance, creating a unique landmark.

Photo: Olof Thiel

that architectural and urban environment in a near future will be drawn according to the daylight properties, and then we plan the electric lighting, keeping the well-being of people at the forefront. We are only beginning to gauge light satisfactorily and have a new understanding of how people are affected by daylight and electric light. Could it be that we are heading towards a new architectural era with this new knowledge?

Kai Piippo, Chief Designer in ÅF Lighting, Sweden

Kai Piippo is an award winning and well renowned lighting designer in Sweden.

Kai Piippo is the founder of the internationally recognized lighting design company Ljusarkitektur and in August 2013 the company merged with ÅF Lighting. With more than 30 years of experience, ÅF Lighting is in the forefront of the professional lighting consultancy field. Their multidisciplinary team of experts possesses a wide range of competences in all facets of professional lighting, right from initial concepts and ideas through to finished solutions. Their consultancy services are based on a combination of highly specialized engineering services and a Scandinavian design approach.

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European Photovoltaic Market contracts in a rapid expanding global market

By Arnulf Jäger-Waldau, European Commission

During the last 10 years, solar photovoltaic electricity generation has grown from a niche market to provide about 180 TWh electricity in 2014, roughly 0.8% 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 , the market grew again by almost 30% in 2011, 11% in 2012 and another 28% in 2013. The rapid growing markets in China, Japan and the USA more than compensated the stronger than expected market contraction in Europe and resulted in a new installed capacity of about 38 GW in 2013. For 2014, an increase to about 45 to 49 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.

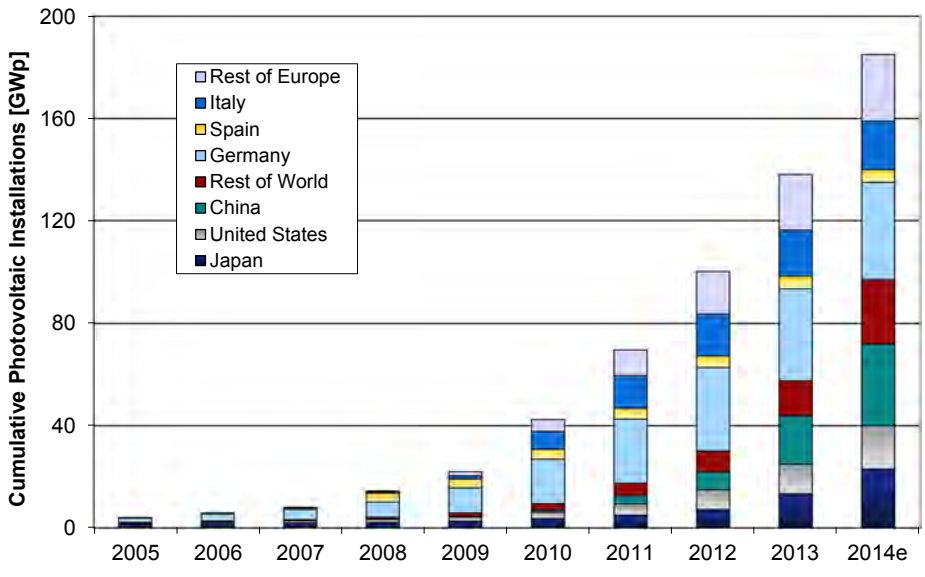
Between 2004 and 2012 Europe was the largest market for photovoltaic installations, before China took this spot in 2013 (Fig.2). With a cumulative installed capacity of about 80 GW, the European Union is still leading in PV installations with 58% of the total world-wide 138 GW of solar photovoltaic electricity generation capacity at the end of 2013, 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 Member States have set specific

Figure 1 Cumulative Photovoltaic Installations from 2005 to 2014 (Data source: EPIA[1], Eurobserver[2] and JRC analysis)



photovoltaic solar energy targets, adding up to 84.5 GW in 2020. At the end of 2014, this target will have been reached for the European Union and the absence of binding targets for the period beyond 2020 give no investment security to potential investors. The driving force behind the anticipated installations is the fact that the cost of electricity generated by solar photovoltaic systems is falling below retail prices for residential and small commercial customers.

One of the consequences are the effects on local jobs and the local economy: The growth of the PV industry in Europe resulted in the generation of over 260 000 jobs or 38% of the worldwide employment in the PV sector in 2011 (Table 1). Most jobs in the PV sector were created in the two main areas of construction & installation and cell & module manufacturing. To calculate the jobs/MW, employment figures and annual output stated in annual reports of public companies as well as private communications with private ones were used. Jobs in the general supply chain like mining, glass manufacturing or general equipment were not considered. In addition jobs in the equipment manufacturing industry and public R&D are not included as well.

In 2011, the European share of PV related jobs was about 38%. 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 from 2011 to 2013 has more than halved these local jobs and with it the positive effect on the local European economy.

In addition, the contracting

Figure 2 Annual Photovoltaic Installations from 2004 to 2014 (data source: EPIA[2], Eurobserver[3] and JRC analysis)

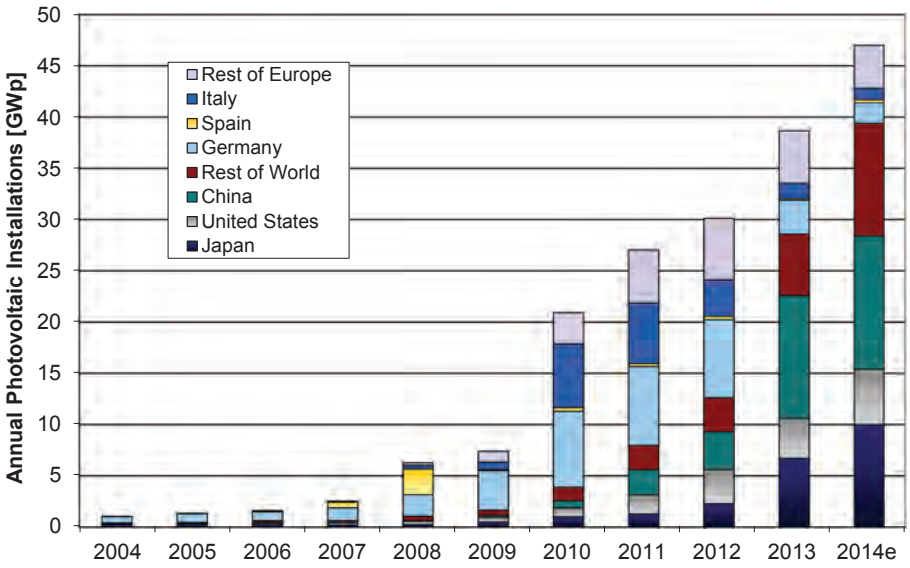


Table 1: PV Jobs in 2011

2011	MW	Jobs per MW	Total Jobs	European Share %	European Share Jobs
Operation and maintenance	42,000	0.15	6,300	70	4,410
Construction	7,000	3.20	22,400	70	15,680
Installation	20,000	9.80	196,000	70	137,200
Polysilicon	31,000	0.75	23,250	25	5,810
Cell and Module manufacturing	35,000	9.60	336,000	10	33,600
Inverters	27,000	1.50	40,500	60	24,300
Balance of plants	27,000	1.80	48,600	70	34,020
Project development	14,000	0.45	6,300	50	3,150
Financial services	27,000	0.10	2,700	70	1,890
TOTAL			**682,050**	**38**	**260,060**

Table 2: PV Jobs in 2013

2013	MW	Jobs per MW	Total Jobs	European Share %	European Share Jobs
Operation and maintenance	100,000	0.15	15.000	57	7,350
Construction	18,000	3.20	57,600	20	11,520
Installation	20,000	8.90	178,000	30	53,400
Polysilicon	40,000	0.50	20,000	25	5,000
Cell and Module manufacturing	42,000	8.00	336,000	5	16,800
Inverter	38,000	1.3	49,400	40	19,760
Balance of plants	38,000	1.5	55,500	30	16,650
Project development	36,000	0.35	7,000	35	2,450
Financial services	38,000	0.10	3,700	35	1,300
TOTAL			**722,200**	**19**	**134,230**

Bibliography:

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.

Since 2011 he is the Technical Chairman of the European Photovoltaic Solar Energy Conference (EUPVSEC) and the European Co-Chair of the upcoming 6th World Conference on Photovoltaic Energy Conversion to be held in 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).

solar photovoltaic electricity system market in Europe has an influence on the choice of solar modules and inverters as well. If these manufacturing industries contract further, the willingness for public R&D weakens and with it the ability of the equipment manufacturing industry to innovate fast enough to stay competitive and provide the next generation of equipment needed for further cost reduction. However, these job effects are much more difficult to quantify and therefore often neglected in the overall assessment of the sector.

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.

In July 2014 the European average price of a residential system was 1.27 €/Wp including installation but without tax and administrative and connection costs. Taking this price and adding a surcharge of 0.13 €/Wp for fees, permitting, insurance etc., an installed PV system costs 1,400 €/kWp without financing and VAT.

It is interesting to note that already at 5% Return on Investment (ROI) the financing costs are the largest single cost factor. Together with fees and permitting costs they contribute to one third of the electricity generation costs from a residential PV system during the first 20 years.

The average European residential electricity price given by EUROSTAT for the 2nd Semester 2013 was 0.201 €/kWh and higher than PV generated electricity for the lower ROI financing options, which are more realistic for private consumers. Denmark, Germany, Cyprus and Ireland had the highest prices with 0.294 €/kWh, 0.292 €/kWh, 0.248 €/kWh and 0.241 €/kWh respectively. It has to be mentioned, that the LCOE in Cyprus are more than 20% lower due to the higher solar radiation.

Without any support, the profitability of a solar PV system primarily depends on the self-consumption by the owner, as less energy has to be purchased from the utility. In the case of a PV system size that generates as much electricity over a year as the customer uses, the actual consumption during the time of generation is in general just around 30% if no demand shifting or local storage is applied. Therefore, 70% of the generated electricity has to be sold to the grid. The question is at which price: contract, wholesale or day ahead price. The second option is to size the system that it only provides 30% of the used electricity, all electricity is used locally and nothing is fed to the grid. In the case where all the generated system is self-consumed, VAT is added to the system price, because it can not be considered a commercial operation.

Table 3 shows at what price surplus electricity has to be sold to break even with a ROI of 3% and what are the savings for a system where no electricity is sold.

Table 3: Case 1 – Necessary selling price of PV electricity to break even if the PV system generates the same amount of electricity as consumed, 30% is consumed locally and 70% has to be sold to the grid; Input parameter: system price of 1 400 EUR/kWh (excluding taxes), 1.5% O&M cost, ROI of 3% and a 20-year financial payback.

Case 2: Savings compared to household without PV system if the PV system generates 30 % of the consumed electricity and the total production is self- consumed (no feed-in to the grid). Input parameter: system price of 1 400 EUR/kWh + the local VAT rate, 1.5% O&M cost, ROI of 3% and a 20-year financial payback.

For these countries, self-consumption is already a cash generation and the necessary selling price is also quite moderate as well. Now, it can be argued that these are extreme cases and not applicable for the European Union as a whole. However, if we look at the North of France, with average residential electricity prices 25% below the European average and very moderate solar radiation, it becomes obvious that self-consumption is already generating a positive balance.

Table 4: Case 1 – Necessary selling price of PV electricity to break even if the PV system generates the same amount of electricity as consumed, 30% are consumed locally and 70% have to be sold to the grid; Input parameter: system price of 1 400 EUR/kWh (excluding taxes), 1.5% O&M cost, ROI of 3% and a 20-year financial payback.

Table 3

	Average electricity consumption and no PV system	Case 1	Case 2
Denmark (VAT 25%)			
Purchase from utility (kWh)	4 200	2 940	2 940
Own PV electricity use (kWh)		1 260	1 260
PV electricity generation costs at		525.00	196.56
900 kWh/kWp (EUR)		525.00	196.56
Utility bill (EUR) at 0.294 EUR/kWh	1 233.12	863.18	863.18
Necessary selling price of PV electricity to break even at 900 kWh/kWp (EUR/kWh)		0.075	
Saving (EUR)			173.38
Germany (VAT 19%)	3 500	2 450	2 450
Own PV electricity use (kWh)		1 050	1 050
PV electricity generation costs at		392.00	140.70
1 000 kWh/kWp (EUR)		392.00	140.70
Utility bill (EUR) at 0.292 EUR/kWh	1 022.35	715.65	715.65
Necessary selling price of PV electricity to break even at 1 000 kWh/kWp (EUR/kWh)		0.035	
Saving (EUR)			166.00
Cyprus (VAT 18%)	5 200	3 640	3 640
Own PV electricity use (kWh)		1 560	1 560
PV electricity generation costs at		447.20	159.12
1 500 kWh/kWp (EUR)		389.48	116.85
Utility bill (EUR) at 0.241 EUR/kWh	1 290.12	903.08	903.08
Necessary selling price of PV electricity to break even at 1 500 kWh/kWp (EUR/kWh)		0.007	
Saving (EUR)			270.19
Ireland (VAT 23%)	5 300	3 710	3 710
Own PV electricity use (kWh)		1 590	1 590
PV electricity generation costs at		662.50	244.86
900 kWh/kWp (EUR)		662.50	244.86
Utility bill (EUR) at 0.241 EUR/kWh	1 274.65	892.26	892.26
Necessary selling price of PV electricity to break even at 900 kWh/kWp (EUR/kWh)		0.076	
Saving (EUR)			137.53

Table 4

	Average electricity consumption and no PV system	Case 1	Case 2
France (reduced VAT 10%)	6 300	4 410	4. 410
Own PV electricity use (kWh)		1 890	1 890
PV electricity generation costs at			
900 kWh/kWp (EUR) (North)		787.50	258.93
PV electricity generation costs at			
1 200 kWh/kWp (EUR) (South)		592.20	194.67
Utility bill (EUR) at 0.159 EUR/kWh	1 001.07	715.65	715.65
Necessary selling price of PV electricity to break even at 900 kWh/kWp (EUR/kWh)		0.114	
Saving (EUR) (North)			26.49
Necessary selling price of PV electricity to break even at 1 200 kWh/kWp (EUR/kWh)		0.086	
Saving (EUR) (South)			90.75

Case2: Savings compared to household without PV system if the PV system generates 30 % of the consumed electricity and the total production is self-consumed (no feed-in to the grid). Input parameter: system price of 1 400 EUR/kWh + the local VAT rate, 1.5% O&M cost, ROI of 3% and a 20-year financial payback.

As further price reductions for PV systems and rising electricity prices can be expected over the coming years, solar photovoltaic electricity generation is getting more and more interesting for European citizens. 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 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 its PV market will remain weak.

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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. European Photovoltaic Industry Association, Global Market Outlook for Photovoltaics until 2018, 2014
3. Photovoltaic Barometer – EUROBSERVER – April 2014, ISSN 0295-5873
4. "Construction" covers the labour need for large projects, whereas "installation" reflects the higher labour intensity of decentralised smaller installations.
5. PVinsight, 18 July 2014, http://pvinsights.com/SolarSystem/SolarSystemPrice.php
6. EUROSTAT, Electricity prices for domestic consumers, from 2007 onwards - bi-annual data [nrg_pc_204]; Last update: 13-06-2014

The ECOSOLE project

HCPV (High Concentration PhotoVoltaic) generator suitable for high efficiency PV power plants in desert areas

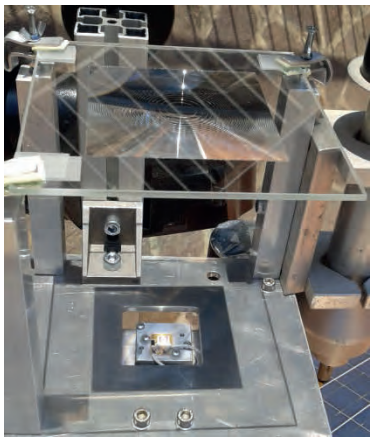
ECOSOLE (Elevated COncentration SOlar Energy), is actually one of the largest FP7 European Demonstration projects in solar photovoltaic.
The project is focused on the study, design, and realization of an innovative HCPV generator made of new high efficiency PV modules equipped with:

- SoG (Silicone on Glass) fresnel lenses, with concentration factor >1100X
- III-V multi-junction solar cells, with efficiency >43%
- low cost self-adaptive solar tracker with distributed inverters approach

The project also demonstrates new high throughput methods for the industrial large scale productions, at very low manufacturing costs; started in August 2012 it will be completed within 2015.
The new HCPV solar generators will be a cost effective solution for electric energy production especially suited for high DNI desert areas where the standard silicon panels suffer from hot climate efficiency losses. The advantages of HCPV with respect to standard PV solutions are:

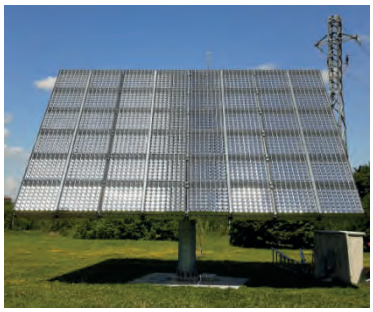
- greater efficiency (+100%)
- better land use (less surface needed and land multi-use thanks to no permanent shadowing)
- scalability and fast deployment of huge solar power plants
- no need of cooling water, (compared to CSP),
- constant power output all over the day from sunrise to sunset.

One of the project targets is also to demonstrate how the industry can achieve competitive LCOE with HCPV technologies.
The demonstration project will end with the installation of prototype systems in Italy and Israel.
The project is leaded by BECAR srl, a BEGHELLI group company, and includes relevant scientific partners as primary research institutions, like
ENEA (Italian agency for renewable energies),
UPM (Universidad Politécnica de Madrid) (UPM),
Ben-Gurion University of the Negev (Israel),
TECNALIA (Spain),
and several European industrial companies partners.

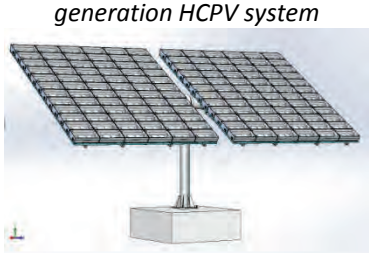


Concentration unit

The new module is made of 72 multi-junction solar cells. Its power output is greater than 200W, with a net conversion efficiency in excess of 34%.
More than 120 modules are assembled on each 100 square meters wide tracker giving a peak output power of almost 30kW @ 1000W/sqm DNI irradiation, for each tracker. The trackers can be easily deployed on any kind of terrain to quickly set up big solar farms with several MW power output. Each tracker realizes an upside-down feature for the easy clean and maintenance operations
The project is funded under EU FP7, Seventh Framework Programme (ENER/FP7/295985) with the title "Elevated Concentration photovoltaic solar energy generator and fully automated machinery for high throughput manufacturing and testing"



HCPV Becar-Beghelli first generation HCPV system



ECOSOLE new tracker

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Creating the right framework for investment: Targets and renewable energy

Providing financing for renewable energy is one of the key challenges that faces society in Europe today. Despite huge amounts of public support for renewable energies[1], governments are struggling to find the capital that decarbonising the economy requires. It is therefore clear that private funding will also play a significant role in the development of renewable energies in Europe. Only very recently it was reported that so called green funds would be worth up to $50 Billion USD in 2014 already, and that this is a growing phenomenon[2]. The challenge is for governments to ensure that this finance source continues to grow to deliver the energy transformation that is needed to create a low carbon economy.

This is where the importance of policy can be seen. As investors look for secure and stable options to invest in, the right policy signals need to be given to direct smart investments.

Dr James Watson, CEO, European Photovoltaic Industry Association (EPIA)

The debate in Europe around the "at least 27%" renewable energy target - included in the set of proposals for a Climate and Energy framework for 2030 put forward by the European Commission in January - highlights the importance of creating the right investment climate for private funds. Such targets set the tone for the long term investment climate and provide an indication of likely growth and return.

The question is whether the proposed renewable energy target is a sufficient incentive to drive private capital into the renewables sector. Examining

the target in more detail you find that the 27% renewables target is barely more than the 24.4% European Commission's predicted business-as-usual scenario share. Moreover, an EU-wide target without binding national targets would not provide the stability and predictability any investor would need. Therefore, to ensure that private capital can be driven towards renewable energies stronger political support is needed. European politicians and policymakers need to firmly support more ambitious targets for renewables.

There is, however, room for optimism. In a speech to the European Parliament in July, the Commission President elect, Mr. Juncker, came forward in support of a 30% energy efficiency target for 2030, which is now backed by a Commission Communication. Such an energy efficiency target had seemed the least likely of all the targets to gain political support earlier this year. However, with a new Commission President comes new room for manoeuvre and new ideas. Further optimism can be harnessed by looking to the European Parliament who earlier in 2014 called for a 30% binding renewables target in 2030. Nevertheless to effectively give investors the right signal on renewable energy Mr. Juncker needs to bring forward an ambitious plan to incentivise investments in renewable energy. This investment signal should consist of binding national targets for renewable energies and an overall framework at the European level. This will speed up the process of driving private funds into the renewable energy sector and truly create the low carbon future the majority of Europeans want.


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As European Heads of State will gather again in October to discuss the Commission proposals for a 2030 Climate and Energy framework, President Juncker should seize the opportunity to upgrade the European Commission's position on renewable energy. The necessary renewal of the European power fleet will require large capital-intensive investments. While a strong CO2 price can help close the most polluting power plants, alone it will not be enough to fully negate investment risks in renewables now.

Europe has a leading position in developing renewable energies, but to maintain this position it needs an ambitious, stable and predictable regulatory framework. That will enable renewables and solar photovoltaics to thrive in Europe, generating growth, jobs and a much-needed economic boost for the continent. The right signals for investors can go a long way to achieving this vision.

1. According to the Special Eurobarometer 364 from May 2011, people are "more favourable to renewable energy than other energy sources, particularly solar (94%), wind (89%) and hydroelectric (85%)" energy.
2. The Economist, "Green bonds: Green grow the markets, O", 5 July 2014.

The OrPHEuS project

OPtimising Hybrid Energy grids for smart citieS

OBJECTIVES

The OrPHEuS project elaborates hybrid energy network control strategies for smart cities implementing novel cooperative local grid and inter grid control strategies for the optimal interactions between multiple energy grids.

The OrPHEuS project aims at optimising the synergies between multiple energy grids by enabling simultaneous optimization for individual response requirements, energy efficiencies and energy savings. The global demand for energy will challenge energy supply directly impacting the productivity for future growth and prosperity of cities. Stability and efficiency across multi domain energy grids are crucial. Although multi-dimensial synergies are increasingly apparent, they neither have been comprehensively investigated so far. The control strategies to be implemented within the OrPHEuS project will provide a relevant contribution for a sustainable energy growth in our communities.

IMPLEMENTATION

The project investigates the implementation of the control strategies on specific use cases scenario in two demonstration sites located in the City of Skellefteå in Sweden and in the City of Ulm in Germany. The operational focus of the project is the cross-domain coupling of energy infrastructures in order to increase energy efficiency through energy transformation and grid coupling. With respect to the hybrid energy characteristics, both demonstration sites are quite distinct. At the Sweden demonstration site, the reduction of vertical production (driven unsustainable with fossil fuel) is in the centre of the targeted control strategies.

Looking on the specifics of the Ulm testing site, the major issue is the balancing of the high

Source: WIP

penetration of solar Photovoltaic (PV) generation under today's operation with a pre-dominant operational challenge for PV control. The key focus is to define control strategies to increase the intake of the energy supply from PV on the roof generation into the grid while maximizing the benefits for the low voltage power grid.

The project will optimize the PV electricity production at the Ulm testing site, which presents, at the test demonstration site area Einsingen, an over production, without self-consumption, of PV electricity of 230 MWh annually on an average annual electrical consumption of 1000 MWh. The test area Einsingen covers the area of one low voltage grid transformer in the village Einsingen.

The test site contains a single secondary substation transformer with a nominal power of 630 kVA (10 kV/0.4 kV). 137 houses are connected via eight feeder lines to this transformer. The houses are single family houses or multi-family houses as well as a couple of agriculture estates with living house and estate building. At the moment 20 PV systems with a summarized nominal power of 233 kWp are installed. The single system powers range from 2.2 kWp to 47.84 kWp. This equals to a penetration rate of 37 % of the transformer nominal power.

Airborne image of the test area Einsingen in Ulm (Germany) with the position of the PV systems and the transformer.

CONCLUSIONS

The OrPHEuS project investigates the challenges of complex communication coupling for hybrid energy grids towards new opportunities for increasing PV integration and researches control strategies embedded over networked communication and control system facilitating distributed system intelligence across coupled smart grids. This will result in a higher integration of renewable energy sources such as PV into the energy grids, in a reduction of CO_2 emissions, in energy savings and security of energy supply which will provide economic, social and environmental benefits to the communities where the OrPHEuS control strategies will be implemented.

The OrPHEuS project has received funding from the European Union´s Seventh Programme "Smart Cities 2013" for research, technological development and demonstration under grant agreement No. 608930.

Project website: http://www.orpheus-project.eu/

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Now is the time to change Europe's windows

By Bertrand CAZES, Secretary General, Glass for Europe

On July 22nd, the European Commission published a Communication on the EU energy efficiency framework by 2030. This Communication was supposed to lay out a strategy to improve the EU efficient use of energy, including policy ambition and proposal for concrete actions. In fact, it only proposes to improve energy efficiency by 30% in 2030, but does not specify, nor give indications on how this could be achieved. It only highlights the huge cost-effective energy saving potential associated with the renovation of existing buildings.

It even rightly suggests the huge energy efficiency gains which could be achieved thanks to state-of-the-art windows, when stressing that 44% of windows are still single-glazed in the EU. Unfortunately, no measures are suggested to address this fate.

REDUCING THE IMPACT OF ENERGY DEPENDENCE

At a time when Europe is directly confronted with the economic, political and geostrategic consequences of its growing energy dependency, the EU needs an urgent plan to reduce its energy dependency.

In the short term, the EU can increase its stock of oil and gas, while pursuing a diversification of supply strategy over the long-term, through investments in grids interconnection and new pipelines. However, such an approach does not solve the fundamental problem associated with high energy prices and its consequences for EU households and businesses. This will not solve energy waste issues either. Indeed, huge amount of energy are wasted each year in Europe mainly in the built environment, since buildings account for about 40% of the EU overall energy consumption and the majority of existing buildings are poorly insulated. In addition, EU countries which are the most dependent on one single fossil fuel supplier are also the one where buildings are the most energy inefficient.

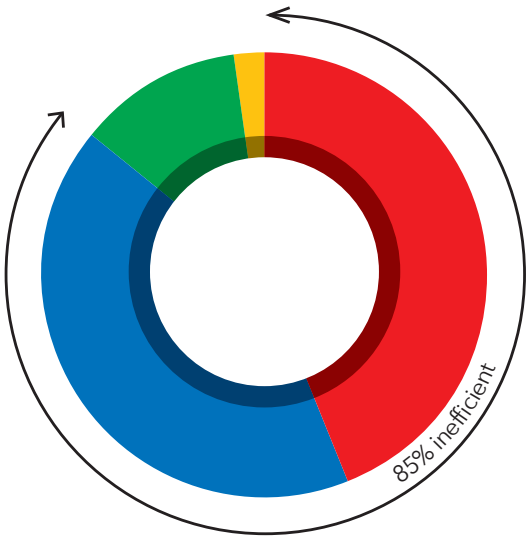
Against this backdrop, it would not be a sound investment to spend billions of euros over the next decade to reduce energy dependency upon one supplier, while continuing to waste significant amount of energy in poorly insulated buildings. Now is the time for a paradigm shift in the EU energy policy.

A NEW PARADIGM FOR ENERGY POLICY

The upcoming adoption by the European Council of the 2030 framework for climate and energy policies and the current geopolitical tensions at the eastern border of the EU provide the momentum for such paradigm shift in EU energy policy. This new paradigm should be to prioritize energy demand reduction and efficient use of energy over indigenous energy sources development and diversification of imports.

In practice, it means starting by reducing energy demand in buildings, through thermal renovation of the building

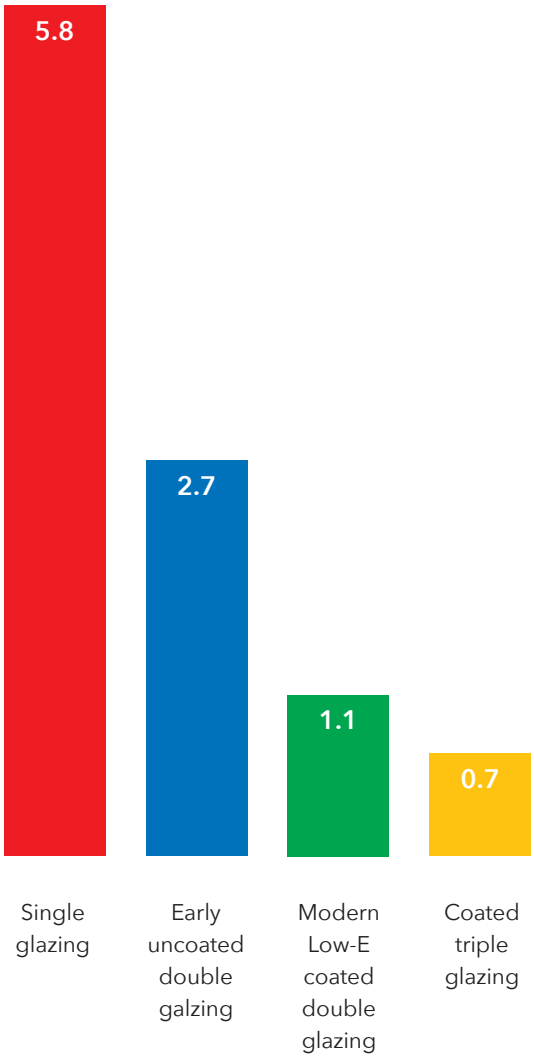
Glazing type distribution in the EU



- Single glazing 44%
- Early uncoated double galzing 42%
- Modern Low-E coated double glazing 12%
- Triple glazing 2%

Glazing insulation performances
U_g value W/m² K

975 TJ of energy and 100 million tonnes of CO_2 to be saved annually thanks to modern glazing solutions



envelope. However, given the importance in volume of the European building stock, following this thermal renovation path requires long-term planning and clear political ambition to attract investments. This is why high policy ambition for energy efficiency by 2030 and concrete policy measures are needed.

PRIORITIZE WINDOW RENOVATION THROUGH ADEQUATE POLICY INSTRUMENTS

In the short term, priority should be given to replacing the 44% of windows in Europe that are still single-glazed with high-performance double and triple glazed windows. These modern glazing solutions are 5 to 8 times more insulating than single glazed windows. By the way, modern glazing solutions are also nearly 4 times more performant than the early uncoated double glazed windows installed from the 1970's to the early 1990's and which represent about 42% of existing windows. A study by the Dutch Scientific TNO estimates that 975 TJ of energy and 100 million tonnes of CO_2 could be saved annually if all buildings in Europe were equipped with adequate windows solutions. Replacing single-glazed windows by modern solutions will also have the immediate consequence of reducing households' energy bills thanks to reduced heating and cooling needs while improving comfort. Most importantly, replacing inefficient windows by efficient ones is also a significant step towards mitigating the economic effects of high energy prices for households and reducing the negative consequences of a gas supply disruption during winter.

To facilitate the replacement of existing windows, an EU energy labelling scheme for windows needs to be rapidly developed to provide clear and easy information to consumers about the energy performance of windows on the market and to serve as a policy tool for subsidies and fiscal incentives.

Once the EU energy labelling scheme has been adopted, Member States should be required by a revised Energy Performance of Buildings Directive to establish fiscal incentives for the replacement of inefficient windows by top-rated products and set out new minimal energy performance for window replacements based on the energy ranking of the label.

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Energy efficiency policy and measures towards its improvement in Poland

By Ryszard Wnuk, The Polish National Energy Conservation Agency

Poland has made a significant progress on the way to meeting its national target in the field of rational energy management, i.e. achieving, by 2016, the final energy savings of no less than 9% of the average national final energy consumption in 2001-2005. As a result of GDP growth being faster than the growth in energy consumption, primary energy intensity and final energy intensity decreased (with the exception of the year 2010). In 2006-2009, the improvement rate exceeded 5% for primary energy consumption intensity, and amounted to nearly 4% for final energy consumption intensity. The sector with the largest demand for final energy was industry, although its demand dropped from approximately 38% in 2000 to 30.5% in 2011. Energy-intensive industries (steel industry, chemical industry and mineral industry) consumed about 60% of the overall industrial energy consumption. At the same time, a significant increase in energy demand, from 16.8% to 25.4%, occurred in the transport sector. The share of household sector consumption was 27%-29%, and the share of agricultural sector consumption dropped from 7.7% to 5.2%. Poland's distance to the average European values of key energy efficiency indicators decreased to over ten percent but compared to the most efficient economies it still remains significant.

ENERGY POLICY OF POLAND UNTIL 2030

Since 2010 Poland has been implementing the "Energy Policy of Poland until 2030". The policy, developed pursuant to the Act of 10 April 1997 - Energy Law (Journal of Laws of 2012, item 1059, as amended) aims at tackling the main challenges facing the Polish energy sector both in the short term perspective and in the long-term perspective until 2030.

Energy Policy of Poland is aimed at increasing energy efficiency of the country's economy which translates into a reduction of its energy intensity. The policy is implemented with the following goals in mind:

- the planning of activities which to the largest possible extent are based on market mechanisms and to the lowest possible extent make use of public funding;
- pursue the goals in accordance with the principle of cost effectiveness, inter alia through the maximum use of existing mechanisms and organizational infrastructure;
- make use of the national potential in the field of energy efficiency improvement;
- take into account technological requirements relating to energy generation, transmission or distribution.

The Energy Policy of Poland sets out the following measures to improve energy efficiency:

- Setting the national energy efficiency increase target;
- Introducing a systemic mechanism to support measures aimed at attaining the national energy efficiency improvement target;
- Stimulating development of cogeneration through support mechanisms taking into account cogeneration sources up to 1 MW as well as adequate policy of municipalities;
- Using mandatory *energy performance certificates* for buildings and apartments upon their marketing or renting;
- Determining energy intensity of devices and energy

consuming products, as well as introducing minimum standards for energy-consuming products;

- Committing the public sector to serve as an exemplary role in the field of economical consumption of energy;

- Providing support to energy saving investments, through preferential loans and grants from domestic and European funds, including funds available under the Act on supporting thermal modernisation and renovation, the Operational Programme Infrastructure and Environment, and the National Fund for Environmental Protection and Water Management;

- Supporting research and development work on new solutions and technologies reducing energy consumption in all fields of energy processing and use;

- Applying Demand Side Management techniques stimulated e.g. by diversification of distribution fees within a day and of electricity prices, based on reference prices resulting from the introduction of an intra-day market, and sending price signals to customers through remote two-way communication via smart meters;

- Informational and educational campaigns promoting efficient energy consumption.

The above mentioned measures were improved and updated with time and their implementation was evaluated in the subsequent National Energy Efficiency Action Plans.

FIRST AND SECOND ENERGY EFFICIENCY ACTION PLANS

Pursuant to Article 14 paragraph 2 of Directive 2006/32/EC, in 2007 the Polish Ministry of Economy developed the first National Energy Efficiency Action Plan (NEEAP). The document determined the final energy saving target for the year 2016. The target was set as no less than 9% of average annual energy consumption in the period 2001 - 2005 (i.e. about 53 452 GWh). Also, an interim national energy saving target was determined for the year 2010 in the amount of 2%. The interim target was a stage on the path of achieving the 2016 target and helped to assess the progress in its achievement. The Energy Efficiency Action Plan also outlined the measures and activities implemented and planned at the national level with the aim to achieve the national indicative targets in the period in question.

The main difficulties in developing the energy efficiency improvement measures and the implementation of the first National Energy Efficiency Action Plan (2007) were:

- too little interest in the energy efficiency improvement measures on the side of energy companies;

- lack of incentives in the form of preferential tariffs for consumers who rationally use energy;

- too little support for measures taken by citizens in order to increase energy savings;

- financial obstacles (e.g. lack of predetermined budget, limited assistance funds);

- small-scale effects of energy saving measures taken by households;

- limited knowledge and low awareness of energy consumers (e.g. lack of knowledge of sources of information on energy efficiency).

In Poland until 2011 there was no legislation that would ensure the implementation of energy efficiency improvement programmes and measures necessary to achieve the required savings. There were not existed sufficiently strong market mechanisms to encourage the implementation of energy saving measures. Therefore, a new legal regulation entitled Energy Efficiency Act, was adopted on 15 April 2011, with the aim to develop mechanisms to stimulate energy efficiency improvement. The Act introduced the obligation to obtain a sufficient number of energy efficiency certificates (so-called white certificates) by energy companies selling electricity, heat or natural gas to final customers connected to the grid or network within the territory of Poland.

The second National Action Plan included a description of energy efficiency improvement measures relating to final energy consumption, as well as calculations of energy savings achieved in 2008-2009 and expected by 2016 in accordance with the requirements of the above mentioned directives.

Table 1. Energy efficiency targets for 2020, pursuant to Directive 2012/27/EU

Energy efficiency target	Energy consumption in 2020	
Reduction of primary energy consumption in the years 2010-2020 (Mtoe)	Final energy consumption (Mtoe)	Primary energy consumption (Mtoe)
13,6	71,6	96,4

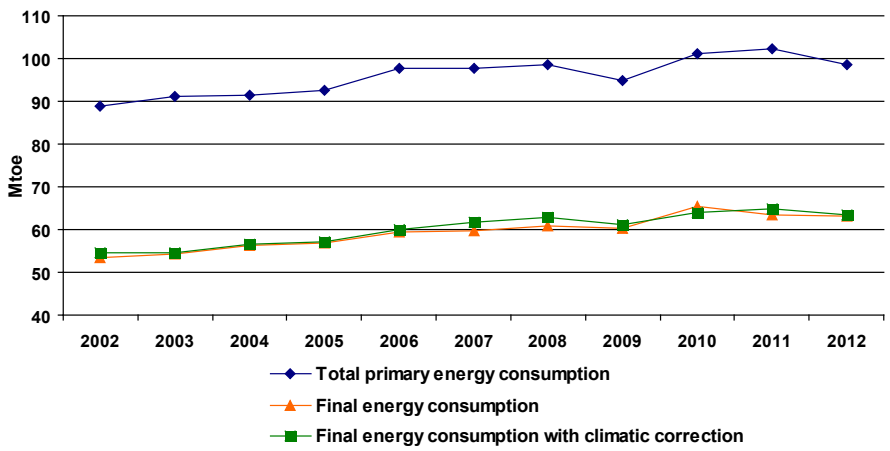
The document was developed by the Ministry of Economy, in cooperation with: the Ministry of Transport, Construction and Maritime Economy; the Central Statistical Office (GUS), and the National Energy Conservation Agency (KAPE). The document contained, in particular, a description of the planned measures to improve energy efficiency in the sectors of the economy in order to achieve the national energy saving target for the year 2016.

The third National Energy Efficiency Action Plan (2014), which is currently being finalised, summarises the achieved energy efficiency improvement targets, sets up the targets for 2020 and updates undertaken measures. Many of the measures set out in the document were already mentioned in the second NEEAP.

NATIONAL ENERGY EFFICIENCY TARGETS AND ENERGY SAVINGS ACHIEVED

Pursuant to Article 3 paragraph 1 of Directive 2012/27/EU, a national energy efficiency target for 2020 was set, as presented in Table 1. The target is understood as the achievement in the years 2010-2020 of primary energy consumption reduction by 13.6 Mtoe, which in the conditions of economic growth also means an improvement of energy efficiency of the country's economy. The target was also expressed in terms of an absolute level of primary energy consumption and final energy consumption in 2020. The energy efficiency target for 2020 was set up based on data developed as a result of the analyses and forecasts carried out for the needs of the governmental document "Energy Policy of Poland until 2030".

Fig. 1. Total primary and final energy consumption in 2002 - 2012



Total primary energy consumption increased during years 2002-2012 from 89 Mtoe to 99 Mtoe (1.0%/year). Decrease in consumption was recorded in 2009 and 2012 i.e. during periods of low economic growth. In case of final energy consumption average annual growth rate amounted to 1.7% during given period. In absolute terms, this represents an increase from 53 to over 63 Mtoe. In this case, the fall in consumption was observed, in addition to those earlier years, also in year 2011. After taking into account different weather conditions, that is in case of final energy consumption with climatic correction consumption growth rate amounted to 1.5%/year in the period 2002-2012.

Table 2 presents final energy saving targets (final energy consumption) calculated in accordance with Directive 2006/32/EC (the 2% intermediate target for 2010, and the target for 2016: 9% of the average national energy consumption in 2001-2005), as well as energy savings achieved.

The 2020 target of primary energy consumption is ambitious taking into account its steady growth in last ten years.

The energy savings have been calculated in accordance with the European Commission recommendations contained in the document *Recommendations on Measurement and Verification Methods in the Framework of Directive 2006/32/EC on Energy End-Use Efficiency and Energy Services.*

Growth of GDP faster than the growth in energy consumption

Table 2. Final energy saving targets and final energy savings achieved

I	Final energy saving targets		Final energy savings achieved in 2010 and savings planned to be achieved in 2016	
	ktoe	In %, in relation to the average consumption in 2001-2005	ktoe	In %, in relation to the average consumption in 2001-2005
2010	1020	2	4725	9,3
2016	4596	9	7085	13,9

resulted in observed decreasing, with the exception of year 2010, primary and final energy intensity of GDP (Fig. 2). In the first half of the decade, energy intensity decreased by over 2% per year, in years 2006-2009 the rate of improvement exceeded 5% in case of primary intensity, and amounted to nearly 4% in final energy intensity. In years 2009-2011 the rate of improvement has fallen (2010 the energy intensity of Polish intensity increased first time in many years).

The calculations of energy savings executed by using ODEX indicators confirm the improvement of energy efficiency of Polish economy and its sectors.

ODEX indicator declined in years 2002-2012 from 91.8 to 71.6 points. The average rate of improvement amounted to 2.5%/year. The fastest rate of improvement (4.8% annually) was achieved by manufacturing. In the household sector ODEX indicator was dynamically falling until year 2003, then the rate of improvement was little. Average annual improvement in the years 2002-2012 in this sector amounted to 1.7%. In the transport sector, the indicator remained at similar level to 2004 and then began to decline. Overall in the period 2002-2012 the average rate of improvement amounted to 1.6%/year.

Table 3 presents final energy savings achieved in the years 2010-2012, broken down by final energy consumption sectors.

On the base of ODEX the calculations of energy savings and its prediction for next years was executed. The calculations confirm the top-down results and proved Poland progress in the field.

The top-down calculations of energy savings and by ODEX indicate significant increase of energy efficiency of economy. There is a role of measures implemented by government, also influences positively awareness of society showing importance and benefits of decreasing energy consumption.

Table 3. Achieved final energy savings by sectors

Sector	**Achieved final energy savings (GWh)**		
	2010	**2011**	**2012**
Households	1458	1192	1863
Services	0	0	0
Transport	1525	1247	2162
Industry	1742	2185	2317
Total	4725	4625	63422

Fig. 2. Energy intensity of GDP

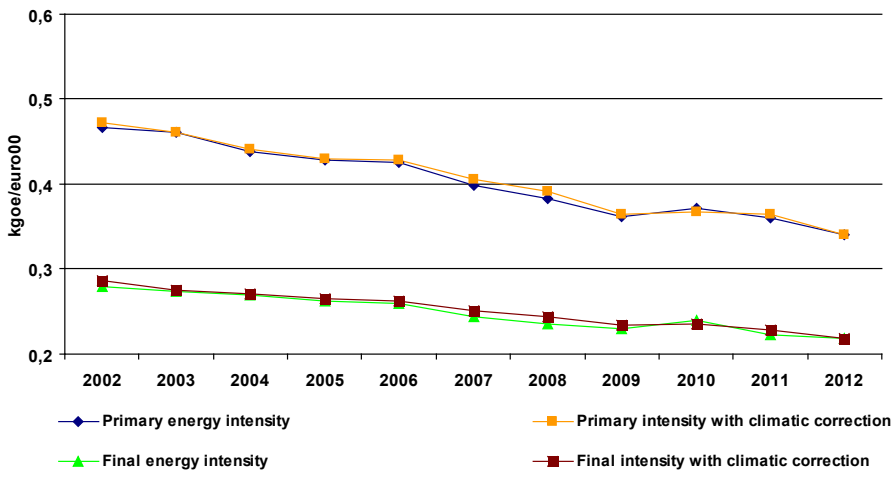
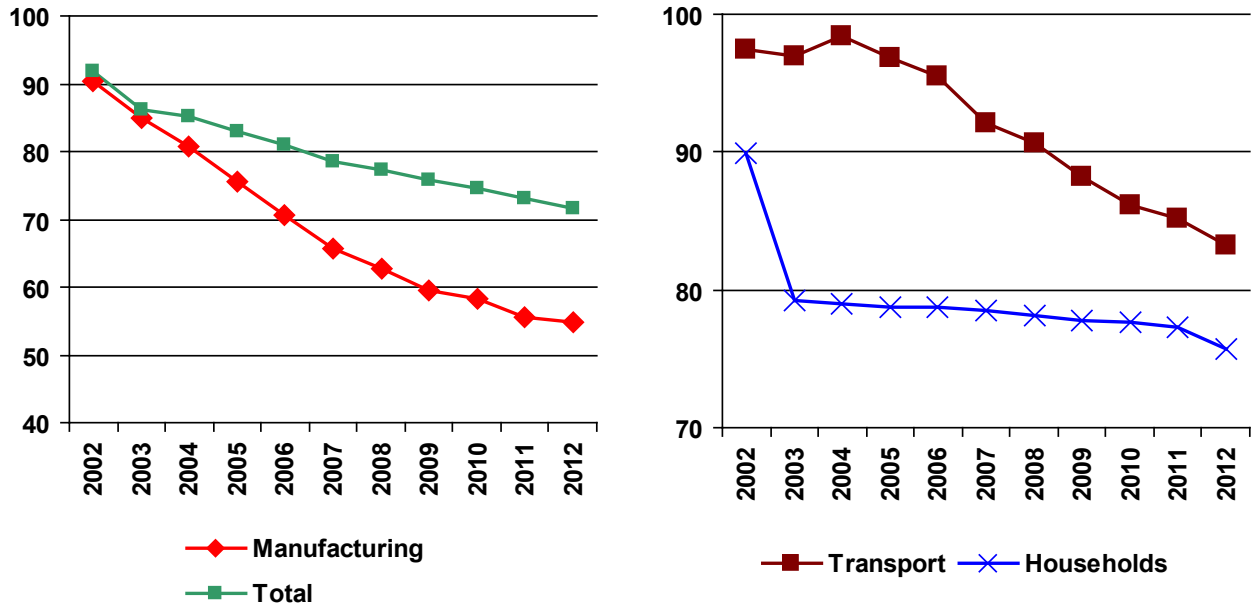


Fig. 3. ODEX indicators for economy sectors and total



ENERGY EFFICIENCY IMPROVEMENT MEASURES

The draft *Third National Energy Efficiency Action Plan* of 14 May 2014 provides for the following energy efficiency improvement measures:

Horizontal measures:

- the obligatory energy efficiency improvement scheme (white certificates);
- support for entrepreneurs - energy audits of companies;
- the priority programme "Smart Power Grids";
- information and education campaigns.

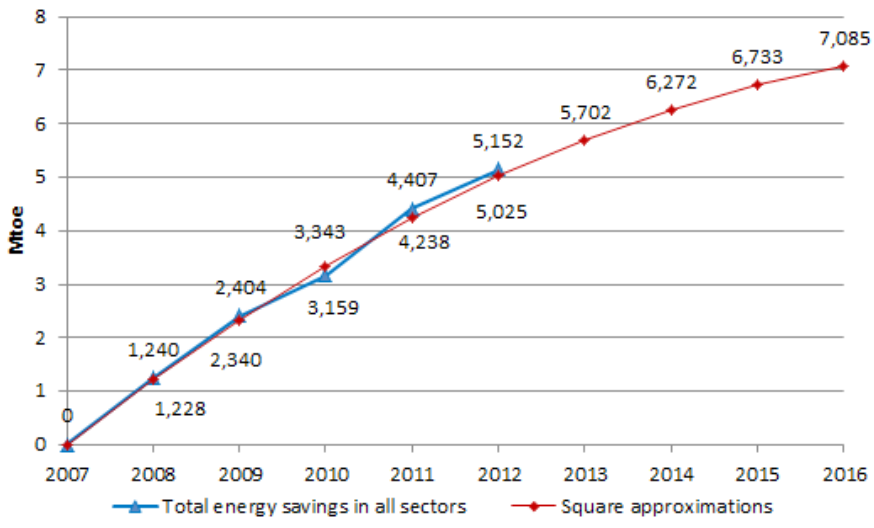
Measures in the field of energy performance of buildings:

- Thermal modernisation fund;
- Green Investment Scheme (Part 1) - Energy management in buildings of selected public sector entities;

Energy efficiency measures in public institutions:

- Operational Programme PL04 "Saving energy and promoting renewable energy sources" (area no. 5 - energy efficiency);
- Green Investment Scheme (Part 5) - Energy management in buildings of selected public sector entities;
- Efficient use of energy (Part 4 - LEMUR) - Energy-efficient public utility buildings;
- Operational Programme Infrastructure and Environment (Measure 9.3) – Thermal modernisation of public utility buildings;
- Efficient use of energy (Part 6 –

Fig. 3. Total energy savings up to 2012 (for 2007 as a base year) calculated by ODEX and its square approximation 2007-2016



SOWA) – Energy-efficient street lighting systems.

Energy efficiency measures in industry:

- Support to entrepreneurs focused on low-emission economy - energy efficiency increase;
- Access to financial instruments dedicated to SMEs (PolSEFF);
- Operational Programme Infrastructure and Environment (Measure 9.1) - Highly efficient power generation;
- Operational Programme Infrastructure and Environment (Measure 9.2) - Efficient energy distribution.

Energy efficiency measures in transport:

- Traffic management systems, freight transport optimisation systems and fleet replacement programmes for urban transport companies;
- Green Investment Scheme (Part 7 - Gazela) - Low-emission urban transport.

The measures listed above are described in MURE database (http://www.odyssee-mure.eu/), in framework of ODYSEE-MURE project Intelligent Energy for Europe programme activities.

Especially interesting is Polish "white certificate system", being introduced 2012.

THE ENERGY EFFICIENCY OBLIGATION SCHEME IN THE FORM OF ENERGY EFFICIENCY CERTIFICATES

The energy efficiency obligation scheme was introduced under the Energy Efficiency Act of 15 April 2011 (Journals of Laws: No. 94, item 551; and of 2012, items 951, 1203 and 1397). The scheme has been operating since 1 January 2013. The Act requires energy sales companies which sell energy to final customers to obtain energy efficiency certificates, hereinafter referred to as „white certificates", and submit those certificates for redemption to the President of the Energy Regulatory Office (ERO).

Pursuant to Article 25 of the Act, the energy efficiency certificates are a source of transferable property rights which constitute a commodity tradeable on commodity exchanges, within the meaning of the Act of 26 October 2000 on commodity exchanges (Journal of Laws of 2014, item 197), and are thus tradeable on the Power Exchange. Energy efficiency certificates may only be obtained for projects characterised by the highest economic efficiency. The projects are selected by way of tenders organised by the President of ERO. The successful winners are those entities which declare the largest energy savings compared to the value of energy efficiency certificates obtained.

The first tender to select energy efficiency improvement projects for which energy efficiency certificates might be obtained was announced by the President of ERO on 31 December 2012, and covered the following three categories:

- increase in energy savings by final customers,
- increase in energy savings by devices operated to meet own needs, which devices were understood as a set of auxiliary facilities or installations used for electricity or heat generation process,
- reduction of transmission losses or distribution losses of electricity, heat or natural gas.

Under the scheme, companies subject to the energy efficiency obligation have to obtain certificates with a specific value and present those certificates for redemption each year starting from 2013. The certificates' value and the method of its calculation is set out in the Regulation of the Minister of Economy of 4 September 2012 on the method of calculating primary energy amount corresponding to the value of an energy performance certificate, and on the unit value of the substitution fee (Dz. U. [Journal of Laws], item 1039).

The bottom-up calculations of the listed above measures indicate much less energy savings than presented by top-down methodology, which illustrates the effects of governmental activities. First of all the activities towards energy efficiency improvement are being continuously undertaken by industry, obliged by market forces to increase competitiveness. Other sectors and society themselves are also being aware of benefits coming out from energy efficiency measures.

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Poland to implement a new RES support scheme soon

By Arkadiusz Sekscinski, Deputy President, Polish Wind Energy Association

Is the new, planned auction-based support scheme for energy from renewable sources capable of supporting wind energy development to enable Poland to achieve its 2020 targets as laid down by the EU regulations?

Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources imposes on the EU Member States an obligation to achieve a certain share of energy from RES in gross final energy consumption. For Poland the share has been specified at 15%. The target pertains to final energy, including electricity, heating, cooling and transport fuels.

The renewable industry in Poland claims the Government's actions in the area of implementation of the Directive are insufficient. Despite many efforts and subsequent versions of the Renewable Energy Sources Act no final solutions have been implemented to date. Moreover, on 27 January 2011 the European Commission launched a formal procedure concerning non-transposition of Directive 28. On 21 March 2013 the EC filed a complaint against Poland with the EU Court of Justice[1].

The latest draft RES Act has been accepted by the Council of Ministers on 8 April 2014. However, it has not been submitted directly to the Parliament, as the Government at the very last moment decided not to subject the modifications to the existing support scheme (green certificates) and the new support scheme (RES auctions) to the notification procedure. Such an opportunity is given by the new EU regulation applicable from 1 July 2014 – "General Block Exemption Regulation for state aid". In accordance with the Polish Government's assumptions the auctions would become effective on 1 January 2016. Investments completed before the deadline could remain in the green certificates scheme or undergo a transition to the new scheme. The transitory period issues are still subject to discussion and will be finally settled in the Polish Parliament.

The wind energy industry sees opportunities in the new draft, however it stresses that several crucial elements still need to be improved. The first reading of the draft was made on 22 July in Parliament. The substantial work on the new law should be in the energy parliamentary committee starting on 27 August when MPs will be back from vacation.

Marshall of Seym (lower chamber of Parliament) expects the second reading of the law to be made by the end of September. MPs and NGOs expect much work but they all want to finish with a very good outcome and implement the new law no later than by 1Q 2015.

THE NEED TO SETTLE ELECTRICITY IN THREE-YEAR PERIODS

Provisions of the draft RES Act stipulating that the subject of the auctions will be the amount of MWh produced per year, with the right to perform settlements in three-year periods, in the opinion of the Polish Wind Energy Association discriminate the wind energy sector. An investor intending to comply with the declared amount of MWh supplied over a three-year period would have to substantially understate the productivity of a wind project compared to the P50 level, constituting a recognized standard. Therefore, the investor would be forced to offer a higher price during an auction to achieve the assumed revenue level.

Auctions for the amount of energy require introduction of a declared production adjustment scheme taking into account methodologically legitimate deviations from the estimated productivity (a scheme applied in the Netherlands assumes 20% deviation during a year). It seems that this remark filed by the Polish Wind Energy Association might be accepted by the legislator.

INTRODUCTION OF A DIVISION INTO PROJECTS ABOVE AND BELOW 4000 MWH

Limiting auction volumes for technologies operating ≤4000 h/year clearly contradicts the

1. Cf. the EC's press release dated 21 March 2013, available at http://europa.eu/rapid/press-release_IP-13-259_pl.htm.
2. "European Commission guidance for the design of renewable energy support schemes" COMMISSION STAFF WORKING DOCUMENT

document entitled "European Commission guidance for the design of renewable energy support schemes" , developed by DG Competition and published on 5 November 2013. The document stipulates the so-called technological neutrality criterion as one of the fundamental criteria. This means that each RES technology shall be assessed and considered only and exclusively in terms of a single criterion, i.e. the cost of construction of capacity or production of electricity in a renewable source. Furthermore, such a provision contradicts Directive 2009/28/EC, in accordance whereof Member States shall ensure guarantee of transmission and distribution of electricity from RES by transmission and distribution system operators as well as priority access to the network system for energy from RES. The solution is subject to a discussion and might be modified – obviously, there are not only legal, but also technical and economic premises to do so.

NO SUBSTITUTION FEE INDEXATION

The draft Act stipulates that unit substitution fee (constituting a benchmark for certificate prices in the current scheme) will not be subject to indexation and will be fixed at PLN 300.03 per 1 MWh. The substitution fee substantially affects green certificate prices. Therefore, the substitution fee substantially affects the value of green certificates, and its freeze might result in the decrease of market value of green certificates, leading to adverse financial results for investors.

In accordance with the draft Act the nominal unit substitution fee would remain unchanged irrespectively of the inflation level in Poland. It is crucial that the support cannot be regulated on the basis of a parameter independent both from the Government and market participants, i.e. inflation. No substitution fee indexation would lead to a number of adverse effects for both the Government and investors.

In such circumstances investors will expect higher rates of return from the support scheme, what will have to be ensured by higher auction bids, resulting in higher support scheme costs. However, such an approach is contradictory to the Government's approach under the so-called "optimisation" of the support scheme, which in principle is to create a scheme that is less expensive compared to the current one. Therefore, it is necessary to restore substitution fee indexation by inflation.

ONE-YEAR TIME HORIZON FOR THE SPECIFICATION OF AUCTION VOLUMES AND REFERENCE PRICES

The frequency of announcement and methodology for the calculation of Reference Prices is also subject to discussion. The Reference Prices are to constitute a price cap – the fundamental auction scheme entry criterion. In the opinion of the Polish Wind Energy Association the Reference Prices shall be announced for a period of three subsequent years, subject to annual "rolling" update as well as potential application of a degression factor in subsequent years to reflect the expected technological progress for particular technologies (a solution proposed in the previous version of the RES Act).

Similarly to Reference Prices, also auction volume (MWh limit) for each year shall be planned for at least five years in advance and announced upon introduction of the new scheme. The auction size would then be announced pursuant to a rolling scheme to always maintain the three-year period. This will ensure system transparency and enable entrepreneurs to accordingly plan their business operations. MWh limits unused in a particular year shall increase the next year's limits.

Arkadiusz Sekscinski

SUMMARY

The renewable energy industry stresses that the draft RES Act is an opportunity to introduce stable solutions for further development of the sector. Although the sector is critical in its remarks, it has to be admitted that many of the remarks have been accepted during the governmental works, enabling the green certificates scheme and the new auction scheme to operate efficiently. The wind energy industry solely expects to build at least 3 000 MW of new capacity by 2020 (current installed capacity amounts to approximately 3 500 MW). However, to achieve the goals we need a stable legal framework. The discussion on the RES Act is pending, shifting from the government to the Parliament. It is clear that the decision-makers and the industry head for a compromise, which means that the new law can be adopted before the end of 2014.

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