european energyinnovation

SPRING 2016

INDUSTRY: ENERGY EFFICIENCY

SHIPPING

TRANSPORT DECARBONISATION

Includes editorial contributions from:

Violeta Bulc
EU Commissioner
for Transport

Jos Delbeke
Director-General
DG Climate Action
European Commission

Gesine Meissner
MEP

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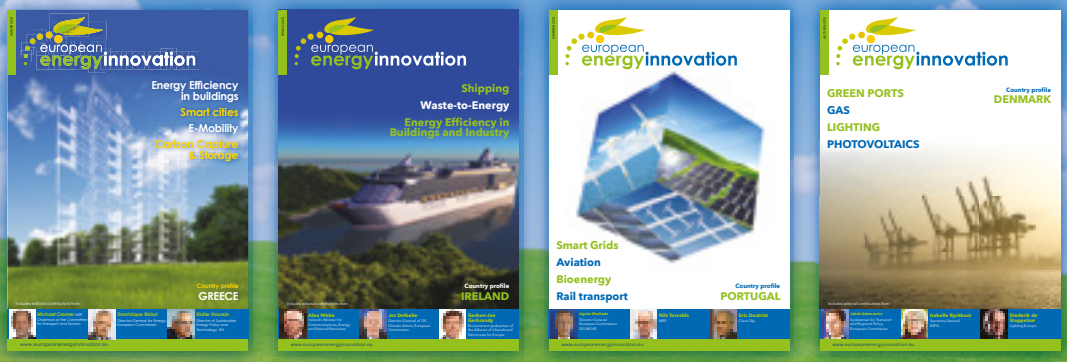

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The publishers of European Energy Innovation would like to offer their sincere thanks to all individuals and organisations who have contributed editorial images photos and illustrations to the magazine. Whilst every effort has been made to ensure accuracy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

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

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www.europeanenergyinnovation.eu

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DESIGN & PRODUCTION
RayHeathDesign.co.uk

WEBSITE DESIGN
pulseart.co.uk

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

Foreword

Welcome to the Spring Issue of EEI, which focuses upon Shipping and Manufacturing. We are delighted to feature Transport Commissioner Violeta Bulc, who explores how European transport is contributing to the fight against climate change. She draws our attention to the importance of the task ahead, and how new technologies, new organisation and new legislation can contribute to the decarbonisation of transport. Jos Delbeke, Director-General at DG Climate Action emphasises the importance of the COP21 agreement as a turning point in that fight. He discusses how shipping emissions are expected to rise sharply in the absence of further measures, but that initiatives such as The Energy Efficiency Design Index; and market-based measures and the anticipated global adoption by the IMO of EU-MRV, the EU's own monitoring system together can help the shipping sector play its part in achieving the emissions reductions called for in Paris. In his excellent review, Mark Clintworth from the EIB examines the legislative environment (such as SECA and the sulphur directive) and its funding implications for an industry that contributed €56 billion to EU GDP and €6 Billion in EU tax revenues in 2012. Patrick Kennedy of EFFRA discusses REEMAIN, MEMAN, and SUPREME, three projects under the €1.5 Billion 'Factories of the Future' initiative, while distinguished trio Maher Chebbo, Patrick van Hove, and Professor Nikos Hatziargyriou explore the role of digital technologies in a 21st century low-emission energy system. With intelligent contributions from MEPs Pilar del Castillo, Seán Kelly and Karima Delli; and a forward-looking article from Hans ten Berge of EURELECTRIC, there is a great deal more for you to read inside.

Meanwhile, there is a tide of migrants flowing across a sea of misery, to be washed up on European shores that seem less prepared and less hospitable. The situation in Syria, Greece, Macedonia, Turkey and elsewhere is both desperately sad and increasingly urgent; and it begs the question how much worse must it have been to force so many to make that journey; indeed, how much worse still it must be for those left behind. We cannot ignore the humanitarian catastrophe that is unfolding, for even if it does not yet directly concern the energy community, there are nevertheless indirect consequences of the assimilation of large numbers of new Europeans: consequences for planning, infrastructure, transport - and energy. All this is to say nothing of the ramifications of increased border controls and their effect upon the flow of goods and services across the continent; and of distraction from the situation in Ukraine, with all this entails for oil and gas pipelines from the East.

There is also a great deal more to think about.

Michael Edmund
Editor

European Commission

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SUSTAINABLE ENERGY WEEK
13-17 June 2016

Energy

Three questions to Morten Helveg Petersen

Vice Chair of the Industry, Research and Energy Committee, MEP Morten Helveg Petersen

As a Member of the European Parliament in the ALDE group and Vice Chair of the Industry, Research and Energy committee, Morten Helveg Petersen's mission is to support the development of a European Energy Union and a genuine single market for energy, based primarily on renewable energy sources and highly energy-efficient technologies to meet Europe's energy needs in the 21st Century while fighting climate change.

WHAT DOES SUSTAINABLE ENERGY MEAN TO YOU?

Sustainability means many things to many people. For me the discussion about sustainable energy should go beyond environmental or social considerations taken in isolation. What we need, and what we are in many cases seeing is the best use of energy – by this I mean optimising outcomes with the most efficient use of resources available.

By building this kind of thinking into our urban planning, our electricity grids, heating and cooling systems and our transport networks, we can create synergies that lead to highly efficient, cost-effective and environmentally-friendly solutions.

The obvious example is coupling waste heat from industrial or commercial processes to district heating systems, turning waste heat into a product, cutting gas consumption, lowering costs to consumers and making the most of available resources. We're seeing limited examples of this today, but to really optimise this possibility we need to go for genuinely smart planning that cuts across different sectors. In so many cases, the opportunity is there but the strategic vision isn't. If we can develop this approach we can achieve genuinely sustainable energy systems.

WHAT ARE THE TRENDS THAT WE SHOULD LOOK OUT FOR IN SUSTAINABLE ENERGY? AND WHAT IMPACTS DO THEY HAVE ON WHAT WE'RE DOING NOW OR IN THE FUTURE?

More innovative thinking: It's a cliché, but we are beginning a genuine period of energy transition now. One way or another fossil fuels and centralised power generation are in decline, and many more intermittent renewables are coming into Europe's power grids.

There are huge possibilities to transform our energy systems to give us more energy security and resilience, lower costs for industry and consumers, and minimise or even eliminate greenhouse gas emissions. But this can only be achieved when we change our mind-sets.

We're looking at a much more dynamic but also challenging energy market. Monopolies will slowly break up and we will see much more regionalisation and localisation of energy supply and use.

This creates a much more open environment for innovation and new thinking to influence how we use energy, but the true potential of all this will only be realised with much more innovative thinking and with more input from outside the old guard big energy companies. It's genuinely exciting!

DO YOU PLAN TO ATTEND EU SUSTAINABLE ENERGY WEEK (EUSEW.EU) IN JUNE? WHAT WOULD YOU HOPE TO GET OUT IT?

Absolutely! This initiative is a fantastic opportunity to build connections and partnerships with others active in this important area. It's always great to catch up with friends and colleagues as well as developing new connections and new ideas.

"It's a cliché, but we are beginning a genuine period of energy transition now. One way or another fossil fuels and centralised power generation are in decline."

Morten Helveg Petersen, MEP

"There are huge possibilities to transform our energy systems to give us more energy security and resilience… But this can only be achieved when we change our mind-sets."

How is European transport contributing to the fight against climate change?

By Violeta Bulc, EU Commissioner for Transport (pictured)

No matter our background, location or income – mobility and transport affects our daily lives. Changes to how the transport network operates in Europe can often be an emotive issue. However, reform to how the system works currently is necessary. We cannot maintain the status quo and maintain the planet for future generations. The EU played a central role in brokering a historic climate deal at the COP21 in Paris, where 195 countries adopted a new universal, legally binding global climate deal. It is my intention, as European Commissioner for Transport to build on this momentum.

The EU has set targets to reduce greenhouse gas emissions by 40 per cent overall by 2030 (on 1990 levels) and transport – which accounts for 24 per cent of CO_2 emissions in the EU – has its part to play.

To reach our targets, significant changes will have to occur. New

technology, for example to increase the share of renewable energies in transport or make vehicles and vessels more energy efficient, will play a central role as we decarbonise our transport network to better serve the needs of people and business. Investment will be vital, as well as a regulatory framework that allows Europe's pool of talented people and companies the freedom to innovate and provide mobility solutions and services.

There will also be a need to organise our transport system differently, to make a greater use of less greenhouse gas intensive modes such as inland waterways or railways, plan our cities better to allow for a greater share of walking and cycling, and better integrate the different means of transport to get the right mix.

But for now let us look a little closer at each of the four main modes of transport.

On road, the European Union has set CO_2 emissions standards for vehicles. There are targets running until 2021. By that year, the average emissions of new cars sold in the EU (per manufacturer) will be 95 grammes of CO_2 per kilometre, compared to 124 grammes today. Changes to the procedure to test emissions will soon enter into force and will guarantee a more accurate assessment of car emissions. We will also need to improve the efficiency of road transport operations, avoiding empty runs and stimulating fleet renewals. Strengthening public transport is particularly important in that respect. And if we want to increase the demand for vehicles using alternative energies, a critical condition is sufficient infrastructure for recharging and refuelling. In 2014 the EU adopted a framework for creating this infrastructure which Member States are now implementing.

In the **skies**, much is being done to reduce the impact of **aviation** emissions. In order to be effective, my preference is to tackle CO_2 emissions from aviation through global action, as aviation is global by nature. We are working closely with the International Civial Aviation Organisation (ICAO) on two ambitious global measures. The first is on a CO_2 Standard for aircraft, where a landmark agreement was reached at expert level at ICAO in February. It could save up to 650 million tonnes of CO_2 emissions by 2040.

The second is to develop a global mandatory system to offset aviation emissions. The goal is to achieve carbon neutral growth from 2020 in a cost-effective manner. I also welcome the recent news by an EU airline taking the first steps to develop a hybrid plane. In the medium term alternative propulsion systems will have to be developed to make aviation more sustainable, in view of the ever-increasing demand for flights.

On **rail,** work is progressing on the **Fourth Railway Package**. Agreement was secured on technical aspects last year, improving interoperability and facilitating the placing on the market of new rolling stocks. Work is ongoing to get agreement on opening up domestic passenger rail markets. There is a need for investment in our rail infrastructure. The **Fourth Railway Package** provides a framework to attract much needed investment and new operators into the market. Competition has revitalised other sectors and I am confident, if a deal can be reached in the coming months, that rail can be revitalised too.

Briefly to **maritime**: The major goal for this year is to ensure International Maritime Organisation member states agree on a global CO_2 reporting scheme as a first step towards making serious inroads into cutting emissions in this sector.. In parallel, the EU and its international partners should start thinking about an effective global measure to reduce CO_2 from shipping. Again, the Paris agreement has given renewed impetus in finding a deal.

It is important that challenges are changed into opportunities, so the EU can become more competitive and lead the change globally. I invite industry to come on board, seize the opportunity and maintain the momentum.

Of course, while it is necessary to have strategies to reduce the impact of individual modes of transport, ultimately, we are moving away from the 'silo' mentality of the past. The future of mobility will see carbon-free, smart and seamlessly integrated transport network.

Owning the transport we use, such as cars will be less important. Switching modes will become easier, as real-time information planners become more integrated. Not only will this be good for us as citizens today, but it represents a huge opportunity to reduce the impact of climate change, so we can hand our planet on to the next generation.

Energy Labelling: More than Just a Sticker

By Ashley Fox, MEP

When the eco-design (2005) and energy labelling (1995) directives were introduced it was with the primary aim of reducing the life-cycle environmental impact of energy using products. If drafted and applied correctly, the directives can also have a positive effect on product innovation and as a result the competitiveness of manufacturers. However, the legislation has been a pet hate of the tabloid press in the UK, and in other EU counties, with the recent eco design requirements on vacuum cleaners causing much consternation. It's unfortunate that public perception is so negative towards a policy that can not only save them money on their energy bills but has been cited by the International Energy Agency as having been one of the EU's best instruments at reducing energy demand and consumption. That does not mean that eco design should completely ignore consumer concerns, the end user experience should not be altered in any noticeable way, be it the suction power of a vacuum or the brightness of a lightbulb.

This isn't to say the legislation has been without problems. In the European Parliament we are now working through the latest revision proposed by the European Commission. The legislation was last revised in 2010, introducing the A+, or A++, or A+++ classes so that a range of different scales exist across the labelled product categories. I don't think that works for consumers. Indeed, several studies have shown the A to G scale to be

the most easily understood and it seems that there will be an agreement to (eventually) revert back to it - this improved clarity will almost certainly improve consumer understanding and purchasing behaviour.

However, perhaps the most important aspect of the rescaling should be ensuring that the top energy classes are not reached too early. They must remain empty as an incentive for manufacturers to develop new and innovative products. This is why it is important to develop a system where we consider the future evolution of a product category over the longer-term development cycle. In simple terms this would mean introducing a label today where, say, no products are in the top one or two categories (A or A and B) and are unlikely to be populated by more than 25% - 35% of the products available on the market within the next 10 years. Achieving an A therefore offers a clear incentive to develop a product and invest in the innovation process.

Beyond the label we also need to look at what more can be done within the legislation to improve the market for energy using products as well as boost the innovation potential of the product categories. Therefore we need to identify and optimise the regulation - which will include focussing on ambition; the participation of industry in the process; and improving market surveillance. Finally we will also need to provide the long term stability and predictability of the regulatory process, which given the number of revisions to this legislation to-date, needs to be achieved this time.

The emphasis on Lowest Life Cycle Cost (LLCC) also needs to be reconsidered, though we may perceive this direction to be the best course of action today, it may preclude channels that offer better life cycle costs in the long run. Instead, allowing more focus on equivalent costs and potential learning curves would not only offer more flexibility but it can also extend possibilities for greater technological advancement over time. The legislation must remain cognisant of the extent to which innovation is possible within a product category. If the technologically reasonable limits of energy efficiency innovation has been reached, then categories shouldn't necessarily be marked down - at the very least other factors such as resource efficiency should be considered.

An issue that has been raised is a number of products that do not comply with eco design requirements are still in circulation. The lack of market surveillance has stymied the motivation of manufacturers to innovate. The effect of this is that manufacturers lose confidence in the system and therefore the energy efficiency gains (and costs savings for consumers) do not materialise in the volume that they should. This requires not only greater efforts by the market surveillance authorities in the EU's 28 Member States but also requires improvements to the legal terms for following up on non-compliance as well as specific clauses related to defeat devices.

To improve surveillance the draft legislation on labelling proposes the creation of a pan-European database for products that are sold with an EU energy label. The premise behind this idea is that it will assist market surveillance authorities to access the information they need, as well as ensure that a business only has to provide the information once to the database rather than responding to numerous requests. However, this proposal has triggered intense political debate. Selected parties on the left want to turn it into a do-it-all database of sales data; resource use; and anything else they can think of. This has benefits; the creation of this dataset could enable data mining so that consumers searching for products can do so not only on purchase price, but also on energy consumption or even costs over time. However, the other side of the argument is that the idea of having such a vast amount of sensitive commercial material held on servers at the European Commission or with market surveillance authorities is a step too far. Further, it would be remiss of the group not to explore the cost implications of creating such a database, both in monetary terms and time. It is without question that market surveillance has to improve, or else there will not be an incentive for manufacturers to provide the innovation required to achieve the high energy efficiency ratings. Though a product database provides a solution to this and certainly makes the job of surveillance authorities easier; we must carefully consider all possible options and guarantee that commercially sensitive data is never put at risk.

ECO Platform makes the dream of European EPD a reality

ECO PLATFORM MAKES THE DREAM OF EUROPEAN EPD A REALITY

For a long time the provision of environmental information has been a time consuming and costly issue for the industry. Now the ECO Platform solves this problem with the ECO EPD – a truly European solution for all construction products.

THE CONSTRUCTION SECTOR HOLDS HUGE POTENTIAL FOR SAVINGS!

While we are looking for ways to reduce our environmental impact on this planet, we realise that the building sector is responsible for roughly one third of all energy consumption and greenhouse gas emissions. A big part of that impact is linked to construction products. The use of resources and the related emissions from production, transportation, construction, quality, costs, as well as the potential of recycling, needs to be considered along with their effects during the stages of use over the building's lifetime. Sounds complex? It is. But there is no other way to learn about the real and full impact of various types of construction and choosing the best materials for the environment.

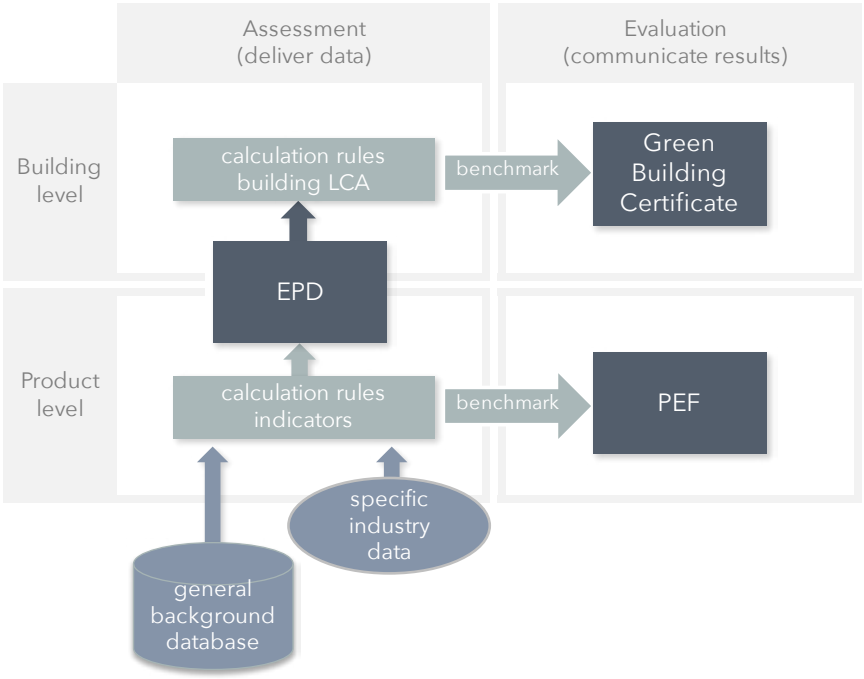
WHAT IS THE MOST SUSTAINABLE BUILDING PRODUCT?

There is no easy answer to this. Sustainability describes the holistic view of environmental, economic and social impacts. Holistic means that the entire lifespan and all side effects are considered. A sustainability assessment only makes sense at the building level because construction products are not final products but intermediates and in order to answer the question of what material is the most sustainable, the building context needs to be defined

ASSESSMENTS SHOULD BE MADE AT THE BUILDING LEVEL – PRODUCT-TO-PRODUCT COMPARISONS ARE ALWAYS INCOMPLETE!

The evaluation of the sustainable performance of buildings is described in the rating schemes for buildings like LEED, BREEAM, HQE or DGNB, which have rapidly gained international relevance in sustainability reporting. To evaluate environmental performance, it is important to do a life cycle assessment (LCA). The impacts of the building and the building elements become transparent throughout the different life cycle stages.

As the building consists of building materials, the life cycle data from the construction products is required for any building stage. This is the modular



THE AISBL ECO PLATFORM

A common European solution to communicate the environmental impacts of construction products.

Membership Groups:

- EPD Programme Operators
- European Trade Associations
- LCA Practitioners
- Green Building Councils / Rating Scheme Operators

Liaison with: CEN/TC 350

Number of EPDs in the market: >2,000

approach. The format to provide product-specific life cycle data is called an environmental product declaration (EPD).

THE ECO EPD – A TRULY EUROPEAN SOLUTION

The established building rating schemes reward the provision of EPD. Due to the lack of a common European EPD solution, various rating schemes initially concentrated on national solutions. The provision of various EPD to be recognized in all rating schemes in Europe and abroad resulted in an unacceptably large effort on behalf of the product manufacturers.

The ECO Platform was conceived to solve this problem. All established EPD programme operators in Europe formed an alliance with the objective of developing a common European solution: the ECO EPD – recognized by all programmes throughout Europe.

The European ECO EPD has existed since 2014 and is starting to replace the former national solutions.

PUBLIC EUROPEAN INITIATIVES

The European Commission intends to support customers in their purchasing decisions with simple environmental information on products. The idea of a "Product Environmental Footprint" (PEF) is currently being tested. While a simple solution based on a product-to-product comparison is useful for many consumer products, it can be misleading for construction products, as described above.

While modular product-specific data are needed for the assessment of the sustainable building performance (B2B), it is necessary to have simplified information for consumers (B2C). EPD are the solution for B2B communication. PEF may introduce some benchmarks that are able to provide simpler solutions for B2C communication. However, both EPD and PEF should be based on the same data from the industry to avoid double efforts for the manufacturers and confusion in the market.

THE PLATFORM ECO

The members of ECO Platform from all relevant stakeholder groups offer their experience and know-how to find quick suitable solutions for construction products. On the basis of the existing EPD principle, it is possible to find appropriate solutions for the comprehensive PEF approach.


Christian Donath

Get more information on the ECO EPD and the Platform's activities on the "ECO EPD Day" in Brussels on 6 October 2016. Please find detailed information in the ECO Platform PEF Position paper and register for the event on the ECO Platform homepage www.eco-platform.org.

EPD – ENVIRONMENTAL PRODUCT DECLARATIONS ARE

- LCA-based product information for the entire life cycle with a core set of indicators
- based on international and European standards: the ISO 14040 series, ISO 14025 and EN 15804 for construction products
- independently verified
- a comprehensive data basis for the assessment of the environmental performance of buildings
- an accepted industry standard for construction products in Europe

EPD provide product specific information about the environmental impact during all stages of the life cycle. There is no benchmark or pre-assessment on product level. The interpretation happens on the functional unit – the building level. EPD provide the data for life cycle assessments on the building level.

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After Paris 2015
How shipping can contribute to efforts to limit climate change

By Jos Delbeke (pictured), Director-General, DG Climate Action, European Commission

The Paris Agreement adopted by world leaders last December marked a critical turning point in the fight against climate change: a move from action by few to action by many.

The historic Agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C, and to pursue efforts to limit the increase to 1.5°C.

As a universal and legally binding agreement, it sends a clear signal to investors, businesses, and policy-makers that the global transition to clean energy is our future and that resources have to shift away from fossil fuels.

The combination of the clear call for global action and the "well below 2°C" goal shows that no part of the economy can be excluded. It is clear, therefore, that CO_2 emissions from international aviation and maritime transport should also be addressed as a matter of urgency, particularly as they are expected to increase sharply in the coming years.

INCREASING EMISSIONS FROM SHIPPING

Studies suggest that global CO_2 emissions from international maritime transport increased by around 65% between 1990 and 2010. If no further measures are taken, this trend is expected to continue. The third greenhouse gas study by the International Maritime Organisation (IMO), the UN body dealing with international maritime transport, predicts a significant increase in the coming decades. Depending on future economic and energy developments, emissions are estimated to increase by between 50% and 250% by 2050 (see Figure 1).

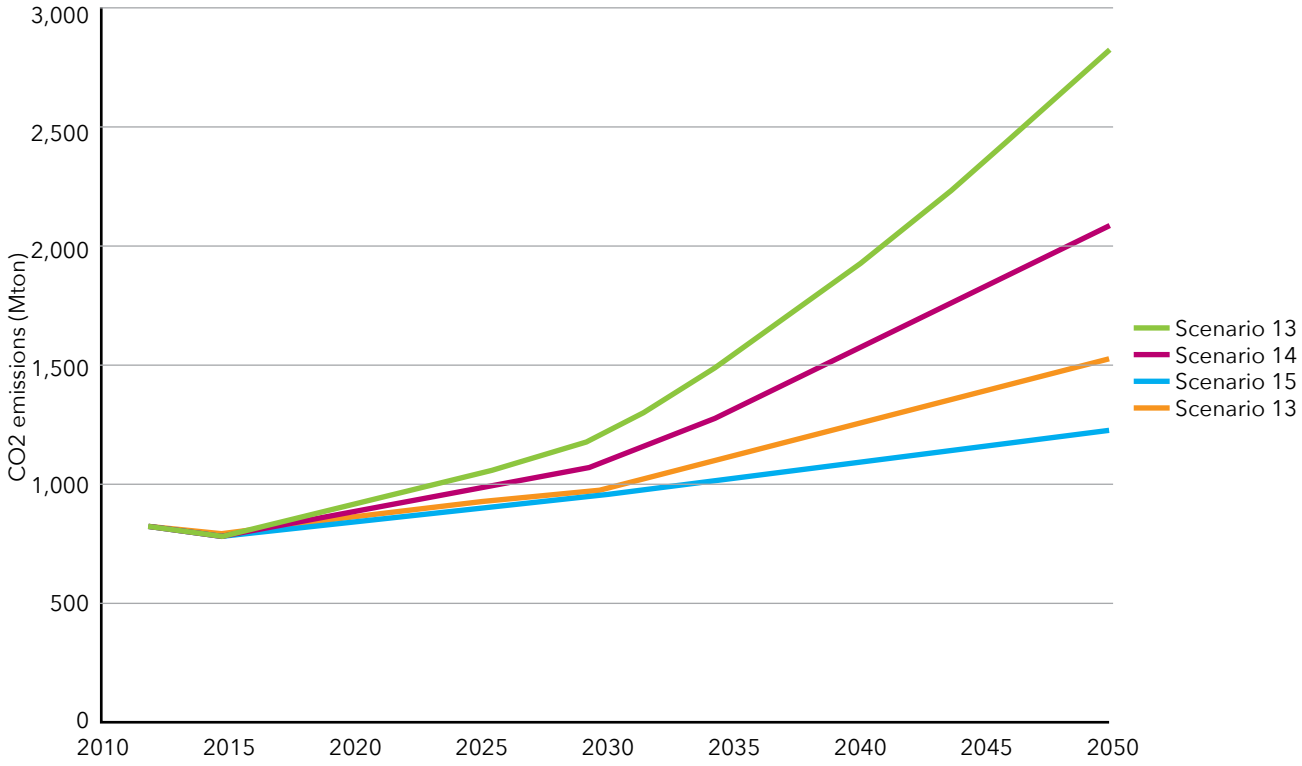
Such growth would increase the share of shipping in the global total of CO_2 emissions, which today stands at 2.5%. Given the need to reduce global emissions in line with the "well below 2°C" objective, it therefore risks undermining the efforts of other sectors. This clearly underlines the need for the shipping industry to deliver its fair share contribution to the fight against climate change.

Stopping and reversing this alarming growth in shipping emissions is possible. According to the second IMO greenhouse gas study, there is significant untapped potential to reduce emissions by up to 75% by using existing technologies and operational measures. Many of these measures can be described as 'low-hanging fruits' and would be paid for by the resulting fuel cost savings. So taking action on emissions from shipping does not have to lead to significantly higher costs.

IMPORTANT PROGRESS BUT GREATER EFFORTS NEEDED

At global level, the IMO, which started its work on greenhouse gas emissions back in the 1990s, has made some important progress. The Energy Efficiency Design Index (EEDI), which was adopted in 2011 and set CO_2 standards for new ships built after 2013 with increasing levels of ambition until 2025, was an important step forward. It is expected to reduce the sector's greenhouse gas emissions by 20% by 2030 compared to a 'business as usual' scenario.

Figure 1: Projections of CO2 emissions from international maritime transport (Business as usual scenarios, 3rd IMO GHG study 2014)



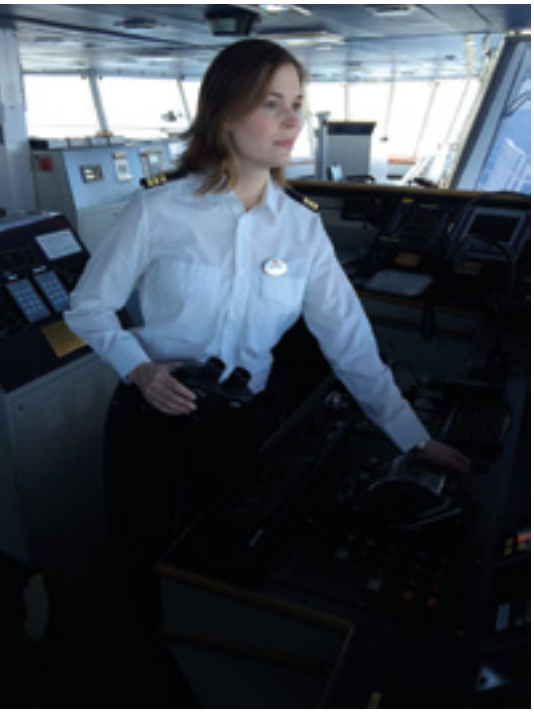
However, bearing in mind the expected growth in global trade and the long life-span of ships, this measure alone will not be enough to ensure that shipping emissions are reduced fast enough to deliver their fair share of greenhouse gas emission reductions, both internationally and in the EU.

The IMO has also discussed market-based measures and emissions reduction targets – without any conclusions or decisions to date – as well as the introduction of a global data collection system for fuel consumption, CO_2 emissions and energy efficiency. This system is similar to the EU's system for monitoring, reporting and verification of greenhouse gas emissions from ships (EU-MRV), which was adopted in 2015. Discussions under the IMO made substantial progress in 2014 and 2015 and we expect the adoption of a global MRV system under the IMO this year.

FURTHER ACTION AFTER PARIS

The European Commission favours further global action through the IMO. This needs to include a process to consider a specific emissions reduction objective to ensure that shipping contributes its fair share of the efforts required to achieve the objective agreed in Paris. To achieve this, further action such as market-based measures or further operational efficiency standards will also be required. Discussions in the IMO on such measures are expected to be launched soon.

The EU counts on the shipping industry to contribute its share of the reductions required to achieve the objectives defined in Paris. We hope the Paris spirit will guide and inspire the IMO to agree on global measures to reduce emissions from shipping.



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Our home port is Sweden, a country with a proud maritime history and the longest coast line in Europe. From here we operate a fleet of around 170 vessels. Our ferries and RoRo vessels form an important part of the European logistic network – whilst worldwide our fleet of tankers contribute to transportation of vegetable oils, crude and gas/LNG. Stena's rigs and drill ships are continuously exploring new energy supplies.

Our success is achieved by always caring about our customers, and investing long term in a fleet that suits their needs. Through technical competence and innovative design, our vessels carry freight efficiently with less environmental impact.

We wish for our success to contribute to our customers long term success and at the same time contributing to a sustainable development of the society. Our 16,000 employees on – and offshore work by these principles of Care, Innovation and Performance every day.

Stena

How a market-driven approach can instigate change towards green shipping

By Gesine Meissner, MEP (pictured)

The Climate Conference in Paris was praised as an important step in tackling global warming - rightly so. The international community has clearly voiced its determination to reduce emissions with collective efforts. The final agreement can, however, only serve as a starting point. The real challenge starts from here. And: I think it was a mistake that shipping was left aside and needs to be taken into account.

Industries need to be restructured on an unprecedented scale. Given the complex nature of the global economy, this can only be achieved by developing a sector-by-sector approach. Domains of the economy - such as transport - need to be looked at individually. Only then can progress be measured and efficient strategies be developed.

According to Eurostat, transport contributed almost one quarter of the EU's greenhouse gas emissions in 2013 - being the second largest greenhouse gas emitter behind the energy sector.[1] The European Commission's Climate Action programme concluded that CO_2-emissions from maritime transport related to the EU increased by 48 per cent between 1990 and 2008.[2] To break it down even further: In terms of sulphur dioxide the emissions of one cruise- and container ships equate to those of several million cars.[3]

Another example: The transport of German manufactured cars to the US produces five times more nitrogen oxide than the cars would during their use. Taking into account the significant increase in global trade, the current number of about 4.000 container-ships

is bound to increase a lot. In fact, the emissions from containerships are expected to be the fastest growing segment of marine shipping.

This is not to say that shipping is bad. The opposite is true. Almost 90 per cent of the EU external freight trade is seaborne. Short sea shipping represents 40 per cent of intra-EU exchanges in terms of ton-kilometres. More than 400 million passengers embark and disembark in European ports.

Shipping is most crucial for trade, extremely efficient and we need it! It is, however, a crucial variable in the climate equation. A holistic approach is required, addressing all pollutants and types of ships. Important steps were taken with the Sulphur Emission Control Areas (SECAs) in Northern Europe. In these zones emission rates were lowered significantly by using LNG or scrubbers. The same should be done in the rest of European waters.

It is my firm conviction that we can offer significant contributions on a European level. After all, the European shipping sector is strong and influential. Moreover, a common approach by European member states would set the right signal! As liberal coordinator for transport and president of the maritime intergroup in the European Parliament I want to push for the right steps.

Initially, the awareness for the problem had to be raised. Much progress has been made in this regard. Various parliamentarians and associations have hosted conferences on questions related to green shipping. My first seminar on LNG, for instance, took place in 2010. It is important to extend the debate beyond Brussels to the European capitals. Conferences are helpful to single out problems, bring together people with expertise and initiate action.

Existing regulatory barriers need to be identified and overcome. Generally, the obstacles can be categorized in technological, commercial and financial. Regarding the former it needs to be seen what technologies are on the market and how they can be integrated. With regard to the latter points, it needs to be assessed, which incentives and pressures will facilitate the right decisions.

There have to be commonly accepted measurements and technical standards. Introducing the Energy Efficiency Design Index in 2011, which set compulsory energy efficiency standards for new ships, was the right step. In terms of new technology, weather routing, the use of auxiliary power and a focus on aerodynamics are possible solutions. The EU has to support innovation in the field by supporting projects with its research funds. Regarding existing ships, optimisation of maintenance and operational practices, such as regular propeller and hull cleaning, can also reduce power requirements. All methods offer energy savings that far outweigh their upfront costs.

Commercial and financial developments in the sector are related to the oil price. Policies need to take into account that the financial viability for saving fuel depends on a specific price level. Moreover, the complex contractual arrangements between proprietors and operators need to be taken into account when thinking about the right incentives. Ships often have to meet tight schedules and cannot slow down. It is, however, vital that we find the right balance in making changes. European companies are already facing increased pressures by global competitors and should not be damaged.

Overcoming the barriers and achieving change is to a large extent a question of culture. We need to establish the optimism it needs to make reforms thrive. Last year's agreement from Paris is good for industries because it offers new markets with new potentials. Rather than setting too many barriers and constraints, market-driven efficiency improvements should be the goal. Given the enormous potential for growth in green shipping a liberal market-driven approach is going to work.

Gesine Meissner (MEP/ALDE) *comes from the German state of Lower Saxony. She is the FDP's delegate for Germany's Northern and North-eastern regions in the European Parliament. She is the liberal group's coordinator in the EP's Transport Committee and substitute member in the Environment Committee. Moreover, she is president of the European Parliament's Intergroup on Seas, Rivers, Islands & Coastal Areas (www.searica.eu/en/) as well as president of Germany's Liberal Women. Maritime and transport issues are close to her political heart because of the sectors' immense importance for the future.*

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Global LNG Markets: An opportunity we must not miss

By Seán Kelly MEP (pictured)

With increased gas production in the US and Australia and growing import requirements in the EU and Asia, global gas markets are rapidly developing and an increasingly liquid market is emerging. With Europe now heavily reliant on a small number of suppliers, diversification of gas supplies is the key to creating a competitive market. As trade in Liquefied Natural Gas (LNG) increases globally – up 45% by 2020 – we are presented with a great opportunity that we really should not miss.

In February of last year, the European Commission began moves towards an Energy Union – arguably a direct response to heightened tensions with Russia and its perceived lack of reliability to supply gas to Europe. The goal was to provide secure, sustainable, competitive and affordable energy to EU citizens. A key focus was on the need to diversify gas supply and reduce dependence on a single external supplier. Most recently we have seen the EU's Security of Gas Supply Package, which includes a strategy on Liquefied Natural Gas (LNG).

The benefits to Europe of pursuing this strategy are clear. First of all, gas is a perfect backup to for renewables and helps to increase deployment. Additionally, an advantage of LNG that may sometimes go unmentioned is that it is a viable option for the maritime sector to reduce emissions – vital given the pressure put on the sector at the recent COP21, and also as the IMO tightens environmental

requirements on vessels. These aspects, along with the increased supply security and competition in the energy market show that the Commission's emphasis on the importance of LNG for the EU makes an awful lot of sense.

A FAST DEVELOPING MARKET

A quick look at market projections show the scale of the opportunities presented by LNG. Changes in global gas markets over the next number of years are set to be characterised by increases in exports coming from the US and Australia. In 2015, US gas production continued along the steep upward trend that it has enjoyed in recent years and according to IEA, it is set to increase its production by a further 114 bcm by 2020, with production growing almost twice as fast as domestic consumption. This means that at some point over the next few years, the US will become a net gas exporter. At the same time, Australia will increase its production by 230% by 2020 with domestic production reaching 140 bcm, with 75% of this set to be exported.

While US and Australian production levels continue to increase, over the same period, Europe's indigenous production will fall rapidly, and with strong opposition to fracking in Europe, coupled with low oil prices reducing the appetite for investment into additional gas exploration activities, new indigenous production of any great scale is unlikely. Therefore, although our demand for gas is not expected to rise dramatically, our import requirements will, with additional import needs of around 70 bcm by 2020 required to replace reduced indigenous production. It makes sense then that Europe will turn to increased imports through LNG.

With such huge supplies from the US and Australia in particular helping to create a liquid global gas market, the EU stands to benefit more than most. With the added option of buying from global LNG markets, we are given a choice – piped gas from Russia or LNG. This makes the European energy system increasingly competitive with supply secured and increased competition driving down costs. Gazprom will have to be competitive to maintain market share in the EU. I feel this is an important step for Europe and I'm pleased that our Commissioners have moved early to benefit from the huge opportunities that these gas market developments present.

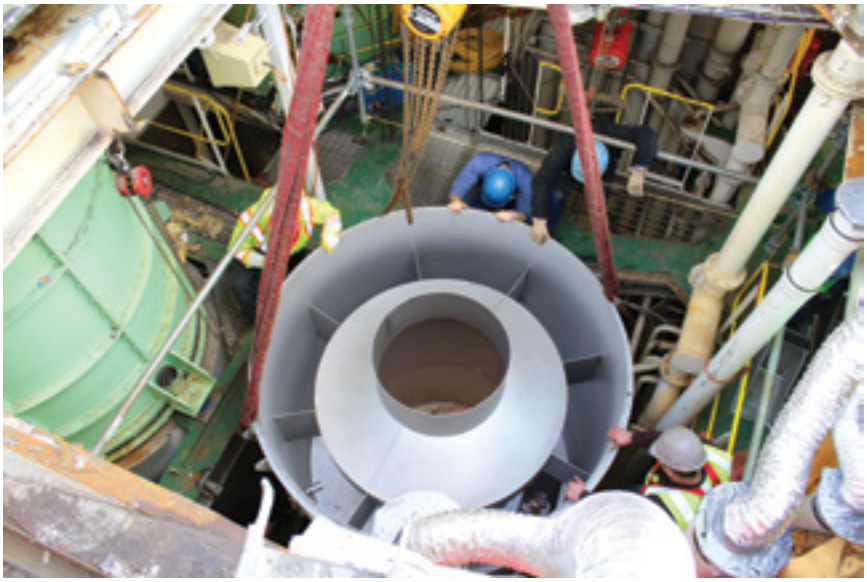
REDUCING MARITIME EMISSIONS

While the benefits of increased LNG supplies to secure fuel for heat and electricity are well documented, a mention must go to the potential benefits in the transport sector, more specifically, in the maritime transport sector. LNG allows the shipping sector to greatly reduce its emissions. A sector currently dominated by heavy fuel oil, the maritime sector was much criticised at COP21 for the contribution it makes to global warming. The IMO is now, however, moving to tighten restrictions on maritime sulphur emissions. Increased restrictions on sulphur over the next few years are already agreed, while it's possible that further restrictions will follow. A move towards low-sulphur fuels in the sector is therefore inevitable.

The opportunity therefore for low-sulphur LNG should be clear, however current low bunker fuel prices make it less attractive and make marine gasoil the easy option as a fuel for vessels seeking to meet requirements. However, I feel the sector should look beyond the current low oil prices. In LNG there is a solution available that will meet current IMO requirements and any additional ones that may be brought in in the future. Investment in LNG powered vessels now may just prove to be a better investment than sticking with marine gasoil and then being forced to fit abatement technology down the line when requirements are tightened further. On top of this, as global gas markets become increasingly liquid, they are becoming more and more certain and investment-friendly; it is debatable whether we can say the same for volatile oil prices.

To conclude, I welcome the Commission's initiative on LNG and feel that we are taking the needed action to benefit from these fast developing markets. My own country, Ireland, epitomises where we stand to gain in all of this – completion of the proposed Shannon LNG project on our west coast would link us to the global market and reduce our reliance on gas imports from the UK by half, creating a competitive market and lowering energy costs in the process. Setting the right policy framework for LNG, along with the completion of Projects of Common Interest (PCI), such as Shannon LNG, will be crucial to ensuring the EU is not left behind.

Goltens clears the air



The international air pollution requirements of Annex VI establish limits on nitrogen oxides (NOx) emissions and require the use of fuel with lower sulfur content, protecting people's health and the environment by reducing ozone-producing pollution, which can cause smog and aggravate asthma. The requirements apply to vessels operating in Emission Control Areas (ECA).

Current and possible future ECA's shown in the map below.

Within these areas sulphur limits for fuel have gradually been reduced from 1.5% prior to 2010 to a limit of 0.10% starting last year in 2015.

The rest of the world's fleet will feel the impact of the legislation in 2020 when sulphur limits are scheduled to drop globally to 0.5%.

From 1 April 2016, the Yangtze River Delta core ports - Shanghai, Ningbo, Zhoushan, Suzhou and Nantong - will require that vessels use fuel of less than 0.5% sulphur content whilst at berth.

In its role as technical service provider, Goltens offers laser scanning, pre-engineering and complete retrofits – either to fit a scrubber (to remove sulphur and particles) or SCR installations (Selective Catalytic Reduction, to remove NOx from exhaust gas). Alternative ways to comply with the sulphur emission limitations are to switch over to low sulphur fuels or LNG.

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LNG CASE (Clean Available Safe Economical) in shipping

By Katarzyna Chrulska (GIE)

ADVANTAGES OF LNG

Firstly, one unquestionable benefit of LNG (liquefied natural gas) as a marine fuel should be outlined: its ecological character.

The complete removal of SOX and particle PM emissions and a reduction of NOX emissions of up to 85% by using LNG is a strong argument for its use. In addition, LNG also reduces CO_2 emissions by at least 20%. LNG offers multiple advantages to both human health and the environment.

Secondly, the technology is proven and the LNG distribution network continues to expand. There are many examples around the world where LNG as a ship fuel is already applied successfully. LNG is available in large quantities and is able to meet the fuel demand of shipping.

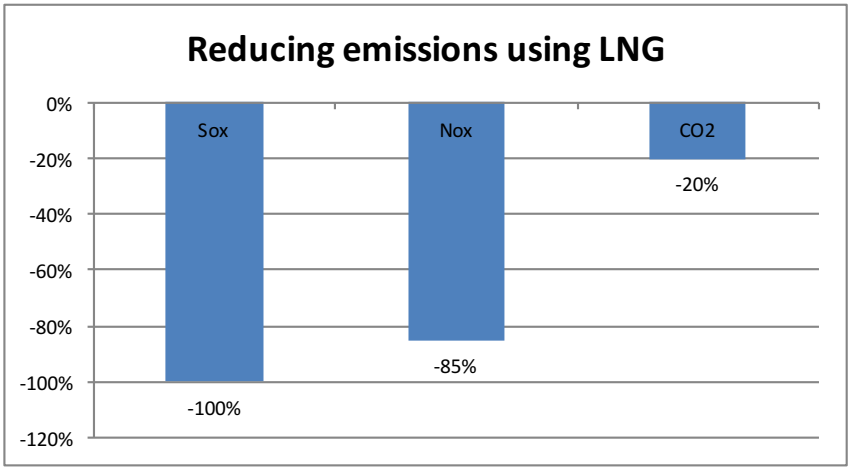
Moreover, the production technology of ship engines powered by LNG is now available. Market leaders (e.g. Rolls-Royce, Wärtsilä, MAN) are receiving more orders for this type of installation.

Thirdly, we can observe a good safety record for LNG operations for many years. LNG can be safely produced, transported and distributed.

Fourthly, LNG can be an attractive solution from both economical and commercial points of view. At the moment, LNG as a ship fuel is still being sold on a small scale to a few customers from the shipping sector and the prices are settled individually. In a few years, we can expect more LNG suppliers, LNG bunker facilities and LNG powered vessels. We can assume the better the infrastructure and higher the competition becomes, the lower the price will be. Of course the price of LNG is already much lower than the price of Marine Fuel Gas Oil (MGO) or Marine Diesel (MDO). Reducing pollution will lower emission fees and provide marketing benefits by highlighting the ecological nature of the fuel used.

However, there are also some challenges. LNG means extra investment for ship-owners. They need to spend money on new engines, tanks and pipes. One significant problem appears: the need for better insulation and the cylindrical shape of the tank reduces vessel cargo capacity. A smaller tank means the need for more frequent bunkering. Some studies (e.g. NLI Innovation AS) focus on the possibilities of optimizing the size of the tank and adjusting it to the shape of the hull. As the market grows, it will be possible to come up with solutions that will make tank size less problematic.

There are different options that ship-owners can choose. LNG is one



Author: Katarzyna Chrulska (GIE) based on DNV data

Advantages of LNG as a ship fuel
LNG CASE
- Clean
- Available
- Safe
- Economical

of them. The other main ones are: installing scrubbers (SCR) for exhaust gas purification, the use of low-sulphur content MGO or MDO, or change to alternative fuels.

With a ship's lifetime at 25 years or more, ship-owners will have to make a careful calculation. However, we assume that in many cases the LNG option is economical.

NO LONGER THE CHICKEN OR THE EGG PROBLEM

A few years ago, it was very popular to refer to the issue of using LNG as a fuel in shipping as the chicken or the egg problem. Many stakeholders asked which one should come first; a bunkering stations' system or an LNG-powered ship.

These days, there is no need to ask this question any more. We can observe both a development of a bunkering infrastructure and a significant increase in the number of LNG-powered vessels.

On the one hand, there are currently around 75 LNG-fueled ships (excluding LNG carriers) in operation worldwide, while another 84 new ship-building orders have now been confirmed[2]. And it means a significant growth taking into account how young is the LNG-powered ships'sector. For example, the world first ferry to run on LNG was M/F Glutra in Norway in 2000. The first large LNG-powered vessel was the Viking Grace which started operations in the Baltic Sea in January 2013.

On the other hand, the main condition for the wide use of LNG as a ship fuel is a developed LNG infrastructure and a good distribution system. For example, in the Baltic Sea (SECA Sulphur Emission Control Areas, where from January 1st 2015 ships have had to use fuel oil with a sulphur content of no more than 0.10%, as opposed to the previous limit of 1.00%) there are a lot of initiatives aimed at the establishment of a small to medium l scale LNG infrastructure (for details see LNG in Baltic Sea Project[3]).

DNV experts believe that we will reach the number of 1,000 non-LNG carrier vessels running on LNG in 2020 or shortly thereafter[4]. Other experts are not so optimistic. For sure, in the near future conventional oil-based fuels will still be the main fuel option for most existing vessels. However, LNG is an interesting solution for many vessels to be newly-built. So we can expect dynamic developments.

GIE SUPPORTING SMALL SCALE DEVELOPMENT

GIE is active in LNG advocacy and interested in the small scale. GIE regularly gathers and actualizes the *LNG New Services Inventory*[5]. It provides an overview of the new services (reloading, trans-shipment, bunkering ships, truck and rail-loading) offered by the LNG terminal operators.

In 2011, GIE prepared the GLE[7] Position paper: GLE's views on Small Scale LNG concluding as follows, *"GLE is excited about the opportunities offered by Small Scale LNG and will play its part in promoting its further development in a safe way."* Today we confirm our statement and support LNG CASE (using LNG because it is Clean, Available, Safe and Economical).

Author:

Katarzyna Chrulska

GIE Member and Manager LNG Division of GAZ-SYSTEM in Poland, GLE[1] Gas Advocacy Chairwoman within GIE in the years 2011-2014

Gas Infrastructure Europe (GIE) is an association representing the interests of European natural gas infrastructure operators active in natural gas transmission, storage and LNG regasification. 16 European LNG terminal operators from 9 countries, operating around 90% of the existing LNG regasification capacity in the European Union, are members of GIE.

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1. GLE - Gas LNG Europe is one of three subdivisions of GIE, representing the LNG Terminal Operators. The other two subdivisions are: GTE - Gas Transmission Europe and GSE - Gas Storage Europe (see http://www.gie.eu/index.php/about-us/who-we-are).
2. DNV GL – LNG fuelled vessels. Ship list – Vessels in operation and vessels on order - updated 11 January 2016
3. www.lnginbalticseaports.com
4. DNV. LNG as ship fuel.
5. www.gie.eu/index.php/maps-data/gle-lng-services-inventory
6. More information in MAPS & Data section at www.gie.eu website.
7. GLE - Gas LNG Europe is one of three subdivisions of GIE, representing the LNG Terminal Operators. The other two subdivisions are: GTE - Gas Transmission Europe and GSE - Gas Storage Europe (see http://www.gie.eu/index.php/about-us/who-we-are).

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EU Maritime Environmental Regulations – Who pays?

By Mark Clintworth (pictured), Head of Shipping, European Investment Bank

In line with EU transport policy the EIB provides financial support to the EU Maritime sector including for the purposes of this paper, EU commercial shipping. As regards the EU Shipping sector, the Bank gives particular attention to projects that better assist the sector in dealing with environmental challenges and encourage, in line with EU legislation, the development of clean technology and increased fuel efficiency[1]. This not only benefits EU ship owners and ship builders but also supports the multitude of SME's and midcap equipment suppliers involved in the EU's maritime knowledge economy. In 2012[2], the EU shipping industry is estimated to have directly contributed €56 billion to EU GDP, employed 590,000 people, and generated tax revenues of €6 billion.

However, small and medium (SME) sized EU short sea ship-owners are increasingly facing serious difficulties funding 'green shipping' investments required to meet both current and impending environmental regulations and reduce harmful air emissions. Furthermore, due to the ever decreasing availability of commercial funds, which are required to meet these regulations, the EU shipping industry is under even greater financial pressure. This has led to requests from the industry and the EC within the framework of the European Sustainable Shipping Forum (ESSF)[3] as to how the EIB can widen its financial assistance in order to help to reduce the funding gap required to meet these increasing environmental demand on the industry.

ENVIRONMENTAL REGULATION

The immediate major regulatory challenge to the EU Shipping industry is the 2015 regulation which limits the sulphur content of emissions from ship's exhaust gases to 0.1%. This affects all vessels operating in the North sea, English Channel and Baltic sea areas. These areas are collectively known as Sulphur Emission Control Areas (SECA).

The effect of this rule has been either the burning of expensive low sulphur fuels or the adoption of abatement technologies such as sulphur exhaust scrubbers or retrofitting LNG engines for example, in order to meet these regulations.

There are an estimated 5,000 ships operating in the proposed SECA, of which 2,000 operate exclusively in SECA waters. Up to 71% vessels operating in this area belong to European operators. This could mean a potential overall cost of between 10 to 40 EUR billion to the industry depending on the abatement technology chosen.

FUNDING CHALLENGES

The economic crisis has drastically reduced ship values and freight rates making it difficult for many ship owners to finance either the necessary environmental upgrade of existing ships or the acquisition of new vessels which are required to meet ever more stringent environmental regulations. This situation has obvious negative effects on short-sea shipping and ferry operators who have with limited funding capacity when confronted with substantial investment costs for clean technology investments.

In addition, the financial sector is also under severe pressure and financial assets are 'on sale' in some banks which means that risk appetite is severely limited for new shipping investments. Furthermore, the introduction of new European financial regulations is expected to render the financial system even more shipping risk averse.

Various European banks are under pressure to reduce shipping exposures[4] due to capital and funding constraints, de-risking, the need to focus more on core businesses and regulatory impacts. Less funding is available from the traditional shipping banks and this will remain so in the near future. This means that alternative sources of capital will need to be found.

With regard to the impact of regulations on the sector, Basel II introduced a rating-dependent approach to capital requirements. For example, the rating of a containers vessel of 3,500 "boxes", constructed in 2007 during Basel II makes 4 on the rating grid. In a Basel III environment and due to the crisis the rating for

this vessel can go up to 15. This is the impact of the crisis on deal parameters.

In short, the market is not able to respond, effectively leading to higher external costs. This has the effect of waterborne transport losing competitiveness, even though by complying with the ever increasing environmental regulation it creates positive EU added value.

According to various studies, any increase in vessel operating costs and a lower competitiveness of shipping could lead modal shifts from short sea shipping to road transport in these areas. Stated in an EU context, the increasingly negative outlook, European Added Value and potential market failure or sub-optimal investment conditions may be addressed through consideration of market oriented instruments using a risk-sharing approach to accommodate adaptations to respect SECA and other environmental standards.

It should be noted that commercial financial institutions are not incentivised to lend against ship upgrades that improve environmental performance but which bring no additional revenues or cost recovery opportunities. Furthermore, both ship brokers and commercial Bankers do not consider the installation of air abatement technology or clean fuel burning engines, as adding to the value of the asset as generally the secondary market for these vessels is outside SECA areas and therefore of little business relevance. In other words, the new clean technologies do not necessarily ass to second hand ship values.

EIB/EU RESPONSE

In 2013 the European Commission announced the creation of the ESSF to assess developments towards compliance with the new regulations. The ESSF acts as a dedicated expert group, bringing together representatives of member states, as well as private and public organisations including the EC and EIB. Its six working groups will deal with abatement technology implementation, LNG process and implementation, competition issues, finance and R&D.

There are several EU-funds available for shipping industry, each with its own characteristics, goals and selection criteria. EC policy in the domain of Maritime environmental development is demonstrated and defined within various funding schemes including Connecting Europe Facility (CEF), TEN-T (including Motorways of the Sea), European Structural and Investment (ESI) Funds and Horizon 2020. All of these schemes set objectives, define eligibility and budgets aimed at assisting various sectors including maritime. However, they are naturally limited as to the amount of financial assistance that can be provided and indeed, within the context of the current maritime environmental regulations, can only provide very high level support and limited funding.

It is within this context that the EC had been engaging with the Bank to identify ways in which it can develop EIB financial assistance in order to better address the funding gap faced by the industry.

GREEN SHIPPING GUARANTEE SCHEME

The EIB has already an array of financing tools available for such environment investments but as mentioned earlier, the issue is not a lack of liquidity in the market but a lack of risk appetite by commercial lending institutions. Any new tools would have to be designed with this in mind and as such the EC and the Bank have derived scheme aimed at encouraging commercial lenders to return to the ship finance market. After much deliberation the idea of a 'Green Shipping Guarantee Scheme' (GSG) was developed with the EC using the CEF. This GSG is as yet only in 'pre-pilot' phase with a small number of EU national shipping entities and banks. Depending on the success of these pilots the intention is to roll the scheme out EU wide as soon as practical.

The GSG in short is a first loss guarantee provided to commercial lending institution partners of the EIB in order to cover their investments in the environmental retrofitting of vessels and in some cases the investment costs of fitting these technologies onto new build vessels.

It is important to state here that it is not intended to be prescriptive of the EC or the Bank as to which individual technologies are supported. The scheme will cover any proven technology.

Finally, it must be added here that the greatest barrier to uptake of green technology investments, besides commercial risk aversion, is the current low fuel price. Ship owners are current discouraged in making these expensive investments whilst the price of Marine Gas Oil (MGO) low sulphur fuel is so low. However, this can change and furthermore, it is the intention of the EU and other international regulatory bodies to continually introduce more stringent environmental regulation which in turn will maintain upward momentum for adoption of such environmental technologies.

1 The EIB Transport Lending Policy states that lending for inland waterway, port, logistics and maritime projects are also prioritized in support of sustainable transport solutions.

2 Oxford Economics Report, 2014, commissioned by the European Community Ship Owners Association.

3 The ESSF is a platform for the communication and coordination of structural, financial and technical dialogue amongst relevant EU maritime industry stake holders, the Commission and the EIB to better address environmental sustainability challenges confronting the EU maritime transport sector.

4 For Bank's who were traditionally major players in the shipping sector, these problems were caused by failing shipping portfolios.

Impact of transition to low carbon vehicles on oil prices and energy security

By Nicolò Gasparin is chair of the Automotive Battery Committee (ABC) of Eurobat (pictured)

Behind every story there is a subtle and intriguing back-story. The story of last year's plummeting oil prices is not exception. On the face of it, this development was dominated by the expansion of US oil shale, which eroded OPEC's monopoly advantage. In November 2014, the cartel abandoned its historic role of constraining supply to maximise prices, and instead started competing for market share. Add to that Iran's re-entry into the market after nuclear sanctions were lifted; and we arrived at where we are today.

It is natural that discussions of oil prices have previously focused largely on changes to supply. They are usually dramatic and accompanied by conflict and geo-political upheaval. They make for interesting news. Changes to demand are occasionally mentioned, but then it is only in passing: broad changes to economic growth, for example. What is rarely mentioned is the gradual and steady decline in the energy-intensity of developed economies. Yet this factor – driven primarily by vehicle standards around the world -- is increasingly important.

While few would argue that the expansion of US shale oil and OPEC's subsequent reaction did not play a role, it is also simplistic to exclude the role played by vehicle efficiency. The VW scandal has demonstrated the difficulty with relying on official fuel-economy data, but regardless of that, it is clear that without vehicle standards in place, several billion barrels more oil would have been needed during the last decade. This would have pushed the market to a slightly higher equilibrium than today, most likely resulting in slightly higher oil prices.

It is when we look into the future that this dynamic becomes particularly interesting. Forged last December, the Paris Agreement pledges to confront the threat to our planet from climate change. To maintain global average temperatures within 1.5-2 degrees Celsius of pre-industrial temperatures, carbon emissions will need to be radically reduced from all sectors. The transport sector is no exception. It is the world's second-largest source of carbon emissions, and it is on track to become the largest.

Much more needs to be done. Existing efficiency standards have forced cost-effective technologies, such as start-stop and hybrid engine systems, onto the market. New models of shared vehicle ownership promise more efficient utilisation of assets. And electrification of vehicles offers the chance to replace petroleum fuels in transport with a growing share of renewable electricity.

In a business-as-usual scenario, demand for oil could be expected to return to growth, outstripping supply some time around 2020 and causing prices to return to growth. But in a post-Paris world, with carbon mitigation underway globally, demand for oil would likely peak some time around 2025, and reduce thereafter, with profound impacts on oil prices. This has several important implications:

- The economies of oil-importing regions, such as Europe, would be boosted by lower energy costs and less volatility
- By using policies to reduce oil demand, European governments now have a powerful new card to play in setting global prices
- High-cost oil extraction, for example in the Arctic and ultra-deep water, would become uneconomical

Low-carbon vehicle technologies also deliver numerous other co-benefits beyond reducing CO_2 and helping lower oil prices. Europe is heavily dependent on imports to service its oil needs, with 87% imported during 2014. By shifting away from imported petroleum and towards domestically produced electricity or hydrogen, Europe could reduce the absolute volume of energy imported for its transport sector and improve its energy trade balance.

Admittedly, the technologies to drive this change come at a cost. However, consumers should be able to handle these costs, because the money invested in fuel-saving technology is usually recouped in 2-3 years via reduced spending at the pump. Meanwhile, expenditure on fuel-saving technology feeds through to technology suppliers: several successful European companies, such as members of EUROBAT, the European Association of Automotive and Industrial Battery Manufacturers.

At the same time, the increasing electrification of vehicles, whether hybrids or fully electric, will make a significant contribution to urban air quality by curbing health-damaging NOx and particulates. According to a recent OECD report, outdoor air pollution costs OECD countries about $1.7 trillion a year in terms of the value of lives lost and ill health, with around half of that pollution coming from road transport[1].

The transition away from oil is not without its challenges. Within Europe, we will need to provide re-training and re-skilling to those who have lost their jobs in the refining and distribution of fossil fuels, or in manufacturing outdated vehicle technologies. And oil-exporting economies will need to manage this transition carefully to avoid social upheaval. But what is becoming clear is that this transition is overwhelmingly beneficial for oil-importing regions such as Europe.

Of course, the transition described above also creates a dilemma for policymakers. While an improved energy trade balance; lower oil prices and reduced mobility costs deliver an economic boost for Europe, the lower oil prices will also make gas-guzzling vehicles more appealing.

The challenge for policymakers, therefore, is to harness the economic benefits generated by this transition and ensure they are redistributed in such a way as to ensure that we do not slip back to the world of fossil fuel vehicles, and ultimately back to a world of high oil prices.

1 WHO Regional Office for Europe, OECD (2015). Economic cost of the health impact of air pollution in Europe: Clean air, health and wealth. Copenhagen: WHO Regional Office for Europe

Tackling transport emissions at EU level thanks to sustainable urban mobility:

By Karima Delli, Greens-EFA Member of European Parliament, Coordinator of Transport Committee

As a French Green Member of Parliament, coordinator of the Transport committee, my contribution has always stood in finding a way to reduce transport emissions and improve mobility at the meantime. In the past decades, this equation seemed to be almost impossible. Since the COP21 agreements, what I considered as a personal road map has become a worldwide challenge. As the 3rd biggest carbon emitter (12% of GHG after China: 24% and the US: 15%), EU is somehow "too big to fail" and the Greens-EFA's group at the European Parliament is pushing for a whole strategy in every single sector of its economy.

Among the economic sectors at stake, transport is one the most challenging. In the EU, transport sector is responsible for 20% of GHG (versus 14% at world level). In Europe, as in most well-developed territories, transport is a very energy-related issue. And if we assume that we are entering a new technological era, as it is claimed by Jeremy Rifkin under the concept of "Third Industrial Revolution", one needs to seek for a closer cooperation between transport, energy and information technology. This is what innovation in transport must be all about. Synergy between these three aspects provides plenty of leverages to reach the objectives set by the COP21.

As a first step towards this complex approach of transport, I was assigned rapporteure at the European Parliament for the report

on "sustainable urban mobility". Considering that 70% of GHG for transport are produced in urban areas, setting the rules and the objectives for a better urban mobility turns out to be a giant step. I am also proud that we passed a text which was well-balanced between various aspects of sustainable mobility: economic, social, climate, air quality and security aspects were all combined. For instance, we recognised, on an equal footing with fuel poverty, that sustainable mobility poverty is a major social issue to tackle when it comes to transport.

Unfortunately, urban mobility is not in the scope of competence of the EU. It means that the European parliament only had a brief window of opportunity to endorse and speed up this topic. But we count on local governments in making it a priority. They proved it during the COP21 when 700 mayors of big cities around the world took the resolution to reach 100% of renewable energy for 2050. If urban planification lies in their hand, Europe can help funding platforms for exchanges of experience, leading studies on time policy (teleworking, ICT technologies and teleconferencing) to improve business mobility, prescribing models for new areas accessible only to public transport, bicycles, pedestrians, zero-emission vehicles, car sharing and carpooling and also smart access for the last kilometer, etc. As you may see, the field of investigation is infinite. Sky is the limit.

Regarding innovation and new technologies, a low-carbon economy in transport depends on a subtle combination of resource-efficient solutions and Intelligent Transport Systems (ITS). On the first hand, we need to find a way to better support research about electric vehicles, hydrogen-powered vehicles, including those using methane reforming, natural gas vehicles, hybrid vehicles, LPG vehicles and eliminate fossil fuel and diesel from subsided economy. On the second hand, if ITS is developing as well as it's expected to be, there will be a twist in people's mind. Solo car will no longer be an option if real-time traffic facilitates access to public transport and makes life simpler.

Another aspect that is going to show up very soon is the sharing economy for moblity. I put this subject on top of my list. There is an obvious benefit to get from ride-sharing and carpooling platforms because it helps reduce traffic jams and emissions per person. At the meantime, we are facing this new challenge of organising a new market, regulating competition, protecting consumer's privacy and security, protecting independent workers, protecting startup creators and finding a way to make professional users contribute their intensive use of public infrastructures. All these questions will be on the table in the forthcoming months.

On these matters, one should reach a climax at the end of the year when the European Commission (EC) is going to give a communication about their regulation proposal on decarbonation of transports. I wish the EC would be more ambitious, putting on the table a "2030 climate & transport package" setting key targets such as: 30% cut in greenhouse gas emissions (from 2010 levels), +30% of energy from renewables, 30% improvement in developing bike tracks and 30% for multimodality. Whatever happens, I will pay a peculiar attention to it and will be pushing for ambitious objectives.

To finish with, I believe that the Juncker plan could play a key role in financing sustainable urban transport and infrastructure projects I and call the Commission and the Member States to increase their financial support for sustainable urban mobility projects, to ensure the necessary synergies between the various funding sources and programmes, and to develop links between urban mobility, the new Digital Agenda and the Energy Union.

CO_2: New problem, new solution. But is the old solution better?

"Gamora: *History repeating itself?*

Warlock: *History doesn't repeat itself, Gamora, but sometimes it rhymes.*"

– Dan Abnett

The COP 21 discussions last December marked an historic commitment to restrain global temperature rise, even as the meeting also achieved consensus on the need to reduce greenhouse gas emissions (for which, read "principally CO_2"). Behind these observations lie two incontrovertible facts: the climate is changing; and atmospheric CO_2 levels are rising. And behind those facts lie increasingly strident warnings from the IPCC about the anthropogenic component of climate change and of the potential damage it may cause:

Rising CO_2 = Rising temperature = Rising Sea Levels = Planetary disaster

QED: Man's carbon habit is destroying the planet.

A quick look at graphs of atmospheric CO_2 and global temperature over recent times is both impressive and alarming. Nevertheless, correlation is not causation (an observation that sums up the climate debate); and pending any revelations about Man's ability to influence global climate, it seems logical, superficially at least, to try removing CO_2 from the apocalyptic equation above. According to the IPCC, 35% of total anthropogenic emissions in 2010 were derived from power generation, and our proposition is made even more encouraging by the bold claim of Britain's CCS Association that up to 90% of the CO_2 emissions from thermal electricity generation and industrial processes can be prevented from entering the atmosphere. Using Carbon Capture and Storage (CCS) with renewable biomass, it says, may even remove CO_2 from the atmosphere.

CCS may be viewed as a three-stage process, by which CO_2 is first captured at the point of emission, then transported to some designated storage site, finally to be injected so as to prevent its re-emergence into the atmosphere for the foreseeable future; or until some other solution can be developed.

It is immediately apparent that current CCS technology is unsuitable as a means to deal with transport emissions – who would drive around with some gigantic balloon attached to the exhaust pipe of his car? Nevertheless, it is eminently possible to retrofit capture technology to fixed installations such thermal power stations. Another technique is to increase the amount of oxygen in which the fuel is burned. This increases the efficiency of combustion (incidentally producing more energy) and results in a higher proportion of CO_2 in the exhaust gases, making its separation easier. Elsewhere, the beverage industry already uses a technique to capture CO_2 in solution and then release it by heating. Capturing CO_2 does not therefore seem to pose huge problems. Transport of gaseous CO_2 does not require much technological innovation either, for millions of kilometres of

20 metres thick and 80 million years old: natural carbon capture and storage.

perfectly suitable oil pipeline have already been installed across the globe, while we have well developed systems for moving large volumes of LNG by sea. Meanwhile, geological serendipity means that the very basins which contain conventional oil and gas reservoirs also provide excellent CO_2 storage facilities. What is required is a porous rock to contain the gas, overlain with a cap that is impervious to CO_2. The oil industry already pumps CO_2 into oil reservoirs as they deplete so as to flush out more oil: this is in effect the 'S' in CCS. CCS would seem therefore to offer an almost irresistibly attractive prospect. We already have the technology to do it, and it removes the principal danger to our climate control aspirations.

But what lies behind the CCS proposition? What about the science behind the science?

To begin with, there is no evidence that a single atom of the Earth's carbon has been created or destroyed since its creation. In other words, for over 4.5 billion years carbon has simply moved between the atmosphere, the lithosphere, the hydrosphere and, more recently (as in for the last 600 million years or so), the biosphere: this is the carbon cycle. According to the best science we have, atmospheric CO_2 levels, currently 400 parts per million (ppm) were as high as 7,000 ppm during the Cambrian period some 500 million years ago (mya). By about 200 million years later, during the Carboniferous period, atmospheric CO_2 and global temperatures are both thought to have greatly decreased. Much of this time coincided with the evolution of, and growth in, terrestrial plant populations: plants whose remains created the world's coal reserves which geologists use to name the period. Meanwhile, it would not be long (in geological terms) before dead marine organisms were raining down on the floor of the Tethys Ocean, into conditions right for the formation of petroleum.

And this is the point: for literally millions of years, carbon has been captured from the atmosphere by both terrestrial and marine organisms, and stored naturally through the process of burial and the effects of heat and pressure. A perfect natural CCS system, still going on today in peat bogs and lignite deposits: one is a precursor of the other; and both are precursors to coal. Combustion of these fossil fuels simply returns stored carbon to the atmosphere, forming the basis of the compelling argument for CCS as the technology to solve this immediate problem. Compelling, that is, until one asks how the plants of the future will photosynthesise when all the Earth's CO_2 is locked underground.

For the longer term, perhaps we should still look to renewable energy sources; and to developing various well-known chemical processes that can convert CO_2 into hydrocarbons. In that way, we would be copying nature, not fighting it.

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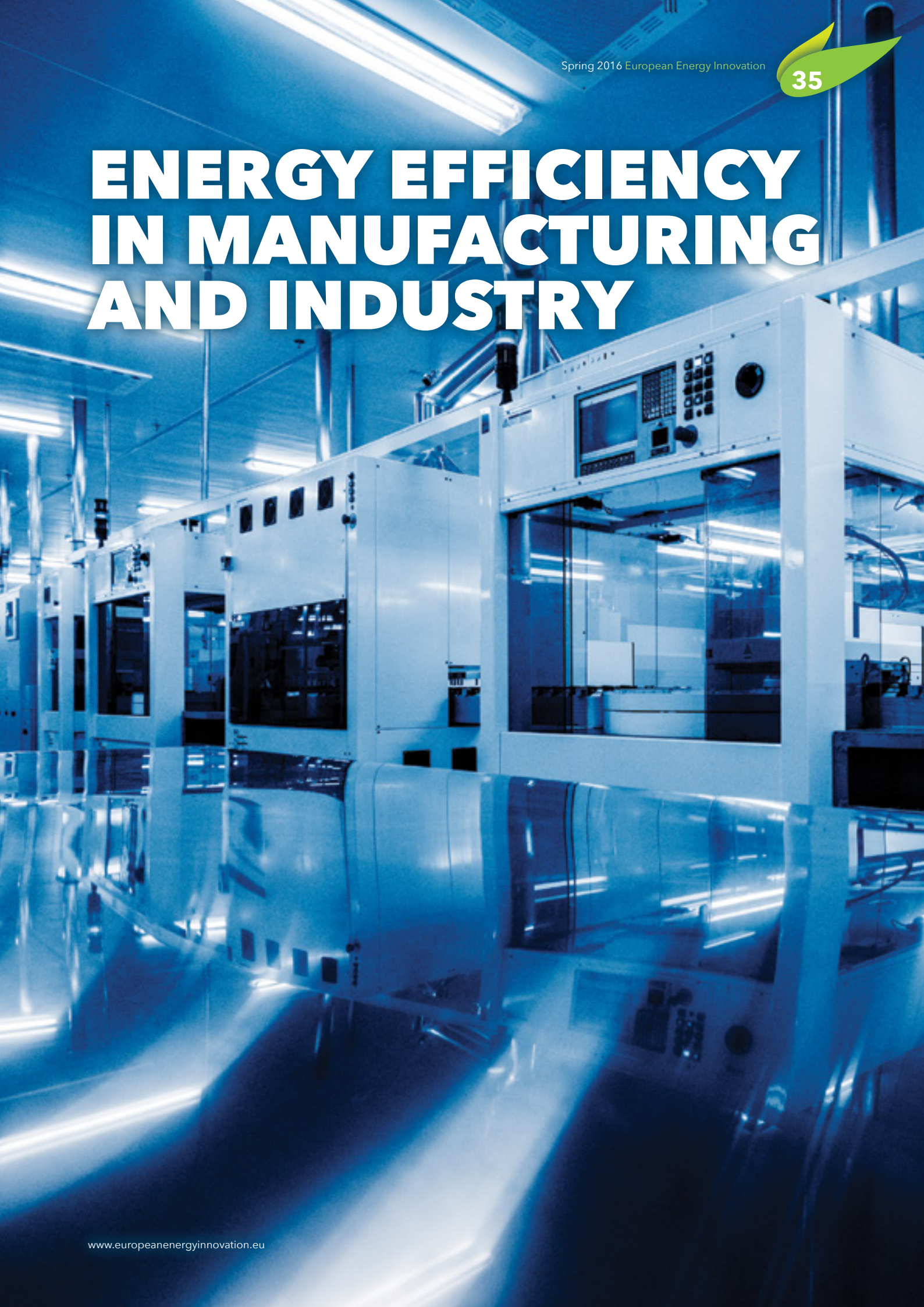
ENERGY EFFICIENCY IN MANUFACTURING AND INDUSTRY



Smart Manufacturing

By Pilar del Castillo, MEP, Industry, Energy and Research Committee (ITRE)

Digital developments are truly transforming and enabling technologies (such as 3D printing, Cloud computing, big Data, Machine to Machine communications and very soon 5G), which can improve efficiency, effectiveness, productivity, competitiveness and customerisation across the economy as a whole. This process affects all sectors, from energy to health, from transport to education, etc. Its potential is so great that it is estimated that digital technologies could cut global total economic costs by $4.9 trillion: $1.2 trillion from reduced electricity expenditure, $1.1 trillion from reduced fuel expenditure.

Being an integral part of our economy, manufacturing cannot be an exception. In fact it is even more pressing in this area. Not just because of its importance. Manufacturing represents the major share of investment in R&D (62.3% in 2013), it's a key source of exports (80% of total EU exports) and in terms of employment it has been demonstrated that each additional job in this sector creates between 0.5 to 2 jobs in others. In addition Europe has shown that it has found difficulties in maintaining a strong industrial base and a competitive position at international level (in the last 6 years the share of manufacturing in GDP has fallen from 15.8% to 15.1%).

For all of these reasons we must move away from past and current mainstream thinking and practices regarding industrial policy. There is an urgent need for a shift towards a coordinated approach at all levels, that is: between Member States, across industry, between public and private entities, and even between the different directorates-general of the European Commission.

This new coordinated approach must boost the application of advanced communications systems to conventional manufacturing processes, making them more flexible, efficient and responsive. In other words it has to fully embrace "smart manufacturing".

This transformation will be possible due to Cyber-Physical Systems, also known as “Industry 4.0” or as “The Industrial Internet of Things. In the context of manufacturing it will imply a combination of Smart Machines, Smart Materials and Smart Products, all of which are interconnected and generate continuous data that is collected, processed and analyzed in a central location.

Making our manufacturing “smart” will effectively transforms factories from traditional cost centers into high-performance plants, fully optimized in their use of direct material inputs as well as their use of energy. It will help improve production costs and quality, while minimizing natural resource use, and energy consumption. Only in energy terms, according to #SMARTer 2030 report, industry smart manufacturing solutions have the potential to create global energy savings of 4.2 billion MWh and could abate 2.7Gt CO_2 emissions.

We are none the less still far away. A recent Accenture survey in this area showed that a little over a third of companies currently apply automation technology, thus showing the current low rate of ICT adoption among manufacturers.

Several technological barriers must be overcome before a truly smart manufacturing operation can be realized. If we manage to overcome these barriers, Smart Manufacturing will enable innovations like virtual manufacturing, customer-centric production, 3D printing and virtual production networks, and circular supply chains for resource efficiency to become commonplace.

I believe that the European Union is well aware of the opportunities and challenges, and in this regard, "Industrie 4.0", "Usine du Future", "Smart Industry", "High Value Manufacturing" and "Fabbrica Intelligente" are just a few of the 20 initiatives that exist around Europe to use advanced ICT to transform Europe's industrial heritage and future. However, we must avoid the risk of fragmentation from all these national initiatives in order to fully exploit the digital transformation of Europe's industry.

In addition, much more must be done, as policy makers we must incentivize investments in infrastructure geared to connecting the unconnected while establishing a balanced and consistent regulatory approach to electronic communications that promotes innovation and investment, protects intellectual property rights and ensures consumer privacy and security.

Lastly, the responsibility of fully seizing all the potential of the digital revolution lye in everybody's hands and the private sector has a great role to play. Business leaders must drive investments in ICT uptake and cooperate with other sectors and explore ICT-enabled revenue and cost-saving opportunities.

Even more than in other sectors of the economy, regarding industry first movers have a great competitive advantage, let us not lose this opportunity for Europe.

Smooth robot movements reduce energy consumption by up to 30 percent

By Prof Bengt Lennartson and Dr Kristofer Bengtsson, Chalmers University of Technology, Gothenburg, Sweden

By minimizing the acceleration of industrial robots, energy consumption can be reduced by up to 30 percent – while retaining the given production time. This is the result of a new optimization algorithm that has been developed by researchers at Chalmers University of Technology. The research was initiated by General Motors, and is now further developed in the EU project AREUS, together with, among others, Daimler and KUKA.

MOVE SLOWER INSTEAD OF WAITING

Optimization of the robot's movements reduces acceleration and deceleration, as well as the time the robot is at a standstill, since being at a standstill also consumes energy. A basic idea is here to let a robot move slower instead of waiting for other robots and machines to catch up, before carrying out the next operation sequence. The optimization also determines the order in which the various operations are carried out, to minimize energy consumption without reducing the total execution time.

REDUCED ENERGY AND PEAK POWER

Evaluations on industrial robots show that it is possible to save up to 30% energy and 50% peak power, neither substituting any hardware nor provoking negative consequences on the overall plant production. The fact that the solution still keeps a desired production time is crucial to get industrial acceptance. Furthermore, the solution does not depend on any physical model parameters, but only a simple recording of the robot path generated by the original robot program. This makes the proposed method very attractive from a user perspective.

COLLISION AVOIDANCE

The optimization tool is included in a software developed at Chalmers, called Sequence Planner. To achieve a safe optimization, several robots moving in the same area need to be coordinated. Collision zones where robots may collide can then be automatically generated by CAD software for robots. The intersections between sweep volumes of the individual robot motions then determine these collision zones, and a robot needs to book such zones to be allowed to path corresponding region. This collision avoidance procedure is integrated in the energy optimization. Thus, we obtain both a collision free and energy optimal robot system that keeps the desired production time.

EXPLOITATION AND IMPACT

The goal is to make this kind of optimization standard, and included in robots from the start. However, since the optimization procedure is based on the original robot behaviour and does not change the robot's operation path, it can also be applied to existing robot cells. A quick optimization can then be performed without changing the current production conditions, just reducing the energy consumption. The optimization concept is also not limited to robot motions, but can be applied to, e.g., automated guided vehicles (AGVs), conveyor systems, and press lines.

Finally, we observe that in robot-intensive manufacturing industries, such as bodywork factories in the automotive industry, robots consume about half of the total energy used for production. This means that the proposed energy and peak power optimization could lead to potentially significant savings, especially in automotive industry.

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Spintronics: A path towards ultra-low power electronics

Spintronics or spin-electronics is a merging between magnetism and electronics. Whereas conventional microelectronics only uses the charge of the electrons, spintronics also uses its spin which is its intrinsic magnetic moment. Magnetic materials constitute spin polarizers and analyzers. As in optics where polarizers and analyzers can be used to tune light beam intensity, magnetic stacks comprising magnetic layers alternating with non-magnetic ones allow tuning the electrical current flow. In 1988, Pr A.Fert and P.Grunberg independently discovered the phenomenon of Giant Magnetoresistance (GMR) in magnetic multilayers. This discovery launched this whole field of spintronics. They received the Nobel Physics Prize for that in 2007. Since then, a number of breakthrough discoveries such as the possibility to switch the magnetization of magnetic nanostructures by a current flow, have dramatically expended the range of investigations in this field.

Since its birth, spintronics has largely benefited from a strong synergy between basic research and applied developments. Materials called spin-valves exhibiting giant magnetoresistance at low magnetic fields were introduced in the read heads of hard disk drives (HDD) in 1998 allowing an annual doubling of the areal density stored in HDD. However, another very important application of spintronics is arising in microelectronics. Indeed, non-volatile magnetic memories called STT-MRAM (Spin-Transfer-Torque Magnetic Random Access Memories) are about to reach large volume production. These memories combine the non-volatility of FLASH (ability to keep the information when powered-off), the speed of SRAM (used in Cache memory), the density and write endurance of DRAM. Among all emerging non-volatile memory technologies (Phase change RAM, resistive RAM), they are the only ones having a long enough write endurance to be used as main working memories in complex electronic circuits such as microprocessors.

Thanks to their non-volatility, they allow powering off all temporarily unused parts of electronic circuits and instantaneously restart them on demand. This significantly reduces their static power consumption (typically >4x). In addition, since these magnetic memories do not use the properties of the silicon wafer, the memory level can be straightforwardly stacked above the logic level.

Compared to standard technology where logic and memory must be built side to side on the silicon wafer, this stacked approach makes the communication between memory and logic much more efficient in terms of bandwidth and energy consumption. This also reduces the dynamic power consumption of electronic circuits. Thanks to this hybrid semiconductor/magnetic technology, a new Normally-Off/Instant-On electronics is emerging. In Europe, SPINTEC laboratory is particularly active in discovering new spintronic phenomena and implementing them in spintronic devices.

SPINTEC was created in 2002 to bridge the gap between basic research and applications in spin-electronics. Affiliated to CEA, CNRS and Grenoble Alpes University, it now counts 30 researchers. Since its creation, SPINTEC has filed more than 80 patents and spun off three start-up companies: Crocus Technology developing/producing magnetic memories and magnetic field sensors; EVADERIS, a fabless company of design of ultra-low power hybrid silicium/magnetic circuits particularly suited for the Internet of Things (IoT) and Hprobe developing STT-MRAM electronic probers. SPINTEC also received 4 grants from the European Research Council in the past 6 years.

Characterization of magnetization switching dynamics at sub-nanosecond time scale in spintronic devices

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Digitalisation of Energy: a vision becoming today a reality

By Maher Chebbo, Chairman of the ETP SmartGrids Energy Digitalisation group, Patrick van Hove, Senior Expert Smart Energy Systems at European Commission DG Research & Innovation and Prof. Nikos Hatziargyriou, Chairman of the ETP Smartgrids

With the 2020 energy-climate package and the 2050 energy roadmap, Europe has engaged early in the transformation of its energy system. The EU's "*Energy Union*" strategy and the recent CoP 21 strengthen the energy policy axes of *security of supply, sustainability and competitiveness*, together with the need to invest in research and innovation to embrace the necessary changes. **Digital technologies will be an essential ingredient of the 21st century low-emission energy system, and will support the new panorama of the service-oriented energy responding to new expectations of customers, with many new players and new roles for existing players**. Digital technologies are also stressed in the EC's Digital Single Market strategy.

Digital technologies have reshaped the customer views on the services and interactions they will expect from "public" service providers such as health, transport, energy, administration. In the energy sector, customers of the 21st century will likely expect beyond products, high-quality, personalized services that are accessible 24/7 also through mobile and/or social media. The wide roll-out of smart meters and of related technologies in Europe will lead to massive amounts of data and information that will support the development of such services, while respecting privacy.

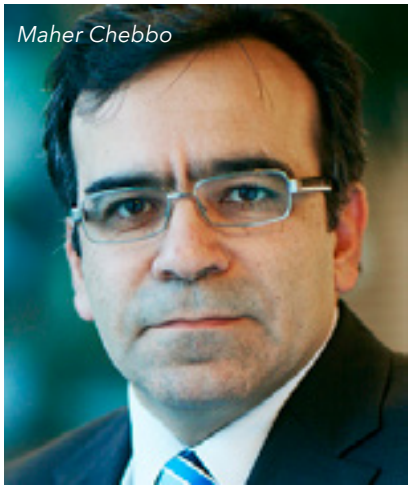
The energy sector has embraced digital technologies for a long time in the context of technical applications such as simulation, modelling for product design, monitoring, control, planning, markets, forecasting, etc. This has allowed the industry to improve the quality of service and to reduce costs. Many of these applications were developed over the years as best solutions for particular problems and are often isolated in silo-based applications and data.

The energy sector is now embracing the major change linked with the transition to a low-emission future, and is faced with a wide range of major issues. The supply and balance of the system will no longer rely on large dispatchable power stations, but rather on variable renewable sources that need to be balanced with a combination of distributed generation, demand response, storage and interconnections. The system will become much more decentralised with a multiplication of millions of distributed energy sources and active consumers, many of them connected to distribution grids. Customers will increasingly become active and will manage themselves a combination of generation, use and storage; new use patterns will come from electric vehicles and electric heating; customers will organize themselves in energy communities. New stakeholders such as aggregators and energy service providers will take increasing roles while new ones will be required from existing players.

The further digitalisation of the energy system will increasingly break the barriers:

- among silo applications and silo data sets; building synergies between the "back-office" technical data, information and applications, and the "front-end" link with the customer.
- among business processes; improving the ability to embrace change and facilitate information exchange and service composition among players.

Recently integrated smart grids


Maher Chebbo


Patrick van Hove


Prof. Nikos Hatziargyriou

standards and architecture model will enable the development of open interoperable solutions to implement innovations.

Learning from other industry transformation cycles, the energy digital transformation will go through the same disruptive journey making the status quo not anymore an option. Digital energy transformation will help system operators making rational decisions and in the same time customers getting every day benefits and value added services.

The stakeholders of the SmartGrids European Technology Platform have created a Digital Energy task force with the objective to identify new services that could emerge in this context and develop use cases and benefits of the digital transformation of the energy system. The results will be summarized in a white paper in April 2016 addressing policy makers. Hereafter the main use cases identified are summarised in the table below.

To implement the listed use cases, top 3 decision imperatives are needed to transform the energy sector:

1. Building new business models by re-imagining the end to end business processes and the customer centricity,
2. Considering IT as the platform for growth and innovation,
3. Enabling the digital disruption across the value chain with a deployment of high security standards.

The digital energy journey starts now! All the energy stakeholders, operators, technology providers and researchers should collaborate jointly to make it happen with the right speed and the right sense of urgency in order to deliver the highest benefits to the European consumers, consumers and citizens.

1 See: www.ev-merge.eu
2 See : www.flexiciency-h2020.eu

General Use case	Description	Detailed Use Cases	Expected benefits
Asset management	Transmission & Distribution Networks and Power Generators' Assets new models: Smart products, Data-driven business models, Technology-driven customer engagement and New alliances. (80% of companies who invested in IOT increased their revenues.)	Predictive maintenance (predicting the loss of life of assets, e.g. transformers)	Increase reliability of supply, Reduce cost of Operations and Capex, Improve quality of service
		Collaborative Asset Management using Cloud (Asset Intelligence networks)	
		Asset Information and Health	Provide real time Asset Cockpits reducing incidents and outages
		Dynamic line rating	Defer grid upgrades
Network planning and Operations	Improved digital options for network planning Smart operation of the network using IT & OT integration, Big Data and Predictive Services (a large Dutch DSO collects 1.5 billion Grid sensor measurements to forecast the required operations in real time)	Digital planning of grid reinforcements	Decrease grid upgrade costs
		Demand-driven predictive planning , voltage control and smart grid re-configuration	Increase DER penetration, reliability of supply and better Network usage
Customer participation	Full Customer Energy Management using Big Data and IOT (800 million estimated installed smart devices by 2020 to understand customer behavior by Utilities)	Smart Metering 15' data Building Energy Data Analysis Demand Response Peak load management Real time energy visibility Peer to Peer comparison to change behavior	Energy Efficiency Cleaner energy consumption Reduced bills
Balancing	Digital tools allow the TSO and DSO to balance the network more efficiently	IOT big data collection from end customers and data aggregation balancing. Islanding operation using DER, Micro-grids	Better matching of demand and supply across the energy mix
Integration of EV and storage	Storage assets and EVs can become part of the solution to integrate DER (estimated total world energy storage market by the year 2020 is 50 billion $)	V2G Services Use cases defined by the "Merge" project[1]	Increase reliability of supply Decreasing grid upgrade costs Avoid over-voltages
		EV coordination schemes	Peak shaving for the consumer
Market Facilitation (e.g. DSOs) Data Hubs	The data that market facilitator provides (e.g. DSO) can be offered to other commercial parties to facilitate market operation	Use cases described by the market model to facilitate the market	Enable flexibility to enter the market Strengthen case for building energy management technologies
		Use cases defined by the "Flexiciency" H2020 project[2]	Increase Energy Efficiency and collaboration services between Distributors and Retailers

DSOs to take on new roles in an evolving energy market

By Hans ten Berge, Secretary-General, EURELECTRIC (pictured)

In the context of a rapidly evolving energy market, the coming years will be crucial for Europe's energy systems. Strict environmental objectives aimed at reducing carbon emissions, increasing penetration of decentralised distributed generation and the electrification of transport are bringing on a new energy reality. New industry players are emerging and interacting with Distribution System Operators (DSOs), forcing changes in the way they operate and plan their networks. DSOs are consequently moving away from their role as passive network operators towards active system management of the distribution grid. They are taking on a more active coordinating role in facilitating markets while continuing to provide a stable and high-quality service to all customers in a smarter grids context.

THE COMPLEXITY OF FUTURE SYSTEM DEMANDS

DSOs must continually adapt and extend their central role in facilitating an open and competitive market. Being at the heart of the changes that are happening within their own networks and with a deep understanding of how their own distribution systems work and operate, DSOs are in a position to act as neutral energy market facilitators and coordinators of all customers. In the future evolution of energy networks towards a smarter grid concept, DSOs are responsible for guaranteeing distribution system stability, power quality, technical efficiency and cost effectiveness through the intelligent use of technology.

DSOs are key to upgrading and operating an increasingly more complex network, allowing market parties to enable customers to optimise the way they use energy and benefit from it while keeping costs and complexity at acceptable levels.

DATA MANAGEMENT HIGH ON THE AGENDA

A key part of the DSO's role in facilitating the energy market is data management. The goal of any data management system does not revolve only around ownership, but rather around correct and fair information sharing in an efficient, transparent, non-discriminatory way. In order to manage their networks in a more active way, policy makers need to clarify the DSO involvement in data management.

Clearly, there is no 'one-size-fits-all' approach to data management. Different data hubs, formats and market models have been and are being implemented in different European Union Member States. The evolution of technology and ICT systems, alongside the deployment of smart meter infrastructure, will enable much better observability and operability of the distribution grid, thus speeding up the achievement of smart grids.

As competition and choices increase for the customer, new data privacy challenges emerge. The transformation will lead to a ramp-up in information and data flows, leading to the need for appropriate measures to be established to guarantee secure, neutral and efficient data management.

A DSO-TSO BALANCING ACT

In contrast with the transmission network, in which connected customers and connection points

to other networks are very few, distribution networks are usually characterised by a large number of customers, self-generators and larger-scale (distributed) generators. The connection of a greater number of generation resources, such as renewables, to satisfy demand requires substantial growth in the size and complexity of distribution grids.

As the technical contact point for customers, DSOs are in a unique position to meet their needs and choices in terms of connection, quality, security and continuity of power supply. Hence, DSOs are ideally suited to manage very large numbers of connection points and to balance local grids. DSO activities must therefore be separate from - and complementary to - TSO ones, bearing in mind that DSOs are the only players capable of exploiting the benefits of a local approach in terms of grid management and customer support.

RECOGNISING AND INCENTIVISING THE NEW ROLE OF DSOS

To meet the challenges ahead, national energy regulators must make sure that DSOs are properly incentivised through a sound regulatory methodology covering both traditional and innovation-related assets. Regulatory schemes must incentivise DSOs to be efficient, to deliver long-term investment according to a predictable and consistent regulatory framework and to make efficient trade-offs between active system management and physical grid reinforcement.

Performing these new roles will evidently lead to extra costs related, inter alia, to the introduction of smart grid solutions and the increasing complexity of data handling. The new energy reality requires energy regulators to ensure that all these changes benefit customers and other network customers. Policy, regulations, roles and procedures have to be set taking into account efficiency and non-discrimination. The new setup must make sure that costs are minimised whilst competition is nurtured and a level playing field is guaranteed for all market participants.

Amongst growing concerns about high electricity tariffs across the EU, it is important to limit and avoid any unnecessary extra costs. Any proposal of creating new regulated entities such as separate and regulated data hubs should be carefully assessed to make sure that the benefits accruing from new solutions are truly superior to any resulting increase in the cost and/or complexity of the system.

CONCLUSIONS

DSOs are key players in enabling a successful energy transition. The evolution of the energy sector towards an efficient and smarter system will only be possible if DSOs play an active coordinating role between all market participants, facilitating markets and services in a neutral and non-discriminatory manner. For this to happen, DSOs must operate within a consistent regulatory framework, where competition is encouraged and a level playing field is guaranteed for all market participants. ●

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Cognitive computation and communication for IoT

By Van Tam Nguyen, UC Berkeley / Telecom ParisTech

1. INTRODUCTION

In the next decades, Internet of Things (IoT), the interconnected networks of physical objects embedded with electronics, software, sensors, and connectivity will revolutionize how we work, live, exercise, entertain and travel. IoT is experiencing explosive growth in both quantity (20.8 billion IoT devices by 2020[1]) and utility, with increasingly important applications in healthcare, military operations, transportation and urban planning[2]. However, IoT faces several major growing challenges. First, incorporating appropriate intelligence and smart connectivity into IoT objects requires a computing paradigm that exceeds the current computing capabilities of smart phones and portables[3]. Second, ensuring privacy, security and safety of IoT applications is critically important, as IoT is susceptible to external attacks that can cause either leak of private information or dangers to users. Third, many IoT applications require a high degree of reliability, robustness and a low degree of latency that exceeds the current design of wireless communication and cloud computing. Fourth, since IoT requires process of large amount of data from numerous devices, hardware design for IoT applications need to be not only flexible and adaptive but also highly energy-efficient.

In the current architecture of IoT, cloud computing provides the virtual infrastructure for data collection, analysis, visualization and service delivery[3]. With the growing number of billions of IoT devices, there will be a great demand on cloud Data Centres (DCs), resulting in massive energy expenditure and emission of CO_2. Today, the DCs are already responsible for about 2% of global greenhouse gas emissions, a similar share to aviation[4]. In 2007, the DCs consumed on the order of 330bn kWh, equivalent to the entire electricity demand of the UK. This demand is projected to triple or quadruple by 2020, and accounts for 1.5-2% of all global electricity demand, at a growing rate of 12% per year[5]. Many IoT applications, such as smart vehicular traffic management system, smart driving and smart grid require real-time and low-latency services. If the processing, computation and storage of the enormous amount of data are performed only within DCs, the massive data traffic generated from IoT devices will result in network bottlenecks, and affect the performance of all IoT applications. In order to better handle the communication demand of the IoT, and reduce the energy consumption and the emission of CO_2, Bonomi et al. proposed the concept of Fog computing[6]. Its key principle is to bring the cloud closer to the end user by transforming as much as possible data into action at the network edge. The recent work in[7] showed that in the context of high number of latency-sensitive applications, Fog computing outperforms cloud computing. However, the privacy issues, the security and reliability problems remain unsolved.

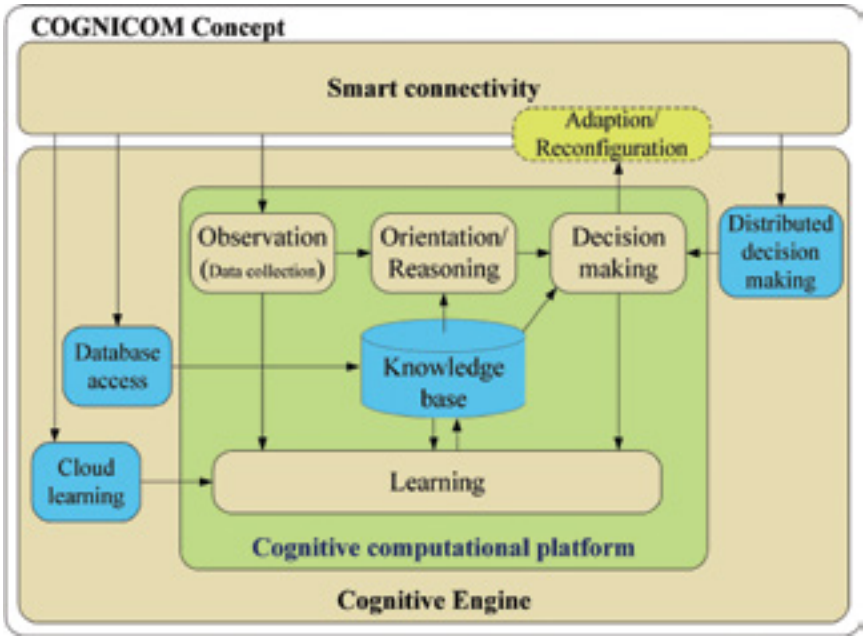

Fig. 1: COGNICOM concept

2 COGNICOM SOLUTION

To address those four major challenges, we propose the development of COGNICOM, a hybrid architecture powered by Cognitive Engine (CE) that facilitates optimal

use of both local smart application gateways and cloud computing. COGNICOM shares some common features with Fog computing in terms of bringing computing closer to the end user, however with one key difference: where computation occurs will be decided by the CE to maximize utility, reliability, and privacy and minimize latency and energy expenditures of the entire IoT networks. At the heart of the CE are deep-learning algorithms organically integrated with advanced game-theoretic decision analytics to supply cognitive functions for selective smart objects as well as the complete IoT application. An equally important feature of COGNICOM is Smart Connectivity (SC), which enables seamless, energy-efficient and reliable connection to the cloud, smart-objects and other IoT devices and sensors.

3 COGNICOM CONCEPT

The COGNICOM architecture depicted in Fig. 1 consists of two entities : the CE and the SC. The CE concept is an extension of the previous research on cognitive radio[8,9]. CE is defined as an intelligent agent that manages the cognition tasks. First, CE performs observations, collects data and extracts the information and the knowledge regarding environment or user. The CE then reasons in order to analyse and classify the situation and decides on the appropriate response. Once decisions are made, the CE adapts and reconfigures its parameters with respect to user-defined objectives. The learning component of CE evaluates the outcomes of the decisions and is responsible for building up knowledge and context awareness to be exploited in future orientation/reasoning phases. It should be powerful enough to enrich the knowledge base, to foster the increased efficiency of the reasoning and to enhance the decision. As a result, there is a close interaction between learning, knowledge, reasoning and decision, which complement each other to improve the operation of the system as a whole.

The SC enables connections with the cloud and other objects to amplify the capabilities and the value of the CE. Its goal is to enable connectivity to every device everywhere and anytime. SC will leverage the CE to support Dynamic Spectrum Access (DSA). SC is multifunctional, flexible and scalable.

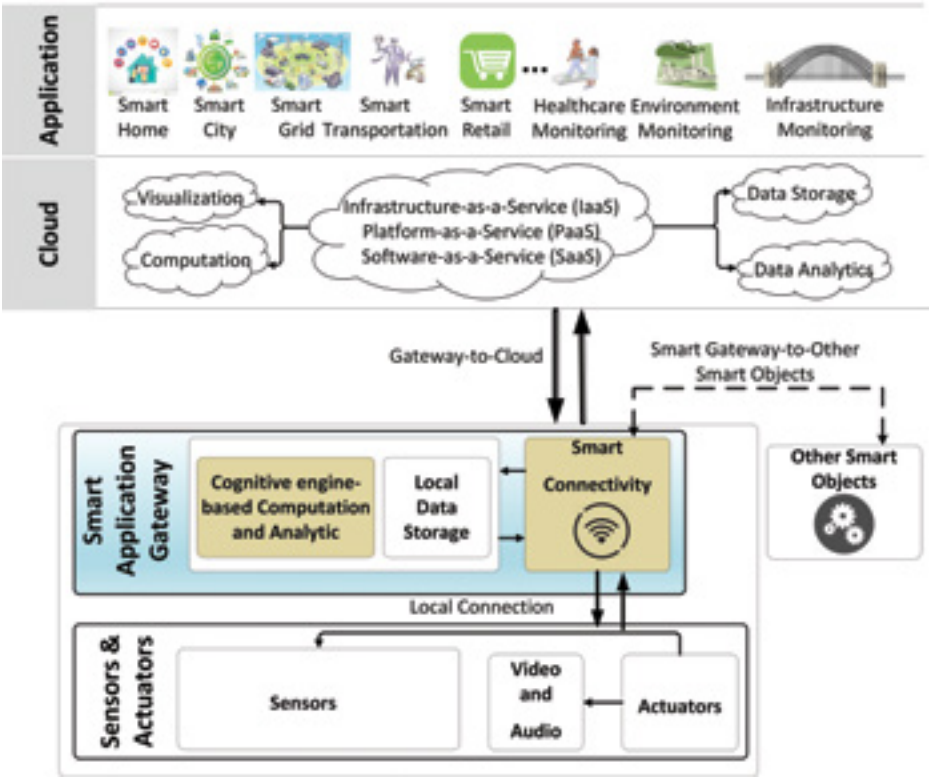

Fig. 2: COGNICOM Implementation based on SAG.

4 COGNICOM IMPLEMENTATION

The IoT hybrid architecture shown in Fig. 2 is inspired by a past trend in mobile communication, where base stations became smaller, less expensive and more capable over time (micro-cells, pico-cells and femto-cells[10]). The idea is to move away from cloud computing and Fog computing, and to leverage local computing whenever possible. This not only reduces costs, boosts capacity, reduces latency and speedups network expansion, but

also enhances privacy, security and reliability of the network. It will also improve the sustainable development of the IoT ecosystem. In order to do so, the key enabler is the smart application gateway (SAG), which should be able to perform many tasks that are currently relegated to cloud computing. In addition to its traditional functionalities, SAG will also (1) collect, classify, and integrate data; (2) interpret data to generate appropriate responses; and (3) perform actions and/or generate alerts/warnings. The majority of data will be stored and processed in local databases. The interpretation of the data will be performed by the CE, whose deep-learning algorithms will be pre-trained using cloud-based computing. The CE will detect abnormal activities and emergency situations and directly provide appropriate responses. It is also responsible for timely response services and decision of which data should be sent to the cloud platform for further analytic and interpretation. It is also capable to learn to adapt its functionalities, capabilities and behavior to the environment and user in order to achieve predefined objectives.

5 CONCLUSION

IoT is experiencing explosive growth in number of devices and applications. However, the existing cloud-centric architecture of IoT poses serious challenges regarding cognitive capacity, connectivity, safety, privacy, flexibility, latency and energy-efficiency. We have proposed to develop COGNICOM, a brain-inspired software-hardware paradigm, to support IoT's future growth. COGNICOM brings computing closer to end-user and focuses on optimal uses of local SAG and cloud computing. COGNICOM consists of two key components: Cognitive Engine and Smart Connectivity. CE is powered by deep-learning algorithms integrated with game-theoretic decision analytics, implemented on low-power Network Multi-Processor System on Chip. CE provides cognitive functions to smart objects. SC integrates neural network inspired designs of cognitive radio, transceivers and baseband processors. SC provides flexible and reliable connections to IoT objects and optimally distributes communication resources.

ACKNOWLEDGEMENT

The author acknowledges many of his colleagues and students from BWRC and Telecom ParisTech who have contributed to the ideas presented in this paper. In particular, he would like to thank Duc-Tuyen TA and Nhan NGUYEN-THANH for the figures and Tuan DINH from Cogitativo for interesting discussions and his help.

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Improved energy efficiency in WDM network elements

By Dr. Klaus Grobe, Director Global Sustainability, ADVA Optical Networking SE, Germany

INTRODUCTION

The internet as a whole, the number of its connections, their bit rates, throughput – all of this is exponentially growing now for decades. So is the negative environmental impact of the ICT sector. From an estimated 2% of the worldwide electricity production, ICT is predicted to grow toward 10% beyond 2020. The increasing energy consumption creates a dual-fold problem. Firstly, and as long as electricity production hasn't been fully converted to renewable energy, it contributes to CO_2 production. Secondly, in the recent decades, the average energy-cost trend was exclusively increasing.

THE INTERNET AND WAVELENGTH-DOMAIN MULTIPLEXING

Today, Wavelength-Domain Multiplexing (WDM) is the basis of all broadband wireline connectivity. Without it, the internet as we know it would not exist. It is based on independently using multiple wavelengths, each one carrying digital information, for capacity increase in fiber-optic transmission. Although its contribution to global ICT electricity consumption is comparatively low (routers and end-user equipment cater for the majority), it must improve in efficiency, too. This is driven by several facts.

The internet's ever-increasing bandwidth appetite requires similar development in efficiency (otherwise, internet's energy consumption would be exponentially increasing). Then, without improvements, WDM equipment like some other gear as well could easily create hot spots in data centers and similar places. Finally, it is well-known from Life-Cycle Analysis, that the majority of green-house gas and some other relevant environmental-impact factors (like ozone depletion) is determined by the use phase, and that is, by the energy efficiency during the lifetime of the respective network elements.

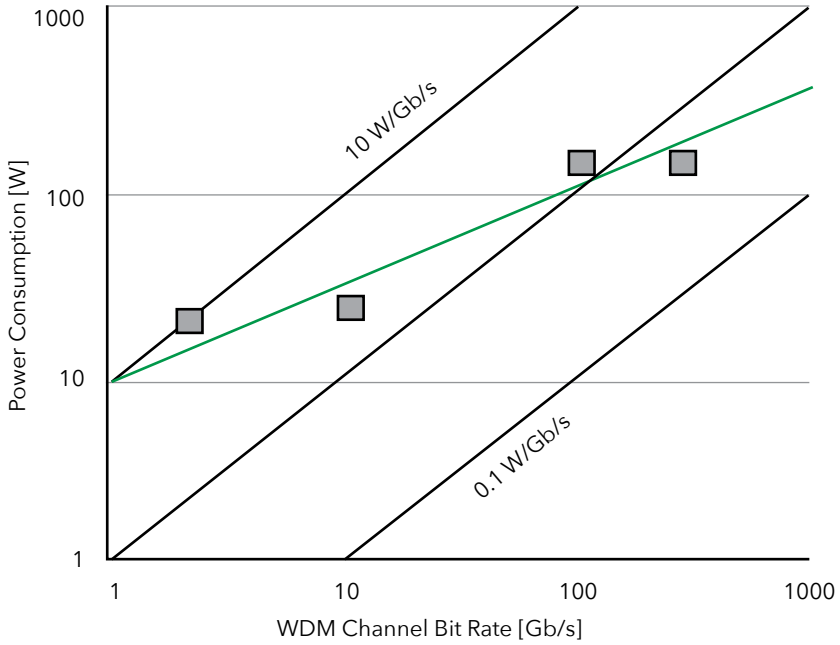

Figure 1: Increase of WDM energy efficiency over time

A STORY OF IMPROVING WDM ENERGY EFFICIENCY

ADVA Optical Networking started developing WDM gear in 1994. For certain operational reasons – avoidance of the hot spots in data centers already mentioned – energy efficiency has always been a primary concern. This is reflected by the fact that, to first approximation, the same number of WDM channels always fit into one shelf, irrespective of the channel bit rate. This was only possibly by massively increasing the per-bit-rate energy efficiency (expressed in W/(Gb/s)). Research enabling this improvement has been supported by several EU projects, among them the projects C-3PO and the more recent and ongoing CEEOALAN. These projects supported specific photonic-components and high-speed-modulation aspects with special regard to energy efficiency.

One result of the continuous WDM energy-efficiency improvement is demonstrated in Figure 1. It shows, over bit-rate generations and that is, over time, and for typical WDM transport configurations, the development in energy efficiency. One can derive from the figure that our most-recent 400-Gb/s technology exceeds 0.5 W/(Gb/s) efficiency, which for the time being is record-breaking. This was enabled, on the basis of long-term research and development, by combining latest chip-sets, ever increasing power-supply efficiency, optimized voltage distribution within the WDM shelves and smallest form factor (the latter leading to less shelf overhead).

CONCLUSION

Improvements in ICT energy efficiency are crucial. If all relevant aspects are considered and combined, the results necessary to avoid internet's energy-consumption explosion can be achieved. On top, proper use of the internet will help reducing energy consumption elsewhere.

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Factories of the Future: Energy Efficiency in Re-Industrialization

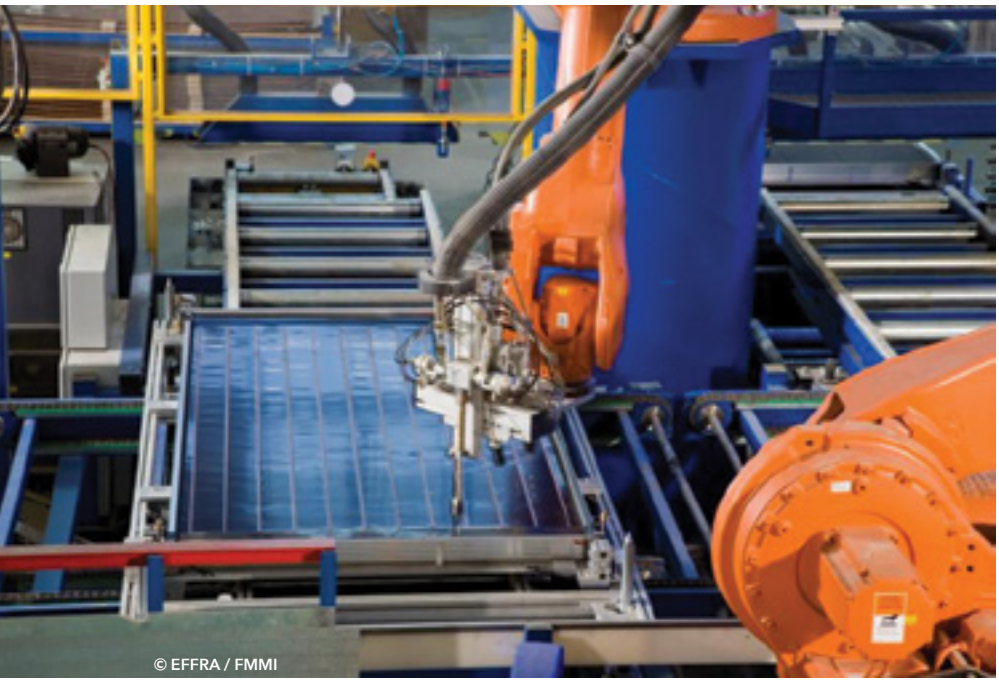
By Patrick Kennedy

Europe has a strong and vibrant manufacturing sector. Despite numerous challenges from competition and economic crises, this industry continues to grow. In Europe manufacturing is responsible for the employment of around 30 million people and for more than 80% of exports. Clearly manufacturing matters for Europe.

Every high-value product or service has a manufacturing process behind it. This includes, but is not limited to, the products/services that rely on photonics, nanotechnology, advanced materials, micro/nano-electronics and biotechnology, along with advanced manufacturing systems. Manufacturing processes themselves require increasing amounts of energy. However manufacturing companies continue to push for greater energy efficiency. Reducing the consumption of energy, while increasing the usage of renewable energy, is crucial as nearly one third of global energy demand can be attributable to manufacturing. Achieving reductions in the consumption of energy and increasing energy efficiency is no easy task.

In order to support advances in manufacturing, including greater energy efficiency, the European Union launched the 'Factories of the Future' research and innovation partnership. Supported through the EU's Horizon 2020 research and innovation programme, 'Factories of the Future' is a €1.15 billion seven year partnership supporting pre-competitive collaborative research.

The 'Factories of the Future' programme identifies the European Union's 'Europe 2020' strategic aim of a 20% increase in energy efficiency, as one which it can help to realise. The programme supports research and innovation to produce goods which will realise greater energy and resource efficiency through efficient factories.



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The research and innovation priorities of our 'Factories of the Future 2020' strategy include those that focus directly on energy efficiency and related issues. These include energy-monitoring and management, product-service simulation for greater sustainability, on-demand manufacturing and new approaches to the design and management of manufacturing strategies.

Our strategy makes it clear that products of the future will become increasingly complex. Therefore our manufacturing process must evolve whilst reducing energy consumption through intelligent, adaptive and scalable systems.. For us the future means that, in an agile market, Europe's manufacturing systems and processes will need to adapt to the differing demands of both the market and the factory by making use of intelligent robots and machines which cooperate with each other and with people, in an autonomous manner while maximising their efficiency in energy consumption.

The factories of the future will not only be continuously more energy efficient but will also be the places in which new energy-efficient technologies will be manufactured. Therefore the partnership is aiming to achieve greater efficiencies as well as to increase our ability to manufacture those technologies which will enable greater energy-efficiency in other sectors.

'Factories of the Future' energy-efficiency is not an issue which can be considered in isolation. From planning to real-time management, multiple issues need to be considered as each one has an effect on the other. In the 'Factories of the Future' partnership

this understanding is central to our approach. To date the 'Factories of the Future' programme has launched more than 200 research and innovation projects with more to follow. 'Factories of the Future' projects tackle the challenge of energy efficiency through different approaches. A number of examples illustrate such approaches.

The REEMAIN project focuses on resource and energy-efficiency in manufacturing through innovation in technologies for better use of renewables, predictive simulation models for production, and factory energy and resource planning tools. The ultimate aim is to achieve a substantial increase in energy-efficiency through the intelligent employment of renewable energy technologies.

Another energy-focused project is MEMAN, which is concerned with integral material and energy-flow management. It is focusing on how energy and raw materials flow through a production chain, analysing all the stages of a manufacturing process and measuring the key factors affecting the environmental and economic impact. As part of this process the project will develop new business models to increase energy-efficiency so that it is not simply a matter for one technology or another, but rather a holistic strategy.

With an emphasis on sustainable predictive maintenance, the SUPREME project aims to develop and use advanced signal and data processing dedicated to predictive maintenance and the reduction of energy consumption.

These three project examples show how the 'Factories of the Future' partnership is addressing the challenge of greater energy efficiency through different approaches with research and innovation that can be applied within specific sectors or across them. This application means that the 'Factories of the Future' partnership will substantially contribute to reducing energy consumption. Looking towards the future it is already possible to foresee factories which are low energy consumers, production lines which drive efficiencies to new levels and factories that are sites of self-generation. Realising such possibilities requires both ambition and vision. Europe's 'Factories of the Future' partnership has both.

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INFIERI

Intelligent Fast Interconnected and Efficient devices for Frontier Exploitation in Research and Industry

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INFIERI is an inter-disciplinary and multi-national **network**, **aimed to train young physicists and engineers** in developing, designing and managing intelligent devices and tools for cutting-edge applications in the fields of **Astrophysics, Particle Physics, Medical Physics**, and **Telecommunications**, also exploiting their technological spin-offs and cross-field synergies.

The network gathers leading academic institutes, European laboratories (NIKHEF, RAL), high-tech companies (PHILIPS, THALES) as full partners. Associated partners in Europe (CERN, several leading companies and Universities), the USA (FNAL, Purdue University, Tezzaron Semiconductor) and Korea (Seoul National University, SAMSUNG SAIT) bring advanced and complementary scientific and technological expertise.

The **Research & Training program** is focused on specific case applications, which require **innovative technical solutions** for an **extremely fast on-instrument signal processing,** a **proficient event selection phase,** an **efficient transmission** and a **final step of high-level data filtering:** these are the goals of the Research & Training of INFIERI.

The three main applications on which the INFIERI program is focused are:

1. The **new ways to exploit the tracking system information** in **real-time trigger filters** for exploring New Physics in the harsh environment of the **Large Hadron Collider (LHC)** a**t CERN**, running at the highest luminosity in the next decade.

2. The **next largest terrestrial telescopes array data systems**, made of numerous detectors spread over kilometres, for **Astrophysics**.

3. The use of **advanced Silicon sensors** and **Silicon photomultipliers technology** with **advanced data processing** for **Astrophysics, Particle Physics** and **Positron Emission Tomography** in **Medicine.**

The research and R&D are arranged around Workpackages WP's among which:

• WP1 on Intelligent Front-End (on-instrument) Processing,
For developing advanced signal processing on the Front End Readout Electronics (FEE) on-detector for Astrophysics, High Energy Physics (HEP) and Medical Imaging Instruments for performing, in sometimes very harsh conditions, an **efficient data reduction** and **selection**, based on a **real time** understanding of the **Physics** and **diagnoses**.
This early stage decision making implies major technological breakthroughs, in the Front-End Electronics circuits based on advanced microelectronics that process the signals from **Silicon PM**'s (SiPMs) and **Silicon sensors all based on most advanced technologies.**

• WP2 on R&D and Applications of New Interconnect Technologies with the development of **3D vertically interconnected** devices, enabling **extreme compactness** and **very high speed** for future CMOS architectures. **3D Integration** can create intelligent detectors and data processing elements with unprecedented capabilities.

A new intimate mixing of technologies, achievable only within 3D integrated circuits, permits **per-pixel processing** and evaluation circuitry that **reduces power and increases detector sensitivity**.

Entirely new advances in detector technology are made possible. **Key to success is**: strong collaboration among partners from Academics and High-Tech Institutes and Firms

• WP3 on New Data Transmission Technologies for the transfer of data from detector modules to the far-end processors, with high-rate and high speed data transfer conditions, in harsh environments, are vital to future experiments and a number of real-life applications:

WP3 targets unprecedented transfer rates with low mass, radiation hard devices, novel optical wireless communication, and, given the large number of data links, their interconnectivity.

• WP4 on Massive Parallel & High Performance Computing

The High Level Trigger of a **large area telescope system** will combine and appropriately handle the information from all the individual components (telescopes) of the network. Innovative aspect for the **Medical application** includes a high level processing to treat the information delivered by the highly pixelated Imaging device. **HEP Level 1 Trigger** will require matching the charged tracks with the calorimeter or the muon system information for identifying peculiar features of interesting Physics processes. It implies developing and testing the use of new advanced technology for processing **in real time huge amount of data**.

This WP is closely related to **Massive Parallel Computing developments (hardware & firmware)** and to **Advanced Telecommunications Computing Architecture** (ATCA).

The INFIERI project aims maintaining Europe leadership, at the forefront of the top research fields and high technology domains it addresses.

Fuel cell systems and hydrogen supply for early markets

INTRODUCTION

The European FP7 project Liquid Power is coming to an end after 5 years of developing a new generation of fuel cell systems for back-up power markets and for material handling vehicles, as well as developing new innovative hydrogen supply methods for onsite methanol reforming.

The present report illustrates the development of an integrated fuel processor (FP) and pressure swing adsorption (PSA) system for onsite hydrogen production to fuel cell systems. In this project, Catator is responsible for the development and delivery of the pressurized FP system. ZBT is responsible for the development and delivery of the PSA system as well as for the integration and evaluation of both FP and PSA systems. Dantherm Power is responsible for the development of fuel cell systems for back-up power and for material handling vehicles.

A new generation fuel cell system for backup power has been developed in the project.

The fuel cell system is constructed in such a way that it is scalable in nominal output power from 1.6kW to 5.0kW. Also, the system can be modified with an add-on Cold Climate Kit, which enables the system to operate at very low ambient temperatures (-40 degrees Celsius).

ONSITE FUEL PROCESSOR SYSTEM

The fuel processor which has been developed is based on a coil-concept, where a steam reforming catalyst is inserted into a helix shaped tube (Optifomer design). The basic idea is to minimize thermal stress on the steam reformer section. The overall dimension of the reactor is ca. diameter 312 x length 415 (mm) and its weight is ca. 50 kg, which makes it suitable for onsite fuel reforming.

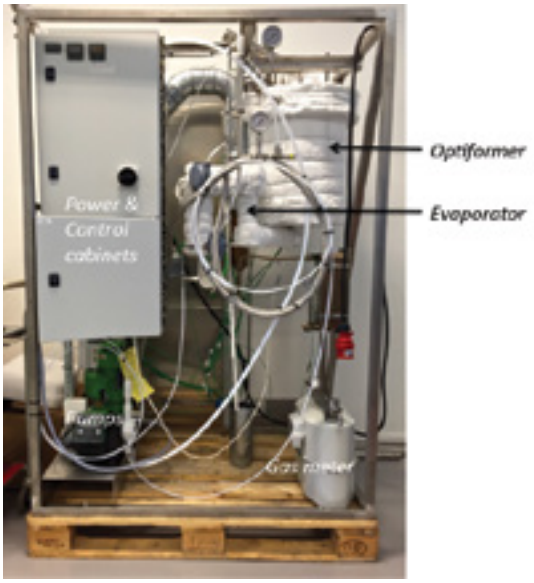
PRESSURE SWING ADSORPTION SYSTEM

On an industrial scale, state of the art pressure swing adsorption plants have typical outputs of up to 100,000 m³/h of pure hydrogen. Small to medium hydrogen production plants in the range of 10 m³/h commonly apply alternative purification technologies, which often lack in hydrogen purity or have to employ very costly materials like Palladium/Silver (Pd/Ag)-membranes. To overcome these lacks is the target within the LiquidPower project.

The main challenge for the development of the PSA is the technical and economic feasibility of the small scale PSA in the context of pressurized methanol reforming. The nominal capacity is in a range of 10 m³/h (30 kW) pure hydrogen and the design pressure is 12 bar, suitable for onsite hydrogen production. The PSA contains commercially available components, and the system design makes it capable of achieving a following third party CE certification. The application of both the Machinery Directive and the Pressure Equipment Directive specify a clearly structured roadmap for a future commercial launch of the PSA.

ONGOING WORK

The present work is focused on commissioning and evaluating the fuel processor and pressure swing adsorption as an integrated system as well as evaluating the new fuel cell systems for back-up power and material handling vehicles for the markets. The final results are expected to be available in the spring of 2016.



The FP system during verification tests

Assembly of Pressure Swing Adsorption System (rights by Photograph: www.eventfotograf.in / ©JRF e.V.)

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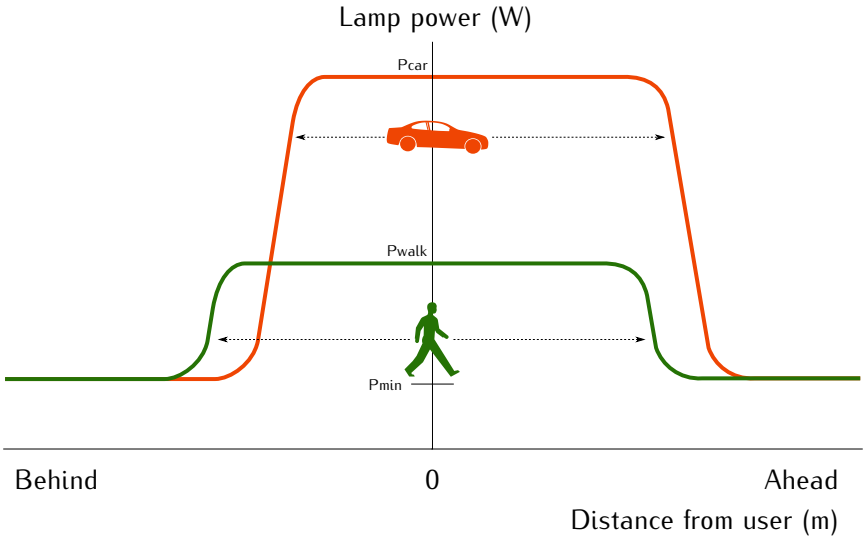
Smarter Cities thanks to Smart Street Lighting!

Smart Street Lighting is the natural entry point for Smart Cities hardware infrastructures!

Smart Street Lighting control is based on deploying intercommunicating sensors along the streets to adapt, in real-time, lighting levels to traffic density and type of users (cars, cyclists and pedestrians). Without sacrificing security or visual comfort, Smart Street Lighting control contributes to minimize electrical energy consumption and light pollution.



This is exactly the SmartNodes™ (www.smartnodes.be) design philosophy: each street user receives a light bubble that moves with him!

The best results, in terms of service performance, are obtained by dedicating to each luminary a control module (sensors, communication with neighbor modules and local computing power). This confers maximal response speed, system robustness and ease of extension. The lighted zones are stand-alone, but nevertheless, thanks to appropriate gateways, they are able to communicate with the outside world, allowing tele-control, tele-monitoring and embedded software upgrades.

With that approach, Smart Street Lighting offers you a dedicated computer network that fits precisely to the streets network. It provides a high resistance to failures (information hops over a failing module), and it is stand-alone but easily acccessible to the outside world.

Such an infrastructure, equipped with adequate sensors, is precisely what is needed to acquire the information about outdoor public space and required to manage Smart Cities. That information may be processed by a common Control Monitoring System (CMS), providing, whatever the domain, an integrated access for city administration and relieving it of a multiplicity of different dashboards.

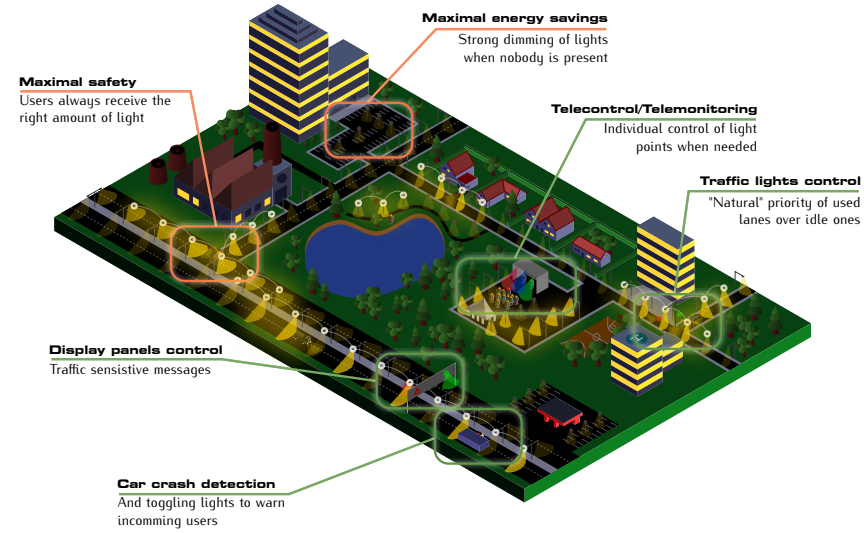
By design the system gives you the best control of street lighting (for EACH luminary: real-time individual control, electrical energy consumption statistics, monitoring of the driver and the LEDs, etc.). Moreover, it gives you real-time access to traffic information, sampled under each luminary!

It is already a good entry point for the management of mobility, a pillar of Smart Cities, opening the way to many applications by controlling, in the most secure (and user friendly) way, traffic lights, pedestrian crossings, traffic and warning signs. All the information needed is available through the sensors of street lighting.

SmartNodes is also introducing a range of remote sensors, tied wirelessly to the SmartNodes network, with local energy harvesting, providing a fully maintenance-free access to other parameters needed for Smart Cities administration. The first applications are aimed at: management of parking lots by detection of free spaces, optimization of waste collection by remote monitoring of garbage cans filling level, street sound level monitoring, atmospheric pollution monitoring, road icing conditions, etc.

In addition to their lighting function, Smart Street Lighting networks are the natural candidates to gather and transfer information, measured in the streets, for Smart Cities administrations. That exceptional versatility largely compensates their additional cost compared to dimmed traditional solutions.

More info at info@smartnodes.be



Bringing the Power of Heat to the European Assembly Line

By Roberto Francia, Managing Director, COGEN Europe – The European Association for the Promotion of Cogeneration

When electricity is generated in thermal power plants, heat is a significant by-product. However, large electricity producers in Europe are wasting it because of the distance between centralized power stations and industrial heat users. This inefficiency represents a great cost to the European economy. Cogeneration - or Combined Heat and Power (CHP) - ensures that this heat is captured and used. CHP is a valuable tool in light of the EU's 2030 climate and energy objectives and of the climate targets agreed by the wider international community in Paris. Heat conscious policies could also lead to significant competitiveness gains for the European industry.

Today, industrial consumption reflects 37% of Europe's heat demand. One of the key virtues of CHP is its appropriateness for efficiently meeting this demand. Industrial processes demand large amounts of heat, making them ideal for high-efficiency cogeneration. In addition, using cogeneration to provide both heat and electricity on site allows an industry to substantially reduce its carbon footprint - for energy intensive industries, this figure is even greater. CHP is embedded in many sectors including food, agriculture, ceramics, chemicals, refining and paper and in the supply chain of many more industries including packaging, food processing and the automotive sector. In fact, recent studies have shown a significant market for new efficiency gains that dynamic CHP technologies could deliver.

CHP also provides industry with alternative business models that give entities more control over their energy supply at local level. Instead of consuming electricity in a passive way and being subject to fluctuating electricity retail prices, industrial plants are able to generate their own power and heat. These benefits allow industries to boost their productivity by reducing the cost of heat by up to 30%. The savings obtained through cogeneration may be reinvested in the production process and make European industry more competitive.

Smart technologies can also allow CHP to increase the inter-connectedness between stakeholders on the grid and produce efficiency gains all along the value chain. Therefore, CHP could significantly contribute to the revitalization of European Industry within the 2020 Industrial Renaissance strategy.

Just as Cogeneration technologies are ideally placed to satisfy industry's energy demand, industry is well positioned to transfer cogenerated

electricity supply onto the grid. Industries using CHP have much to offer electricity networks in addressing issues of capacity and predictability of supply. Industrial CHP electricity is reliably available with scheduled maintenance times, and plant capacity is normally modest in size compared to central generation, allowing industries to play a role in aggregated supply. However, the availability of flexibility will vary among different industries and their participation to capacity and balancing services will depend on the opportunity cost of deviating from existing production schedules.

At European level, the Junker Commission's focus on energy efficiency has led to the first ever Heating and Cooling Strategy. This will encourage policy makers to focus on the added value of CHP for energy efficient industry across a range of legislative fields. The Strategy has clearly been informed by a strong awareness of the energy saving potential of CHP in industry: it takes a holistic approach to energy production and demonstrates an institutional trend away from an electricity centric energy policy. It also takes into account the fact that heat demand is not purely a consequence of seasonal household heating needs, but is also the result of year round industrial processes. This new approach is encouraging and we hope to see it reflected in legislative reform.

Maintaining the *Energy Efficiency First* approach of the Strategy not only strengthens the trilemma of the EU's energy goals but also synergizes: the security of supply, competitiveness and environmental protection. Policies directed towards industrial CHP would facilitate all these objectives for the following reasons:

- By optimizing on site production, energy supply becomes more secure and less contingent on fluctuating market conditions;
- Efficiency gains from CHP production further the aims of the Energy Efficiency Directive. For this reason, on site energy savings should be encouraged.
- CHP technologies enhance environmental protection on many levels: they significantly reduce $C0_2$ emissions by making industry more energy efficient; they improve the performance of renewables overall by stabilizing intermittent RES supply through energy storage; in addition, market for CHP technologies using 100% renewable fuels is growing rapidly.
- Within the Circular Economy, CHP facilitates waste to energy processes by making heat intensive incineration 90% more efficient.

Cogeneration is ideally placed to facilitate energy savings in industry, and industry is in the right position to Cogenerate. Utilizing untapped potential of CHP in industry will lead to substantial and dynamic efficiency gains that will strengthen EU energy and industrial policy as a whole. Legislative reforms currently in the pipeline are promising, particularly in the context of energy intensive industry.

The CODE2 project, co-funded by the European Union, demonstrates that 20% of electricity and 25% of heat could be produced in cogeneration mode by 2030 in a cost-effective manner. It is high time to bring the Power of Heat to the European Assembly line.

Waste-to-Energy in the European Union

By Lighea Speziale and Lorenzo Ceccherini

Every year around 250 million tonnes of municipal waste are produced across the 28 European countries. New Circular Economy Targets, set by the European Commission at the end of 2015, require that at least 65% of this amount should be prepared for re-use or recycled by 2030. In cooperation with Recycling, European Waste-to-Energy (WtE, incineration with energy recovery) plants help Member States divert waste that cannot be recycled from landfilling, thus achieving the maximum reduction of environmental impact. Residual Waste which would otherwise be buried in landfills is better used when it can supply electricity and heat as a secure and affordable source.

Together with District Heat (DH) for households, the WtE sector worked extensively to improve the connection with industries, in order to provide efficient, cost-effective energy that allows diversifying their energy supply, reducing carbon footprint and reaching sustainability objectives.

This short article focuses on energy efficiency of the WtE process, showing some virtuous example of existing plants across Europe.

WASTE-TO-ENERGY IN THE EUROPEAN UNION

During 2013, about 82 million tonnes of household and similar waste that remains after prevention, reuse and recycling was treated in 457 WtE plants in Europe (EU28+CH and NO). From this waste around 33 TWh of electricity and 82 TWh of heat were generated, sufficient to completely satisfy the electricity needs of 15 million inhabitants and the heat needs of 14 million, and at the same time capable of replacing fossil fuels, such as coal, gas and oil, used by conventional power plants.

WtE is involved in EU environment as well as energy policy and helps reaching the EU targets for renewable energy. In average, 50% of energy produced in WtE plants qualifies as renewable, thus helping to reach the 2030 target of 27% share of renewable energy in the energy market and the 40% further greenhouse gas reduction. In addition, the European Council committed the EU in 2009 to decarbonize its energy system by at least 80% below 1990 levels by 2050. As thermal energy represents around 45% of total energy consumption, renewable heating and cooling are vital to achieve this goal.

The European Commission's Energy Union package announced in February 2015 suggested that exploiting the potential of waste to energy would help to further establish synergies between energy efficiency policies, resource efficiency policies and the circular economy.

The electricity and heat produced in WtE plants also follow the "Energy efficiency first" principle promoted by the European Commission, powering the synergy between energy-consuming industrial activities and energy providers (that e.g. produce energy as a by-product of other industrial activities). European Waste-to-Energy plants provide such synergy by treating residual waste and at the same time producing energy in the CHP (Combined Heat and Power) mode or as electricity/heat only.

Render of the new Copenhagen plant

ENERGY EFFICIENCY IN WASTE-TO-ENERGY TECHNOLOGIES

In Europe, around 60% of WtE plants are CHP, recovering both electricity and heat from the energy content of residual waste and providing affordable and secure energy to the neighbour houses, public services and industries. Around 50 TWh were provided to DH networks from WtE plants in 2010 and potentially in 2050 the contribution could raise up to 200 TWh, with the appropriate investment to improve infrastructure and connections between the energy providers and the networks.


Medieval town of Ferrara

The following examples of energy recovery from residual waste in Europe can help illustrate in practice how the WtE sector provides clean and useful energy to the neighbour municipalities and industries, while at the same time plays a crucial role in the waste management

- **Vaanta, Finland**
  In the city of Vaanta the new WtE plant, operational since September 2014, was developed with an innovative technology. In the plant, that covers 30% of the electricity demand of the city and 50% of the district heat, the steam produced in two grate boilers is superheated by the remaining heat of the exhaust gases of a gas turbine. This way the steam can reach higher values of thermodynamics parameter optimizing the efficiency of the thermal conversion and reducing the corrosion of the boiler pipes at the same time.
- **Ferrara, Italy**
  In the medieval town of Ferrara, the WtE plant is connected to the 56-km DH network, together with a geothermal plant and a natural gas boiler. The WtE plant's management is developed in order to adapt to seasonal changes: during hot periods, when heat demand is low, the electricity production is maximised; during winter the focus shifts to maximise heat recovery. The average yearly contribution of WtE to the network is around 40% and the energy produced helped to achieve fossil fuel savings of around 238 GWh/y.
- **Copenhagen, Denmark**
  From 2017 a new WtE plant in Copenhagen will substitute a 45-year-old plant, treating around 400,000 tonnes of waste annually and supplying a minimum of 50,000 households with electricity and 120,000 households with district heating. Through an innovative water-cooled grate furnace, and high steam parameters (440°C / 70 bar) it will reduce the NOx emissions by 95% and will double the electrical efficiency of the former plant. In addition to the technological merits, the plant´s architecture includes a roof-wide artificial ski slope open to the public.
- **'ECLUSE', Flanders**
  "Ecluse", French for 'sluice', was chosen as the name for the Waasland Port heating network because superheated steam will be sluiced from three WtE plants to companies in the port. The 5-km long pipelines will have a capacity of 110 MW and will be laid partly underground, partly above ground. By connecting to the heating network, the participating companies will be able to replace their gas-fired boilers entirely or in part. The annual CO_2 emissions avoided will be approximately 100,000 tonnes (same environmental saving that would come from using 50 standard 2.3 MW wind turbines). The whole ambitious project will additionally cover 0.8% of Belgian electricity demand.

These 4 examples provide a sneak peek of the level of technology that this sector aims to reach in the future. Energy efficiency has a key role in EU decarbonisation of the power sector, and should be enhanced through new efficient district heating and cooling infrastructure, the development of high efficiency cogeneration and the use of heating and cooling from available waste and renewable energy sources.

CEWEP (Confederation of European Waste-to-Energy Plants) is the umbrella association of the owners and operators of Waste-to-Energy plants (waste incineration with energy recovery) across Europe. CEWEP's members are committed to ensuring high environmental standards, achieving low emissions and maintaining state of the art energy production from remaining waste that cannot be recycled in a sustainable way.

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Energy efficient technologies for data centres

Data centre design was originally focussed on reliability, however today there is greater awareness of the need to make them more sustainable. Life Cycle Assessment (LCA) studies have identified that a data centre's energy use, embodied impact and source energy are all important factors in its environmental impact.

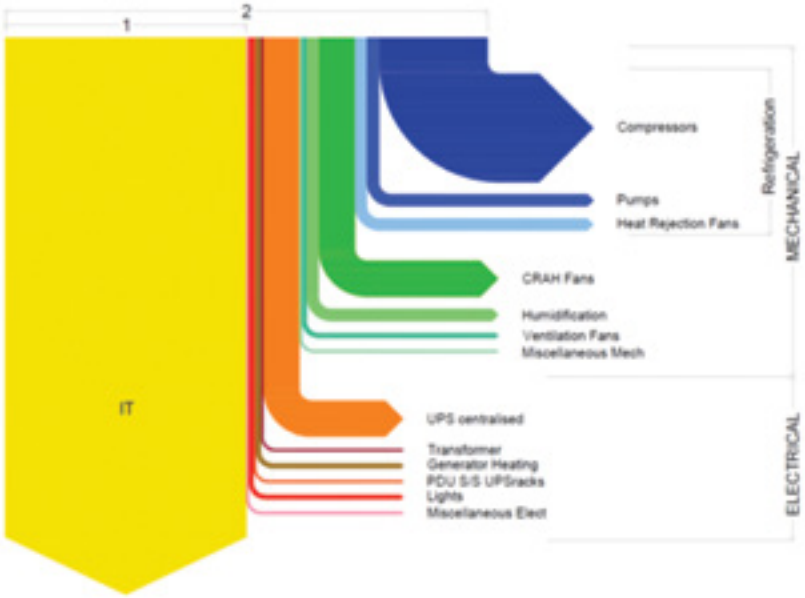
Increasing policy and cost pressures have forced the data centre industry to look at how to become more energy efficient. Cooling is usually the largest energy consumer after IT load in a legacy facility and the area with the greatest potential for improvement.

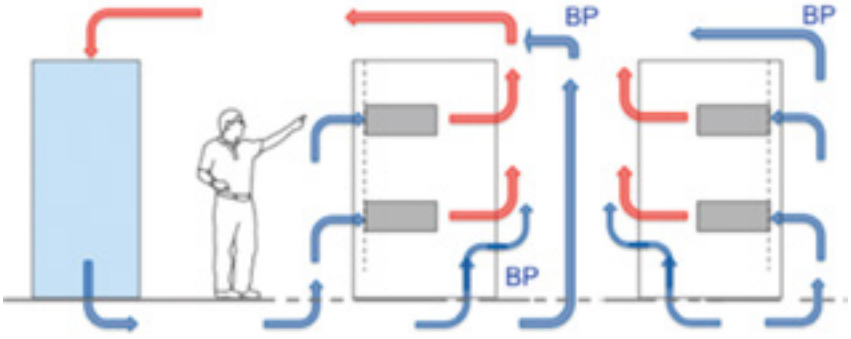
Most IT equipment in the data centre is air-cooled. Better understanding and management of the environmental requirements for IT equipment enables significant improvements to both the performance of cooling and the potential reduction in its energy requirements.

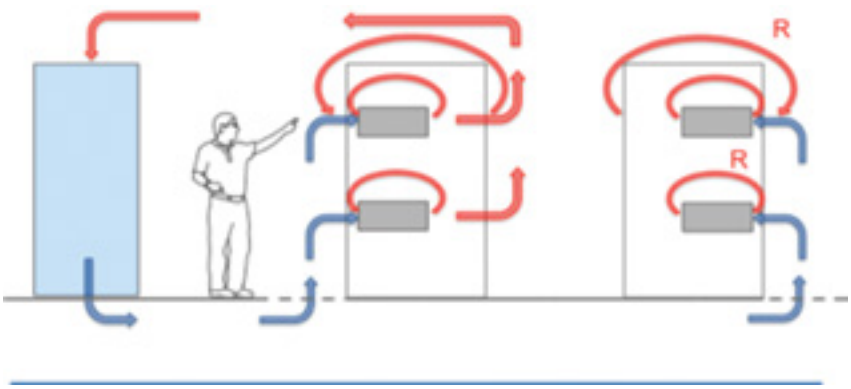
The results from several surveys in legacy facilities has identified poor delivery of cold air to IT equipment, caused by both bypass of air from the cooling units and recirculation of hot server air [as illustrated in the diagrams on the right]. The typical solution is to reduce temperature set points and increase cooling unit fan speeds, both of which result in increased energy consumption and do not address the root causes of the problem.

This is in part caused by the different stakeholders and contractual requirements: the designer must ensure the cooling units deliver the required amount of cooling to the room but are usually not responsible for the delivery path of the cold air to the IT equipment. This is also not the responsibility of the IT infrastructure team, however, the racks they choose, their layout and their management will impact the air delivery. Collaborative working and sharing of knowledge is important to allow cooling performance to be optimised.

The temperature and humidity requirements for IT hardware have







The main types of free cooling for data centres are:	
Direct Air Side	Supply outdoor air into data hall, mixing, humidifying when required.
Indirect Air Side	Outdoor air used to cool data hall air via an air / air plate heat exchanger. Allows more free cooling, particularly when hot but dry (adiabatic, evaporative cooling)
Water Side	Chilled water supplied to data hall cooling units uses outdoor conditions for cooling rather than refrigeration, e.g. via dry coolers or cooling towers.

widened in recent years. ASHRAE TC 9.9 (American Society of Heating, Refrigeration & Air Conditioning Engineers Technical Committee 9.9 on Mission Critical Facilities https://tc0909.ashraetcs.org/) have worked with IT hardware vendors to expand the recommended and allowable environmental ranges so that data centre cooling systems can run at warmer temperatures and capitalise on reduced refrigeration / increased free cooling operation.

The upper temperature limit of the recommended range is 27C, however it is also possible to deviate from this range, on occasion, into the allowable ranges A1-A4 (A1 upper limit 32C, A2 upper limit 35C). With these requirements it is possible to design and operate cooling systems without refrigeration (i.e. 100% free cooling / economizer) in most of the world, particularly in European climates. This allows a significant operating cost saving from reduced energy consumption; the facility's overhead factor, described by the industry as PUE (power usage effectiveness), reduces from 100% of the IT load to below 20%. There is also a reduction in maintenance cost and capital cost, not only for the mechanical plant but also the reduced electrical plant needed to support it.

Of these, indirect air-side free cooling offers the best performance in most cases. Direct air-side free cooling may use slightly less energy in cooler climates but there are risks associated with supplying air directly into the data hall. In addition, sometimes these systems are installed with a refrigeration system for back-up, which has associated capital and maintenance cost implications, even if it does not run often. Water side free cooling solutions have more heat exchange processes and therefore offer fewer free cooling hours, however they may be the preferred choice for a retrofit solution where it is difficult to move large volumes of air adjacent to the data hall.

In all cases it is important to properly define the design brief and analyse the requirements so that technology is properly applied, rather than purely looking for a product solution. Frequently, energy efficient products are purchased and installed but not properly understood or commissioned and hence underperform once live.

Operational Intelligence are data centre specialists who work collaboratively with operators to optimise their data centre reliability and energy performance through consulting and education
www.dc-oi.com

The European Code of Conduct for Data Centre Efficiency is a voluntary initiative launched by the JRC which publically shares guidelines for energy efficiency best practice, including those described in this article.
http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/data-centres-energy-efficiency

SMART CITY event

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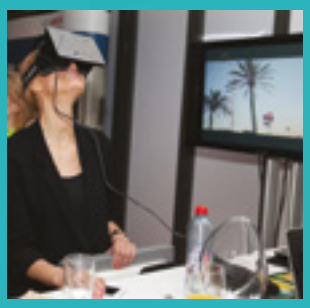



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