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**Smart Grids**

**Aviation**

**Bioenergy**

**Rail transport**

Country profile  
**PORTUGAL**



**Aguiar Machado**

Director General  
European Commission  
DG MOVE



**Nils Torvalds**

MEP



**Eric Dautriat**

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Energy



SUSTAINABLE ENERGY  
WEEK 15-19 JUNE 2015

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To obtain additional copies please email  
info@europeanenergyinnovation.eu

#### **EDITOR**

Michael Edmund  
editor@europeanenergyinnovation.eu

#### **BUSINESS DEVELOPMENT DIRECTOR**

Philip Beausire  
philip@europeanenergyinnovation.eu

#### **COMMUNICATION & ADVERTISING**

Stephen Hayter  
stephen@europeanenergyinnovation.eu

#### **HEAD OF BRUSSELS OFFICE**

Sophia Silvert  
Mob: +32 4737 30322  
sophia@europeanenergyinnovation.eu

#### **DESIGN & PRODUCTION**

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# Foreword

Welcome to the Summer 2015 issue. As EUSEW rightly celebrates European efforts to make itself and its systems more sustainable, we are reminded that the ongoing hostilities in Ukraine and uncertainties over energy security impart fresh impetus to these aims.

In our feature on smart grids, Manuel Sánchez-Jiménez and Flavia Gangale from the European Commission review the policies, technology and financial instruments at the heart of the EU climate and energy strategy. "We are witnessing", they say, "big changes to the way electricity is produced, transmitted and used". It will be no surprise that CEN and CENELEC together put the case for standardisation in the energy sector, such as in the integration of the European electricity and gas markets.

Louise Ciaravella, of the European Bioenergy Research Institute places the rapid growth of bioenergy in the context of 2050 targets for CO<sub>2</sub> reduction. Part of the solution lies in new technologies, such as 'Pyrofabs'. Another part is a new organisation, Bioenergy North West (BioenNW), which sees 11 European partners working together to promote bioenergy within five regions in North West Europe. Nils Torvalds MEP pulls no punches in his excellent and wide-ranging analysis. Looking back to 2007, he chides that work on strengthening EU energy policies has been ongoing for a long time, yet the objectives seem to have remained the same for at least a decade. Referring to the Ukraine crisis and unrest elsewhere, he questions the wisdom of over-reliance on diversifying energy supplies, suggesting that Interconnectivity might have a role, though requiring enormous investment. Bioenergy may, he concludes, have much to offer.

From the aviation sector, Eric Dautriat reports progress on many fronts that brings the Clean Sky Joint Undertaking closer to its CO<sub>2</sub>, noise and NO<sub>x</sub> targets. He also tells us that several Clean Sky 1 projects are ready to be tested this year. While the sector might still have its environmental detractors, Michael Gill reminds us that the modern air transport system connects the world, flying over 25,000 aircraft across nearly 50,000 routes, each year transporting over 3.3 billion passengers and 50 million tonnes of cargo while supporting over 58 million jobs and \$2.2 trillion in global economic activity.

As COP 21 approaches, Aguiar Machado, Director General at DG MOVE reminds us that despite technical progress, energy efficiency improvements and policy efforts, EU transport still depends on oil and oil products for 96% of its energy needs. He notes that four of the seven Horizon 2020 Joint Undertakings concern transport. Meanwhile, Philippe Citroën underlines the environmental credentials of rail transport and the ambitious goals set for the European Transport system. He shows how the €920 million Shift2Rail project seeks to improve the capacity and reliability of the rail system, before making the bold claim that rail-bound solutions should be the starting point of any future EU policies aimed at promoting sustainable transport.

And there is much more for you to read inside.

**Michael Edmund**  
Editor

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rotterdam



# Breakthrough value creation

The port of Amsterdam has been importing goods and materials from all over the world for more than seven centuries. Nothing characterises the port of Amsterdam more than its entrepreneurial drive. This quality is highly relevant if we look at topical issues such as the depletion of raw materials worldwide, one of the greatest challenges and uncertainties of the next twenty years.

**A**s a world-scale energy port, it is self-evident to Port of Amsterdam that it should seek to contribute substantially to innovations in fossil energy, the transition to clean energy and the creation of a bio-based and circular economy.

## THE SEARCH FOR ALTERNATIVES

Amsterdam is a major European port for agricultural products (agribulk) and recycling. Those are exactly the pillars required to recover raw materials and energy from waste and basic and residual flows. Transformations the port of Amsterdam facilitates include those from fryer fat to biodiesel, from urine to phosphate for the production of artificial fertilisers and from sewage sludge to bio-LNG. Renewable energy offers countless opportunities for the region. Residual flows for raw materials and energy production are intelligently exchanged in Amsterdam test gardens to produce lucrative cycles, often in combination with innovative biotechnology. Bio-based and circular business activities have taken root here alongside the existing industry. Start-ups operate next to established businesses. We ensure a solid connection between global logistics and regional production. Between supply, use and re-use. And between mineral and bio-based. In other words, the port of

Amsterdam is one ecosystem on three scale levels: international hub, industrial hotspot and cross-pollination for the region.

## PORT OF PARTNERSHIPS

This approach ties in seamlessly with our Vision 2030 (<http://www.portofamsterdam.com/Eng/Vision-2030>) to develop the Amsterdam port region into an intelligent hub in both the global trade network and the regional economy. Port of Amsterdam works shoulder to shoulder with all parties concerned. We are simultaneously market master, matchmaker and co-creator. Our task as market master is to strengthen the core clusters and new niches. As matchmaker we bring people, technology and sectors together. In our role as co-creator, we help to generate new initiatives, activities and start-ups. Sustainable growth within the existing area is the priority. The port may be the engine of the regional economy, but it should be as clean and quiet as an engine can be.

## PORT OF AMSTERDAM

Amsterdam is the 4th port in Western Europe, the largest petrol and cacao port in the world and the second coal port in Europe. Located on busy shipping routes, in the large European delta with water connections reaching far into Europe (e.g. the Rhine), Amsterdam is a perfectly suitable European and international energy port. ●



CFO Ed Nieuwenhuizen:

*"The port of Amsterdam is a catalyst for increasing sustainability within the industry on a broad basis. Many companies demonstrate successfully here what the added value of sustainable business can be."*



AEB



Rietlanden



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# The New Politics of Energy: Supply, Demand - and, of course, Power

By Michael Edmund

*Human perversity, then, makes divisions of that which by nature is one and simple, and in attempting to obtain part of something which has no parts, succeeds in getting neither the part- which is nothing- nor the whole, which they are not interested in.*

- Anicius Manlius Severinus Boethius, *The Consolation of Philosophy*

## **SUPPLY AND DEMAND; PRODUCTION AND CONSUMPTION**

EUSEW rightly celebrates Europe's sustainable energy achievements, its technologies and its people: recent figures indicate that the continent has already achieved one of the 2020 climate and energy goals it set itself, that of deriving 20% of its energy from renewable sources. Perhaps even more impressively, production of renewable energy grew by no less than 81% between 2002 and 2012. However, when Eurostat informs us that 22.3 % of total primary energy production in 2012 was renewable, it is perhaps salutary to infer that 77.7% was not. Having remained relatively constant for five years, energy consumption decreased sharply (by 5.8%) in 2009, and rebounded almost as sharply (by 3.8%) in 2010, followed by further small decreases in 2011 and 2012. Notwithstanding the impact of the 2020 goals, this pattern has largely been attributed to the effects of the financial and economic crisis, rather than any fundamental or structural shift in the pattern of European energy consumption. Oil therefore continues to be our most important energy source, while gas remains the second most important. Meanwhile, our dependency on energy imports in 2012 stood at over 53%. Indeed, for the last decade, net imports of energy have been greater than primary production: put simply, our industry and our lifestyle continue to require a great deal of energy; and we import more than we produce for ourselves. This is perhaps not an ideal state of affairs.

But before we rush to judgement, it

is hardly a revelation that 500 million people inhabiting a technologically advanced continent should require considerable quantities of energy. And neither is it particularly surprising that there are energy-producing countries elsewhere that are eager to satisfy this demand. In an era of large-scale exploitation of oil, the acronym OPEC has become almost synonymous with the word wealth, which in part explains Russia's more recent efforts to develop its own considerable reserves. From a European perspective, it is interesting to examine gas in a little more detail: gas features heavily in the 2020 package because burning it for electricity produces less CO<sub>2</sub> than does the burning of coal. According to Gazprom's figures, Europe imported 161.5 billion cubic feet (Bcf) of gas from Russia in 2013, with the vast majority (127.1 Bcf) going into the more industrialised countries (Austria, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Switzerland, Turkey and the UK). And Russia has benefited accordingly: the topforeignstocks website notes that oil and gas products accounted for two-thirds of the value of all Russian exports in 2013, and about 50% of the Russian Federal budget revenues in 2014. Beyond Europe, of course, the Shale Gas Revolution has transformed the US energy scene, while Turkmenistan, Azerbaijan and now Uzbekistan are eyeing the European market. Although dwarfed by those of Russia, Turkmenistan's proven natural gas reserves as of December 2012 stood at 353.1 Trillion cubic feet (Tcf). The country, however, faces significant challenges in developing these

reserves, of which the largest is in the Amu Darya basin in south-east of the country: almost as far from Europe as it is possible to be. The other main issue relates to insufficient pipeline infrastructure or foreign investment. Meanwhile, Azerbaijan's Shah Deniz reserves under the Caspian Sea, though smaller (estimated between 50-100 Billion cubic metres) are much closer to Europe.

## **BIG MARKET, HIGH STAKES: AND SO TO THE POLITICS**

Having seen Latvia, Lithuania and Estonia join the EU, Moscow has naturally sought to consolidate its sphere of influence, perhaps with particular concern over access to the warm water port at Sevastopol in the Crimea. It is perhaps no surprise that energy has become a new battleground, and co-incidentally a weapon; and that Ukraine has become the focus of much of the activity. Its current Head of State President Poroshenko declared in a recent interview with the BBC his desire that Ukraine become part of the EU; and it is perhaps not an oversimplification that some parts of Ukraine share his aspiration while others prefer to look toward the Kremlin. President Putin had used the prospect of cheap gas to encourage Poroshenko's predecessor President Yanukovich to resist Europe's overtures, but when Yanukovich was overthrown, Gazprom raised its price by 44%, and Ukraine has run up a huge debt. Indeed, it is probably no exaggeration to say that Ukraine's finances seem somewhat precarious. Meanwhile, Russia's apparent willingness to use gas as

an economic weapon exposed the lack of a European plan to withstand a shortage of energy in general, and gas in particular, and added renewed impetus to Brussels' 2020 climate and energy objectives. One of these, that of increasing the share of energy consumption from renewables by 20% by 2020, seems immediately logical from this new perspective. Arguably, its importance is now even greater.

EUSEW is an example of what is possible when people combine their

efforts in pursuit of an objective. Let us hope that Ukraine does not become an example of what could happen when people pursue separate objectives: we should not forget that, like the Baltic States, Turkmenistan, Azerbaijan and Ukraine were also once part of the USSR. Meanwhile, OPEC is flexing its muscles again - albeit much more subtly than it did in the 1970s - and is apparently keen to forestall growth in market share by either Russia or America. Each issue now makes its own contribution to a perfect storm of

territorial influence, natural resources, money, energy security and climate change. Resolving it will require huge investment and an acceptance that all parties have much to gain from co-operation - and much to lose by forsaking it. This complex and many-layered situation offers an explanation for the European need to seek a more diverse energy supply (diplomatic code for "reduced dependency on Russia"), which has put Ashgabat and Baku firmly in the spotlight. And Kiev firmly in the crosshairs. ●



# The Flexplate - A sustainable and compact alternative to conventional heat exchangers

## INTRODUCTION

Whether to generate more profit or to be more energy efficient, increasingly customers ask us to make their existing plant, process and/or factory more efficient. This echoes today's zeitgeist exactly. It is not only governments that are making ever more stringent demands on industry, but consumers and individual employees too are demanding more awareness from companies. The call is for companies to make their production processes more sustainable, more efficient and more energy efficient. Bronswerk is willing and able to respond to this and, therefore, we are investing time and money in the development of products and solutions to enable our customers in achieving their goals. Examples of this are the case studies we have already reported on: high-efficiency cooling using Whizz-Wheel fans, for one. Air-cooled coolers that are equipped with these efficient fans consume up to 60% less energy and are 4-6 dB(a) quieter than air-cooled coolers equipped with conventional fans. We have also reported on the Compact Header heat exchanger, which enables customers to achieve weight and space savings of up to 70%, resulting in weight reductions for the supporting steel structures, for example on drilling platforms, too. In the same vein, we would like to draw your attention to

the Flexplate heat exchanger, a sustainable and compact alternative to the conventional heat exchanger.

## WHAT IS THE FLEXPLATE?

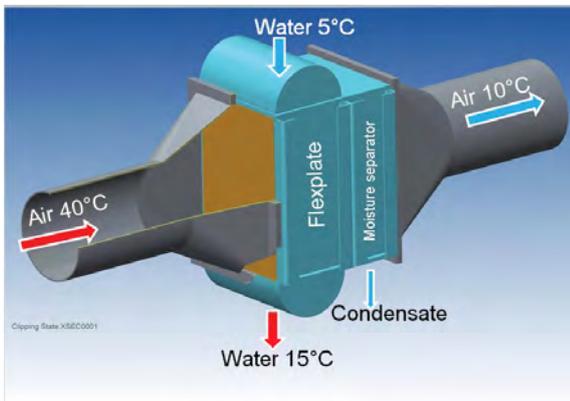
Similar to a plate exchanger, the Flexplate (see the drawing and photo), consists of a series of stacked stainless steel plates welded together two by two along the outer edges, resulting in a kind of envelope. Advanced spot-welding processing of these two stacked plates makes it possible for the inside of these plates to be used for the liquid medium while the outside is used for the gas medium. Because these sets of stacked plates are very thin and close together, the heat transfer relative to the content is quite considerable, resulting in a compact installation. The Flexplate is an entirely new development in the cooling or heating of various liquids or gases by means of air. Until now, liquid has often been cooled by means of air using conventional heat exchanger tubes, consisting of the familiar finned tubes. Notwithstanding the advantages these finned pipes have - resistance to high pressure, for example - the Flexplate will be a suitable, and in many cases, a better alternative. The Flexplate, which largely resembles a plate heat exchanger (see drawing), has many different applications, such

as for condensers, evaporators, heaters and air cooling, as will be described later in this article. But besides being a suitable alternative to conventional heat exchangers, the Flexplate will - depending on the process - also be suitable for other, and even new, applications. This could include the following process conditions:

- Moist air from which the moisture condenses; here the Flexplate doubles as a moisture separator
- Polluted air; since the surface of the Flexplate is smooth, when combined with high air velocity there is little chance of dirt adhesion.
- High air temperatures; the Flexplate is made of stainless steel or Inconel, which makes it very suitable for high temperatures and is corrosion resistant too.

## CASE DESCRIPTION

The installation illustrated here cools process air by means of water and is used in a plastics production plant. The biggest challenges for this design were the low pressure drop and limited installation space. The low pressure drop was necessary, as an existing fan had to be used. The reason for the installation space being limited was that



Above: case description air cooler by use of Flexplate. Above and to the right: radiax compressor surrounded with flexplate.

the design was an extension of an existing process, meant to increase the efficiency of the entire process.

Additionally, it is essential for the air in this process to be dry after cooling and for it to remain below 10°C. Another requirement was for the installation to have a very long service life (sustainability) despite lots of moisture, which could cause corrosion. The drawing above shows an outline sketch of this process. The air, which enters at 40°C, is cooled down to 10°C with a cross counter flow of water. Since the water vapour in the air condenses through cooling, this water has to be drained off, so the plates serve as a moisture separator as well as heat exchanger (condenser).

The example in the photos is our revolutionary Radiax compressor in which, after compression, air is cooled by means of these Flexplates. This Radiax compressor is very efficient and, combined with the internal Flexplate cooling plates package, it creates an extremely compact compressor.

#### COMPACTNESS

Owing to its compact design, it was possible to fit the unit (Flexplate in combination with built in moisture separator) into the available space. And owing to the requirement for a low pressure drop, the plate distance had to be correct (not as close to each other as in a plate heat exchanger), so that the pressure drop would remain limited yet capacity be maintained. Condensing water vapour gives an enormous increase in the heat transfer coefficient, but only if the water droplets formed are able to flow away quickly. Due to the shape and vertical arrangement of the Flexplates, this is the case here.

#### SUSTAINABILITY

The sustainability of this unit could be guaranteed on two points: because the installation is made entirely from stainless steel, it is corrosion resistant – guaranteeing long service life. In addition, owing to the low pressure drop, the existing fan could be used. In short, this unit complies with the sustainability requirements in all respects. ●



#### Contact details:

For more information or to find out what this can mean for your system, send an email to [info@bronswerk.com](mailto:info@bronswerk.com).

# Joining all energies to deliver innovation for transport

*By Mr Aguiar Machado, Director General, European Commission (pictured)*

**W**hile COP 21, the United Nations Climate Change Conference, is approaching, the transport sector is increasingly reminded of one of the biggest challenges it faces: its dependence on oil. Despite technical progress, energy

efficiency improvements and policy efforts, EU transport still depends on oil and oil products for 96% of its energy needs. This does not only impact our climate and local air pollution but also affects our economy. In 2010, the oil import bill was around €210 billion for the EU. If we do

not address this oil dependence, people's ability to travel - and our economic security - could be severely impacted with dire consequences on inflation, trade balance and the overall EU competitiveness.

The 2011 Transport White Paper duly recognised the importance of this challenge and proposed as a response a roadmap to improve transport efficiency and decarbonise the sector by 2050. This goal has been translated in specific objectives to make the existing means of transport more efficient, to improve the transport system as a whole (for instance through measures on traffic management) and, last but not least, to ensure low-energy means of transports become more effective.

The Transport White Paper listed a number of policy instruments and levers that were at the disposal of the European Union to achieve these goals. These cover a broad range of tools from regulation to pricing, infrastructure funding and standardisation. In addition, the White Paper recognised that 'innovation is essential for this strategy', not only to deliver new technologies but also to promote more sustainable behaviour.

Following the experiences which were initiated under the 7th Framework Programme for Research and Technological Development (FP7), the European Commission has decided to further enhance the cooperation of all actors to address the full cycle of research, innovation and



deployment in an integrated way. As a result, a number of Joint Undertakings have been (re-) established under the Horizon 2020 Framework Programme so that all actors involved in specific sectors could come together and deliver coherent and result-oriented research and innovation programmes.

Out of the seven Joint Undertakings in Horizon 2020, four are directly or indirectly related to transport, namely: Single European Sky ATM Research (SESAR) 2020 to develop the new generation of European Air Traffic Management system that will enhance the performance of air transport; Fuel Cells and Hydrogen 2 to accelerate market introduction of clean and efficient technologies in energy and transport; Clean Sky 2 to develop cleaner, quieter aircraft with significantly less CO<sub>2</sub> emissions; Shift2Rail to develop better trains and railway infrastructure that will drastically reduce costs and improve capacity, reliability and punctuality. These partnerships are expected to complement and add value to the research carried out through the regular Horizon 2020 calls for proposals.

The improvement of the vehicles' efficiency and the use of cleaner energy are the first elements on which innovation can contribute to improving today's transport system. Given the size of the challenge ahead of us, research and innovation should not be limited to incremental improvements but should also, where necessary, be disruptive and produce a real step change compared to today's technologies

and behaviours. Research and innovation activities in these fields need to also be accompanied by appropriate regulatory measures, deployment and standardisation efforts, in order to help transport 'growing out of oil' and thus becoming cleaner and more competitive.

In addition, to the improvement on the means of transport, the better use of existing networks would also contribute to improving the overall sector's efficiency. As a result, activities on automation, intelligent transport systems (ITS) but also on the deployment of smart mobility systems such as the air traffic management system of the future (SESAR), the European rail traffic management system (ERTMS), and the next generation of multimodal traffic management and information systems will be essential. The example of the development of next generation's air traffic management system though SESAR is particularly appealing. Following its development phase, the SESAR Joint Undertaking is currently launching its deployment phase, which will see the large scale production and implementation of the new air traffic management infrastructure, composed of fully harmonised and interoperable components guaranteeing high performance air transport activities in Europe.

Last but not least, another element of our strategy is to make greater use of more energy-efficient modes and ensuring that these are more competitive. With Shift2Rail, the Commission has decided to considerably boost the research

and innovation effort on rail (by tripling its financing) with a view to develop and accelerate the bringing to market of technological breakthroughs, which should improve the competitiveness and the reliability of the rail sector. By ensuring the participation of all relevant stakeholders from the entire rail value chain, Shift2Rail will deliver a consistent and coherent plan to appropriately answer the challenges of the rail sector through a real system approach. Moreover, the early involvement of operators in the initiative will also guarantee that the technologies developed fit the needs to the sector and can be rapidly deployed.

For the future, as announced in the Commission's recent Energy Union package, we will be developing a strategic transport research and innovation agenda. This will aim at further deepening our understanding of the potential of new technology to improve transport - and identifying the key steps to deliver the appropriate research work.

Of course, the EU research and innovation initiatives are only pieces of the puzzle, but essential one. Recent experiences have demonstrated that by 'joining energies', result-oriented research and innovation programmes can achieve a faster and cheaper transition to a more efficient and sustainable European transport system. Combined with regulatory initiatives, standardisation and funding efforts, innovation is therefore a great asset to achieve a truly safe, competitive and resource efficient transport system. ●

# The Thermaco Project: Smart Thermal conductive Al MMCs by casting

## SUMMARY

Due to their improved properties compared to traditional metals or polymers, composites are promising materials for use in several technologically advanced products. The main focus of THERMACO lies on heat evacuation applications in fields such as power microelectronics, e-mobility or (renewable) energy generation as well as highest performance combustion engines.

The ever-growing demand for heat evacuation applications is motivating today's suppliers to come up with better and better heat conductive materials. Most of the products which were recently introduced to the market are carbon based materials aimed for extremely high heat conductivity (up to 2,000 W/mK). While delivering extremely good thermal properties, the carbon products themselves usually do not have a structural

value in terms of mechanical properties, hindering stand-alone applications. However, when enclosed in metal envelopes, they could be used to form MMC (Metal Matrix Composite) parts which are significantly more durable and strong. Due to the lack of satisfactory machining and manufacturing technologies, this approach could not yet be implemented. So far, complicated and cost-intense multi-part cooling systems have to be applied, hindering a further functional integration or power increase.

THERMACO aims at providing manufacturing technologies for extremely efficient solutions in heat evacuation based on Aluminium Metal Matrix Composites (Al-MMC) with Carbon-based inserts, like Graphene, applicable in many key technologies and products bolstering several sectors in Europe.

## KEY FEATURES

- Deliver **knowledge-based design/layout guidelines** for extremely efficient metal matrix composite parts with **integrated carbon-based thermal highways**
- Develop reliable and efficient **production technologies for cast metal matrix composites** with integrated thermal highways including

- Develop **design definitions for surface micro structures** to ensure an optimal heat transfer from the heat source to the thermal highways
- Develop optimal **machining processes for precision finish and surface structuring** of metal matrix composite parts with carbon-based thermal highways including:
- Deliver **Life Cycle Analysis and environmental impact** information on novel metal matrix composites with integrated carbon-based thermal highways
- Develop **complete process chain** to manufacture composite parts with thermal highways and increased properties to enhance cooling efficiency
- **Secure and exploit intellectual property** from generated knowledge to bolster competitiveness and market strength of consortium partners and European industry

## KEY BENEFITS

- Delivering the proposed new, much more efficient heat evacuation solutions will therefore significantly **boost the competitiveness of a wide range of European high-tech and cutting-edge industry sectors.**



Thermal measurement of the THERMACO demonstrator



- **Higher utilization of advanced materials** in products with improved performance without a cost.
- **Decrease in raw materials and energy consumption** during the processing, manufacturing and/or dismantling phases and reduction of waste increase.
- The **THERMACO developments will provide the industry with a unique opportunity to introduce completely new, integrated product designs into the market that are currently unthinkable of.**

**POTENTIAL AREAS AND MARKETS OF APPLICATION:**  
Nanoelectronics

- Power modules for **industrial applications** and **renewable energies**: semiconductor power modules
- Power modules for **automotive applications** (electro mobility): industrial motor driver applications
- Power modules for **lighting systems** (LEDs) ●

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**Contact details:**

Project Coordinator:

Prof. Dr.-Ing Andreas Schubert

Micromanufacturing Technologies, Technische Universität Chemnitz

E-Mail: [mft@tu-chemnitz.de](mailto:mft@tu-chemnitz.de)

Website: [www.thermaco.eu](http://www.thermaco.eu)



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# A Low Carbon Built Environment: policy to practice through a bottom-up approach

By Professor Phillip Jones, Chair of the European COST Action "Smart Energy Regions" (TU1104)

SOLCER low carbon dwelling



The need for an eventual transition towards a zero-carbon planet is nowadays generally accepted. Burning fossil fuel at global, local and building scale negatively affects the environment and influences climate change, having a strong impact on air pollution and the security of energy supply. The problem is how and over what period, this transition takes place, and also how government and industry will rise to this societal challenge.

Globally, the built environment accounts for nearly 50% of CO<sub>2</sub> emission, and significantly more if urban transportation is included. We have been working for more than 40 years since the 1970's oil crisis on how to make buildings more energy efficient. We understand how to plan and design for low to zero carbon buildings. Therefore, it is high-time we start to implement it wide-scale.

The EU-funded COST Action<sup>1</sup> "Smart Energy Regions", chaired by Professor Philip Jones (UK) investigates how academic research, industry and government can work together in order to deliver a low carbon built environment. The COST Action (**TU1104 - Smart-ER**), now in its final year, has been looking at the drivers and barriers that may impact on the long-term

creation of low carbon regions in Europe. The term “smart” applies to energy supply and energy demand, from smart grids to smart living. Energy is looked at from a “systems” approach, linking reduced energy demand, renewable supply and storage. All this is considered at a regional scale, relating government policy and aspirations to industry capacity and needs.

Since 2012, the Smart-ER’s 28 member countries have identified various case studies, illustrating good and best practice, and are now developing a framework of solutions to enable long-term, large-scale implementation of low carbon technologies considering regional contextual issues.

These low carbon technology-ready solutions for applications in the built environment along with appropriate training and skills can produce affordable results with added value through multiple benefits, such as improved quality of life, reducing fuel poverty and energy demand.

However, progress on the application of such low carbon technologies can be sometimes slow as most low carbon initiatives require approval from a central body and are characterised by top-down decision making and supply-driven approach. There is less focus on local bottom-up demand driven actions. Some industries, such as the energy supply industries and the mass house-builders often seem to resist change, while others in manufacturing welcome change

as a stimulus to innovate and produce high-value products and processes. Government seems to prefer big industry solutions, and there are many vested interests and hidden subsidies to maintain the status quo. The low carbon economy will be a major future growth area and has the potential to contribute to a vibrant economy with products that can benefit our everyday life. Unless there is change in our approach, Europe may fall behind.

The focus on top-down solutions to reduce CO<sub>2</sub> emissions has so far failed to deliver a viable future energy solution. On a large scale, many technologies and processes are not sufficiently developed, such as large-scale storage, CCS (Carbon Capture and Storage), smart grids, financial “green deals” and carbon credits. They will need huge investment, there are many unforeseen difficulties, and by the time they are delivered, many technologies may be obsolete. It seems that the old industries have a culture and vested interests that apparently cannot adapt to the changes needed.

A way forward is to focus on a bottom-up system approach, applying existing solutions, linking reduced energy demand, increasing renewable energy supply and energy storage, on a building and community scale. The solutions identified by the members of the COST Action “Smart Energy Regions” will be regionally driven, providing stakeholder action, jobs, investment and profits, all on a local scale.

Typical case studies include the **SOLCER** low carbon dwellings project, funded through the Wales ERDF Structural Funds as part of Cardiff University’s Low Carbon Built Environment Programme. This has involved low carbon studies of both new build and housing retrofit. A new build SOLCER house has been designed and constructed to a **Passivhaus** level of energy demand. It uses a timber SIPS construction, which took 16 weeks to build. In winter, heat is provided by passing external air through a transpired solar air collector, then through a mechanical ventilation heat recovery unit (MVHR), and finally delivered to the space. Exhaust air is passed through the MVHR and then through an exhaust air heat pump, which heats a thermal water store.

The thermal store heats domestic hot water. A solar PV roof provides electricity to the battery store, which powers the heat pump, LED lighting and internal plug loads. There is grid electricity back-up and the house is predicted to be around 70% autonomous, being able to export around 70% more energy to the grid than it imports from the grid. The SOLCER programme also includes a series of 5 energy retrofit houses, using a similar systems approach. Retrofit measures include external wall insulation, a solar PV roof and battery storage, mechanical ventilation heat recovery, new controls and an upgraded heating system.

Both new build and retrofit have focused on performance

1 COST Actions are a flexible, fast, effective and efficient networking instrument for researchers, engineers and scholars to cooperate and coordinate nationally funded research activities. COST Actions allow European researchers to jointly develop their own ideas in any science and technology field. [www.cost.eu](http://www.cost.eu)  
 The COST Action TU1104 “Smart Energy Regions” is funded by the COST Association with support of the EU Framework Programme Horizon 2020

Picture of a before and after retrofit house



affordability and replicability. The new house has been constructed within acceptable social housing costs whilst the retrofit house costs have been reduced by around 50% compared to previous case studies.

The research network has also produced a "Smart Energy Regions<sup>2</sup>" book, containing regional case studies. It is shortly to publish books on "Cost and Value", and "Skills and Training". Furthermore, the Action recently held a 4-day training school in Belgrade on an "Integrated Approach for Retrofitting Existing Dwellings" which was attended by **16 Early Career Investigators**.

The outputs from this COST Action are timely in relation to EU policy and the introduction of new 2030 CO<sub>2</sub> emission targets. Governments need to provide leadership through action, pushing forward energy codes and regulations, which will therefore stimulate technology innovation. A fresh approach is needed also from industry in order to tackle the transition to a low-carbon economy. Ultimately,

researchers need to engage with both industry and government through real world projects.

In its final year **Smart-ER** is planning a thorough

programme of dissemination, including a workshop planned for November in Munich and the Action's final conference, which will take place in Cardiff in **February 2016**. ●

***Phillip Jones** is a Professor of Architectural Science at the Welsh School of Architecture, Cardiff University. He chairs the **Low Carbon Research Institute**, which is a network of six Wales Universities representing research interests across the low carbon agenda. The multidisciplinary **LCRI** aims to support the energy sector, UK, and globally, to develop low-carbon generation, storage distribution and end-use technologies and to offer policy advice. Professor Jones also chairs the Welsh Governments Building Regulation Advisory Committee, and he is the chairman of the board of directors of the community interest company, Warm Wales, which carries out wide-scale energy retrofits in the housing sector.*

*T: +44(0)2920 874079*

*E: JonesP@cardiff.ac.uk*

**Disclaimer:** The views expressed are purely those of the author and may not in any circumstances be regarded as stating an official position of the COST Association.

COST (European Cooperation in Science and Technology) is a pan-European intergovernmental organisation allowing scientists, engineers and scholars to jointly develop their ideas and initiatives across all scientific disciplines. It does so by funding science and technology networks called COST Actions, which give impetus to research, careers and innovation. [www.cost.eu](http://www.cost.eu)



# All new cars electric as of 2035 is going to require some effort

*ECN study reveals necessary steps for low-emission transport sector*

**PETTEN - In 2050, all private cars in Europe will have electric motors powered by batteries or hydrogen fuel cells. But how can countries ensure that there will be enough charging stations? How can they make certain that electricity grids will not become overloaded? And that hydrogen fuel stations will be available? In order to get all Europeans to switch to zero-emission vehicles (ZEVs), policy-makers at the local, national and European levels still have to push hard and, above all, cooperate.**

The EU aims for a 60 percent reduction in CO2 emissions for the entire transport sector, which will cause a revolution in the automotive world in the coming decades. Combustion engines and petrol stations will be replaced by batteries, fuel cells, charging points and hydrogen fuel stations. As a result of the strict reduction requirements, private cars and vans will have to run on sustainably-generated electricity and hydrogen. Only the emissions of long haul trucks, aircraft, ships and trains will remain, since these vehicles will still partially use fossil fuels. Since it will take about 15 years for the entire fleet to be replaced, from 2035 only new electric cars will be sold.

In the European Green eMotion project, the Energy research



*Electric cars should be able to charge everywhere in Europe without difficulty as of 2035*

Centre of the Netherlands (ECN) has specifically investigated what a large-scale roll-out of battery-powered electric cars would require. "We need infrastructure that enables cars to charge anywhere in Europe. The electricity grid has to be capable of supporting this, people have to want to purchase an electric car and policymakers have to pursue common objectives," say Hilke Rösler and Hein de Wilde of ECN.

To make this transition possible, a number of top priorities have been identified. Because not everyone can charge in their own garage or parking spot, a public charging infrastructure is needed. However, utilisation of this infrastructure is not yet cost-effective. Subsidies may convince early investors. In addition, smart locations must be found, such as petrol stations or shopping centres, where services can be combined to assist the development of the business cases. Furthermore, as of now some level of installation readiness for charging infrastructure should be taken

into account in the construction of new buildings.

In order to prevent the electricity grid potentially becoming overloaded during peak moments, charging must be carefully thought out and staggered. Charging must also be interoperable - in other words, all plugs, payment systems and other necessities must be standard throughout Europe.

By continuing to progressively lower the maximum permissible CO2 emissions per kilometre, the EU will force the automotive industry to innovate in the coming years. ECN can use its expertise to support authorities at the local, national and European levels. Rösler and De Wilde: "Our expertise lies in the development of well-balanced policy frameworks that facilitate the transition to electric cars at the lowest cost and support cooperation between all parties involved." ●

[www.ecn.nl](http://www.ecn.nl)  
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# Sustainable city planning in action: the STEP UP project

**S**TEP UP (Strategies Towards Energy Performance and Urban Planning) is an EU FP7 energy and sustainability planning project in which four European cities – Ghent, Glasgow, Gothenburg and Riga – are enhancing their Sustainable Energy Action Plans (SEAPs) and integrating energy planning into their wider city plans and strategies. The project, which runs from November 2012 to July 2015, is a partnership of twelve organisations, consisting of local government, research and commercial partners in each of the four cities. STEP UP aims to bring together excellence in energy planning and low carbon energy projects from these cities to create a coherent and easy-to-use model for energy planning.

Through enhancing the cities' existing SEAPs and creating a model for energy planning, STEP UP is helping to develop strategies and projects that can contribute to meeting Europe's 2020 energy and climate change targets, as well as delivering wider policy objectives such as improving security of energy supply, tackling fuel poverty, achieving urban regeneration, economic growth; making the cities better places to live, work, learn and do business. All four cities' enhanced SEAPs have been finalised, and a guide for other cities developing their own enhanced SEAPs has been produced (available at [www.stepupsmartcities.eu](http://www.stepupsmartcities.eu)).

STEP UP cities have also undertaken an inventory of existing projects to identify best practice solutions and the elements that contributed to their success. A total of 36 best practice projects have been identified, all of which contribute to the EU 2020 goals of energy efficiency, lower greenhouse gas emissions and an increase in renewable energy.

The scope and focus of the projects varies widely, from large district heating networks to small retrofit developments. From the list of 36 best practice projects, nine have been identified as lighthouse initiatives which are based on an integrated approach to project development, bringing together several sectors and actors in innovative ways.

These projects have potential for replication, either in part or in their entirety, and have specific success factors that other cities can learn from. A new publication which offers guidance to cities developing their own innovative projects, using the lighthouse initiatives as examples, is available on the STEP UP website.

STEP UP also engages with other cities in a Learning Network, where excellence and best practice in energy planning and integrated energy solutions are shared. Selected participants in the network have become companion cities, receiving coaching on producing a city



*Sustainable Urban Planning is essential for cities*

SEAP and developing their own innovative projects.

As part of STEP UP, both the University of Strathclyde and Riga Technical University have developed new Masters programmes that draw on the experiences and outputs from the project. These programmes seek to deliver a growing number of high quality graduates who have the necessary knowledge, skills and capabilities to deliver sustainable city planning in practice around the world. Both programmes will start in 2015 and will continue to be taught as part of the legacy of the STEP UP project. ●

For more information on the STEP UP project go to [www.stepupsmartcities.eu](http://www.stepupsmartcities.eu)  
Follow us on Twitter: @StepUpEu

STEP UP will also be at EU Sustainable Energy Week in Brussels from 16-18 June – please visit the website for more information.

# Smart Grids in Europe: Policy drivers, technology and investments

By Manuel Sánchez-Jiménez and Flavia Gangale, European Commission

## **ENERGY UNION AND THE NEEDS FOR FLEXIBILITY/ SMART GRIDS**

We are witnessing big changes to the way electricity is produced, transmitted and used. Those changes are driven by our EU Energy and Climate policy that aims to a cost-efficient energy transition by balancing competitiveness, sustainability and security of supply. It requires the implementation of existing legislation and market rules as well as further transformation towards more flexibility of the energy system, especially to

what concerns the integration of variable renewable energy sources and the further electrification of energy uses, such as electric vehicles.

The Energy Union initiative sets the framework for efficiently managing this transformation. It is based on five mutually reinforcing and interconnected dimensions: the internal market, energy efficiency, decarbonisation, energy security and research and innovation.

Energy markets and grids have to be fit for the new requirements of the energy system. Smart grids are clearly one of the enablers for realising the Energy Union – both in terms of infrastructure and market. They are a part of the solution for managing our grids in times of ever increasing shares of renewables, decentralised generation and new loads, but also for creating new value streams (i.e. services and products). Moreover, smart technologies, including smart metering systems, will enable consumers to reap benefits from the energy market by taking control of their energy consumption and providing their flexibility to the system. This is part of the “new deal” for consumers advocated in the Energy Union.

Smart Grids are also part of an innovative and competitive Energy Union. They provide an important opportunity for European manufacturers

to develop attractive smart solutions and boost their global competitiveness.

## **ACCUMULATED PROJECT EXPERIENCES IN THE UNION AND MATURE TECHNOLOGY AREAS**

Smart metering systems are a building block of the smart grid and their deployment will facilitate the integration of new smart technologies and innovations across the grid. Many research and demonstration projects have already been set up in Europe to investigate and demonstrate these new technologies, tools and techniques. Today, smart metering is a mature technology. If Member States’ plans materialise, by 2020 almost 3 out of 4 European households and businesses will have electricity smart metering systems; an investment of 35 billion Euros on ca. 200 million of meters. Additionally, about 40 millions of smart meters for gas will be installed by 2020, amounting to an additional investment of about 10 billion Euros. The key issue is whether all this equipment follows recommended functionalities and recent developed standards which make these systems interoperable.

In the last five years, the Commission’s Directorate General for Energy and the Joint Research Centre have been cooperating to map smart grid projects in Europe and to identify best practices and lessons learned<sup>1</sup>. To



date, c.a. 450 projects have been analysed, accounting for over 3.15 billion Euros of investments. The mapping exercise is carried out on a regular basis and it is now extending its outreach to cover smart distribution system architectures/models, laboratories and technologies on the verge of industrial diffusion.

The inventory identifies key smart grid applications in different stages of maturity. Smart network management applications have attracted the highest investments and successfully tested several solutions to improve the monitoring and controllability of the networks. The integration of distributed energy resources, particularly variable renewable generation, has also attracted much interest and projects' results show that technical solutions for their integration are becoming consolidated.

Investments in smart customer/smart home projects are also rising steadily, showing a growing attention to the interaction between the new technological solutions and end-users. Consumers' attitudes, concerns and expectations are increasingly factored in the design of the new technological solution and in the development of consumer engagement strategies. As reported in the European Commission's smart grid inventory however, even if smart customer and smart home applications have been targeted by many smart grid projects, they are still in the demonstration phase and more work is needed on their scalability and replication potential before moving to the

deployment phase.

Looking ahead, European R&I in smart technologies must also lead to the next generation of enabling technologies, such as power electronics and storage solutions, putting the EU at the forefront of smart grids and smart home technology.

#### **TODAY'S FINANCIAL POSSIBILITIES AND FRAMEWORK CONDITIONS**

We also may need to further reflect on a regulatory framework that could better accommodate the novelty and specificities of smart grids and incentivise investments. Overall, the EU will need to invest an estimated € 480 billion by 2035 to enhance the automation and control of the networks, develop smart appliances for easy demand side flexibility and smart homes, charging infrastructure for EVs, etc.

In addition to Horizon 2020 for R&D projects, additional instruments which can be used in funding/financing smart grid projects are:

Connecting Europe Facility (CEF). Even if CEF targets primarily interconnectors and TSOs, under certain conditions also smart grids projects can be labelled as Project of Common Interest and possibly receive funding. Under the first round of funding one smart grid Project of Common Interest (between Ireland and UK) received funding support of 32 million Euros.

Structural funds. Smart Grid projects are supported under

structural funds for example in Greece, Poland and Romania. The inclusion of smart grid projects remains under the responsibility of Member States.

European Fund for Strategic Investments (EFSI). This is a new lending instrument to be managed by the European Investment Bank (EIB) that is expected to be operational by summer this year and that can provide financing (loans, guarantees, equity, etc.) to commercially viable projects, including smart grids. To our knowledge, through contacts with Member States and stakeholders, we identified almost 80 smart grids projects, amounting to a total investment of 67.2 billion Euros. These projects are rather heterogeneous and range from local smart grid projects to large smart meter roll-outs with a volume of up to 5 billion Euros or national smart grids projects of up to 8 billion Euros. Approximately half of the projects relate to smart meter roll-outs while the other half covers mainly investments in automation and control systems. Those projects represent workable investments, i.e. investments that will not become stranded assets but parts of smart solutions for better, more resilient, efficient and flexible grids. To guarantee this effect, the recently adopted smart grids standards will be an important precondition as well as guarantee. ●

*Disclaimer: This article reflects the views only of the authors. European Commission cannot be held responsible for any use which may be made of the information contained therein.*

1 Smart Grid Projects Outlook 2014, Ref. EUR 26651 EN, at <http://ses.jrc.ec.europa.eu/smart-grids-observatory>

# Europe's Way to the Digital Future

The European Commission predicts that Europe will be able to achieve an additional economic growth of up to 250 billion euros and create many new employment opportunities by 2019 if it makes use of the opportunities in digital transformation. At the moment, the largest internal market in the world is working intensively towards creating the necessary groundwork for this purpose. The ICT specialists at TÜV Rheinland are currently working on a crowdsourcing project on behalf of the EU, one of many initiatives to make smart grids a reality.

**R**egardless of energy transition, electromobility or smart homes: Intelligent electricity grids are the fabric that make up the future. Smart grids are based on the close interrelation of energy grid and data network, the high-performance and robust infrastructure required in IT and telecommunications fields. "One of the central questions is: Can and should planners, decision-makers and investors rely on existing communication infrastructures when developing smart grids, or are new networks required?" Andreas Windolph, an ICT expert at TÜV Rheinland, said.

## LEARN FROM THE BEST

Every one of EU's 28 member

*Andreas Windolph*

states are likely to have different answers to this question because the energy and telecommunication sectors in every country are developed and regulated differently. The EU commission has tasked TÜV Rheinland with conducting a study to learn from the best systems within the largest common market worldwide. The research project "Energise" ("ICT-based ENERGY Grid Implementation - Smart and Efficient") will be conducted over 27 months; Brussels has set aside just under 1 million euros for the project.

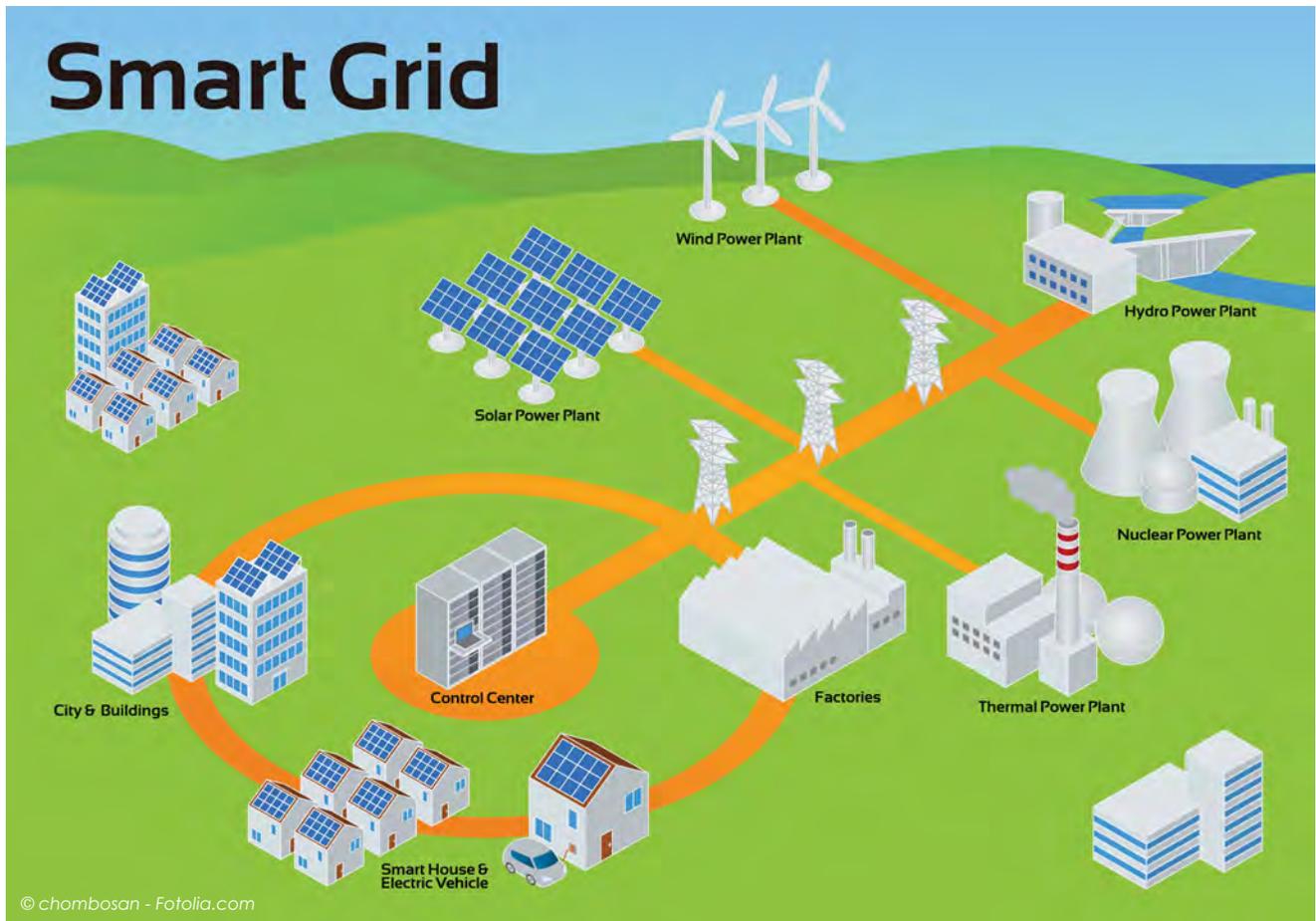
TÜV Rheinland has comprehensive expertise in the fields of telecommunication and broadband networks. For many years now, its specialists have been supporting network operators, government agencies and ministries in planning, constructing and operating public or private telecommunication networks over and beyond all project phases: from strategic consultation, project initiation, network planning, monitoring and inspection of implementation, to operation of passive and active telecommunication infrastructures.

The current study which TÜV Rheinland has been tasked with is, in a way, crowdsourcing on an EU level. Led by the department

manager Andreas Windolph, the team will begin this month to exchange experiences with all important stakeholders from the EU countries. The study is addressed to economics and energy ministries of EU countries, regulatory agencies for energy and telecommunications, national distribution network agencies and large service providers. The goal is to specifically investigate the best practices for upgrading ICT infrastructures for smart grids and to learn more about their costs and benefits. "We are very excited about the experience but also expect to obtain very heterogeneous results," Andreas Windolph said. "After all, the project is very complex. Besides high requirement on security of electrical networks, there are also many factors, such as the regulatory framework, to consider."

TÜV Rheinland will develop a theoretical model based on individual nation's policies. The model shall facilitate the planning of ICT-based intelligent networks in each country and support the development of smart grids in Europe. The team from TÜV Rheinland hopes to identify innovative business models; experience which all EU member states can learn from. TÜV Rheinland will establish a European project forum which includes representatives from the





ICT sector. The forum will examine crucial factors of the theoretical model, such as its feasibility and practicality.

**ASSISTING IN PLANNING BROADBAND GEOGRAPHICAL INFORMATION SYSTEMS ON EU LEVEL**

For years, TÜV Rheinland has been assisting public sectors on national, local and EU levels to shape their future digital strategy. The experts at TÜV Rheinland possess a comprehensive overview of customized strategies for ICT infrastructures, practical solutions and current support programs. They also have extensive conceptual and practical experience in the field of broadband information systems, one of the success factors of constructing modern and high-

performance next generation networks (NGN). Among other things, they conceptualized the Broadband Atlas on behalf of the German federal government. The application's information density and usability has received wide admiration within and beyond Germany.

The ICT experts at TÜV Rheinland have also produced a practical Guide to Broadband Mapping on behalf of the EU commission. In 2014, TÜV Rheinland analyzed the broadband information systems that the EU member states currently operate for the first time. The specialists studied 45 mapping initiatives and developed a set of methodological recommendations, with which every EU country can design

their own broadband information system or further optimize an existing system - a pragmatic approach which takes into account different regulatory requirements and technical frameworks. This effort shall accelerate the implementation of mapping systems and lower development costs. The European Commission has declared this as their goal so that the necessary tools can be quickly provided for rapid expansion of broadband infrastructure in Europe. ●

Visit [www.project-energise.eu](http://www.project-energise.eu) to learn more about TÜV Rheinland and Project Energise.

Andreas Windolph, Team Manager Broadband and Smart Networks,  
 TÜV Rheinland, [andreas.windolph@de.tuv.com](mailto:andreas.windolph@de.tuv.com)

# European Standards - supporting innovation in the energy sector

By Elena Santiago Cid, Director General of CEN and CENELEC (pictured)

Since the start of the 20th century, standardization has played a vital role in supporting the development of the energy sector - from the design and construction of power stations to distribution networks for electricity and gas, as well as all kinds of appliances and machines that use energy. Now, in the 21st century, with rapidly-changing technologies, an emphasis on efficiency and increasing reliance on renewable energy, we can say that the role of standardization is more important than ever before.

Whether one is looking at the generation and distribution of electricity, the oil and gas sector, the nuclear power industry, or renewable energy sources such as solar and wind, standardization is essential. Having suitable standards that are widely accepted and applied brings benefits in terms of performance, reliability, compatibility and interoperability. Standards contribute to protecting the environment and ensuring high levels of safety, and they also facilitate the market acceptance of new technologies and innovations.

With the European Commission's commitment to creating an 'Energy Union', it seems that energy has never been higher on the EU's policy agenda. Moreover, when we look more closely at the Commission's proposals, we can see that there are several areas in which standardization has a

key role to play. These include: ensuring the most efficient use of energy, enabling the integration of the European electricity market, facilitating the acceptance of new technologies, developing Smart Grids and promoting the growth of renewables, as well as supporting the spread of electromobility and alternative fuels.

CEN and CENELEC are supporting standardization activities in all of the above-mentioned areas, working in close cooperation with key players in the energy industry and also with the European Commission. Thousands of experts from across Europe are participating in the Technical Bodies of CEN and CENELEC, in order to develop standards that are adopted and published by our National Members in 33 countries. All of these standards are reviewed and revised on a regular basis, in order to incorporate the latest technological advances and take account of feedback from industry and other stakeholders.

For many years, CEN and CENELEC have been developing standards to enable the integration of the European electricity and gas markets. We cooperate closely with the European Networks of Transmission System Operators for Electricity (ENTSO-E) and Gas (ENTSO-G), in order to ensure that European Standards are fully compatible with the relevant Network Codes.

Standards support the expansion of renewable energy, which is vital for achieving Europe's objectives in terms of de-carbonizing the economy and reducing CO2 emissions. CEN develops standards in relation to thermal solar systems as well as bio-fuels and bio-mass, while CENELEC produces standards in relation to solar photovoltaic energy systems and wind turbines. Our collaboration with ISO and IEC is especially intense in these areas.

CEN and CENELEC have also been collaborating with ETSI (the European Telecommunications Standards Institute) and with a range of key players in the energy sector on the development of standards for Smart Grids. We have already produced a common reference architecture and a set of consistent standards to support the implementation of Smart Grids in Europe (following a request from the European Commission). Currently we are working with ETSI and the IEC to fill the remaining gaps as swiftly as possible, and also to develop standards for smart metering systems for both electricity and gas.

As well as producing standards for the energy sector, CEN and CENELEC also develop standards for a wide range of products that use energy, from computers to washing machines. In particular, we produce standards that support the implementation of the EU Directives on Ecodesign (2009/125/EC) and Energy

Labelling (2010/30/EU). Such standards can make an important contribution to achieving higher levels of energy efficiency, thereby reducing demand for energy and helping businesses and households to cut their energy costs.

In addition to the areas already mentioned, there are many other energy-related activities being carried out within CEN and CENELEC. These include: the development of standards on energy audits to support the implementation of the Energy Efficiency Directive (2012/27/EU); standards for calculating the Energy Performance of Buildings (EPB); standards for various kinds of gas appliances; standards to support the deployment of alternative fuels infrastructure and 'smart charging' of electric vehicles; standards to help implement the revised Low Voltage Directive (2014/35/EU); and our cooperation with ISO and IEC to provide standards for Europe's nuclear energy industry.

Most European Standards are voluntary, which means that businesses and other organizations are not legally obliged to apply them. However, around one-fifth of the standards adopted by CEN and CENELEC may be used to ensure compliance with legal requirements contained in European directives and regulations. These 'harmonized standards' enable manufacturers and operators to comply with the essential requirements laid down in the relevant EU Directives.

In an increasingly globalized



economy, there is a clear added-value in having standards that are accepted and applied worldwide. In CEN and CENELEC, we collaborate closely with our international counterparts (ISO and IEC), and some 43% of all our deliverables are identical to international standards (in the electrotechnical sector it is more than 70%!). The alignment of European and international standards helps to eradicate technical barriers to trade (TBT) and facilitates European companies' access to global markets.

Looking ahead to the coming

years, we can see that there are many areas where standardization is necessary to support innovation in the energy sector. These include new battery technologies, the further expansion of renewable energy and electromobility, and the concept of 'smart and sustainable cities'. In CEN and CENELEC, we will continue to work with our National Members, European stakeholders and international partners in order to help bring about a cleaner, greener and more efficient energy future for Europe. ●

[www.cencenelec.eu](http://www.cencenelec.eu)

# Smart metering opens up new opportunities

While many European countries are in the stage of migrating to remote energy metering, in the Northern Europe, smart metering is developing at a fast pace as an essential element of smart grid. At the same time, the requirements for the Automated Metering Infrastructure (AMI) solution's functionality and related business benefits are increasing.

The recent large smart metering projects for example in Norway are stretching the role of AMI far beyond remote meter reading. The focus is in providing comprehensive support for the utilities' business operations. The big challenge - and at the same time a substantial opportunity - lies in deploying AMI for effective

grid management and service operations while also addressing the environmental and energy challenges of the 21st century.

#### **BUILDING THE BIG PICTURE**

When planned carefully and integrated with utility's distribution management system, Automated Metering

Infrastructure is a purposeful monitoring and planning tool that provides near to real-time picture about the distribution network in a very detailed level.

Take, for example, the metering points as intelligent sensors installed in each house. In addition to energy consumption data, the metering devices provide information about the consumption point's load quality variations as well as details of failures or disturbances which may be caused by malfunctioning electrical supply



or faulty installations. When this information is used to trigger automatic messages to the utility's service centre, the service teams can quickly locate the problem, and corrective action can be taken to prevent accidents and minimise any further damage.

### **COST SAVINGS IN DAILY OPERATIONS**

The benefits of smart metering can be immediately seen as cost savings in the utility's customer service. The operations related to fault prevention and fixing as well as reacting to network disturbances are significantly more efficient. When the detecting of faults is improved, less time is needed on troubleshooting and repair work. Not to mention the fact that in general, AMI helps utilities prevent some of the failures from happening at all. At its best, a fault in the grid or at a customers' destination can be fixed before the customer even notices it. Minimised network downtimes also mean significant savings in compensations to be paid to the customers.

Furthermore, as utilities and their customers have access to actual consumption data, and billing is based on actual consumption, less time is needed on answering questions and clarifying billing issues. Therefore, the focus of the utility's most labour-intensive departments can be shifted from responsive help-desk activities on a proactive customer service.

### **IMPROVED EFFICIENCY ON THE LONG RUN**

On top of the daily operational costs, an advanced AMI helps utilities' business also on a longer perspective. From the

grid efficiency's point of view a good overview on the network resources is needed in order to optimise the maintenance work and plan the forthcoming investments. Information on the low voltage grid on transformer station level can provide a significant contribution. For example, monitoring the voltage levels at a transformer station and throughout the power line up to the last metering point helps analyse eventual deviations and eventual overload. This helps planning maintenance and the need for new investments so that the required, good supply quality can be retained. This again results in remarkably decreased equipment wear and failures while improving the overall grid performance and safety.

### **MAKING THE MOST OF AMI - THE AIDON WAY**

The recent development within AMI industry, where the utilities' focus shifts from meter reading to comprehensive power grid management calls for advanced ways to manage the ever increasing amount of data. The emphasis is on information; how to gather, analyse and utilise it in a way that makes sense to both utilities and their customers, in the

light of what modern technology makes possible. AMI has become an essential and integrated part of the utility's business system.

For Aidon as an AMI technology provider, openness and platform thinking are at the core of our philosophy and offering. Most likely the need for additional functionality will grow throughout the AMI system's lifetime - that is why it is important to have flexibility to grow along the new needs, for example by downloading new applications to the metering devices. For utilities this concept creates adaptability throughout the entire lifetime of the AMI solution. The open platform also provides a future-proof path to develop their smart grid one step at a time. ●



#### **Leading in the Nordics**

Aidon's proven technology, customer-driven innovations and industry expertise are helping Nordic energy distribution companies improve their operational efficiency and gain the best financial value for the AMI investment. In Norway, the nationwide AMI roll-out will be completed by the end of 2018. In February 2015 Aidon signed a contract with Norway's largest energy distribution company Hafslund Nett for the delivery of an advanced AMI solution which will cover 700.000 customers in the capital of Oslo and the surrounding municipalities. Altogether, Aidon's installed base and signed contracts on the Nordic market sum up to 2.5 million metering points (status June 2015).

**Find out more: [www.aidon.com/rising](http://www.aidon.com/rising)**

# Accelerating Smart Grid Innovation

*The purpose built Power Networks Demonstration Centre in Scotland is playing a critical role in accelerating the European Electricity Networks Smart Grid Agenda.*

**D**elivering the future low carbon electricity network is a key strategic challenge for the energy sector. With global populations increasing and the shift to electrification of transport, the growing demand for renewable power sources to be integrated into the existing grid has become a serious challenge to achieving a national and international vision of low carbon energy.

The UK is largely viewed as a leader in this transition and this is in part attributable to the large investment that is being undertaken in research and development through regulatory and other funding mechanisms. One such facility that is taking R&D a step further is the purpose built Power Networks Demonstration Centre in Glasgow, Scotland.

The Centre is an innovative

development and demonstration facility founded by the University of Strathclyde, Scottish Enterprise, Scottish Funding Council and founding members Scottish Power Energy Networks and Scottish and Southern Energy Distribution. The Centre brings together academics, engineers and technologists to define and execute research, development, and demonstration projects that will help shape the electricity industry of the future.



The 13,000 sq. ft. facility comprises of a unique 11kV and LV network environment representative of various networks, secure test bays, MW-scale MG Set, dedicated SCADA control room and real-time simulation suite. This affords the pre-commercial testing of HV and LV equipment and secondary control, protection and measurement systems. The centre has a unique frequency and voltage variation capability along with a fault throwing functionality which is useful in validation and development activities.

The PNDC's purpose is to undertake a range of innovative projects that will accelerate the proving and adoption of new 'smart' technologies.

The centre provides a unique platform for conducting applied research in the following ways:

- Testing solutions in a realistic power system setting, which can provide more insight

into the behaviour of these solutions, potentially leading to enhancements in the performance of solutions and accelerating their acceptability to end users.

- The ability to conduct accelerated testing by creating several testing conditions within a short period of time that may never be witnessed by typical field trial's life span.
- Characterising system problems where simulation may not be suitable for doing so (e.g. realistic and varied behaviour of inverters).

There are two ways in which companies can engage with the Centre. As a member, companies gain access to and have input in shaping the Core Research Programme. This is in partnership with leading academics and provides a unique opportunity to bring academia and industry together to innovate. Alternatively, companies can engage with the Centre on an

individual project basis allowing for small companies and start-ups to gain access to the facility and its resources.

The Centre has an open access philosophy underpinned with collaborative practices. The CEO of the Centre, David Rutherford is keen to ensure that the facility maintains its open door approach. "The facility is unique in its capability, being able to develop validate and demonstrate products in a real distribution network environment. The Centre is open to anyone with an interesting and relevant project that may make a contribution to the low carbon future in a UK, European or global setting".

#### **IN FOCUS - HYBRID BUS PROJECT AND INDUCTION CHARGING**

This project seeks to develop a hybrid bus that can be charged on-route using inductive charging. On-route charging allows the bus to extend the range it can operate in electric mode, thereby requiring a smaller

### **PNDC CORE RESEARCH PROGRAMME OVERVIEW**

<b>Power Electronics &amp; Distributed Energy Resources</b>	Integrating new power electronics based systems and distributed energy resources into the power network. Applications include Electric Vehicles (EVs) and off-grid power supplies.
<b>Protection &amp; Control</b>	Ensuring that the protection of future networks is fit for purpose to enable the vision of a secure and reliable smart grid.
<b>Sensors &amp; Measurement</b>	Developing novel sensors and characterising emerging sensor technologies to give greater system and plant observability.
<b>Asset Management</b>	Realising methodologies for the management of asset condition and maintenance practices and risk and cost analysis to support effective decision-making.
<b>Communications &amp; Systems Integration</b>	Investigating existing, emerging and novel communications technologies to support the better integration of smart grid sub systems.
<b>Network &amp; Demand Side Management</b>	Creating systems and schemes for the real-time operational management of distribution networks that meet emerging commercial and technical objectives.

An aerial picture of the PNDC HV Compound during the testing of truck mounted hybrid generators.



battery pack. The goal is to have the bus run in full electric mode within urban or pollution-sensitive areas, while in other areas the hybrid mode is used.

The PNDC have supported the project by installing and operating an inductive charger

at PNDC, supplying data-logger with sensors, recording the energy use on the bus and carrying out grid integration assessments for the charger. In field trials of the technology will be undertaken on major bus routes in London in summer 2015.

The future electricity grid is full of unknowns, open questions and new challenges. The Power Networks Demonstration Centre is supporting industry to reduce the risk and uncertainty of this future and help respond successfully to the energy challenges that lie ahead. ●

For more information visit <http://www.strath.ac.uk/pn dc/> or email: [pn dc@strath.ac.uk](mailto:pn dc@strath.ac.uk)



# CIVIS: cities as drivers of social change

**C**IVIS rises from the consideration that energy may be turned into a good that people can consume, generate and allocate on the basis of their needs, preferences and values. The project explores the potential of social networks and communities to reduce energy use and carbon emissions. It will achieve this by deploying and testing an IT platform that enables a new, smart model of energy management for individuals and communities.

CIVIS uses an experiment-driven R&D approach that involves four pilot neighbourhoods, two of which are located in Italy (Trento) and two in Sweden (Stockholm). Project partners will test and evaluate the technology, clarify business potential and estimate the impact of anticipated deployment on a European scale.

## **CIVIS FIRST YEAR OF LIFE: NURTURING THE IDEA OF A SOCIALLY SMART GRID**

The Socially Smart Grid concept, which depicts the eco-system of values, technologies and dynamics supported by the CIVIS platform, has been devised to support the implementation of actions in the project's pilot sites. These activities have been designed in close collaboration with local energy companies, citizens groups and local administrations in order to capitalise on existing local energy needs and fit existing cultural and social values.

To enable the data loop required



for CIVIS Platform, consortium partners have been busy in implementing a complex sensor and communication infrastructure for the flow of energy data. Moreover, in order to get a clearer picture of the local social dynamics and cultural values, project partners have developed a Simulation Model of Integrated Energy System and organised focus-groups and workshop sessions with local stakeholders and citizens.

Beyond the understanding of local infrastructural and societal environments, CIVIS partners also worked at a higher level for understanding market and regulatory barriers standing in the way of renewable energy innovations.

## **THE BEST HAS YET TO COME!**

The forthcoming months will see prosumers and consumers

engaging with CIVIS Platform, while CIVIS partners will work for the identification of new business models that can support the emergence of new forms of social innovation connected to energy, innovative forms of combining the new opportunities given by ICT with energy efficiency and fresh ways of being neighbours.

## **CIVIS CONSORTIUM AND INFO**

Co-financed by the European Commission within the seventh framework for scientific research, CIVIS is run by an international consortium coordinated by the University of Trento and composed of 11 partners: Aalto University, Enel Foundation, KTH - Royal Institute of Technology Stockholm, TNO, Imperial College London, Instituto Superior Técnico, TU Delft, Santer Reply SpA, Create-Net, KIT - Karlsruhe Institute of Technology, and Bruno Kessler Foundation (IT). ●

### **For more information:**

E-mail: [info@civisproject.eu](mailto:info@civisproject.eu)

Website: [www.civisproject.eu](http://www.civisproject.eu)

Facebook: <https://www.facebook.com/CIVISproject>

YouTube: <https://www.youtube.com/user/CIVISproject>

# INTRaPID Project: a pilot for energy district management in smart homes

By Claudio Borean, Giuseppe Di Bella, Rosario Drogo De Iacovo and Manuel Ramiro

While Information and Communication Technologies seem to be ready for the reliable support of smart grids applications, most of them are not yet sufficiently mature for massive sale in Europe. In the FP7 EU funded project INTRaPID, a real pilot has been setup and it is currently running involving over 50 houses spread over Denmark and Italy. In this note we want to share some insights and lessons learned so far by the validation in the field. Hints on the next features being added to the INTRaPID system for the last phase of the project are also presented.

**D**uring the past years several research projects have shared the goal to find best practices, technological as well as operational, for smart energy grids. In these contexts a relevant role is played by the development of embedded intelligent systems for the home environment and by middleware technologies for the integration of heterogeneous data coming from distributed sensor networks. The design of well-tailored techniques is also a key part in the development of new smart grids services, in order to take into account the complex scenario which derives from unpredictability in renewable energy generation, monitoring and control of appliances or subsystems in buildings and homes.

The INTRaPID project, a 3-year European funded Project under the FP7 program and started in November 2012, tries to solve these challenges by enabling the optimization of energy consumption in residential buildings both at a local level and at district level. The main results of the projects so far have been the following:

- Developing advanced energy monitoring systems, supervisory control strategies able to coordinate large subsystems (renewable energy generation, energy storage, appliance consumption, smart appliances etc.) and orchestrate operation of the

different devices in such systems;

- Building a Middleware Infrastructure to deal with heterogeneous Internet of Things (IoT) systems, where different systems can cooperate seamlessly; in the INTRaPID project different technologies have been adopted, based on Wi-Fi, ZigBee HA1.2, Z-Wave, Modbus over IEEE 802.15.4: the devices deployed at users premises are equipped with the more convenient technology since the INTRaPID Middleware enable the interoperability of the different technologies;
- Experimenting the system through a field deployment in pilot of more than 50 homes (both energy consumers and producers), in order to check users' feedbacks and measure the acceptance of the proposed solution;
- Trying to address users' needs in term of quality of experience while involving the users to actively contribute to the energy district optimization task.

The INTRaPID system is composed by the following element:

- Home Area Networks: each house received a set of IoT devices (smart refrigerators, smart plugs, meter interfaces, smart gateways); the different devices supported different

technologies (Wi-Fi refrigerators, ZigBee Home Automation smart plugs and meter interfaces, other proprietary technologies for other devices) and the integration has been performed at the IoT platform level through a common data model defined in the middleware, which is a relevant output of the project;

- Cloud services: besides the middleware, which represent the IoT platform to manage the interaction with the different HANs, cloud component such as supervisory control strategies, business intelligence, district scheduler and recommendation systems have been also developed;
- User app: mobile application that the users of the pilot rely on to inspect the consumptions of hours, days or months in the past and to understand specific appliance consumption (event if not directly monitored by a plug) by means of a so called "energy-watch" feature, which inspects the meter interface data in real time.

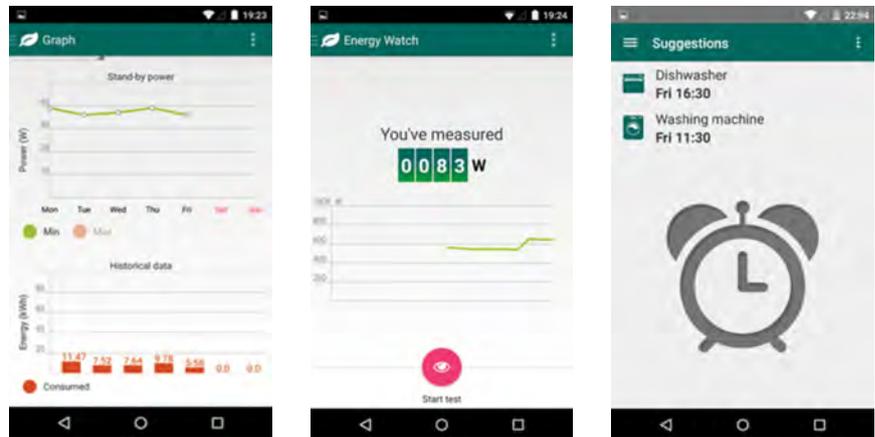
Furthermore, provided that home appliances have been equipped with smart-plugs, the system allowed the users to remotely turn them on and off the devices and monitor specific consumption of each device individually; at the same time, the data feeding to the IoT platform,



have been initially used to tune the recommendation system to send the users specific appliance activation time proposals.

In order to improve the consumption awareness, the users involved in the pilot have been periodically updated with bi-weekly newsletters reporting as anonymized information the comparison of existing usage in each home (Building Unit) and per capita. This comparison with other users provided an improved engagement of the users and a key additional level of understanding about their energy behaviors.

While users consumption awareness has being recognized as the first step for energy optimization at a local level and supported in the first part of the INTRPID pilot, an additional effort to provide a proper orchestration of the consumption is necessary to enable district-side management. The second step of the pilot, leveraging on the 50 connected homes, will be then focused on understanding how to “move” energy consumption patterns of different houses forming a district, in order to control the cumulated load (i.e. the sum of consumption/ microgeneration of all the buildings in the district). Since the pilot sites where spread in different locations, “virtual” districts have been defined as groups of users. In order to actively engage users to shift the appliance usage, the recommendation will be initially done starting from the users’ habits. As a matter of fact, whereas finding a solution to the optimization problem holds technical challenges, putting humans in the “control loop” might have strong implications in the comfort, since the more the habits are challenged, the less the user would be willing to cooperate, at least initially. The recommendation system, implemented in the district



scheduler component of INTRPID, then smoothly try to move users habits, weighting more and more a generalized cost function of the district vs the habits “learned” from the user by machine learning techniques. The system is adaptive since reinforces its learning by means of users’ answers to proposed scheduling through mobile app notification, confirming the users’ centric role in the entire process. Incentives are provided to the users in terms of “gamification”: an energy game supports a reward policy to stimulate the acceptance of unusual scheduling proposals, in order to gradually move users habits to meet the suggestions.

As it emerges from what is stated above, besides addressing energy optimization by means of technological

developments and step forwards, the INTRPID project is also trying to experiment how adaptive applications actively involving the users could accelerate the adoption of energy management applications.

From the first experimental data and feedbacks, the approach followed in the INTRPID project based on user-centered design and gamification appears to be a promising way to increase the user perceived value of smart grids applications and their acceptance in the mass market.

List of INTRPID partners: Telecom Italia S.p.A., University of Aalborg, Honeywell, ENEL Ingegneria e Innovazione, Seluxit, Advantic Sistemas y Servicios, RSE Ricerca sul Sistema Energetico, Gorenje. ●

The INTRPID consortium includes a significant involvement of large enterprises and SMEs from different sectors, including home automation equipment providers, smart appliances manufacturers, telecom operators and energy distributors.



# Successful smart technology starts with smart consumers

**Our entire energy system is going to change drastically. Especially from the consumer's perspective, much will change. Our energy system will function (best) on the assumption that the consumer participated in the market, they may own and operate generation capacity, and use smart technology to manage their consumption. This in turn can result in a reduction on their electricity bills, a reduction in the cost of network operations, and increased energy efficiency. If we want to build a European Energy Union that will ensure secure, affordable and climate-friendly energy for citizens, we need consumers to engage in the new energy system. Not an easy task.**

## INFORM

The VaasaETT Report Empower Demand II<sup>1</sup>, authorized by ESMIG, indicates 10 steps to generate consumer awareness, involvement and engagement. Generally, any type of consumer

information and education tool should be simple, uncluttered, and modern. It should be offered, not sought after. The inter-play of outstanding pre-offering, pre-technology education, especially from independent sources is an extremely important way to prepare consumers for the program to come. As a first step, a consumer must see the bigger picture, the reason why the utility is embarking on this action, why the customer should be interested and why the community should be working together. Only then should technology be introduced. It is after all, not the technology that is the objective; it is only a means to an end.

ESMIG and EDSO are launching "My Smart Energy" at EUSEW 2015: a portal targeting European consumers explaining

how consumers will be able to manage their bills, make a more sustainable future environment and rely on energy supply with the help of smart meters and smart grids. Take a look at: [www.my-smart-energy.eu](http://www.my-smart-energy.eu).

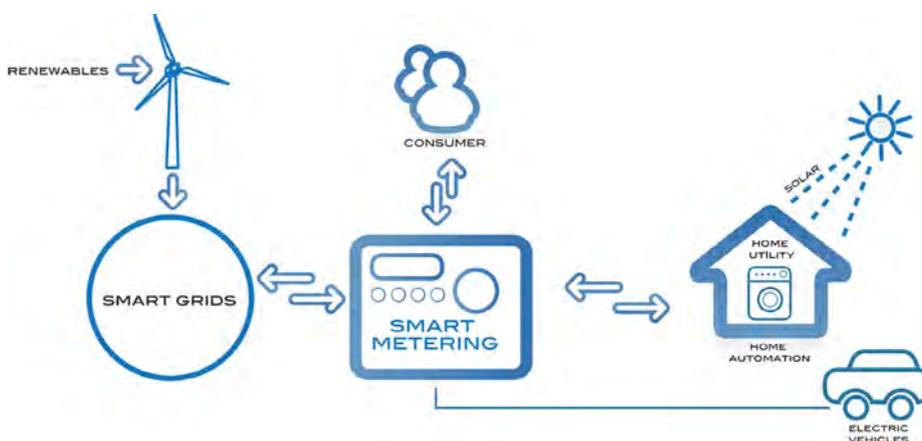
*What needs to be done, soon!*

## PROTECT

For public acceptance of smart metering and use of energy management services, suitable privacy and data protection safeguards need to be in place so that consumers are assured their data is treated securely and their privacy is not infringed.

The Smart Metering Infrastructure should therefore be developed in such a way that distinct information flows for different stakeholders can be identified, implemented and controlled. The information collected by the organization responsible for allocation of the energy consumed or produced (in the context of his legal task) is one information flow that can be regarded as the legal basis for (Smart) Metering. This information has typically a low time resolution, such as bi-monthly consumption readings and power quality data, but also covers alarms from the metering system such as tampering. Because of its nature this information flow has low privacy sensitivity, but should still be sufficiently protected.

Figure 1: The Smart Energy System (ESMIG)



1 [http://esmig.eu/sites/default/files/final\\_empower\\_2\\_demand\\_report\\_final\\_distr2.pdf](http://esmig.eu/sites/default/files/final_empower_2_demand_report_final_distr2.pdf)

To give consumers the possibility to get more detailed insight in their energy consumption and/or production, additional information flows are generated by the meter. This information has typically a high time resolution, such as 1-10 seconds time base, so consumption/production patterns can be generated that can give insight in the energy profile households and specific in-home devices. In a majority of the EU member states, the consumer will be able to decide if this information is generated, where this information goes and by whom it can be used.

By making this distinction in information flows, not only consumers have better insight and control regarding the type of data and its destination, but it is also possible to take the appropriate measures for protection depending on the risks related to the disclosure of this information.

**EMPOWER**

The process of bringing new meter technology into the market has started. Smart Meter roll-out is imminent, but the inclusion of functionalities required for empowering consumers to manage their energy consumption with the help of a smart meter is extremely important, and not present in each Member State. Accurate, user-friendly and timely readings provided directly from the interface of customer's choice to the customer and any third party designated by the consumer are strongly recommended since they are the key to running demand response services, taking 'online' energy-saving decisions and effective integration of distributed energy resources. Also, smart

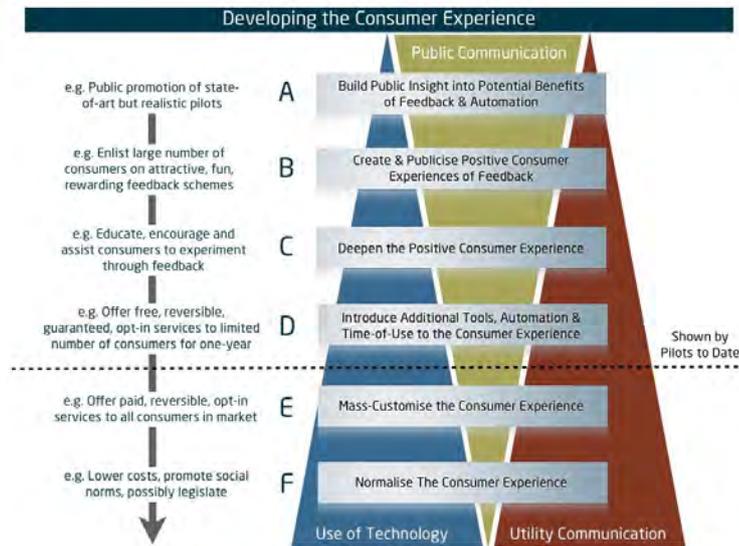


Figure 2: Stages of Optimal Consumer Experience Development (Empower Demand II)

metering systems should include advance tariff structures, time-of-use registers and remote tariff control. This will help consumers and network operators to achieve energy efficiencies and save costs by reducing the peaks in energy demand. The Council of European Energy Regulators (CEER) has defined the characteristics "Reliable, Affordable, Simple and Protected" in order to make these services attractive to consumers.

To make consumers smart, it is absolutely crucial that governments, regulators, different players in the energy market and industry assume their responsibility in informing, protecting and empowering consumers. ●



Nicolle Raven worked as a public affairs consultant in the energy and healthcare sector. After working for the European Commission, she is now EU Affairs manager for ESMIG.

**About ESMIG**

ESMIG is the European voice of the providers of smart energy solutions. Our members provide products, information technology and services for multi-commodity metering, display and management of energy consumption and production at consumer premises.

ESMIG drives the timely introduction of efficient and scalable consumer-friendly products and services fundamental to the participation of end-users in the smart energy and water systems of Europe's future

# The NanoCaTe Project: Nano-carbons for versatile power supply modules

## BACKGROUND:

In developed countries, about 40% of the fuel consumption is used for heating. Of this, about one-third is wasted due to insufficient transformation technologies into electricity. Waste heat is one of the biggest industrial losses which can be used by exploiting the Seebeck effect enabling **special materials to generate electrical energy if exposed to a temperature gradient**, like from waste heat for example.

## PROJECT OVERVIEW:

**NanoCaTe**, a project co-financed by the European Commission, is focused on **innovative flexible thermoelectric materials**, based on standard and modified nanocarbon materials like graphene or carbon nanotubes. Twelve partners from Austria, Denmark, Finland, Germany, and Spain develop **materials for thermoelectric energy harvesting and energy storage** for manifold applications like pulsed sensors or mobile electronic devices.

The integration of the developed materials into harvester and storage devices is a further step to characterize the performance of the innovative materials.

Finally, a demonstrator consisting of harvester, storage and energy management represents a self-sustaining, universally usable, and maintenance-free power supply.

## PROJECT TARGETS:

1. Development of **thermoelectric materials**.
2. Development of **energy storage materials**.
3. **Use of up-scalable and miniaturization**

## manufacturing techniques

like printing for thermoelectric harvesting and storage.

4. **Simulation and modelling of nanocarbon filled materials and TEGs.**
5. Systematic and standardized **characterization and evaluation of nanocarbon enhanced TE and storage materials.**
6. **Demonstration:**
  - autonomous, maintenance-free smart sensor demonstrator with energy harvester, storage unit, wireless communication, energy management, and sensor interface.
  - demonstration of a broad range of exploitable results: separate secondary battery, TEGs, inks or pastes.

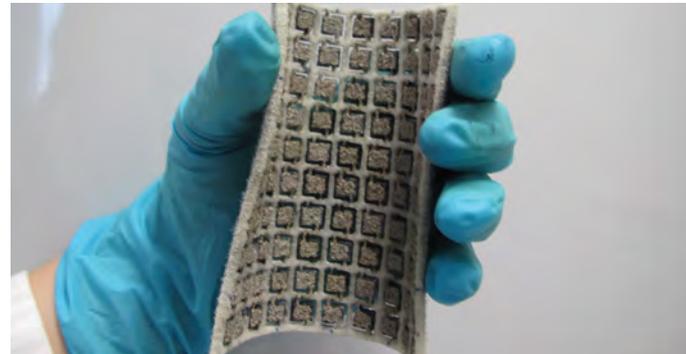
## POTENTIAL AREAS AND MARKETS OF APPLICATION:

With the combination of improved and more efficient harvester/storage materials and low cost processing techniques NanoCaTe offers a high commercial potential with broad application areas and good product exploitability.

- **Healthcare**, Home- and Point-of-Care Monitoring
- **Automotive & Aeronautic** system health monitoring
- **Chip thermal management**
- Stand-alone **TEG application**
- **Spacecraft** application
- **Waste heat recovery** systems in vehicles
- **Wireless sensor** network adoption
- **Consumer applications**
- **Military** and **Aerospace**

## IMPACT:

The **project strengthens the position of Europe in the field of thermoelectric and storage materials** by developing devices



with increased lifetime produced by cost-efficient technologies and therefore contributing to a further promotion of cleaner energy technologies. Aiming on energy harvesting & storage materials for innovative applications, the **NanoCaTe project will seek to establish an internationally leading position for Europe for this integrated energy harvesters technology.** ●

*Figure 1. First printed flexible TEG (Thermo Electric Generators) based on PEDOT: PSS and a n-type polymer synthesized in the NanoCaTe project*

## Partners:

 <b>Fraunhofer</b>	<a href="http://www.fraunhofer.de">www.fraunhofer.de</a>
 <b>TECHNISCHE UNIVERSITÄT DRESDEN</b>	<a href="http://www.tu-dresden.de">www.tu-dresden.de</a>
 <b>DTU</b> Technical University of Denmark	<a href="http://www.dtu.dk">www.dtu.dk</a>
 <b>AALBORG UNIVERSITY</b>	<a href="http://www.et.aau.dk">www.et.aau.dk</a>
 <b>LEITAT</b> Technological Center	<a href="http://www.leitat.org/english">www.leitat.org/english</a>
 <b>VTT</b>	<a href="http://www.vtt.fi">www.vtt.fi</a>
 <b>INVENT</b>	<a href="http://www.invent-gmbh.de">www.invent-gmbh.de</a>
 <b>QUICK-OHM</b>	<a href="http://www.quick-ohm.de">www.quick-ohm.de</a>
 <b>Kim</b>	<a href="http://www.kimglobal.com">www.kimglobal.com</a>
 <b>Infineon</b>	<a href="http://www.infineon.at">www.infineon.at</a>
 <b>alpccon</b>	<a href="http://www.alpccon.dk">www.alpccon.dk</a>
 <b>TU</b>	<a href="http://www.tugraz.at">www.tugraz.at</a>

## Contact details:

Project Coordinator:  
Dr. Aljoscha Roch  
Phone: +49 351 83391- 3415  
e-mail: [aljoscha.roch@iws.fraunhofer.de](mailto:aljoscha.roch@iws.fraunhofer.de)  
Website: [www.nanocate.eu](http://www.nanocate.eu)



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# Demand Response Markets in Europe Begin to Blossom

**REstore raises \$7.5M to serve new markets in the U.K., France and possibly Germany.**

**T**he opportunities for demand response in Europe are growing -- and REstore is raising money to grow with them.

On Thursday, the Antwerp, Belgium-based startup announced a €7 million (\$7.5 million) Series C capital round, to expand operations from its home country and the U.K. to France and Germany, and to beef up its data analysis and control platform for the industrial and commercial customers it's tapping for flexible electricity load.

In the past four years, REstore has grown from a few megawatts of industrial load to more than 1 gigawatt of peak load under management, serving more than 80 industrial customers including Arcelor Mittal, Praxair, Sappi and Barclays. Its revenues grew 700 percent from 2013 to 2014, and since the end of last year, it's increased its share of "95 percent reliable" load from 250 megawatts to 350 megawatts -- a measure of how much can offer equal or better certainty than natural-gas-fired power plants of being there for grid needs.

REstore's new round, led by existing investors LRM, Axe Investments, Ark Angel Fund and other individuals, brings

its total capital raised to €11 million (\$12.5 million), according to Thursday's announcement. REstore wants to grow its always-available portfolio to more than 2 gigawatts by 2018, and "that's steep growth, and that requires some capital," co-CEO Jan-Willem Rombouts said in a Thursday interview.

It's also seeking to expand to "a European-wide scale," he said, to match an expanding set of opportunities for turning flexible loads like steel smelters, freezers, pumps, fans and manufacturing lines into grid resources.

Europe's demand response needs aren't driven by summertime peak loads as they are in the United States. Europe does have some wintertime electric heating loads -- but the bigger drivers are the system-wide effects of the continent's growing share of intermittent wind and solar power, REstore co-founder Pieter-Jan Mermans said.

"Our power plants are increasingly being mothballed. That's a trend that's crystal clear, and will not be reversed any time soon," he said. "Second, the penetration of intermittent renewables continues to grow, which means real-time volatility on the grid."

## **CAPACITY MARKETS BRING U.S.-STYLE DEMAND RESPONSE TO BELGIUM, U.K. AND FRANCE**

Capacity markets are one way to solve the issue of power plants being shut down, he said. That's the form of demand response pioneered in the United States by companies like EnerNOC and Comverge, in which these aggregators bid alongside power plant operators to commit to meeting future peaks in grid energy demand, and then deliver on them years later.

While the majority of U.S. demand response is through capacity markets, Europe has just started to create the structures that allow demand-side resources to participate. Belgian transmission system operator Elia got the ball rolling last year by opening up market bids for 2 gigawatts' worth of capacity to meet winter power shortfalls.

The U.K. held its first capacity auction in December, and while the lion's share of the 45 gigawatts or so of winning bids went to power plants instead of demand response, REstore also won some of them, Mermans said. REstore also competes against a host of demand response companies in the U.K., including EnerNOC, Kiwi Power, Flexitricity, and Honeywell and partner Stor Generation.

The next big capacity market to open up is France, Mermans said. Starting in 2016, French grid operator RTE and other transmission system operators (TSOs) will start asking the country's power suppliers (i.e., power plant owners) to offer capacity certificates to qualified parties on an over-the-counter market.

Out of France's entire 90- to 100-gigawatt wintertime peak load, about 6 gigawatts of capacity is expected to be needed to fill in gaps that can't be met by the country's nuclear and fossil-fuel-fired generator fleet, "and that's obviously where demand response can compete," he said. Competitors in this market are Actility, Voltalis, and Energy Pool, the demand response aggregator majority-owned by French grid giant Schneider Electric, which has a big presence in France's existing capacity programs.

#### **WIND AND SOLAR POWER CREATE DEMAND FOR FAST-REACTING BUILDING CONTROLS**

The second opportunity lies in primary reserves markets, he said. These correspond to frequency regulation or ancillary services markets in the U.S., which operate on a minute-by-minute -- or second-by-second -- basis for generation or load reduction that can help smooth grid imbalances.

In the United States, companies like Enbala Networks, Powerit Solutions, Demansys and Viridity Energy are providing this kind of fast-acting load control. It's a pretty cost-effective way to give the grid the flexibility and

reliability it needs to run amidst more complex and variable conditions, compared to building energy storage systems or tapping power plants.

Back in 2013, REstore was the first European company to network and control building loads for primary reserves markets run by Belgian TSO Elia. Since then, it's started to apply the same technology to similar programs, like the Firm Frequency Response program started by U.K. grid operator National Grid early this year, which opens up roughly 1,000 megawatts for qualified participants, Mermans said.

France is the latest market to allow demand-side resources to participate in primary reserves markets, which opens up the opportunity to compete for a share of about 600 megawatts of fast-acting grid resources, he said. That market is "worth several hundred million euros per year," according to RTE's website.

Still, that's only a slice of what Mermans estimated is a Western European-wide primary reserve market of some 3,000 megawatts. A lot of that remainder lies in Germany, the country at the epicenter of the continent's energy market disruptions.

German utilities like RWE and E.ON are marking multi-billion-dollar annual losses from power plants that can't generate power at prices competitive with government-supported solar and wind power. E.ON announced in December that it's planning to split its business into one unit managing its traditional power assets, and another focused

exclusively on renewable power, efficiency and distributed, customer-sited energy activities.

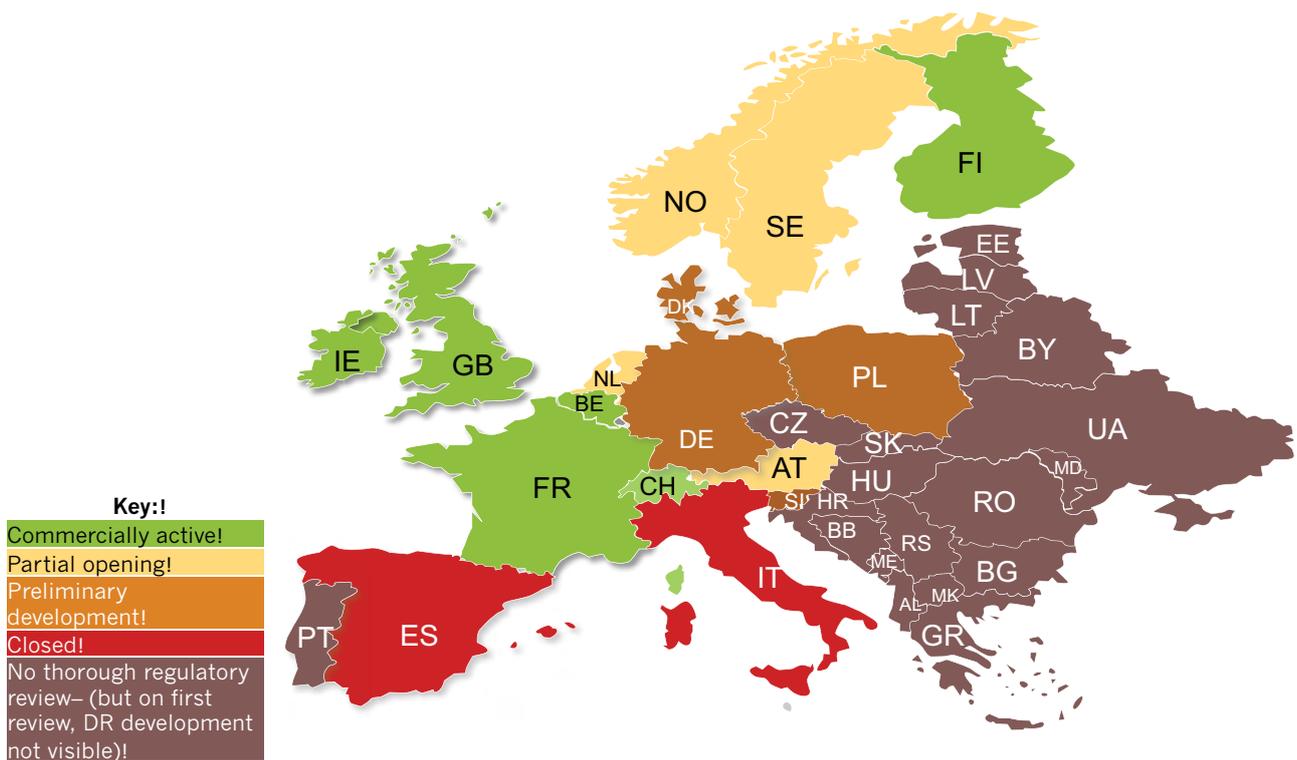
#### **DATA TO PROVE OUT DEMAND RESPONSE'S CAPABILITIES FOR REGULATORS**

Advanced demand response capabilities could be a natural fit for this new grid-edge utility business model, as could virtual power plants, microgrids and other ways to organize distributed, demand-side grid resources as grid assets and energy market participants. But so far, Germany's regulatory structures haven't moved as quickly to create markets to allow third-party demand response providers like REstore to play a role in that transition, Mermans said.

"The big question is how the regulatory landscape will evolve," he said. "Germany has been the country that has not been very welcoming for demand response. It's very simple -- it's all about the fact that you have four big integrated utilities that prefer to run their power plants in a profitable fashion, and prefer to shut the market off from substitutes that are much cheaper."

At the same time, European demand response companies are working on opening those markets, he said. One important player in Germany is Entelios, a startup that brought the first demand-based capacity to Germany's secondary reserves market, and which was bought by EnerNOC last year. Here's a map from the Smart Energy Demand Coalition industry group that ranks different

## Demand Response development in Europe (2014)



SEDC (2014). Mapping Demand Response in Europe Today.

countries' openness to European Commission directives to include demand-side resources in broader energy efficiency and carbon reduction goals.

One of the big questions for European grid operators is how reliable, flexible and scalable demand-side resources can be in meeting grid needs. After all, electricity isn't just a commodity to be traded for grid needs for factories, warehouses, data centers, office buildings and other end customers -- it's the lifeblood of keeping their businesses

running smoothly and profitably.

That's why REstore plugs its 100-percent track record on delivering services to date -- and why it's going to spend some of its new funding on expanding the capabilities of its Flexpond software platform, Rombouts said. In particular, it will be boosting its data analytics capabilities to put the immense amounts of data it's pulling from its customer sites to new uses.

That could open up new possibilities for REstore's

customers to put fast, automated power controls to use in managing exposure to risk on spot energy markets, or predicting and mitigating peaks in energy consumption that trigger high demand charges, he said.

"As an aggregator, we believe we are uniquely positioned, as we log massive amounts of this behind-the-meter data," he said. "We are really looking for patterns in the way that power is consumed. We want to learn what power is truly flexible." ●

This article was first written by Jeff St. John, published on Greentech Media on 8 May and is republished with permission here.

# Energycaps: High power and high energy lithium ion capacitor

A research project in the frame of Industry-Academia Partnerships and Pathways (IAPP) - Marie Curie Actions

The management of the electricity supply interruptions that can occur unexpectedly is vital for hospitals, telecommunication centers, airports, supermarkets, banks, tunnels or critical production plants. About 20 seconds are needed to start an additional electric generator of several megawatts (e.g., a diesel generator). To ensure the uninterrupted power supply (UPS), an intermediate device capable of delivering such a high power within a fraction of a second and keeping it up to about 20 seconds is needed.

Lead-acid battery has been meeting the demand of uninterrupted power supplies (UPS) at a megawatt scale for many decades. Its power to weight ratio is, however, very low and appears as major inconvenience.

Lithium-ion capacitors have recently emerged as an interesting alternative. Their competitive advantage over lead-acid battery is an important reduction of the device size. Compared to Li-ion batteries, Li-ion capacitors offer a better compromise between power and energy for this application.

This technology was identified as a new opportunity for SOLVAY to promote the products typically sold on the lithium-ion battery market. Li-ion capacitor could also be used to improve the fuel saving and reduce the CO<sub>2</sub> emission in hybrid vehicles.

A SOLVAY researcher sought

for partners to the forefront in this field of research in 2010. Two academic teams (Poznan University of Technology, Kiev National University of Technologies and Design) and two small companies (YUNASKO from Ukraine and RECUPYL from France) were selected. They joined SOLVAY in the collaborative project "Energycaps", sponsored by the European Marie Curie funding program "IAPP" (Industry-Academia Partnerships and Pathways) with more than 2 million Euros.

The objective of the project is to demonstrate market perspectives of this emerging technology (Li-ion capacitors).

The project started at the end of 2011. It has a mixture of secondments (26 researchers, 143 months) and recruitments. Academic partners are involved in electrodes, electrolytes, separator and current collector

development/optimization.

RECUPYL is currently developing a recycling process and assessing the environmental impacts.

YUNASKO develops a prototype of Lithium-ion capacitor. The device provides an energy density similar to that of lead-acid battery, a charging time as low as 1 minute, and a number of cycles and power capability improved at least by a factor of 100.

Solvay products have been used in the electrodes, the separator and the electrolyte mixture. According to YUNASKO, LiTFSI, produced by SOLVAY is the preferred lithium salt for Li-ion capacitor. ●

*Electric bus in Nice (FR) powered without any fossil fuel and without cable (photo with courtesy of the "PVI company"). The bus gets the energy at each bus station within 20 seconds. This energy is currently stored in classical supercapacitor (also called ultracapacitors) and allows about 1km range (see: [www.pvi.fr](http://www.pvi.fr)).*



Coordinator and contact: [Fernand.Gauthy@Solvay.com](mailto:Fernand.Gauthy@Solvay.com)  
[www.Energycaps.eu](http://www.Energycaps.eu)  
[www.Yunasko.com](http://www.Yunasko.com)



# Research at AIT Austrian Institute of Technology

The significant increase in the use of ICT technologies within the electrical power supply system brings about a need for cybersecurity considerations. Therefore, smart grid security is one of the research topics that the Digital Safety & Security Department at the AIT Austrian Institute of Technology is focusing on in several projects, both national and international.

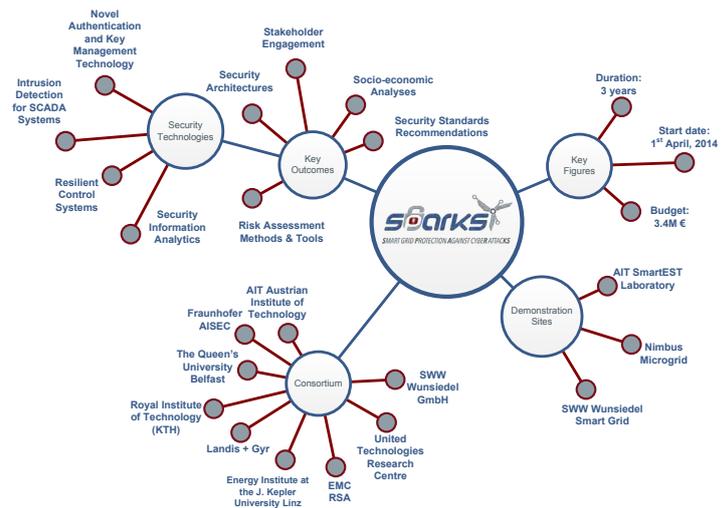
The EU FP7 project SPARKS (Smart Grid Protection Against Cyber Attacks) focuses on developing new methods, tools and technologies for smart grid cybersecurity in order to enhance grid resilience. In one of its early deliverables<sup>1</sup>, the project consortium has explored the area of smart grid reference architectures, providing guidance that an organisation can use for defining, designing and implementing security-related technologies, processes and organisational capabilities for smart grid environments.

The purposes for which organisations turn to smart grid reference architecture resources include 1) adopting a methodology for establishing an effective and durable long-term approach to securing their smart grid environment; 2) defining a durable architecture (including technologies, processes and people) that will secure that smart grid environment over the long-term; 3) developing a particular design based on that architecture;

and 4) creating and using mathematical and algorithmic models and simulations of that design to evaluate its performance or predict failures.

Important resources from which a security architecture for a particular smart grid environment can be derived are, for example, the NISTIR 7628 "Guidelines for Smart Grid Security", the "Smart Grid Architecture Model (SGAM)" defined by the CEN-CENELEC-ETSI Smart Grid Coordination Group under the European Union M/490 mandate, and the Sandia "Microgrid Cyber Security Reference Architecture". The abovementioned SPARKS deliverable provides an analysis of the strengths and weaknesses of each of those, and compares the characteristics of these architectures to help in planning or application of security in any smart grid project.

The importance of designing secure and interoperable smart grid architectures is also addressed in the European Nobel Grid project. Its goal is to explore new services for all the actors of the distribution grid, and to provide innovative solutions and tools for DSOs in order to support them in making the grid more secure, stable and robust. AIT's role in Nobel Grid is to define the underlying security architecture



for the envisaged solutions. More information on SPARKS and Nobel Grid is available on the project website <https://project-sparks.eu/> and <http://nobelgrid.eu/>, respectively.

On a national level, AIT is coordinating the RASSA project (Reference Architecture for Secure Smart Grids in Austria), which aims to develop a secure, interoperable reference architecture for Austrian smart grids, and establish its acceptance among all relevant stakeholders. By instantiating parts of the reference architecture, secure and compatible smart grid components can be implemented in a consistent and efficient way.

Through these and other related research activities, the Digital Safety & Security Department at AIT has built up expertise in the area of smart grid security, and collaborates closely with the AIT Energy Department to offer joint services for impact assessment of smart grid components. ●

1) Available for download at <https://project-sparks.eu/publications/deliverables/>

# Nothing endures but change.

- Heraclitus

# Change brings opportunity.

Nido Qubein

By Michael Edmund

**O**n the seventh of May 2015, it was announced to the world that, for the first time in two million years, global atmospheric carbon dioxide concentrations had reached 400 parts per million (ppm). Is this news important? It should certainly have come as no surprise: the upward trend in atmospheric CO<sub>2</sub> concentrations has long been established, and reaching this particular milestone was merely a question of when, not if. The other inference, by the way, is that CO<sub>2</sub> levels have been as high (and possibly higher) over the course of the Earth's long history - and long before man's first smokestack, jet engine or exhaust pipe.

There is evidence of climate change wherever we care to make measurements: data from NASA show global temperatures are also following an upward trend. Interestingly, since 1980 the rate of rise in the northern hemisphere is distinctly faster than that of the southern hemisphere, albeit following a larger fall during the 1970s. It is beyond the scope of this magazine to observe whether these findings can be linked either to industrial activity or to the oil shock of the 1970s; nonetheless, this subject is worthy of further examination. Elsewhere, core samples, tide gauge readings, and, most recently, satellite measurements all tell us that sea levels are rising, too: over the past century, the Global Mean Sea Level (GMSL) has risen

by 10 to 20 centimetres in that time. More startling is the rate of rise over the past 20 years, which, at 3.2 millimetres per year, is roughly twice the average of the preceding 80 years. Meanwhile, the cyclic variation of the Arctic ice cap (expansion in the northern winter and contraction in the northern summer) has also broken a record recently. In the summer of 2012, the area shrank to the smallest ever recorded in the satellite era; somewhat smaller than half that observed at the same stage in 1979.

Is any of this important? Clearly, the potential impact of climate change upon mankind is enormous: so yes, it is important. A more significant question might be: to what extent is mankind responsible for climate change? More importantly, can he do anything about it?

The best science we have says that man-made greenhouse gas is *very likely* to be responsible for the rise in global temperature. And that it is *extremely likely* that our activities are causing global warming. The italics are those used by the IPCC in its fifth report of 2013.

Elsewhere, the international political response to climate change began at the Rio Earth Summit in 1992, with the adoption of the United Nations Framework Convention on Climate Change (UNFCCC). This set out a framework for action aimed at stabilising atmospheric concentrations of

greenhouse gases (GHGs) to avoid "dangerous anthropogenic interference with the climate system." The annual Conference of Parties (COP) reviews the Convention's implementation: the first COP took place in Berlin in 1995 and significant meetings since then have included COP3 where the Kyoto Protocol was adopted, COP11 where the Montreal Action Plan was produced, and COP17 in Durban where the Green Climate Fund was created. In Paris in December of this year, COP21 will aim to achieve a legally binding and universal agreement on climate, with the aim of keeping global warming below 2°C.

That action is being taken (to which we must add the EU's 2020, 2030 and 2050 initiatives and events such as EUSEW) may reduce the need to ask one more question: Climate change predates man's existence on the planet: what if we simply accept it?

To which the answer is really two more questions:

- What if we really could influence the climate, prevent the icecaps melting and save the low-lying land bordering the seas; but we did nothing?
- What if we really cannot stop the climate changing? ●



# AVIATION

“...to dramatically slash the air industry’s carbon dioxide (CO<sub>2</sub>), noise and nitrous oxide (NOx) footprints...”



# Aerodays and the UK's thriving aerospace sector

**T**his October the UK will host Aerodays 2015; a flagship conference that brings together experts, industry leaders and politicians from around the world for a three-day event that will look at the future of flight.

Held almost as often as the Olympics, Aerodays is run by the European Commission in order to focus global attention on collaborative research and innovation across the aviation sector. This year marks the seventh time the event has run and for the UK it presents an important opportunity to showcase the pioneering technical developments within aerospace for which it is internationally renowned.

Already the event has an impressive panel of speakers confirmed: Warren East, the incoming CEO of Rolls-Royce; Tony Tyler the CEO of the International Air Transport Association, and Carlos Moedas, the European Commissioner for Research, Science and Innovation will all contribute to the vision for aviation.

With 17 per cent of global market share the UK's aerospace industry is the largest in Europe and second only to the US. Around half of the world's modern large aircraft fly on wings manufactured in the UK and a Rolls-Royce powered aircraft takes off somewhere in the world every two and a half seconds.

The aerospace sector is a UK success story and of strategic importance to the country's economy. Last year it turned

over £29bn, it provides 111,000 direct high-value jobs and more than 3,000 apprenticeships. Crucially, the sector provides excellent regional employment opportunities with earnings almost double that of the national average wage.

Recognising the strategic importance of aerospace to the UK economy, and the vital role that growing export market share plays in sustaining its leading position, the UK Government and industry came together to develop an Industrial Strategy as a way to tackle challenges and better exploit opportunities. The Aerospace Growth Partnership (AGP) was established in 2012, with the combined goal of securing the future of the UK aerospace industry for the next 20 years and beyond.

This partnership approach is already influencing international perception of the UK as a place to do business. Support provided through the AGP has created an attractive and competitive environment for investment; almost three quarters of aerospace companies plan to increase investment during the coming year with one in four looking at reshoring activity back to the UK.

A core initiative of the AGP has been to create the Aerospace Technology Institute (ATI). Over a seven-year period the ATI will establish and facilitate the growth of future aerospace and aeronautic technologies. Combining research from Government, industry and leading academia, the ATI will

identify areas of mutual strategic benefit to strengthen the UK's international appeal.

While the ATI is addressing the very latest in R&D within aerospace on a national level, the AGP has also championed the technological advancements made by smaller organisations on a more local level. At the Paris Airshow in 2013, the National Aerospace Technology Exploitation Programme (NATEP) was launched by AGP. With funding of £40 million this key initiative is focused on helping small and mid-sized companies develop innovative technologies and increase their ability to win new global business.

All of this bodes well for a market that looks set to see exponential growth; by 2032 it is estimated that worldwide more than 29,000 new large civil airliners, 24,000 business jets, 5,800 regional aircraft and 40,000 helicopters will be required. Given the UK's technical advantage in developing and manufacturing some of the most complicated and high tech parts of modern aircraft, it is in a strong position to respond to the potential presented by this growth.

Against this backdrop, Aerodays 2015 is being hosted in a highly apt location.

International experts will be welcomed to this unique forum to discuss strategic perspectives in aeronautics and air transport in a country that is pioneering technological developments using a highly original partnership approach. ●

# Airbus Group driving technological

## **SUSTAINABLE AVIATION**

### **More value, less environmental impact**

Airbus Group is proud of its European roots and achievements with more than 90% of its workforce based in Europe. In the meantime, Airbus Group is a strong export contributor with about 70% of its revenue generated outside Europe. Nevertheless, reducing aviation's environmental footprint is one of the primary challenges of the next decades. To sustain the aerospace industry in Europe, innovation should be kept as a key driver.

In 2014, Airbus Group sustained its R&D expenses, investing about €3 billion on research and development, a large part of which results in product improvements with direct environmental benefits. Airbus Group is leading the way to manufacture eco-efficient aircrafts in a highly competitive and global market.

In cooperation with other major European aerospace companies, Airbus Group is radically improving air transport's eco-efficiency through technologies

and solutions that targets Flightpath 2050 carbon goals<sup>1</sup>: 75% reduction in CO<sub>2</sub> emissions per passenger kilometer and aircraft movements are emission-free when taxiing.

## **CONTINUOUS IMPROVEMENT**

### **Enchasing the environmental performance of existing and future aircraft**

In order to answer Flightpath 2050 targets, Airbus Group is playing a leading role in the EU's recently launched CleanSky 2 (CS2) joint technology initiative - the follow-up to CleanSky and





# excellence

the most extensive aeronautical research programme ever launched in Europe.

Airbus is driving the CS2 collaborative research work stream focusing on the future of large passenger aircraft, while Airbus Helicopters is leading the design of LifeRCraft (Low Impact, Fast & Efficient RotorCraft), a compound rotorcraft which combines the speed and efficiency of a plane with the hovering capabilities of a helicopter as demonstrated by the X3.



Airbus also is contributing to the improvement of air traffic management with its participation in the SESAR (Single European Sky ATM Research) joint undertaking, created to improve control of aircraft flying the skies of Europe and reduce airport congestion – which could reduce CO<sub>2</sub> emissions by 10% per flight.

## **INNOVATION & ENVIRONMENT** **Tomorrow's technologies**

**towards a sustainable future**  
 Reducing aviation's environmental footprint is one of the primary challenges of the next few decades. Aside from continuing to reduce greenhouse gas emissions, the spotlight is also on the move away from traditional energy sources.

As said Detlef Müller-Wiesner, Head of E-Aircraft Programmes at Airbus Group, the E-Fan is a crucial step on Airbus Group's journey toward all electrical / hybrid aircraft.

The E-Fan successfully carried out its maiden flight in April 2014, and was awarded the prestigious Personal Aircraft Design Academy (PADA) award the same year at the AirVenture Oshkosh Airshow.

Airbus Group now intends to mature the aircraft for pilot training while also using it as a platform to develop the potential of electric propulsion.

In addition to the E-Fan, Airbus Group is exploring hybrid propulsion systems, with programmes such as the E-Thrust

(in cooperation with Rolls-Royce) which aims at reducing fuel consumption, emissions and noise through distributed propulsion.

Airbus Group Innovations is collaborating with key international research organisations to evaluate potentially ground-breaking hypersonic flight technologies for speeds of up to Mach 6. The ZEHST (Zero Emission High-Speed Transport) concept combines advanced turbo jet and rocket engines, as well as air-breathing, hydrogen-fuelled ramjets for the aircraft's cruise flight at approximately 25 km altitude.

Airbus Group promotes cutting-edge technologies and scientific excellence to contribute to global progress and deliver solutions for the challenges posed by such societal issues as environmental protection, mobility, defence and security, and safety. Around the globe, we search for technological excellence, benefitting from competences in key countries. ●

1) These are relative to the capabilities of typical new aircraft in 2000.

**Contact us:** [contactenvironment@airbus.com](mailto:contactenvironment@airbus.com)

For more information on all these topics please visit: [www.airbusgroup.com](http://www.airbusgroup.com)

Or download the Airbus Group EcoWay app:



# Show time: Demonstrators in the Sky

By Eric Dautriat

**T**he Clean Sky Joint Undertaking is moving closer to reaching its environmental targets to dramatically slash the air industry's carbon dioxide (CO<sub>2</sub>), noise and nitrous oxide (NO<sub>x</sub>) footprints by developing technologies for new engine architectures, improved wing aerodynamics, lighter composite structures, smarter trajectories, and more electric on-board energy.

Since its launch on 9 July 2014 which I reported in these pages one year ago, Clean Sky 2 has not just taken off but climbed even higher. We had a very dense but rewarding period that included a dozen Information

Days across Europe, a first set of Grant Agreements for the start of the preliminary phases, the First Call for Core Partners launched, evaluated, ranked, and negotiated, and the First Call for Partners launched. The second call for Core Partners has recently been published and a second call for Partners is planned for July.

Meanwhile, Clean Sky 1 is also more than active. The time of the large demonstrators has come. An overview of the demonstrators ready to be tested this year include the Rolls-Royce ALPS demonstrator, the High Compression Engine (Diesel engine on a light helicopter), the ATR-72 first round, for a composite fuselage panel in-

flight demonstration, the A340 integration campaign just started in Tarbes to fly the laminar wing, the Open Rotor first tests and a geared turbofan.

Due to the amount and the quality of projects that were successfully completed, we decided to award the three Best Clean Sky Projects of 2015. The Ceremony was held during the Clean Sky Forum which took place on 17 March 2015, in Brussels. The event gathered some 230 participants from industry, research organisations, SMEs and EU institutions mainly. This is very rewarding for the Joint Undertaking in general, for our community, and for those who conducted these projects particular, as the projects showcase the truly innovative

*Picture caption here*





research and aeronautics supply chain that we are set up for.

The progress accomplished by the winners, all those shortlisted and more than 600 Clean Sky Members, is an excellent base for Clean Sky 2, which is certain to deliver benefits for European citizens, for the EU economy, for the scientific community, for the Member States, and for the aeronautics sector. I would like to emphasise that Clean Sky 2 will, in the near future, give more room, when feasible, to the partners' creativity, including small and medium sized companies (SMEs).

The programme offers indeed more opportunities for innovative research centres and SMEs. For countries without an established aeronautics industry, Clean Sky 2 will still represent an important opportunity. Increasing numbers of enterprises with a non-aerospace focus are successfully finding their way into the innovation chains via the Calls for Proposals, thus creating new fields of opportunity for the SMEs while also creating new potential supply chains for the established industry players.

From a more technical viewpoint, the programme will introduce further integrated demonstrations and simulations of several aircraft systems at the aircraft platform level. Innovations from Clean Sky 2 will underpin advances in the next generation of aircraft by mastering the technologies and the risks in time to meet the next market window to replace the current fleet. Clean Sky 2 will be a core European programme, leveraged by further activities funded at national, regional and

private levels. This will allow us to fully realise the environmental objectives of the aeronautical sector for 2020, which are to demonstrate technologies at the highest possible maturity to reach the 50% CO<sub>2</sub> reduction target. Clean Sky 2 will bring these technologies to an even more complex and more representative level of integration at engine and aircraft levels. Beyond this, Clean Sky 2 will pave the way for the next generation of breakthroughs, reaching for a 2035 horizon.

#### **SYNERGIES WITH THE CURRENT EU STRUCTURAL FUNDS**

There is room for more bottom-up imaginative proposals and there is also room for synergies. Due to its increased size, and because of the level of maturity reached, Clean Sky 2 has now been requested, through its legal founding European Regulation, to establish synergies with the Structural Funds going to European regions. This means, clearly, funding complementary activities. This should concretise a more optimized use of public funds, reinforce Clean Sky content, and underpin the Smart Specialisation objectives which are now requested from the Regions by the new funding rules.

This new centre of interest is already producing results: Clean Sky signed a Memorandum of Understanding with the Midi-Pyrenees regions, President, Martin Malvy in March this year. Others will follow as we already have advanced discussions with regions in Spain, Italy, Germany, Poland, Romania, Czech Republic and coming soon, UK - several forerunners.



*Picture caption here*

A number of pilot cases, with actual projects, will follow the signing of the agreements, adapting to different regions policies.

Clean sky will demonstrate a selection of these technologies and debate some of our key themes at The International Paris Air Show taking place in Paris in June 2015 and also at Aerodays, in London in October 2015. I welcome you to attend the conferences and to visit our Demonstration Stands at both events to learn more about our exciting plans for the future. ●

#### **Contact details:**

Web: [www.cleansky.eu](http://www.cleansky.eu)

# Green Aviation Research at Imperial College London

By Professor Paul Robinson, Director of Green Aviation, Department of Aeronautics, Imperial College London

Imperial College London has been at the forefront of aeronautical research since the very early days of powered flight and much of the current research is focussed on the development of technologies that will deliver greener air travel for future generations. This research draws on the expertise and facilities of College's internationally leading

Aeronautics Department together with those of its other pre-eminent engineering and science departments and its specialist cross-disciplinary centres in areas such as transport systems, composites, climate change and bio-fuels. The research is extensively supported by national and European funding bodies (including EPSRC, TSB & EEC), and industry, and addresses

such diverse topics as active and passive drag reduction, air traffic management, modelling for advanced composite airframes, optimisation of jet engines, climate change modelling, structural health monitoring, suppression of combustion instabilities for quieter engines, biofuels and the development of next generation multifunctional composite materials.

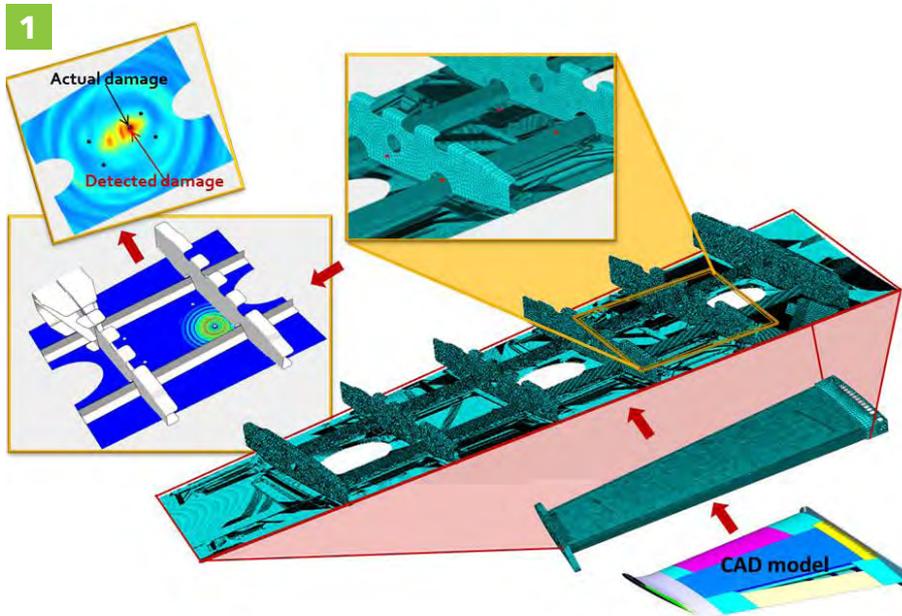


## INVESTING IN FACILITIES

The Department of Aeronautics has state-of-the-art facilities to support these green aviation research activities including high quality wind tunnels equipped with advanced instrumentation, specialist manufacturing, testing and inspection facilities for composite materials, and advanced equipment for low and high velocity impact. These facilities have received a significant boost with the success of a £13m EPSRC proposal led by the Aeronautics Department for the establishment of a National Wind Tunnel Facility to keep Britain at the forefront of experimental aerodynamics research. £4m of the award will be used to enhance the wind tunnels at Imperial.

## TRAINING THE DESIGNERS OF FUTURE GREEN AIRCRAFT

The Aeronautics Department at Imperial is the UK's leading provider of aeronautical engineering training at undergraduate level and also



1) Simulation of the capability of a structural health monitoring system to detect barely visible impact damage in a composite wing using dynamic explicit finite element analysis of ultrasonic wave propagation (part of EU FP7 project SARISTU)

2) Noise reduction investigations using a fractal spoiler mounted on a reduced-size wing. Wings and spoilers with fractal trailing edges rather than fractal porosity have also been investigated showing very significant noise reduction with an accompanying increase in lift to drag ratio.

3) Simulation of turbulent flow generated by a fractal square grid using the high-order flow solver Incompact3d with 8,100 computational cores on ARCHER, the UK supercomputing facility.

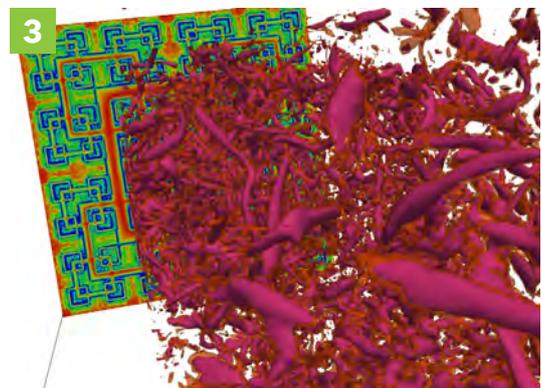
runs flagship postgraduate MSc courses in computational techniques for fluid mechanics and fluid-structure interaction, and in the science, technology and engineering of advanced composites. Both of these MSc courses produce graduates with specialist knowledge and skills essential for addressing the demanding environmental issues facing aviation. Recently an Advanced Aeronautical Engineering MSc course has been launched to train existing engineers in the fundamentals of new enabling technologies required for 'greener' aircraft.

Imperial has a large population of PhD students engaged in green aviation research and this has been expanded recently with the award of a prestigious EPSRC Centre for Doctoral training in 'Fluid Dynamics across Scales'. Over a period of five years this centre will train 75 additional

PhD students many of who will focus on computational and experimental aerodynamics for more efficient future aircraft.

### ENGAGING WITH THE GREEN AVIATION COMMUNITY

The Green Aviation Forum at Imperial led by the Department of Aeronautics has run two very successful symposiums (Green Aviation 2011 & 2012) in London where aviation sector leaders have addressed large audiences of specialists from industry, academia, government and the press on the steps being taken to reduce the environmental impact of future air travel. The next symposium (Green Aviation 2014) was held in Beijing in collaboration with Beihang University and included speakers from a selection of Chinese aviation organisations and from leading international aerospace companies to ensure a truly global perspective. ●



### Further information

[www.imperial.ac.uk/greenaviation](http://www.imperial.ac.uk/greenaviation)

# Aviation's climate action takes flight

By Michael Gill, Executive Director, Air Transport Action Group

**T**he modern air transport system connects the world, flying over 25,000 aircraft across nearly 50,000 routes. Each year over 3.3 billion passengers and 50 million tonnes of cargo are transported. Over 58 million jobs and \$2.2 trillion in global economic activity are supported by the sector.

While the socio-economic benefits of aviation are clear, the industry also has a responsibility to address the environmental impact of its operations. Commercial aviation produces 700 million tonnes of

carbon dioxide per year, which represents around 2% of total human-induced CO<sub>2</sub> emissions. However, robust action is being taken by all sectors of the industry to reduce these emissions.

Six years ago, the Air Transport Action Group (ATAG) convened industry leaders representing airlines, airports, aerospace manufacturers and air navigation service providers and presented a shared strategic vision for aviation's response to the climate challenge centred around three ambitious goals:

1. an average annual 1.5% improvement in the fuel efficiency of the world fleet (a goal which the industry is currently meeting with around 2.9% annual fuel efficiency improvement);
2. stabilising net aviation CO<sub>2</sub> emissions at 2020 levels through carbon-neutral growth; and
3. halving aviation's net CO<sub>2</sub> emissions by 2050 (when compared with a 2005 baseline).

To meet them, the industry has been approaching the challenge through a four pillar strategy.

The first pillar is the development and operation of new technology, such as lightweight composite materials and more fuel-efficient engines. These steps will cut

down on fuel burn which is the main source of aviation emissions. Included in this pillar is the development of sustainable alternative fuels, which could decrease the carbon intensity of jet fuel by up to 80%.

The second pillar is related to improved airline operations, ensuring that all possible efficiency measures are undertaken. For example, reducing the weight of cabin equipment, seats and the amount of water carried on board can substantially cut fuel (and CO<sub>2</sub>). The adoption of new landing procedures has the same significant impact.

The third pillar focuses on infrastructure, driving air navigation authorities and airports to improve airspace design and operations and achieve optimal efficiency.

At ATAG, we are playing a central role in representing the industry at international negotiations through the specialised UN agency, the International Civil Aviation Organization (ICAO), to secure an agreement on a global market-based measure (MBM) for aviation emissions. This is the fourth pillar. Like the global negotiations on climate change taking place in Paris at the end of this year, the discussions around a global MBM for aviation need to reconcile the desire of parts of the world to develop their aviation sector as a means

Michael Gill



of economic and social growth, whilst balancing the important climate change objectives. However, the process at ICAO has shown encouraging momentum and the industry is confident that a comprehensive agreement on a MBM will play an important role in the sustainable development of aviation. It is vital that this agreement is global in nature and preserves fair competition between airlines.

In the last few months, there have been a number of positive developments showing real, on-the-ground progress towards meeting our industry-wide goals:

French-American joint venture CFM International's new LEAP engine is being used in new aircraft models from Boeing and Airbus. The LEAP engine has been made using new materials called ceramic matrix composites, which are far lighter than the traditional metallic alloys and can withstand higher temperatures. This makes them ideal for jet engines as it removes the need for expending additional energy on cooling systems. New advances in engine technology are also being rolled out at Rolls-Royce who tested a composite carbon/titanium fan blade in October last year. This lightweight fan blade, which will accompany a composite engine casing, is expected to reduce carbon emissions by roughly 20% compared to older models.

The development of sustainable alternative aviation fuels has been a long term ambition of the industry and progress, too, has recently been made on this front. In April, Oslo Airport



became the first 'bioport' in the world as alternative aviation fuel produced from used cooking oil became part of the normal fuel mix for flights by SAS, KLM and the Lufthansa Group airlines. This is a significant achievement and Oslo will be followed by other airports around the world as this alternative source of energy is used on more and more flights.

Another company, LanzaTech, has identified another waste product that can be used to create jet fuel: industrial waste gases. Through a process of "carbon capture and reuse", these waste gases can be converted into fuel and used to power aircraft, rather than being emitted into the atmosphere with no benefit. LanzaTech have recently gone into partnership with Virgin Atlantic, who aim to use this type of fuel on two routes in the next few years.

A similar accreditation programme is in place for airports through Airport Council International's (ACI) Airport Carbon Accreditation

project which began in Europe and has now been rolled-out worldwide. ACI member airports have committed to the shared goal of cutting emissions from their operations and aiming to become carbon neutral. The programme works by setting four levels of accreditation: mapping, reduction, optimisation and neutrality. Airports can begin the accreditation process by submitting carbon assessments and gradually develop environmental policies so as to achieve the overall goal of carbon neutrality.

These initiatives are only a small cross-section of the wide range of actions being taken throughout the aviation industry. When taken together, these demonstrate real progress toward cutting aviation emissions and achieving the global climate goals. ●

**Contact details:**

Air Transport Action Group, Geneva  
 Tel: +41 79 429 8710  
 Web: [www.enviro.aero](http://www.enviro.aero)

# The Institute of Aviation

**T**he Institute of Aviation is one of the oldest research centres in Europe. It was formally established in 1926 but its roots date back to 1918. Over 89 years of its history, researchers and engineers working at the Institute of Aviation have made outstanding contributions to the economy and defence of Poland. Before World War Two, all Polish airplanes were manufactured or tested by the Warsaw Institute of Aviation.

Currently, the Institute employs more than 1,700 engineers, scientists, researchers, of which 1,250 are in their late 20s or early 30s.

In recent years, new laboratories have been established within the Institute including the world's second largest laboratory of pressure testing of equipment for the petroleum and natural gas extraction industry. The Institute's key research areas include: space technology, aviation and rocket engines, materials science, aerodynamics, composite material technologies, engineering and testing of aircrafts, noise from aviation and research in the area of petroleum and natural gas extraction. The Institute of Aviation is also a host of international conferences and symposiums and a facilitator of global research projects.

The Institute of Aviation is a member to Polish and international research and technology organisations and associations. Since February 2005, the Institute is a partner of the AERONET "Aviation Valley" project, a consortium of high profile academic units. In April 2008, the Institute of Aviation was accepted as a member of the association of European



Research Establishments (EREA), an organisation aimed at consolidation, coordination and implementation of joint activities. On 7 June 2010, in Luebbenau, Germany, the International Forum for Aviation Research (IFAR) was established. The Institute of Aviation, as a representative of Poland in the organisation, played an important role in its formation as one of the co-founders.

The Institute of Aviation defines its strategy as "provision of services in the global research market". The global market demands the highest competitiveness of the offered research services leading to the development of new technologies. Poland's accession to the European Union opened up more opportunities of co-operation with universities, scientific institutions, research institutes and industrial laboratories in Europe, Americas, Asia, Australia and Africa. The Institute closely co-operates with global leaders of the aviation industry including General Electric, Boeing, Airbus, Pratt&Whitney, Sikorsky and Rolls-Royce.

The Warsaw Institute of Aviation

co-operates with the Ohio State University in Columbus, Ohio, USA. Both partners found it mutually beneficial to implement joint projects in the areas of research co-operation, exchange programmes for students, teachers and researchers, (lectures, studies, scientific research) as well as workshops, symposiums, etc. on topics of common interests. They also release joint publications, research papers and scientific and technical literature. ●

There are five research departments in the Institute:

Centre of New Technologies, Engineering Design Center, Materials and Structures Research Centre, Centre of Space Technologies, Centre for Composite Technologies.

Director of the Institute of Aviation  
Professor Witold Wiśniowski Ph.D. Eng.  
Tel: (+48) 22 846 09 93  
Fax: (+48) 22 846 29 12  
Email: [witold.wisniowski@ilot.edu.pl](mailto:witold.wisniowski@ilot.edu.pl)

[www.ilot.edu.pl](http://www.ilot.edu.pl)  
[www.facebook.com/instituteofaviation](https://www.facebook.com/instituteofaviation)  
<https://twitter.com/AviationPoland>

Address: The Institute of Aviation  
al. Krakowska 110/114, 02-256 Warsaw, Poland

# On target for greener skies

By Simon McNamara

**T**he aviation industry has ambitious short-, medium- and long-term targets that will work towards greener skies and a more sustainable future. These targets address aviation's impact on the environment and, as an association with members representing the entire spectrum of the aviation sector, the European Regions Airline Association (ERA) is at the forefront of enabling these targets. ERA members take their environmental responsibilities very seriously and, as their representative body, ERA plays a key role in expert forums such as the Council for Environmentally Friendly Aviation (CEFA) which have a shared vision of more sustainable aviation. ERA chairs CEFA which is made up of aviation-related associations that coordinate industry policy and promote activities to reduce the sector's carbon footprint, improve air quality and minimise noise pollution. ERA believes that aviation environmental responsibility is not just about complying with relevant legislation but about investigating and investing in ways to build a greener future for everyone.

Aviation plays an essential role, both socially and economically, in an increasingly global world. It facilitates business, connects cultures and communities, promotes economic development and drives trade and tourism. Wherever possible, aviation works

to reduce its resultant impact on the environment through the best balance of social, economic, operational and environmental policies.

Numerous initiatives are helping the whole aviation industry work towards greener skies.

Reduced fuel usage and the use of alternative fuels are both key factors in lowering actual emissions.

The aviation industry agreed in 2008 to the world's first set of sector-specific climate change targets. The industry is already delivering on the first target – to continue to improve fleet fuel efficiency by one and a half

per cent per year until 2020. From 2020, aviation will cap its net carbon emissions while continuing to grow to meet the needs of passengers and economies. By 2050, the industry has committed to reduce its net carbon footprint to 50 per cent below what it was in 2005 (source ATAG).

The aircraft operators have developed many operating procedures that minimise fuel usage, for example, single engine taxiing, reduced thrust take-offs or continued descent approaches where minimum power is used in the approach profile. The reform of air traffic management,

*Simon McNamara*





european regions airline association

which enables fewer delays, less holding and non-direct routings caused by Europe's currently inefficient air traffic control, can also help to cut down fuel usage and the industry's overall fuel burn by as much as 10 per cent. More efficient use of fuel is also being achieved through new engine technology, lower weight aircraft and more aerodynamically efficient aircraft.

With regards to alternative fuels to jet fuel (kerosene), operators, fuel companies and regulators are working to develop biofuels as a complimentary fuel source to existing carbon-based fuel. Over 1,500 passenger flights operating partially on sustainable biofuels have taken place so far. It is expected that carbon reduction from moving to alternative fuels could be up to 80 per cent compared with traditional jet fuel, but the challenge now is to industrialise the production of biofuel and ensure that the infrastructure is available to supply the fuel to the point of use at airports.

Despite progress by the industry on reducing its emissions through the first three pillars, they will not be sufficient to meet the goal of carbon-neutral growth from 2020. Therefore, at least for a period of time, there will be a need to turn to a market-based measure to meet that cap on aviation's CO<sub>2</sub>

emissions. The industry has argued since 2008 that any market-based measure for air transport must be global in scope, to reflect the global nature of the industry.

The standard approach for dealing with greenhouse gas emissions from most parts of the global economy is enshrined in the United Nations Framework Convention on Climate Change (UNFCCC), of which the Kyoto Protocol is a subsidiary mechanism. The Kyoto Protocol provides limits on emissions to be placed on the developed world, while the developing world is not subject to such restrictions.

The industry has been urging governments to back the industry plan for reducing emissions and to agree to develop a single, global market-based measure for the aviation sector. At the 38th ICAO Assembly in 2013, the industry's suggestion was taken up and agreement was reached among governments to develop a global measure, to be settled at the next ICAO Assembly in 2016 and be ready for implementation from 2020. The work to design such a scheme is now taking place through the ICAO process.

In Europe the main tool for aviation is the EU Emissions Trading System (EU ETS) - aviation was included in the EU ETS from 2012. The original aim was to capture all flights that arrived or departed from an EU airport. However, following huge international opposition, the EU amended the scheme and excluded international flights (outside the EU) for one year in 2012. The 'freeze' has been extended until at least 2016 but, in practice, this means that only flights within the EU are included in the scheme.

For ERA, as an organisation

representing primarily intra-EU operators, the decision was disappointing for its membership. At best, the scheme will capture between 25-28 per cent of aviation CO<sub>2</sub> emissions in Europe meaning that it will be environmentally ineffective while adding complexity and cost to European business for airlines to achieve compliance and verification of emissions.

Modern jet aircraft are 75% quieter than the first models that entered into service and each new Considerable progress has been made in recent years in reducing the noise generated by aircraft, driven by technological and design improvements and control of operations at airports. For example, lining up aircraft with the runway as far as 70km away from the airport and then approaching in a continuous descent can more than halve the acoustic energy that reaches the ground, according to an international research consortium. On the one hand aircraft get quieter, on the other airports and air traffic controllers work to provide operational noise mitigation measures and the work of local governing authorities with the aviation industry to more appropriately zone areas around airports.

The aviation industry is committed to addressing its impact on the environment and has made impressive progress on a number of counts. It will continue to work with governments, aircraft and engine manufacturers, airports and air navigation service providers towards enabling ever greener skies. ●



# Green Aviation

Green Aviation Ltd is on the cusp of revolutionising the Commercial Drone market. Using larger drones with long endurance, carrying larger payloads, gathering more accurate data on behalf of clients in the areas of precision agriculture, utilities and infrastructure inspections and crowd control. Our service will be introduced shortly at trade shows and flight demonstrations for future clients. ●



**Contact details:**

Suite 201 Beacon Hub  
96 Bracken Road  
Sandyford Industrial Estate  
Dublin 16  
Ireland  
Tel : +353-1-5313226



# NOVA (NextGen Onera Versatile Aircraft)

*ONERA, the French Aerospace Lab*

**C**urrent airliners are the direct heirs of aerodynamic and propulsive formulas developed in the 50s and 60s, such as the Boeing 707. These “tube and wing” aircraft have been optimized over the last 50 years, thanks to technical progress enabling a considerable reduction in fuel consumption, noise and emissions. But the remaining gains to be obtained by this scheme are now very low. Research must therefore

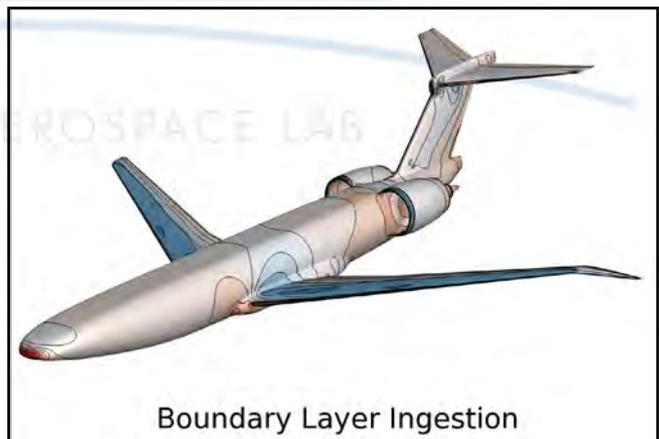
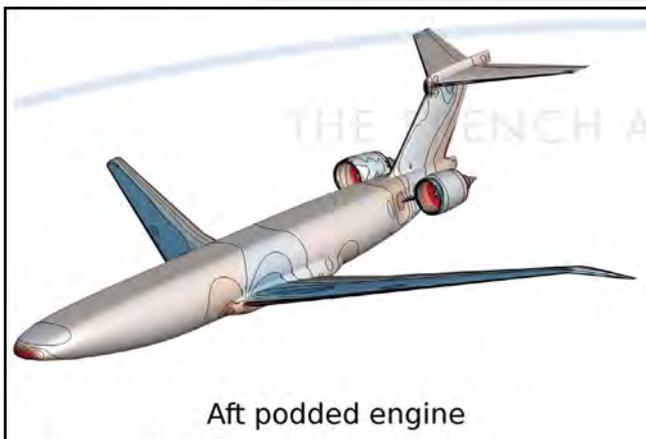
focus on game changing aircraft configurations to face many challenges: ambitious environmental targets, depletion of oil resources and the cost reduction of aircraft operation. These challenges are even more ambitious since air traffic is expected to double in the 15 next years.

The search for reduced fuel consumption of future transport aircraft involves an improvement of the propulsive efficiency.

The current trend for engines is toward lower fan pressure ratio (and higher bypass ratio), which has to be compensated by larger mass flow rate. To deliver this increased mass flow rate, the fan diameter must be larger, making the integration of such engines on conventional aircraft a challenge.

#### WHAT IS NOVA?

NOVA (Nextgen Onera Versatile Aircraft) is a concept of medium-haul transport aircraft taking advantage of several disruptive



technologies with a particular focus on engine integration options. Four configurations have been designed by ONERA to explore different possibilities for UHBR (Ultra High Bypass Ratio) engine integration. NOVA is designed to carry 180 passengers on 3000 nautical miles (equivalent to an Airbus A321) at Mach 0.82, and targets a 2030 entry-into-service.

### MAIN DISRUPTIVE TECHNOLOGIES

NOVA aims at propulsive efficiency improvement and drag reduction. To do so, it differs from a conventional aircraft configuration by the following characteristics:

- **UHBR Geared turbofan (GTF) engines** (By-pass Ratio > 16, compared to 10-12 for A320 NEO). These engines are more fuel-efficient and more silent, but also larger and heavier, so that their integration on the aircraft is a challenge. Consequently the nacelle has to be shorter and thinner in order to mitigate its weight and drag. Furthermore, for noise reduction purpose, the nacelle inlet features a negative scarf angle, which helps propagating sound waves upwards, away from the ground.
- **A wide lifting body of ovoid cross-section**, made of composite material. This fuselage, shorter and wider than that of a conventional single aisle, allows a 2-3-2 cabin layout in order to limit turnaround time.
- **A high aspect ratio wing with downward-oriented winglets**, for a better balance between



NOVA configuration with semi-buried engines for boundary layer ingestion

aerodynamics (drag reduction) and structure (wing root bending moment).

- **Gull wing design** to mitigate the drawbacks related to the engine size, like compliance to ground clearance limitations for instance. For under-wing engines, the possibility of modifying the wing dihedral angle in its inner portion has been investigated and led to a "gull-wing" shape.
- **Boundary layer ingestion:** Aft fuselage mounted engines have also been investigated, conventionally podded, or semi-buried in the fuselage and thus ingesting the boundary layer coming from the fuselage, for increased propulsive efficiency. Boundary layer ingestion is an opportunity to further reduce fuel consumption. It is more efficient to produce thrust by accelerating an already slowed down flow such as in a boundary layer, rather than slowing down fresh air before increasing even more its velocity. The engine will produce the same thrust with a reduced power. The boundary layer is large on the aft part of the fuselage, therefore semi-buried engines are placed here in order to

maximize boundary layer ingestion. Such radical engine integration with boundary layer ingestion is a real challenge but it could enable significant fuel burn reduction. This is the reason why ONERA has been thoroughly investigating this concept, both numerically and experimentally.

This work funded by the French National Agency for Research (ANR), allows ONERA to propose innovative solutions to the industry for an ever greener air transport.

Brought to our attention by Eucass. ●



Boundary layer ingestion

#### Contact details:

ONERA - Applied Aerodynamics  
 8 rue des Vertugadins  
 92190 Meudon - FRANCE  
[www.onera.fr](http://www.onera.fr)



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# BIOENERGY

“ Europe needs to act now, together, to deliver sustainable, secure and competitive energy ”



# A long road to securing energy

By MEP Nils Torvalds

**“Energy is essential for Europe to function. But the days of cheap energy for Europe seem to be over. The challenges of climate change, increasing import dependence and higher energy prices are faces by all EU members. Moreover the interdependence of EU Member States in energy, as in many other areas, is increasing - a power failure in one country has immediate effects in the next. Europe needs to act now, together, to deliver sustainable, secure and competitive energy.”**

**T**his is not a paragraph of the European Commission’s proposal on an Energy Union, although one would be inclined to believe so. The text is from the Commission Communication on An Energy Policy For Europe, dating back to January 2007. Indeed, the similarities are striking.

The work on strengthened EU energy policies have been ongoing for long, and the objectives seem to have remained similar, even identical, for at least a decade. However, the world has changed in many ways during this time. Many of the challenges remain, or have transformed over time. At the same time, one could get the impression that nothing or almost nothing has been achieved during the years.

The Achilles heel of European energy policies is nothing new: Today, the EU still imports over half of the energy it consumes. One third comes from one external supplier - Russia. The import cost amounts to more than 1 billion euros, per day.

The crisis in Ukraine brought back energy security as one of the most urgent issues on EU’s foreign policy agenda, and the concurring crises in the Middle East and Northern Africa add to the challenge of secure energy supplies. This all makes energy

security a topic that the EU cannot - and should not - avoid in upcoming talks on the Energy Union.

One essential challenge is to even identify a precise definition of energy security, in order to pinpoint policies and measures aimed at increasing security of energy supplies. Perhaps the lack of energy security is easier to define. The potential threats to energy supplies are very context bound, and change shapes and faces over time. It’s a mixture of geopolitics, international (and internal) markets, but climate change and environmental policies are also parts of the package.

Being such a broad and crosscutting issue, energy security will be challenging to coordinate in a decision making structure as complex as that of the EU. It will demand streamlined and coherent work in many sectors and by many actors. These requirements will be very challenging - to say the least - for the Commission, for the Member States, for External Action Service, and for the Parliament. Governance will be a key issue, but likely also heavily debated. Although several energy policies have been drawn up before, implementation has always been an uphill struggle. This will be even more critical this time, depending heavily on the

attitudes of Member States.

Previously - especially when it comes to oil and gas supplies - Member States tend to have pursued their own aims and interests. There has been no common orientation in terms of external energy policies, which has been reflected in the EU foreign policy related to energy issues. It is only in recent years this has begun to change, with a number of energy agreements and infrastructure projects, such as gas pipes, with third countries. Yet, progress has been far from easy, and far from solving all problems. The unrest in many supplying third countries makes diversifying energy supplies a questionable solution.

Increased interconnectivity within EU could stabilize energy supply significantly, but require enormous investments for the infrastructure needed. The drafters of the Energy Union proposal have had their eyes on the European Fund for Strategic Investments - or the so-called “Juncker Fund” - to help pour money into cross border cables and pipelines, but the issue will hardly be solved on any short-term basis. Interconnectivity is also desirable in order to reduce energy prices in Europe - which today are among the highest in the world - which in turn could foster investments and competitiveness, and ease the



pressure on consumers' wallets.

The struggles with law proposals such as the Emissions Trading System and Market Stability Reserve as well as indirect land-use change and biofuels have revealed how fundamentally different the energy structures of the EU Member States are. The division is enhanced when forming common policies and pushing for progress, making the least prepared states hit the brakes. This stalls technological and economic development in EU, and also slows down a multifaceted approach to energy security.

Not only - but perhaps in particular - as the COP 21 in Paris approaches, Europe should

not neglect climate goals and undertakings when seeking to increase energy security. Instead, new approaches could enable synergies between these two goals.

For this, the bioenergy sector may play a highly interesting role. Heavyweight actors, both within the EU, but also within UN, stress the potential of locally produced biofuels. Especially forest-based bioenergy could have significant climate benefits, when managed sustainably, and attract much-needed investments and job opportunities especially to rural parts of the EU.

The counterpart of interconnectivity is technological progress. New ways of energy

storage could probably make it more economical and efficient to build local high-tech solutions. The technological breakthroughs in recent years are providing us with more tools than our precedent decision-makers have had. Now, we have the responsibility to make use of these tools - if the Member States can overcome their differences in favour of a common goal. In 1952 that was made possible through the European Coal and Steel Community. It is as needed today, but one could - on good grounds - doubt EU's ability to make far-reaching and intelligent decisions. The EU won't achieve energy security by circulating good intentions, but by concrete action and cooperation. ●

# Forests are Europe's green gold

*By Emma Berglund, Policy Advisor, Confederation of European Forest Owners (CEPF) and Bureau of Nordic Family Forestry (NSF)*



It's easy to fall in love with the forest. It offers a place for recreation, natural beauty and diversity of life. It offers renewable timber resources, bioenergy and new products replacing fossil based chemicals and plastics. It offers green jobs and an answer to climate change. It may sound too good to be true, but when it comes to forests you can both have the cake and eat it.

Forests and forestry can and have to be a part of the solution to the big challenges facing society today. In the Nordic countries we are blessed with a vast forest resource, offering a multitude of values and potentials. However, for those values to be promoted and for realising the full potential of the forests, there is a need to have politicians and society on board, supporting the vision of forests as part of the solution.

In the context of EU policy making, forestry is not a EU competence and the principle of subsidiarity applies. However, the picture is much more complex than that. In reality, forests are impacted by a number of different policy areas, for example climate, energy, environment and agriculture, and these may have conflicting goals. In dealing with this complex policy setting we also need to remind ourselves that the forests and our perspective on them varies greatly across Europe.

#### **THE NORDIC PEOPLE LIVE IN THE FOREST**

For the Nordic people forests are of great importance. Sweden and Finland are among EUs largest countries by area, with forests covering 70% of the land. Flying

in to Stockholm, seeing the shifting colours of green covering the landscape, it becomes clear that we actually live in the forest. Hundreds of thousands of families and individuals own a large part of this forest, managing it sustainably with future generations in mind.

In the Nordics we have extensive forest resources and we are used to sustainably managing them for a multitude of purposes. This close relationship to and knowledge about the forest is not always present in the EU policy making, where some politicians push for detailed regulations on how the forests should be managed and used instead of seeing the potential and the broader picture.

Recently the European Parliament adopted its resolution on the new EU Forest Strategy. It highlights the importance of sustainable forest management and the multifunctional role of Europe's forests. It confirms that forests are important in creating green jobs and growth. "The new strategy must therefore promote sustainable use of timber and other forest materials without adding red tape for forest owners and the sector", said rapporteur Elisabeth Köstinger (EPP, AT). Furthermore, the resolution recognizes the important role that Europe's private forest owners play in taking care of 60% of the forestland.

#### **FORESTS ARE KEY IN COMBATING CLIMATE CHANGE**

Through sustainable and active forest management the best climate mitigation and adaptation is reached in the

long term. Forests contribute to reducing CO2 emissions into the atmosphere by sequestering carbon as they grow creating a carbon sink in the forest biomass and the soil, by storing carbon in harvested wood products and by substituting fossil fuels and energy-intensive materials.

A wooden house creates a net uptake of CO2 in a hundred year time frame and at the same time we can plant new forest, which binds even more carbon. Forests also play a significant role in reducing our dependency on fossil energy. Today, 50% of Sweden's energy use is renewable and 85% of the bioenergy comes from residues from forestry and forest industries. In Europe the growth of the forests is significantly larger than the harvest and the forest area is continuously increasing. Sweden increased its forest stock by twofold over the past century, while at the same time increasing the harvest. This shows the potential for increased climate benefits from sustainable management and use of forests.

#### **INVESTING IN THE BIOECONOMY**

In responding to climate change we need to speed up the transition from a fossil based society to a biobased one. Everything made from oil can be made from wood instead, replacing the black carbon atom with the green one. We can make new smart packaging, bioplastics, clothes, biochemicals, medicine, fuels for our cars and much more.

In the Nordic forest sector and among the forest owners there is a strong belief in the bioeconomy,



with large investments happening. Finnish cooperative Metsä Fibre is investing Euro 1.1 billion into a new bio-product mill in Äänekoski, creating 2,500 jobs in the value chain. Södra, a forest cooperative owned by more than 50,000 individual forest owners in southern Sweden, is investing Euro 530 million in their three pulp mills in the coming years.

**Contact details:**

NSF - Bureau of Nordic Family Forestry  
CEPF - Confederation of European Forest Owners  
emma.berglund@cepf-eu.org  
www.cepf-eu.org

MTK, the Finnish farmers' and forest owners' organisation, recently announced its decision to invest Euro 500,000 in newly formed Finnulp's planned mill in Kuopio. "We see a significant turning point and move to a bioeconomy in the global economy. The world clearly needs more sustainable products made from renewable resources. We want to be involved in this revolution", said MTK chairman Juha Marttila. The total amount of the Finnulp investment is Euro 1.4 billion, making it the world's largest softwood pulp mill investment.

**AN OPPORTUNITY FOR EUROPE**

Active and sustainable management and use of forests should be seen as an opportunity for Europe. Utilizing the domestic forest resource avoids moving EU's carbon footprint and it offers an export opportunity. Forests create green jobs and benefit local economies, while at the same time contributing to climate change mitigation and a sustainable bioeconomy. To turn the green gold into wellbeing for European society, coherent policies supporting sustainable use of Europe's forests and the European bioeconomy is needed. ●



# The EnAlgae legacy - information and interconnection

**A**fter four years of research and analysis EnAlgae is proud to unveil two of its lasting legacies that will go on to inform and interconnect people interested in algae and the algae industry.



The aim of EnAlgae has been to find sustainable pathways for algal cultivation and bioenergy, and both of these outputs will enable that work to flourish and continue in the weeks, months and years ahead.

The first legacy is our Decision Support Tool (DST). This output has captured all the evidence gathered from across the project and translated it into a set of intuitive tools which can inform and guide businesses and individuals who are looking to cultivate algae.

Providing a virtual lab and virtual algae pilot, the DST will walk people through the process of growing algae, the best practices to adopt for microalgae and macroalgae and the likely outcomes which can be expected.

Aimed at everyone from students to businesses and even policy makers, the DST is there for anyone who needs to access credible scientific information on growing, harvesting, processing and using algae.

There is nothing which currently exists that is similar to our DST, and we hope it will enable accelerated adoption and promotion of algal technologies in NW Europe.

The DST will be managed by our second legacy, the Algal Information Network (AIN). This network will manage and implement the results obtained by EnAlgae as well as improve cooperation and exchange of knowledge between research organisations and policy and decision makers.

The AIN, which offers free membership, will also manage support centres across Europe. These will consist of regional information desks, where designated experts will operate as contact points able to offer support and help stakeholders tap into the algae market in each of the North West Europe Regions.

Further information about the AIN can be found on its website: [www.algae-network.eu](http://www.algae-network.eu).

EnAlgae is proud of these outputs and the work undertaken by the project as a whole. NW Europe has incredible strength in terms of algal research and technology expertise and our hope, with the help of these two initiatives, is that investors will see real opportunities for using this location as a hub of excellence and knowledge to progress the development and growth of the algae industry.

**Anyone wishing to learn more about the EnAlgae project can visit [www.enalgae.eu](http://www.enalgae.eu).** ●

**The EnAlgae project** is led by Swansea University and funded by the European Union under the INTERREG IVB North West Europe programme. EnAlgae unites experts and observers from 7 EU member states to determine the potential benefits to NW Europe of algae as a future sustainable resource for bioenergy and remediation of waste streams.



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# Delivering local bioenergy throughout North West Europe

By Louise Ciaravella, Marketing & Communications Officer, European Bioenergy Research Institute, Aston University

**B**ioenergy is a rapidly growing sector driven by government policies promoting the use of low carbon energy and waste recycling. Targets to increase the security of energy supply and reduce greenhouse gas emissions have been set for all European Union member states to ensure the EU reaches a 20% share of renewable energy by 2020.

The progress in North West Europe towards meeting these

challenging targets has been slow. If you look at the UK, ambitious reduction targets to reduce CO<sub>2</sub> levels - 34% by 2020 and 80% by 2050 - have been agreed. Regions across the country have implemented schemes to reduce CO<sub>2</sub>, accordingly however achieving these targets will require a near 300% increase in renewable energy production before the end of this decade. Bioenergy is set to contribute more than 50% of the required increase but to meet this energy demand through existing bioenergy technologies would require a volume of biomass 4 times the height of Big Ben and 1.2km<sup>2</sup> to be consumed every year!

New bioenergy technologies are being developed which offer significant energy efficiency and profit gains but further support is needed to develop these innovations into a viable, sustainable energy source and reduce the world's reliance on fossil fuels.

To address this challenge, a group of organisations in North West Europe are working together specifically to look at how they can accelerate the provision of renewable energy in their countries. The result is a €7.9m European Union INTERREG IVB funded project - Bioenergy North West (BioenNW) - which sees 11 European partners working

together to promote and support the implementation of bioenergy schemes within the North West Europe region, to reduce carbon emissions and to increase energy security and employment opportunities.

Led by the European Bioenergy Research Institute (EBRI) at Aston University in Birmingham (UK), BioenNW offers support to companies, organisations and local authorities looking to set up local bioenergy schemes fuelled by waste on a small to medium scale (5-10MW output). The initiative is active in five regions: West Midlands (UK), Ill-de-France (France), Wallonia (Belgium), Eindhoven (Netherlands) and North Rhine Westphalia (Germany). BioenNW is demonstrating the economic viability of power generation from urban and rural waste by exploring how innovative bioenergy technologies can be used with existing anaerobic digestion and difficult to manage waste streams to increase the efficiency of these bioenergy processes.

BioenNW has four main objectives:

- to create a Network of Bioenergy Support Centres providing support to organisations to deliver local bioenergy more efficiently and cost-effectively.

Louise Ciaravella



- to build an online decision support tool to assist with the investment process and decide where to locate future bioenergy plants.
- to demonstrate the combined operation of innovative bioenergy technologies at a commercial scale and to test a range of biomass and waste streams.
- to identify at least new 25 sites which are suitable for the development of new bioenergy schemes and developing five of these to the point of build by the end of 2015.

#### **SUPPORT THROUGHOUT NORTH WEST EUROPE**

The development of bioenergy technology is a priority particularly for the West Midlands, where BioenNW Lead Partner EBRI is based. Birmingham's location at the heart of the UK means geographical constraints limit the region's potential to generate renewable energy from alternative technologies. This is also the case for the other BioenNW regions: Ill-de-France, Wallonia, Eindhoven and North Rhine Westphalia. It means the need to provide focal points for regional business support, technology transfer and growth opportunities has never been more important.

A European Network of

Bioenergy Support Centres has been established in each of the five regions to disseminate information about alternative solutions and innovative bioenergy technologies by acting as an information hub in each country. Each Centre offers free services including expert advice, testing, workshops and seminars, access to funding etc. and help organisations understand the market opportunity and develop innovative bioenergy solutions.

BioenNW is working to create a much needed bioenergy supply chain within each region. Sourcing local waste for biomass to run bioenergy technologies without having to transport it long distances is crucial for the future. Project partners have been working with businesses that produce waste - such as food and agricultural waste - to test it for suitability as a bioenergy feedstock and reduce the amount of waste being sent to landfill.

#### **PROMOTING THE USE OF INNOVATIVE BIOENERGY TECHNOLOGY**

To enable the testing of waste and residues for suitability for bioenergy applications, two mobile testing units - 'Pyrofabs' - have been constructed. Each Pyrofab consists of a 'Pyroformer™' - an innovative bioenergy technology (developed by EBRI). The Pyrofabs are able to process biomass and waste

streams through intermediate pyrolysis and assess pyrolysis products - oil, gas and biochar -, the energy output and the emissions quality. The Pyrofabs are housed in mobile containers so they can be easily transported and are about to embark on a European tour of France, Germany, the Netherlands and Sweden from July 2015.

The case for increased government investment and policy support for new technologies such as the Pyroformer™ is strong. Bioenergy offers significant business, as well as environmental, benefits. In 2009 the UK government estimated that the global market for low carbon goods and services was worth around £3 trillion a year and could be worth £4.5 trillion by 2015.

BioenNW is committed to providing real-life solutions for tackling biomass-based waste and residues with both environmental and financial benefits for households, businesses and local authorities, as well as opportunities for wider industry collaboration. ●

To find out more about BioenNW and the European Pyrofab tour, visit [www.bioenergy-nw.eu](http://www.bioenergy-nw.eu).

# EUBREN

## Research for Bioeconomy

**A** new independent initiative to support the development of biobased economy is raising in Europe: its name is EUBREN, the first European Biomass Research Network. EUBREN is developed and supported by EUBIA, the European Biomass Industry Association and it consists in a selection of Universities and Research centers in all the 28 European Member states. The

initiative is the result of 18 years of experience where EUBIA dedicated its efforts to promote and support new industry oriented initiative, commercial projects based on innovative and advanced technologies as well as international strategies for creating an efficient exploitation of biomass potentials. Since 1996 EUBIA worked a lot in cooperation with its members, mainly consisting in investors, small and medium enterprises

and large industries. However, given the unique capacity, the flexibility and the market perspectives of biobased this sector, research activities carried out at all level demonstrated to have a crucial role for the final takeoff of biobased economy at commercial stage in EU.

The European Commission funding programmes show how the institutions are pushing to foster new projects and initiatives where industries merge their efforts with research centres and universities in order to combine investment potentials, market influence and political interests with high value research activities. On the basis of this consideration, EUBIA decided to create a network of universities and research centres with valuable experience in different biomass sectors. To this end, the European Biomass Industry Association is currently finalizing the selection of universities from all EU countries, trying its best to involve research institutes from 28 different member states. Selected candidates will become funding members of EUBREN, which is expected to start its activities from the beginning of October 2014.

### The European Biomass Research Network



#### **EUBREN POSITION, INITIATIVES AND OPPORTUNITIES**

The European Biomass Research Network aims to deeply involve research centres in the European



industry sector. EUBREN will actively work on new “Research-for-industry” projects focused on the development of advanced technologies and strategies of actual interest for industry and should be oriented to an improvement of biobased products and bioenergy competitiveness in the European Market.

Too often research activity carried out by public institutes like universities and research centres remains out of the commercial interest. At the same time, it is definitely not easy for private companies, investors and enterprises to be updated on the latest results obtained during research studies, and to identify potential promising new projects. But this well known bottleneck doesn't represent the only existing obstacle. The lack of communication between research centres doesn't facilitate the development of valuable technologies or cooperation initiatives. For this reason, some of the crucial EUBREN activities will be to organize technology platforms and training workshops involving universities specialized in different sectors to present their activities and ideas for future initiatives. Workshops and meeting - organized by EUBIA - will be held in Brussels in order to make EUBREN members communicate, share knowledge, results and opinions regarding most promising sectors.. Thanks to this interaction, new projects could be developed, new valuable technologies could be

defined able to penetrate the market. In addition, industries and enterprises will be constantly informed on the recent results, opinion and programmes developed and discussed by EUBREN members.

Additional objective of this new independent network will be to involve industries working next to universities experts and researchers. EUBIA members will be invited to assist and participate to technology platform and provide their contribution. The strict cooperation will bring benefits to both of the actors, new projects and support for universities, high quality technical consultancy, manpower for industries and enterprises. Many other benefits can derive from a fruitful and active cooperation of high profile European Universities from all EU member states. Many initiative will grow and much more valuable projects will become commercial realities. Biomass based sector can be self sufficient, and biomass is already a competitive feedstock for many application, and if key actors will be able to cooperate to the same end, EUBREN will be new primary stone towards the EU bioeconomy. Many universities already applied to be selected as member of the Network and EUBIA is hard working to finalize everything before october, when the launch is expected. But the submission is open and the idea is to make EUBREN larger and larger every year. New interested universities are welcome from all European countries. ●

# Sustainable Aviation in Europe

By Raffaello Garofalo (pictured)

**T**ransport emissions are rapidly rising - now accounting for more than 25% of EU total greenhouse gas emissions - they are projected to become the largest source of CO<sub>2</sub> emissions by 2020. Aviation is the fastest growing transport modality worldwide with a projected growth of 4.5% annually up to 2050. Considering that the aviation sector is responsible for at least 2% of the global manmade greenhouse gas emissions, the so-called "bio-jet" will have an increasing role in climate change mitigation.

In addition to environmental concerns, Europe faces an energy security gap, triggered by high dependence on fossil fuels imports and particularly diesel from third countries. Biofuels account for nearly 220.000 jobs in Europe, proudly supporting Europe's green economy. In addition to reducing Europe's imports of fossil fuels and animal feeds, biodiesel's main by-product - glycerin - replaces harmful chemicals in food, pharmaceutical or cosmetics industries.

Aviation biofuel can play a safe and effective role in world's transport system. Lifecycle analysis confirmed that sustainably produced biofuels reduce carbon emission by 50 to 80 percent, compared to petroleum, and should play a key role in supporting

aviation's growth while meeting environmental goals.

"EBB members offer EU - made products, reducing greenhouse gases up to 85% compared to diesel. Europe can make the choice of promoting both European growth and employment by playing a leading role in tackling climate change adverse effects" - affirmed Mr. Raffaello Garofalo, EBB Secretary General.

The amount of emissions from aviation is set to account for up to a fifth of global greenhouse gas emissions by 2050. Keeping this in mind, rather than seeking a reduction of demand for flights, the EU should facilitate and promote the transition from standard jet fuel to sustainable bio-fuel - for it is currently the only viable option the industry has to significantly slash its GHG emissions in the near term. Such sources of carbon abatement as: cabin weight reduction, more efficient flight paths, emission trading schemes are insignificant compared to the potential of aviation biofuel.

In the longer term, i.e. between 2020 and 2030, the bio-jet market is said to reach full commercialization, thus increasing bio jet production and utilization and implementing advanced technologies to meet the increasing demand for sustainable fuels. Shortly, in order to satisfy the market's demand, a

separate mandate for biofuels in aviation will be needed in the EU.

At present three main types of bio-jet are favoured to be used in aviation jet engines blended with kerosene (up to 50% - as this is the limit allowed by the American Society for Testing and Materials - the globally recognized certification body):

- 1. Synthetic Fischer-Tropsch (FT)** based kerosene produced through high temperature biomass gasification;
- 2. Hydrogenated Vegetable Oils (HVO);**
- 3. Hydrogenated Pyrolysis Oils (HPO)** produced from lingo-cellulosic biomass.

The large numbers of test flights done worldwide - which have utilized different biofuel feedstock, biofuel production processes, blend percentages and number of engines powered with biofuel - have shown that using biofuel for aviation is technically viable and can be environmentally beneficial and safe for all airlines operations.

The European Advanced Biofuels Flightpath is a European initiative committed to supporting and promoting the production storage and distribution of sustainable aviation fuels with the objective to reach 2 million tonnes of production and

consumption by 2020. The bio jet fuels face a barrier relating to the high cost of their production and deployment. In fact, bio jet fuels are 2-4 times more expensive than fossil jet fuels. Furthermore, the limited availability implies that there is not yet a competitive market for bio jet fuels. On the other hand, the cost will decrease once the production volumes increase and more producers enter the market. There is a great willingness perceived among airline operators – many of them showed interest in flying on bio jet fuels, but lack the financial resources to overcome the significant cost imbalances caused by the utilization of higher blends of sustainable fuel with traditional kerosene.

A sectorial approach is needed to avoid the usage of fossil jet fuels and improve the usage of bio jet fuels without impacting competitiveness of airlines.

These conclusions illustrate that biofuels still represent today the only viable solution to decarbonize the EU aviation sector in the post-2020 perspective. ●

**Contact details:**

EBB - European Biodiesel Board  
Boulevard Saint-Michel, 34  
1040 Bruxelles  
Tel: +32 (0)2 763 2477  
Fax: +32 (0)2 763 0457  
Email: [cg@ebb-eu.org](mailto:cg@ebb-eu.org)  
Web: [www.ebb-eu.org](http://www.ebb-eu.org)  
[www.europeanbiofuels.eu](http://www.europeanbiofuels.eu)





# AlgaePARC: Towards industrialization of microalgae for energy and chemicals

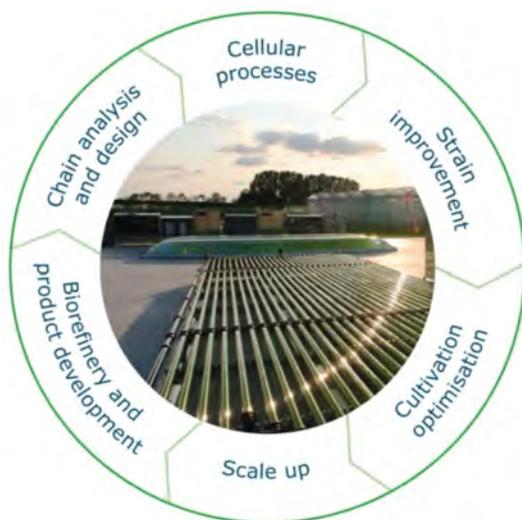
**P**hotosynthetic microorganisms, such as microalgae and cyanobacteria can use a short direct route to convert solar energy to functional molecules and are therefore one of the most promising feedstocks for sustainable production of energy, chemicals food and feed. The

technology for production and biorefinery of algal biomass is promising but needs further development.

The mission of AlgaePARC is to develop a commercial and sustainable production chain for commodity products from microalgae. In 2010 we presented a 15 years roadmap for the development of a microalgal production chain. The roadmap consists out of several research projects like AlgaePARC pilot facilities to bridge the gap between basic research and commercialization, AlgaePARC biorefinery to fractionate algal biomass in multiple products and three EU-FP7 research projects focusing on microalgal production chains for fuels (FUEL4ME), biopolymers (SPLASH) and food and feed (MIRACLES).

The roadmap for industrial algae production started in 2010, with a background of more than ten years of pioneering research. The roadmap runs until the year 2025. The first phase (2011-2015) was focused on cost reduction for production and biorefinery of algal biomass. A techno-economic model was used to identify the research questions in

this first phase. For the planning of the next phase (2016-2020) we improved the techno-economic model, implemented experimental pilot-plant data from the first phase, developed a techno-economic model for biorefinery and integrated the result with a market analysis. This analysis shows that there are market combinations of a number of algal products economically feasible on the short term. Therefore we will work in the second phase in addition to further cost reduction of production and biorefinery for commodity products on the development of production chains for those products. In the third phase of the roadmap (2020-2025) commercial production of high value products will be a reality. Research will be done on development and sustainability of production chains for commodities. At that stage, a new techno-economic and market analysis will examine the feasibility of commercial production of commodities based on experience and data from demonstration plants. ●



**Figure 1: Multidisciplinary approach:** We ensure that different expertises are integrated. Both, biological and engineering aspects of cultivation and biorefinery of algae are included. A multidisciplinary team combines specialist knowledge with practical insight, which unifies laboratory and pilot scale research.

#### Contact details:

[www.AlgaePARC.com](http://www.AlgaePARC.com)  
Email: [Maria.Barbosa@wur.nl](mailto:Maria.Barbosa@wur.nl)



**Figure 2:** The four types of reactor systems at AlgaePARC (left to right): open raceway pond, horizontal tubular reactor, vertically stacked tubular reactor and flat panel reactor

# Rewarding investments in Europe: time for energy efficiency and innovation policy to join together

By Nicola Rega, CEPI Climate Change and Energy Manager

**T**he pulp and paper industry is the fourth industrial energy consumer in Europe, and the second when it comes to electricity consumption. Energy accounts for about 20% of our cost base and, most crucially, it is the key cost component that determines the winners and losers in an extremely competitive market. That is why energy efficiency is such a key priority for our sector.

With 85% of our energy consumption and about 80% of our greenhouse gas emissions coming from pulping and from the pressing and drying section, our sector is in need of both steam and electricity. Thus, it comes as no surprise that our companies have all installed combined heat and power generation, producing almost 97% of the on-site electricity generation, with primary efficiency often above 90%.

Moreover, with 82% of our raw material sourced from within Europe, either from virgin or recycled fibres, the pulp and paper industry is truly a European sector. The plan is to maintain our identity by investing in Europe, tapping into the combined potentials of the low-carbon,

bio, and circular economy. Last year, the industry invested more than 250 million euro in projects directly or indirectly leading to more energy efficiency. For the period 2015-2017, additional investments worth 5 billion euro have already been committed for state-of-the-art processes that deliver jobs, optimum environmental protection as well as higher productivity, improved energy efficiency, and a significantly lower carbon footprint.

This being said, is the future looking bright for our industry? Not quite yet. Besides the weak economic recovery and the difficulties of investing in a mature, and in some cases declining European market, the sector is confronted with two major challenges, for the short and long term respectively.

In the short term, the energy gap with other competing economies outside the EU is a major concern. The recently published European Competitiveness Report already warned that, "even though EU firms have scored highly in terms of energy efficiency, it is not enough to fully offset the negative impact of energy price rises on industrial competitiveness."

Therefore, measures to reduce the energy gap are urgently needed. Measures which include improvements in the functioning of the internal energy market, allowing industry to capture the benefits of low wholesale prices at the time electricity is produced from non-programmable renewables, and conducting research to lower the costs of electricity production. Industry competitiveness should also be preserved, particularly in view of energy-related add-ons due to regulatory costs.

In the long term, energy efficiency improvements will not be sufficient to meet the 2050 greenhouse gas target. In our sectoral roadmap, we have identified a technology gap that will need to be filled by 2030 in order to have breakthrough technologies commercially available.

To address this technology gap, in 2012 the European pulp and paper industry set up the "Two Team Project" to identify breakthrough technology concepts that would give the industry the required dynamic to achieve these targets ([www.unfoldthefuture.eu](http://www.unfoldthefuture.eu)). After one year of intense work, we identified eight concepts to



confederation of  
european paper industries

help revolutionize the European pulp and paper industry. They would also result in savings in the range of 20-50% primary energy reduction and 20-55% carbon emission reduction.

The identified breakthrough concepts have the potential to revolutionise the way our sector operates. But they are not commercially available yet. To bring them to a reality by 2030, a proper innovation policy to support the industry is needed. Innovation funding streams would be needed to particularly support demo and pilot projects, known for being “high capital - high risk” projects.

In this respect, we have high expectations from the upcoming NER400 funding opportunity, as agreed by heads of States and Governments in the October 2014 European Council conclusions. The fund is expected to support also low-carbon projects to support industry. Additionally, we welcome the recent political agreement in the Market Stability Reserve for the Emission Trading System, whereby 50 million credits should be used to support low-carbon innovation in industry. Funding mechanisms under Horizon 2020, together with regional and structural smart specialisation funds, should also be actively combined in a way to support

innovation in industrial processes.

More generally, we would need to streamline regulatory policies with funding opportunities, at both European and national level. The regulatory framework should incentivise and reward investments in Europe. The funding opportunities should be tailored to address those segments of high strategic relevance for the EU economy, but where private capitals are least likely to flow. Under these conditions, the future could very well look bright indeed. ●



# Switch the Green Energy on

*By Jorge Moreira da Silva, Portuguese Minister of Environment, Spatial Planning and Energy (pictured)*

**C**an you imagine your daily routines done with clean energy? Since you wake up to the end of the day, everything can be powered with green energy! Portugal already started to shoot some frames of this green picture: last year we reached 62% share of renewable energy on electricity and our energy dependence reached the lowest level in 20 years.

But we want more! Our houses must have water warmed by solar panels, our vehicles should be electric and charged at home during the night, and all the plugs should be a green and clean connection to energy. In a few years, this will can be a reality. In Portugal the crisis was not taken as a pretext do delay action. It was taken as an additional reason to lead on energy and environment reforms, mainstreaming green growth on the national strategy for competitiveness and jobs. At the same time we launched a new strategy to foster renewable energy, smart grids and energy efficiency and we also cut excessive rents on electricity production showing that it is possible to address both more renewable energy production and tariff debt elimination.

To boost these structural reforms we created the Green Taxation Reform (GTR), based on the assumption of fiscal neutrality and to foster a



triple dividend: environment protection, economic growth and employment. The GTR addresses, for the first time in Portugal in a cross-cutting way, all the sectors and natural resources. It includes a long list of taxes and fiscal incentives, to foster electric mobility and energy efficiency, and introduces a carbon tax in the non-ETS sector with the levy linked to the ETS allowances price. With GTR we are taxing more what we burn and less what we earn, which allowed us to generate an income that will allow to give fiscal benefits to families, through the personal income taxation reduction.

Our journey to Green Growth began last April, after a year of planning and developing a document that includes more than 74 institutional and personal contributions, when the Government and the 82 organizations from civil society signed the Green Growth Commitment: this is our sustainability development path that sets 14 targets to 2020 and 2030 and 111 initiatives to unlock the green growth and green jobs potential in Portugal and ensuring ambition, stability and predictability to green growth politics. One of these targets sets more ambitious figures for renewable energy: in 2013, renewable energy generation accounted for 27% of end energy use and 58% in electricity. We are therefore in a position to

achieve the ambitious target of 31% renewables in 2020 and exceed 60% of renewables in end electricity consumption.

These are the Portuguese objectives for Paris. The countdown to COP21 is already running and there is no room for hesitation, since fight against climate change is already happening and is more and more urgent. According to all relevant and consistent scientific and economic assessment, addressing climate change is urgent but it is also manageable and it can be cost-effective. Having met the Kyoto Protocol goals for 2012, Portugal will overachieve 2020-targets and is advocating very ambitious targets for EU and Portugal by 2030.

Furthermore, the climate and energy package for 2030 is also an opportunity for Europe policies against climate changes. The agreement reached by the European Council and particularly the 2030 targets for greenhouse gas emissions, renewable energy, energy efficiency and interconnections (setting 10% interconnection for 2020 and 15% to 2030) is the fundamental framework in this context. Interconnections would have the benefit of allowing a number of European countries to meet their increasingly ambitious national targets for renewable energy and greenhouse gas emissions by importing from

countries with more resources, thereby reducing the total cost of European decarbonisation and attracting projects, investment and employment to the exporting countries. This is a change in paradigm for Portugal, from a good user to an exporter of renewables.

Portugal is in tenth place on "The Global Energy Architecture Performance Index 2015". We climb eight places in a year in terms of energy competitiveness, accessibility and sustainability. We are able to reach a higher position and be a green energy leader in the world, turning the picture of a green daily life into reality. We have not only expertise in renewable energy, smart grids, energy efficiency and electric mobility, but we also benefit from an ambitious, predictable environment based in green taxation and climate, environment and energy targets beyond the EU 2030 framework. Now we need to transport all this energy to Europe, exploring our natural resources, our smart grids technologies, promoting innovation and the energy highways. When someone asks me if it is possible to foster a comprehensive, fair and cost-effective climate deal, my answer is always yes, a green economy is more competitive and sustainable and nowadays environment and energy are no longer enemies, they are good and faithful partners. ●

# Enernet

## Would an *Energy Broadband* push the EU's agenda forward?

By Carlos Zorrinho, MEP - S&D Group, European Parliament

**T**he society we live in is increasingly shaped by the access to information and by the knowledge and use that institutions, enterprises and citizens make of it. To a large extent, the conditions to access information and knowledge and the capacity to use them determine the context needed to create wealth and qualified work opportunities.

The information cloud together with faster and stronger internet created a platform of distribution, value creation and development of new business models and new social responses. This evolution demands a quantum leap in the approach to the new digital society.

New opportunities and challenges emerge every day. A significant part of these new opportunities arises in the dividing line between the impact of the digital agenda in the social and economic organization and the industrial model to produce and use energy.

The digital society makes the use of energy more efficient. Nonetheless, a fundamental dichotomy still survives. More or

less protected, information is on the net, available for its users at any given time and in any given place. Energy, on the contrary, is distributed inefficiently through a grid to consumers who don't have any control over the process. These consumers rather are the victims of geostrategic, national and regional power games and dependencies.

The digital agenda anticipates the future, while energy markets are still anchored to the glorious past of the industrial revolution. In the digital domain, the last mile in the connection between consumers and their needs is already being covered, while in energy the challenge is to recreate a new model on the ashes of failed single energy markets attempts.

The good news is that we find ourselves in a very favourable situation for this to change. In order for Europe to tackle the risk of shortage of supply, the EU decided to develop a newer framework for a European energy market - the Energy Union.

With new planned interconnections and the convergence of powerful financial instruments like the European

Fund for Strategic Investments and the Connecting Europe Facility, the European Union may have available, within a decade an energy broadband. In this context, energy will progressively be online, an *Enernet* that will allow each user to access, in each moment, the most efficient and competitive energy available.

The joint development of the Digital Union and the Energy

Carlos Zorrinho



1 MEP S&D - Member of ITRE and ENVI Committees

Union constitutes a great opportunity for the European Union. In today's highly complex world, the European Union needs to step up its competitiveness and take the lead in promoting a more sustainable development model on a global scale. This is a truly mobilizing strategic purpose that takes back the humanist principles behind the European Union. It also represents an economic chance for a region losing its competitiveness to transform its high social and environmental protection standards into opportunities.

None of this will happen on its own. It will require a strong political will in fine tuning between the available research, innovation and investment tools and a consistent bet in interoperability of public information and interaction between these systems and enterprises and citizens.

Portugal, with its capability to put in work an internal smart energy network, which assures that more than 65% of produced and successfully distributed electricity within the country is renewable, shows us that change is possible.

The EU must assure, and this is a key condition, once the supply shortages are overcome, Member States will come together to lead the implementation of an energy broadband that will serve as a reference to future developments in other regions of the globe. It's an opportunity to turn a weakness into a strength, a threat into a chance.

With this strategic movement in the field of economic and social choices, the European Union can also transform other threats into opportunities. It's the case of the smart bet in urban renewal, in the generalized adoption of electric mobility or in the development of a new integrated policy to create favourable environments to elderly populations.

I chose these three examples because they relate directly with three key problems that the European Union has to address in order to grow in a sustainable manner: the resurgence of a new generation of construction industry specialized in the rehabilitation and in the ergonomic and energy efficiency of buildings; a new impetus for industrialization based on smart mobility; and the capacity to

create a thriving social market for elderly populations' support and inclusion.

The European Union needs to assume a leading role with reference to these three strategic points. A perfect combination of new technologies - in particular digital ones - with an easy and competitive access to the energy broadband net is needed in order to bring together services and people and develop jobs and value creation platforms.

Along this vision, products and business models with a high potential of internationalization will be developed, as they anticipate solutions to needs that tend to be increasingly global.

Investments will allow the European Union to still maintain itself on the frontline of the fight against global warming and climate change, keeping its important contribution to the planet's sustainability.

The *Enernet* can make a difference. It could be the turning point for a stagnated European Union in need of a new start. A new start to win, and to lead the age of transition towards a better world. ●

# RAIL TRANSPORT

“ ...rail-bound solutions should be the starting point of any future EU policies aimed at promoting sustainable transport. ”

# The case for rail transport – the backbone of energy efficient, low carbon transport systems

By Nicholas Craven (Manager of Unit –Sustainable Development) and Gabriel Castañares Hernández, (Senior Advisor of Energy and CO<sub>2</sub>), International Union of Railways (UIC)

**“E**nergy Efficiency is the foundation of the rail sector’s environmental leadership. This advantage is recognised across the world. The world needs resource efficient transport to enable sustainable development.” Jean Pierre Loubinoux, Director General of the International Union of Railways (UIC).

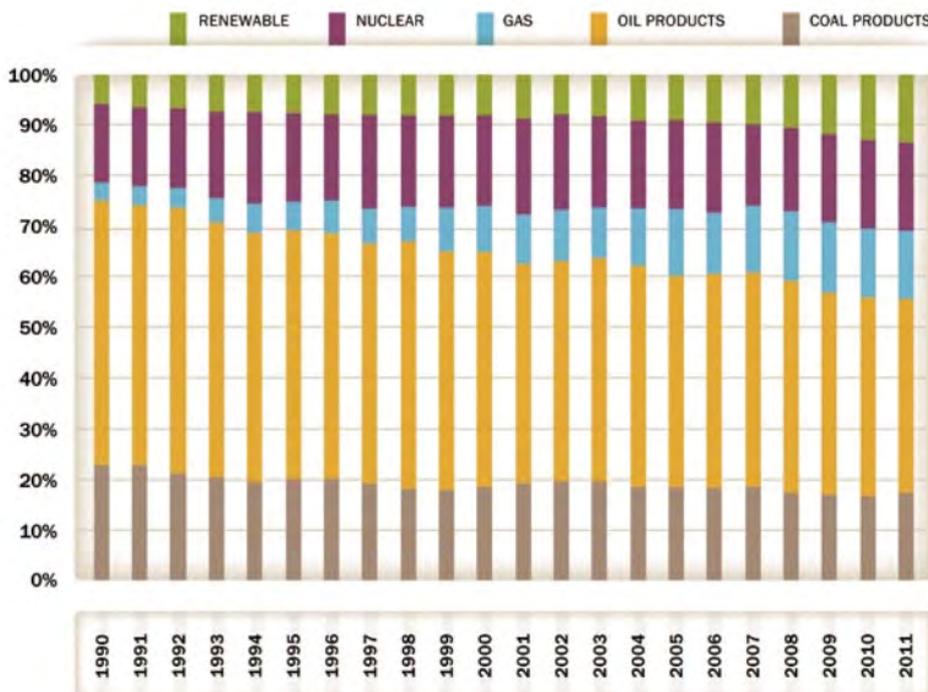
If energy consumption is not measured then it cannot be managed nor reduced. This is the principle that explains why our global economy needs to quantify and report energy consumption. Energy efficiency and low carbon

development are key solutions to global challenges such as climate change, increasing energy prices and energy security.

The transport sector has an important role to play in facing these challenges. Transport is a major consumer of energy and therefore, responsible for high carbon emissions. Transport generates around 25% of the total Green House Gas (GHG) emission averaged across the European Union, varying between 20% to 35% of the total energy consumption and GHG emissions depending on the region.

At world level, total transport GHG emissions have increased by 53% between 1990 and 2011 whilst the share of rail emissions decreased from 4.3% to 3.3%. Since 1975 rail passenger activity has grown by 130% and rail freight by 76%, during the same period an improvement in rail energy efficiency has been achieved, specific energy consumption has decreased by around 50% from 1975 to 2011 for both for passenger and freight. These figures indicate a decoupling between energy consumption and transport activity, with the volumes on rail constantly growing and the energy consumption remaining basically stable.

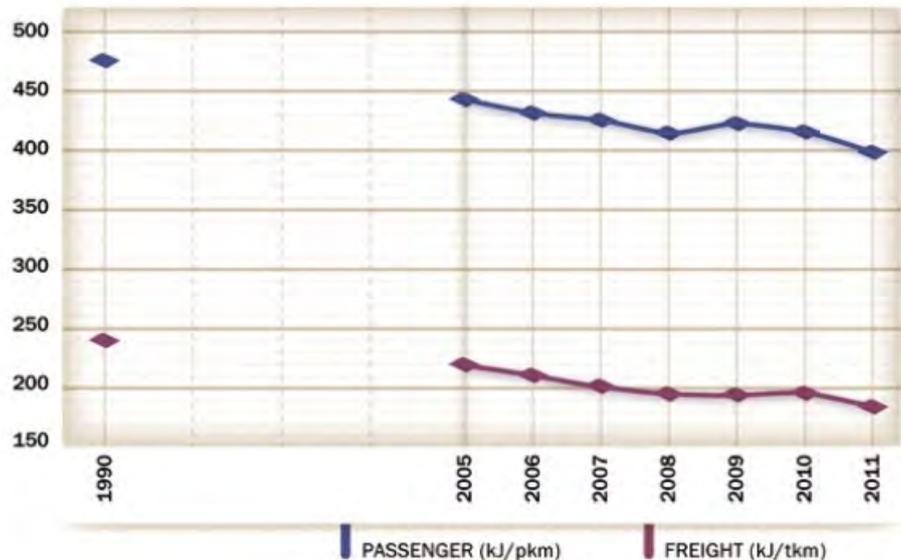
EU27 railway energy sources mix evolution, 1990-2011



Rail is the most emissions efficient major mode of transport with the lowest environmental impact. Rail transports over 9% of world wide passenger and freight transport, but generates just 3% of transport carbon emissions. This strong performance is expected to improve over the coming years with increasing energy efficiency and greater use of renewable energy.

The European rail sector is a major consumer of renewable electricity. The use of renewables doubled between 2005 and 2010, and currently provide 28% of all electric rail traction. There are entire rail networks in Scandinavia, Switzerland or Austria where the electricity used is almost entirely carbon free.

### Railway specific energy consumption, 1990-2011



*UIC/IEA Data Handbook on Railway Energy and CO<sub>2</sub> (2014)*

The International Union of Railways (UIC) together with the Community of European Railways (CER) have set targets and a vision for further improvement of this already strong environmental performance. These include 2030 targets of a 30% improvement in specific energy consumption (per transport unit, passenger-km plus tone-km) and 50 % improvement in specific GHG emissions (per transport unit, passenger-km plus tone-km), complimented by a commitment to reduce total GHG emissions by 30% (relative to the 1990 baseline). The vision foresees a halving in specific energy consumption with zero GHG emission by 2050.

To support credible and robust reporting of progress against these targets, UIC developed the Environment Strategy Reporting System (ESRS). The ESRS is based upon a common and transparent methodology developed following a comprehensive process of stakeholder consultation.

The evolving market for renewable energy has prompted a further evolution of the ESRS. Following a further round of stakeholder consultation, completed in 2014 within the frame of the UIC Zero Carbon Project, UIC has adopted new guidelines compatible with the Scope 2 Guidance of the internationally recognized GHG Protocol (defined by the World Business Council on Sustainable Development and the World Resources Institute).

These guidelines set out a transparent and credible dual approach for reporting of GHG

electricity emissions, this includes the national electricity production mix in addition to a market based electricity mix as defined by EC Directive 2009/28/EC. The market based approach allows rail companies to support additional investments in renewable energy by choosing to pay a premium for renewable energy according to the EU legal frame. The dual reporting approach allows rail companies to work towards a zero carbon horizon whilst avoiding the perception of green washing and reporting to the society the efforts in the implementation of green energies.

This improvement in energy efficiency underlines the rail sector contribution to the 'improve' pillar of the 'Avoid - Shift - Improve' strategy for mitigating transport impacts on transport climate change. Developing the second of these pillars, by increasing rail market share is important to leverage this strong performance and decouple transport carbon emissions from economic growth.

In support of legal agreement on mitigating Climate Change expected to be reached at the United Nations COP21 negotiations, to be held in Paris at the end of 2015, UIC will organize the Train to Paris campaign. This will bring delegates and decision makers from across Europe and also Asia to the negotiations in Paris by low carbon sustainable rail transport. Through this campaign UIC will highlight rail as the backbone of sustainable mobility and the potential of modal shift to provide solutions to the problem of climate change to reach the objective of the 2 Degrees Scenario.

The main contributions of rail sector to foster sustainability is to keep the energy and low carbon advantages of our mode, whilst offering an effective alternative to less efficient and more pollutant direct competitors inside the transport sector. Rail performance in energy, carbon and economic impact stimulate a more sustainable economical growth for a long term horizon. ●

# Attractive Railways for a Greener Transport Future

By Philippe Citroën, Director General, UNIFE—the European Rail Industry Association

**W**hen it comes to making transport more energy efficient, environmentally friendly, and carbon conscious, rail already starts from a strong position. Rail is, undebatably, the cleanest mode of transport and the rail sector and the EU are investing to make it even more sustainable and increase its usage—thus allowing the green benefits of the mode to be fully leveraged. In the EU, transport is the second biggest greenhouse gas emitting sector after energy, and while greenhouse gas emissions in other sectors decreased significantly between 1990 and 2009, emissions from transport increased 28% during the same period—and all transport modes, except for rail, increased

their total emissions. In order to tackle the transport and societal challenges of efficient mobility and climate change, the European rail industry has been actively collaborating with the EU on transport policy and innovative new rail technologies.

## **AMBITIOUS EU GOALS FOR SUSTAINABLE TRANSPORTATION**

In 2011, the European Commission published its White Paper on Transport which outlined the main goals set for the European Transport system by 2050—these goals centred on making Europe more mobile but also reducing the environmental impact of transportation. As such, one of the main themes of this document was eliciting modal shift from road to rail

and waterborne transport—specifically the White Paper calls for a 50% shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport by 2050. The White Paper is currently under a mid-term stocktaking review by the institutions and it is UNIFE's hope that these ambitious targets are maintained. Furthermore, 2015 is an important year in that the EU is currently consulting on its 2030 Climate Package and the UN is preparing for its 21st Conference of Parties in Paris this December where a broad agreement on limiting the impact of climate change is expected to be reached. Incidentally, transport policy plays a huge role in whether or not these goals are realised.

Photo©: Alstom Transport



### **INNOVATION AND MARKET UPTAKE—BUILDING A MORE ATTRACTIVE EUROPEAN RAIL SYSTEM WITH SHIFT2RAIL**

To truly reap the green benefits of rail transport, making the rail system more attractive is essential—in order to do this, technological innovation must be nurtured and developed technologies must be deployed on the rail system. An attractive railway is one that passengers and freight forwarders want to use, it has a high-capacity, is very reliable, and it is cost competitive. The rail industry and UNIFE has had a long history of collaborating with the EU on rail research—this has produced some very successful results especially in the areas of energy efficiency and reduced environmental impact. However these results have not always been easily absorbed by the rail system. This was the focus of the preparatory work, campaign and subsequent adoption of the regulation establishing the Shift2Rail Joint Undertaking in June 2014 by the EU Institutions. This initiative, with total funding no less than €920 million (€450M from the EU's Horizon2020, and €470M from the broader rail sector), takes a long-term, system-wide approach to improving the capacity and reliability of the rail system while reducing its lifecycle cost—thus making the rail system more attractive and encouraging modal shift. In addition to developing cutting edge technologies, the Shift2Rail technical programme places a major emphasis on market uptake by ensuring that developed technologies are integrated and tested on the different rail platforms—making it

easier and less risky for operators and infrastructure managers to adopt the new technologies which will allow end users to benefit from the technologies sooner.

Energy efficiency and sustainability are among the key concerns addressed by the Shift2Rail Joint Undertaking and Key Performance Indicators will be used to measure outputs of the initiative and evaluate reduction in energy consumption. Furthermore, the Shift2Rail cross-cutting activity on energy and sustainability aims at integrating energy efficiency topics in all five Innovation Programmes. All of the Innovation Programmes will develop technological solutions that boost energy efficiency, such as: propulsion components, lightweight car bodies and low resistance running gears.

#### **A STEP FURTHER**

The strategies and investments made by the EU and the sector to revolutionise and further develop the rail system are commendable, but there is still more that can be done. In the framework of the EU 2030 Framework for Energy and Climate, UNIFE will continue to advocate a specific target for CO2 emissions reduction in the transport sector and will promote further pricing mechanisms such as road charging or the use of the Emissions Trading System (ETS) revenues to finance rail. Moreover, UNIFE would like to see a true transport pillar in the architecture of the EU's energy policy. In this regard, the industry was pleased to see that European Commission Vice-President Maroš Šefčovič's landmark Energy Union

Package, adopted in February, called for removing barriers to less greenhouse gas intensive modes of transport, such as rail. Finally, UNIFE fully supports the efforts of DG-Move to digitalise the European rail system—and sees this as another opportunity for the sector to collaborate with the EU to make the rail system both more attractive to end users and more energy efficient.

In order to further progress towards more sustainable mobility, adequate financing, at both EU and national level, should be ensured for rail-bound projects in light of their high economic, environmental and social impacts. UNIFE would like to highlight that rail is by far the largest provider of electric mobility for both urban and interurban transport, providing high transport capacities with the best modal energy efficiency. In addition to the undoubtable environmental benefits of electric mobility; light rail, metros and commuter trains contribute to easing congestion, with positive impacts in terms of quality of life, productivity and Europe's energy security. As a consequence, rail-bound solutions should be the starting point of any future EU policies aimed at promoting sustainable transport. ●

#### **Contact details:**

UNIFE - the European Rail Industry  
221, avenue Louise  
B-1050 Brussels  
Tel +32 26437080  
Mob +32 485213482  
[www.unife.org](http://www.unife.org)

# Boosting the attractiveness and sustainability of rail transport with collaborative European rail research

By Andy Doherty, Chairman, ERRAC

**A**s demands for efficient mobility grow, urban populations surge, and concerns of climate change mount; rail transport is becoming an increasingly attractive solution for European transport needs. As such, the European Rail Research Advisory Council (ERRAC), founded in 2001 with the purpose of defining the rail research and innovation strategy in Europe and promoting collaborative research across the rail sector, continues to stimulate and drive research aimed at making the railways more attractive and even more environmentally friendly. In fact, a primary focus of ERRAC's efforts has been on improving the energy efficiency and reducing the environmental impact of rail transport—a mode which is already regarded as the greenest.

In the effort to combat climate change, the usage of alternative energy sources and the decarbonisation of transport has become an even larger priority in EU Transport Policy. The European Commission's 2011 White Paper on Transport calls for 30% of road freight over 300km to shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050. Moreover, it states that by 2050

a majority of medium-distance passenger transport should go by rail. In support of such ambitious targets of the Transport White Paper, ERRAC published its Strategic Rail Research and Innovation Agenda (SRRRIA) in late 2014, which addresses the development of energy efficient and green rail technologies throughout the whole rail system as a key innovation challenge. Moreover, recent, ongoing, and upcoming research initiatives guided by ERRAC have and will continue to address the formidable transport and environmental challenges facing Europe and encourage a modal shift to rail through the delivery of a more attractive and efficient rail system.

ERRAC's SRRRIA states that in order to meet the challenges of climate change, energy supply, and transport network congestion, rail must increase its share of passenger and freight markets especially for long distance journeys. In order to do this, ERRAC has outlined themes for research programmes in the SRRRIA that focus on more ecological energy supply, improved system management, increased energy efficiency, and reduced energy consumption. Energy supply is a critical function

in the rail system as it enables traction power, heating, comfort and other operational needs. As the European rail system is mostly electrified, R&D in this area must focus on sourcing electric energy from renewable and more environmentally friendly sources. Research focused on energy efficiency will develop solutions to make rail an even greener transport mode through eco-design and systems that require less energy. Also in the same area, the sector will carry out research in rail systems which consume less energy and utilise technologies that regenerate energy. Last but not least, further digitisation applications and innovative solutions applied to the rail market could bring massive energy savings, both with advanced traffic management solutions (such as upcoming step changes in ERTMS) that would optimise network capacity and with advanced energy management systems (infrastructure/substations and on-board) both in mainline urban segments that take into account a smart grid/smart energy city approach.

Indirectly, all technological and operational developments that encourage end users to opt for rail transport over a

more polluting mode will result in environmental benefits. Nevertheless, the past and future research work of the European rail sector takes special aim on research that boosts the energy efficiency and reduces the carbon footprint of the entire rail system. OSIRIS, a recently concluded FP7 Rail Research Project and MERLIN, an ongoing research project both endeavoured to improve the energy efficiency of the rail transport system. OSIRIS has developed optimal strategies to innovate and reduce energy consumption of urban rail systems to reach a reduction of overall energy consumption of Europe's urban rail systems by 10% of existing levels by 2020. Similarly, MERLIN is developing new decision making support tools and operational real time energy management algorithms for smart railway networks. Another project that was concluded a few years back, CleanER-D, focused on improving the environmental performance of diesel traction, which represents only 20% of European rail traffic.

ERRAC has been a trusted supporter and advisor of the Shift2Rail Joint Undertaking which is currently being set up. This initiative with its €920 million of funding represents a massive increase in funding for collaborative rail research from both the sector and the EU. While the technical programme of Shift2Rail is a massive undertaking, the overall goals

of Shift2Rail are ambitious yet simple, and mirror those of the ERRAC and the EU Transport strategies that is: to increase the capacity and reliability of the European rail system while reducing the lifecycle cost. Modal shift is at its heart and the initiative recognises the environmental benefits that will stem from a more attractive rail system. Nevertheless, the Shift2Rail technical programme will also work to make the system more energy efficient and, thus, increasingly green. As such, written into the Shift2Rail Master Plan is a transversal objective of energy and sustainability that will be integrated in all five innovation programmes and the numerous technology demonstrators. In fact, with sustained, large-scale projects like Shift2Rail, the sector expects that it would be able to halve the overall energy usage of the rail system in the next ten years!

Through ERRAC and its many partners, collaborative European-lead rail research is alive and well and focused on making the system both more attractive to end users and more sustainable. Both of these aspirations will lead to a reduced environmental impact of the transport sector of which rail not only remains the greenest mode, but also the only mode with the potential of becoming completely green (usage of only renewable energy) due to the extensive electrification of the rail network. ●



# The hidden power of railways: energy efficiency

By Libor Lochman, Executive Director, CER (pictured)



on reducing greenhouse gas emissions. As clearly identified in the Transport White Paper, Europe needs to reduce its import dependence for all fossil fuels.

By using electricity, which can draw its power from a range of sources, rail is the only major transport mode not dependent almost entirely on fossil fuels. Rail only accounts for 2% of total energy consumption in transport although it carries 17.4% of inland freight and 6.2% of passengers in Europe. Railways steadily improved their energy efficiency in both passenger and freight transport from 1990 to 2011: on average, they were able to reduce the energy used for every passenger-km by 17% and by 23% for every tonne-km.

In the 2010 strategy 'Moving towards Sustainable Mobility: European Rail Sector Strategy 2030 and beyond', the rail sector agreed that by 2030 the European railways will have reduced their specific final energy consumption from train operations by 30%

compared to 1990. Given that 85% of total energy consumption by the rail sector is used directly to power the trains, this will have an important impact on rail's energy efficiency.

The figure below compares the primary energy consumption of different transport modes between Brussels' and Berlin's city centres. For passenger transport, energy consumption travelling by rail is 1.4 times lower than by road, and almost 1.7 times lower than flying.

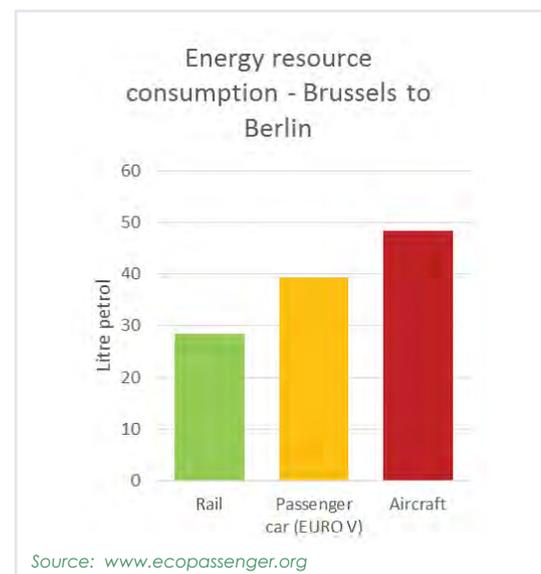
Even though rail is already more energy efficient than most other transport modes, significant efforts have been made at company level in the last decade - and continue to be made - to improve the energy efficiency of their activities. To this end European railways are implementing driver advisory systems, eco driving and energy-efficient traffic management. ●

Continuous improvement of the efficiency with which energy is consumed by end-users is a central theme of the EU's energy policy. In the field of transportation, high energy efficiency is a main environmental characteristic of the rail system and applies both to passenger and freight rail transport.

Moreover with its strong focus on efficiency, EU energy policy is closely related to climate policies

Energy management is a key issue for railway systems and will continue to be a prominent focus area for the foreseeable future. The MERLIN project, part of the European Commission's 7th Framework Programme for Research and Technological Development, is investigating and demonstrating the viability of an integrated management system to achieve a more sustainable energy usage in European electric mainline railway systems. MERLIN will provide an integrated optimisation approach to a cost-effective intelligent management of energy and resources, and will also deliver the interface protocol and architecture for energy management systems in the railway domain. A 10% reduction in energy consumption is expected to be achieved where the results of the project are implemented.

More information about MERLIN: <http://www.merlin-rail.eu>





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