SUMMER 2013

european energyinnovation

European Energy Innovation

Aviation: Clean Skies

Marine Energy

Energy Efficient Buildings

Country profile

Germany

Summer 2013

Includes editorial contributions from:

Eric Dautriat
Executive Director,
Clean Sky

Stephan Kohler
Chief Executive,
German Energy Agency
(dena)

Patrizia Toia
Member of the
Eurpean Parliament

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LpS 2013

LED professional | SYMPOSIUM +EXPO

LED Lighting Technologies

International Winning Approaches

EVENT OVERVIEW

LED professional Symposium +Expo (LpS) is Europe's foremost LED lighting technology event for experts in industry and research focussing on general, industrial and architectural lighting applications. LpS covers LED and OLED lighting technologies for components, modules, lamps and luminaries.

Over **1000** visitors from all LED lighting technology fields anticipated.

Top class contributors will present **45** lectures covering highly relevant technologies.

More than **80** exhibitors expected from all over the world.

KEYNOTE SPEAKERS

Dietmar Zembrot
President of LightingEurope and CEO of TRILUX, Germany

"Challenges and Opportunities of the European Lighting Industry"
Effects of Solid-State Lighting on products manufactured by European companies and the strategies of the new LightingEurope organization.

Menno Treffers
General Secretary of the Zhaga Consortium, The Netherlands

"Zhaga - Lowering the Risk and Cost of Getting LED Technology Innovation to Market"
An in-depth discussion of the impact of the Zhaga interface specifications on the competitive light market.

Dr. Alfred Felder
CEO of Tridonic, Austria

"Lighting Module and Component Industry - Market and Technology Opportunities"
Correlations between market and technology activities in Solid-State Lighting; risks and opportunities for module and component manufacturers in a rapidly changing environment.

EVENT PROGRAM

- **3 Keynotes** | From Opportunities to Strategies
- **45 Lectures** | From Light Sources to Applications
- **5 Workshops** | From Design to Standardization
- **2 Tech Panels** | From Ideas to Solutions
- **2000 m² Exhibition** | From Technologies to Projects
- **Light Art Project** | From Imagination to Inspiration
- **Get Together Event** | From Visitors to Networkers

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Foreword

Early in 2008, a Boeing 747-400 lifted off the runway at Heathrow Airport: the first flight powered by aviation biofuel. Haldane Dodd discusses a 5-point plan, based upon robust sustainability criteria and investment to help ensure a sustainable future for aviation. Eric Dautriat discusses Clean Sky's mission to support Investment in environmental friendly technology, illustrated with six key platforms, including a large turbofan engine for long-range aircraft. They are, he writes, a response to four environmental goals set by the Advisory Council for Aeronautics Research in Europe (ACARE). Luc Tytgat, Director Single Sky points out the need for a range of strategies on research, operational procedures, regulation, and others, to be implemented simultaneously.

A well-written article by Paul Bevan reminds us of the contribution of ICT, district heating/cooling and smart meters to the progress made in cities, which account for 75% of Europe's population and 80% of its energy use. He illustrates the point with the example of Copenhagen, which is attempting to become the first carbon neutral city in the world by 2025. In a separate article, Patrizia Toia MEP explores the role of ICT in energy efficiency and reminds us of the need for Europe-wide collaboration.

The first of two pieces of research, presented by Cosmina Marian, introduces the ENTRANZE project examining the role of Energy efficiency in buildings. Above all, it reminds us, buildings are used by humans, and policies have to take the human component into consideration. The second, conducted by The Economist Intelligence Unit (EIU) concludes that building sector executives are convinced of the benefits of European legislation for energy efficiency and energy performance.

Our country focus on Germany can hardly ignore the Energiewende, the Energy Transformation at the heart of its climate policies. Stephan Kohler makes it clear that the policy requires the fundamental reorganisation of the German energy system. He reports that development of photovoltaic and wind energy has exceeded all previous forecasts, but progress needs still to be made in other areas, such as the energy grid. He also argues that a successful Energiewende requires broad acceptance by consumers and intensive support from Europe. German MEPS Jürgen Creutzmann and Norbert Glante echo many of these points: although many of the detailed decisions have to be taken at national, regional or even local level, he says, the general framework needs to be set at the European level to offer the best way of exchanging best practice. German innvation and technology are highly regarded, and Dr. Andreas Fischer outlines some of the innovative technologies, including nuclear fusion, being explored as part of the Energiewende.

Max Carcas discusses the Importance of Marine Renewables. He complains that it still suffers from a relative immaturity compared to more established technologies such as wind, hydro and solar. This may be about to change, according to Sian George and Gema San Bruno, as more European countries in the arc from Britain through to Portugal explore the potential. Javier Marqués illustrates this with the operational Mutriku wave energy plant and bimep (Biscay Marine Energy Platform), designed for research, testing, demonstration and operation of energy converter systems in open sea conditions.

I was struck by a theme that runs right through the German articles: the importance of European co-operation. This theme resonates far beyond renewable energy.

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

Michael Edmund
Editor

"A cloud, from which mountain was uncertain ... shot up to a great height in the form of a very tall trunk, which spread itself out at the top into a sort of branches."

- Pliny (the Younger)

Written by Mike Edmund

Pliny, an eyewitness, was describing the infamous eruption of Mount Vesuvius in AD79. As the excavations at Pompeii show, rapid uncontrolled release of geothermal energy at the Earth's surface can bring about great destruction and loss of life. Heat is nevertheless constantly flowing from the Earth into space: geophysical estimates of a rate of about 44 TW are directly comparable to global primary energy production (150 PWh for 2011, Enerdata.)

This energy can also exert colossal effects over a much longer timescale, since it powers the movement of tectonic plates over the surface of the Earth's crust. When the Indian Plate, moving at a speed of about 20 centimetres per year, collided with the Eurasian Plate, it pushed up the Himalayan Mountains; the European Alps were formed in similar fashion. Movement of the Earth's crust was also responsible for the 2011 Tohoku earthquake, which pushed the Japanese island of Honshu 2.4 metres to the east. The event is perhaps better known for causing the tsunami that led to the Fukushima reactor disaster. Elsewhere, there is crack in the earth's crust that is responsible for the widening of the Atlantic Ocean: at its northern tip, this crack appears at the surface in Iceland, and makes geothermal energy a major feature of life here. Indeed, mankind has tapped the potential of geothermal energy for many centuries: from Arles in France and Gerona in Spain to the eponymous Baden Baden in Germany and Bath in Britain, the Romans used geothermal hot water in their public baths. Now, three modern projects suggest that taking a new look at this old resource may have significant potential in a low carbon future.

The first of these projects involves the mediaeval Abbey at Bath, in the UK. Here, architects recently located a Roman drain below the Abbey's crypts through which flows 850,000 litres of hot water every day. Church leaders plan to divert this water through a network of underground pipes to create a carbon-friendly underfloor heating system for the Abbey with the same thermal springs that attracted Roman citizens two thousand years ago.

Bath's hot springs arise from rainwater that infiltrates the geology of the Mendip Hills to the south of the city. Drawing heat from the Earth, it eventually reaches a depth of over two kilometres and a temperature in excess of 40 °C before rising rapidly back to the surface to form one of the three springs around which the city was originally built. At present, a total of over a million litres of this water is lost back into the ground every day, suggesting enormous potential of the concept.

In Iceland, hot bedrock near the surface heats precipitation (such as rain and snow) running through it, creating hot springs and underground steam chambers. The hot water is primarily used to heat homes, while steam is led from boreholes to turbines to generate electricity. In this way, Iceland uses geothermal energy (total installed capacity 575 MW) to heat 85% of its housing. Hydroelectric generation makes the country's electricity 100% renewable. Exporting this energy was first explored more than fifty years ago but the idea was not pursued because of cost. However, recent research conducted by Iceland's state electricity producer Landsvirkjun suggests that such a project could now be economically viable, based upon higher electricity prices and an increased demand for renewable energy. Accordingly, Landsvirkjun is considering a 1,000km link to connect Iceland to the UK's electricity grid.

Perhaps the largest of the three projects involves the Campi Flegrei, an active volcanic caldera in the shadow of Mount Vesuvius. Drilling into such a site is clearly not without risk: there was uplift of 2 metres within the caldera between 1982-5, followed by a period of slow subsidence. Lately,

much slower radial uplift has resumed, the area rising by about three centimetres a month. Nevertheless, the last known eruption here was in 1538 and it has been suggested that the most recent drilling programmes serve to increase our understanding of the processes going in within - and beneath - the caldera. Meanwhile, a 1983 report on the Mofete field within the Campi Flegrei caldera confirmed the presence three reservoirs of hot hypersaline water at depths of 2700m, 1900m and 1500m, at temperatures between 360°C and 230-300°C. A current estimate of the potential of the Campi Flegrei is equivalent of four large nuclear power plants; and, reflecting both the European Initiative on Smart Cities and the Horizon 2020 Framework Programme for Research and Innovation, plans have been announced for a sustainable development programme to exploit it. According to Naples city officials, the plan comprises "a trigenerative pilot [geothermal heat and power] plant integrated with solar energy and liquid biomass."

The Neapolitan approach to the potential risks is perhaps typical: Osservatorio Vesuviano director Marcello Martini said that ''it is necessary to look at them alongside the use made of them. We study the geothermal system from a volcanic point of view, but also for the possible use of this energy. Obviously, like everything human, how it is used also determines the safety of it.'' Meanwhile, according to the UK Government, Landsvirkjun's interconnection project in Iceland would improve energy security for the UK, while environmental groups have suggested that it could be the first in a series of similar links. In a more interconnected Europe, Scotland might have access to geothermal energy from Iceland or solar power from Greece, while on other days France or Poland could benefit from wind or wave power from Scotland.

In 1862, the physicist William Thompson (later Lord Kelvin) attempted to determine the age of the Earth. Basing his calculations upon, among other things, the observation that temperature increases with depth; and the rate at which rock conducts heat, he set out to determine the time taken for the Earth to cool from the molten state. Kelvin concluded that this period, and therefore the age of the Earth, was between 20 million and 400 million years. Of course we now know his conclusion to be inaccurate, although perhaps less so than that of Archbishop Ussher, who determined that the Earth was created on Sunday October 26, 4004 BC, at 9 o'clock in the morning. One of the factors that confounded Kelvin's calculations was the then-unknown process of radioactive decay, which releases heat within the Earth. Heat that, apart from helping us combat climate change, therefore has the capacity to move mountains, to surprise us and to unite us. And, it must be said, even to destroy us.

Accelerated Power Sector Innovation Could Unlock €70bn In 2030

Written by Julia Eichhorst, EURELECTRIC

New technological breakthroughs and business model innovation in power generation and downstream energy services could unlock up to €70bn in 2030, or €135 per EU citizen. It could also reduce power generation cost by 11%, a EURELECTRIC report has found. But the study also shows that allowing innovation to play out will require European policymakers to create an enabling EU policy framework. Conversely, slower innovation would put the energy transition at risk and make it much more expensive.

'Innovation in the power sector is central to achieving Europe's climate and energy policy aims. Capturing this potential depends on an agile private sector, supported by effective public policy. European policymakers must make the promotion of innovation a priority in energy policy and act now to streamline innovation policies and pave the way to a greener, smarter and ultimately less costly power system. This is especially relevant as the EU institutions begin their discussions on the 2030 energy and climate policy framework', said EURELECTRIC President and CEO of ENEL Fulvio Conti, handing over the report to EU Energy Commissioner Günther Oettinger at a Eurelectric event on the 14 May in Brussels.

In order to seize the opportunities of a rapidly evolving power sector, European power utilities will need to innovate on three fronts: master new technologies, get closer to consumers, and develop new business models and services. The report clearly shows that utilities are aware of this increased innovation potential and are already shifting their investment in favour of stronger R&D.

'Breakthrough innovation will reduce costs, increase energy efficiency, improve customer convenience, and foster EU competitiveness. That is why innovation is becoming a major priority for EU utilities. Over the last decade alone, annual R&D expenditure by large European utilities has nearly doubled to over €1.7 billion, turning them into powerhouses of innovation. Policymakers must now use every opportunity to keep this momentum alive, for instance next week's European Council meeting of EU government leaders', Mr Conti concluded.

THE REPORT RECOMMENDS FIVE KEY AREAS FOR EU ACTION:

1. **Adopt a systems approach to innovation policy:** take a broad view of innovation instead of supporting individual technologies in isolation.

2. **Nurture public-private dynamics:** The public and private sectors have to work hand in hand to create a sound policy framework that can stimulate a market for innovation.

3. **Prioritise demonstration and commercialisation:** More efforts are needed to bridge the gap between basic research and development (R&D) and demonstration/deployment.

4. **Unlock downstream innovation:** Deregulated retail markets and a rewarding framework for innovative network solutions will open up new opportunities in retail and smart grid services.

5. **Create supportive governance for the Innovation Union:** improve coordination of national and EU policies to foster joint innovation.

The **findings and recommendations** are the result of extensive work carried out by EURELECTRIC over the past eight months. Findings are based on over 40 interviews with experts, including utility Chief Technology Officers, energy and innovation policymakers, and innovation experts, in Europe as well as internationally. The European power sector remains committed to working with policymakers to make the energy transition a success, with innovation as a high strategic priority.

EFFESUS

Researching energy efficiency for European historic urban districts

EFFESUS is researching the energy efficiency and sustainability of European historic urban districts and is investigating measures and tools to make significant improvements whilst protecting heritage values. EFFESUS is a research project funded by the European Union Seventh Framework Programme under grant agreement n°314679, has a duration of 48 months and has started in September 2012.

Europe can become the leader in CO_2 emissions reduction by applying innovative solutions to its built cultural heritage. According to the European Recovery Plan one of the actions that needs to be taken to tackle the current economical crisis, is investing in energy efficiency. 4% of all energy is used in historic urban buildings, which are thereby responsible for 3% of CO_2 emissions.

Improving energy efficiency in historic buildings and districts is essential. Nevertheless, most of the current developments in energy efficiency address new construction are not dealing with the unique problems of historic structures.

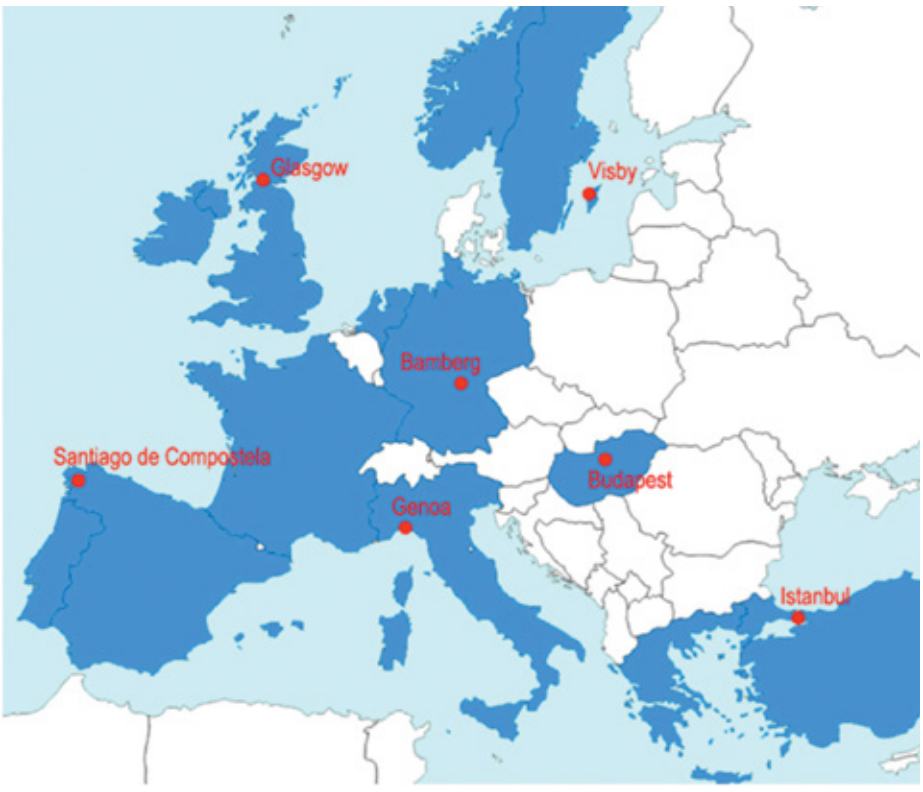
The EFFESUS project will develop technologies and solutions suitable for application in historical buildings. These developments will include a smart energy management system able to interconnect distributed energy generation technologies at urban level. This system will improve the reliability, efficiency and power quality, reducing electricity costs and offering more customer choice.

The applicability and suitability of the technologies developed by EFFESUS will be trialled in seven case studies, of three different types: analytical study, building intervention and urban intervention.

Acciona is leader of the demonstration activities at district level and the development of an innovative reflective coating. This novel technology is an example of the opportunities which nanotechnology brings to the construction industry. Nanoparticles based coatings are used to provide reflective insulation properties which can significantly improve the energy efficiency of new-build and existing buildings.

The coatings developed by Acciona, with the collaboration from other partners, will be based in functional nanoparticles with heat reflectance property that allows reflect infrared radiation. The concept of radiant reflective coatings is that they selectively reflect parts of the solar radiation spectrum, particularly energy from the near-infrared region (700-2500 nm), which accounts for half of the complete solar energy (ranging from 200-2500 nm). Radiant reflective coatings can thereby act as thermal insulating barrier and can play an important role in room cooling. The advantage of such coatings is that they can not only be used in new-build construction, but also in building retrofit where retrofit would otherwise require alternative, complex

Geographical distribution of the case studies



and expensive improvement measures.

Moreover, the innovative coating will be developed so that is does neither impact on a building's appearance nor damage its fabric, thereby making it suitable for use on historic buildings.

The coating will be trialled in a case study in the medieval district of Beyoglu, one of Istanbul's oldest townships. The applied coating will be monitored for one entire year to extract results of thermal insulation improvements and be compared to reference values.

Further to radiant coatings, the EFFESUS project will also develop other construction materials and components, including aerogel insulation products, window upgrade measures and insulating mortars, as well as energy management technologies, including indoor climate management solutions, energy storage systems and adaptations of smart grid solutions for use in historic districts

Furthemore, a dynamic toll based in GIS for the combination of energy generation, controlled demand reduction and energy storage will maximise the use of energy locally generated to cover the heat and electricity demands.

The results from the technologies developed in the context of the Effesus project will be implemented in the Decision Support System (DSS), the main output from the project. It is a software tool to help make informed decisions about improvement measures suitable for historic districts. It will include all the parameters needed to select energy efficiency interventions in historic districts.

Stages of the selective reflective coating development

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EFFESUS project
www.effesus.eu

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At the tipping point in reaching energy efficiency targets

Written by Cosmina Marian of BPIE - Based upon research conducted by Prof. Dr. Eva Heiskanen, Dr. Bogdan Atanasiu, Dr. Kaisa Matschoss and Lukas Kranzl

Energy efficiency in buildings is fundamentally linked to human behaviour, so policy design, implementation and evaluation have to address this particularity. The human element is too often overlooked even when it can have a pivotal impact on either improving or reducing technological efficiencies. This is where the ENTRANZE project comes in by offering effective policy implementation support and an in-depth analysis of stakeholder behaviour in 9 target countries. Mapping the decision-making processes of stakeholders makes it easier to take behaviour into account when putting policies in place. Thus, while a multitude of factors are considered by policy makers when designing policies - ranging from the institutional setup, legal basis, financial possibilities and so on - behaviour patterns have a growing importance.

Because behaviour-based energy efficiency programmes are the next natural step in achieving our targets, it is pivotal to know both the barriers we face and the main drivers for successful implementation. The intricacies of stakeholder behaviour is thoroughly analysed by taking into account a variety of criteria that play a role in the decision making process. As such, ENTRANZE research considers the structures of ownership, building types and level of professionalism with which buildings are managed.

Buildings have considerable heterogeneity in Europe and the differences in ownership structure stand out across Member States. While owner-occupied single-family homes are a category that is relatively similar in all countries, multifamily buildings can differ greatly, resulting in more complex decision making processes.

Graph 1 Initial selection of decision criteria

For instance, co-ownership of multifamily buildings is a problem that needs more attention because the measures taken so far to encourage energy renovations prove to be ineffective. Owners are put in the situation of having to take collective decisions that might affect them in different ways. In this case, owner-occupancy by low income households or by elderly people pose a particular problem: people in different financial situations and of different ages have widely divergent resources and interests relating to energy investments. These problems boil down to the organisational side of any decision making process which also has a bearing on the financial barriers and intensifies the transaction costs, such as concerns over disruption and risk of failure. Prior to dealing with lack of incentives, large-scale energy renovation plans should address organisational issues by putting in place step-by-step technical and organisational support moderated by external and unbiased professionals.

These patterns outline barriers and drivers that serve as decision criteria. Graph 1 shows the decision criteria taken into consideration throughout the ENTRANZE research. It considers intertwined factors of a sociological nature and also takes into account attitudes and perceptions, as well as more technical elements. Country case studies demonstrate that almost all building owners prioritise

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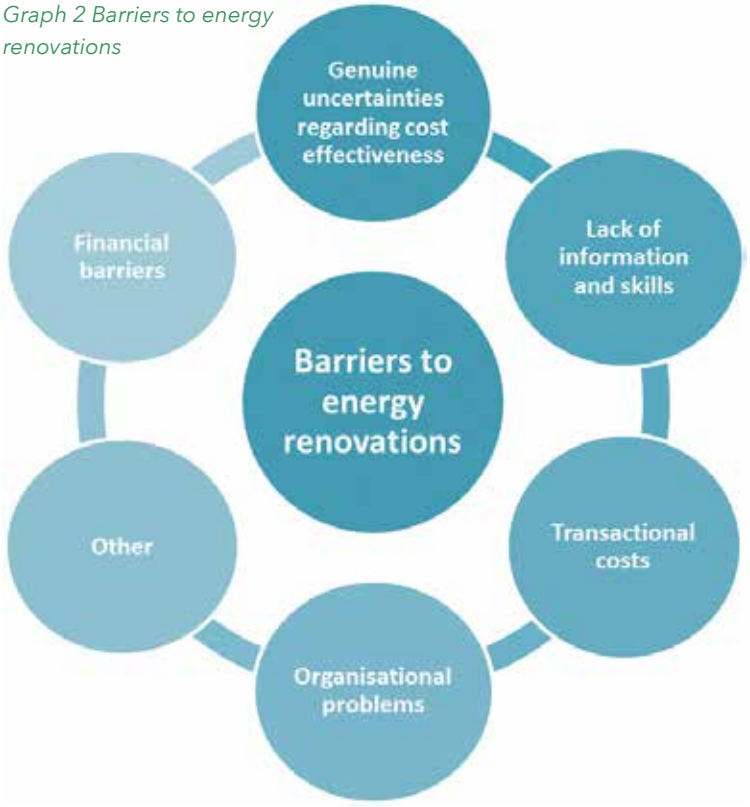
the initial cost in their decision making process. This is due both to the lack of reliable and accessible financial analysis and to genuine uncertainties about other financial indicators for which there are no guarantees. On the other hand, energy cost savings and, even more so, improved comfort are major drivers for renovations in several countries. But by adding government support programmes into the mix there is a possibility to influence even more the type and scope of energy improvements.

Graph 2 identifies barriers to energy renovations also covering a wide range of indicators. While social and psychological barriers cannot be overlooked, external finance and organisational factors also have an important place in the mapping of human behaviour as previously mentioned. What also stands out is the lack of skilled service providers, high information search costs and risks of renovations. Of course the situation of different types of stakeholders creates different conditions for the decision-making process, but overall high initial costs and perceptions of a long payback time are common barriers. In spite of the efforts made to raise awareness about the benefits of energy investments, there are still lingering uncertainties regarding cost-effectiveness which can be better dealt with by policy makers.

Graph 2 Barriers to energy renovations



POLICY IMPLICATIONS

There is a long road ahead before achieving deep and comprehensive energy renovations covering all of Europe. Some of the incentives used at this moment are not sufficient because barriers are structural and deep-seated. And when it comes to human behaviour sometimes habits cannot be changed solely by rational interventions such as information and incentives alone.

For example, engagement of the owner-occupants is necessary and further legislation should be drafted in this regard. But in order to really improve the current situation there is a need for a combination of well-designed advice schemes and the establishment of local and regional networks of qualified service providers. Furthermore, public advice should be strengthened through public-private finance schemes which at this moment pose a problem. Currently, owners do not consider investments in renovations due to long return rates with no guarantees.

However, financial support schemes are only part of the solution, because they must be mixed with advisory services, technical support and supplier certification in order to give particularly good results. Moreover, policy measures should take advantage of "windows of opportunity" like the change of

The ENTRANZE report Literature review of key stakeholders, users and investor can provide more detailed information and behaviour insights:

http://www.entranze.eu/ files/downloads/D2_4/D2_4_Complete_FINAL3.pdf

About BPIE

The Buildings Performance Institute Europe (BPIE) is a European not-for-profit think-do-tank, delivering policy analysis, advice and implementation support. Its focus is knowledge creation and dissemination for evidence-based policy making in the field of energy performance in buildings. The Brussels-based institute is the European Hub of the Global Buildings Performance Network (GBPN).

www.bpie.eu and www.buildingsdata.eu

About ENTRANZE

The ENTRANZE project backed by the Intelligent Energy Europe programme actively supports policy making by providing the required data, analysis and guidelines to achieve a fast and strong penetration of nZEB and RES-H/C within the national building stocks. The project connects building experts from European research and academia to national decision makers and key stakeholders with a view to build ambitious, but reality proof, policies and roadmaps.

www.entranze.eu

BPIE is organising a High-Level Policy Conference within the framework of the European Sustainable Energy Week (EUSEW), entitled *From Ambition to Action: How to best deliver European building sector policies on the ground?* The event will take place in Brussels, on June 26 from 2.30pm. To register, visit: **www.eusew.eu**

ownership of buildings. Timing is of utmost importance in planning renovations. For instance, the technical need to undertake renovation, for example to replace worn-out building components (e.g. windows, roofs) or technical systems (e.g. heating plant or lighting) is a key driver in all countries and other chance opportunities can come up. As for renovation models currently in use, for at least some of the less wealthy single-family homeowners, it might be more rewarding to implement step-by-step energy renovation models which can lead to near-zero energy levels over the course of several years.

All in all, a variety of factors influence consumer behaviour, from technological developments, economic situations to age, social norms and cultural traits. And these relationships fluctuate thus policies have to keep up and take the human component into consideration when designing strategies.

Smart City – Easy Living in an Ecological Urban Environment

IN A SMART CITY, HOUSING, WORK AND LEISURE ENVIRONMENTS FORM FUNCTIONAL, COMFORTABLE AND ECO-EFFICIENT ENTITIES. THEIR INNOVATIVE SERVICES ARE SEAMLESSLY INTEGRATED INTO EVERYDAY LIFE.

"Urbanization is a global trend for the near future. All over the world, demand for the smart city concept is growing at an accelerating rate. We can proudly say that Finland is a frontrunner in supplying innovations for intelligent environments, which is why we have launched a new Tekes programme called Witty City," states **Reijo Kangas**, Director for Real Estate and Construction Industries at Tekes.

The Witty City programme of Tekes aims at developing solutions that integrate advanced technologies with people´s everyday needs in an urban sustainable environment. Tekes will be the main financing body for the five-year programme that has a total budget of 100 million euros. The Tekes share is some 50 percent and the first projects are starting in 2013.

THE DEVELOPMENT WORK WILL BE CARRIED OUT IN REAL URBAN ENVIRONMENTS

"In addition to ordinary development and research projects, we plan to start three to five large pilot projects in different Finnish cities. We require the piloting to be done in close cooperation with residents, companies and the public sector. The cities will be encouraged to participate and to invest in the innovative smart city projects, which can serve as development platforms for companies to test their new services and technologies," Reijo Kangas adds.

The pilot projects will focus on local energy production, open data utilization and reducing carbon footprints. Generally, the framework of the Witty City programme involves development of energy, environmental, digital and construction technologies and services that can be integrated into everyday life.

LOCAL AND GLOBAL NEEDS

Eventually, the goal is to make Finland's urban development environment attractive enough for foreign parties to invest in Finnish companies, and to participate in development projects. The pilot projects are especially aimed at attracting international participants.

Construction, land use plans and technological solutions are based on local needs and strengths. Since local needs tend to be similar all over the world, all the services and concepts that answer these needs can be re-used internationally.

TEKES HAS A BROADLY BASED VIEW ON INNOVATION

Tekes, the Finnish Funding Agency for Technology and Innovation, has an important role in funding and coordinating innovations in Finland. One of the focus areas is to develop new, internationally significant businesses that utilize smart city innovations.

More Information

www.tekes.fi/programmes/kaupunki

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Development of Nanotechnology-based High Performance Opaque & Transparent Insulation Systems for Energy-efficient Buildings

OVERVIEW

Choosing the right glazing for a building's use is the most important factor in determining the amount of daylight that can enter a building interior to ensure pleasant, natural lighting and help save energy otherwise used for electrical lighting. It is also important to consider the individual balance between the following aspects: natural lighting and transparency, light distribution and light scattering, sun protection and thermal insulation, as well as noise protection and anti-glare protection.

The application of nanotechnology based thermal insulation systems materials in the EU Construction and Modern Buildings sector is increasingly becoming popular within the European Union. This has been largely driven by environmental concerns and an increase in service requirements; it has been reported that significant heat losses through inadequate building insulation/poor-performing insulation systems is responsible for 40% of total EU energy consumption. This is a significant contributor to greenhouse gas emissions, approximately 36% of the EU's total CO2 emissions. Therefore reducing this level of energy consumption i.e. by improving the performance of thermal insulation systems, during the whole life-cycle of the buildings is an effective action against climate change. Other environmental drivers deemed as important within the sector include the need to increase recyclability levels and a determined move towards more sustainable products and processes.

Possible applications of VIPs in a building: Roof insulation, walls, floors and transparent VIPs for glass facades

Systems based on nanostructured materials do potentially offer far superior thermal and mechanical properties than modern insulation systems. Among these nanostructured materials, inorganic silica aerogels and organic nano-porous materials are characterised

with very low thermal conductivities, i.e. 0.005-0.015 W/m.K. The barriers to rapid wide scale commercialisation of these materials however is integrating these materials with added functionality into products suitable for use in buildings using low-cost/high-volume

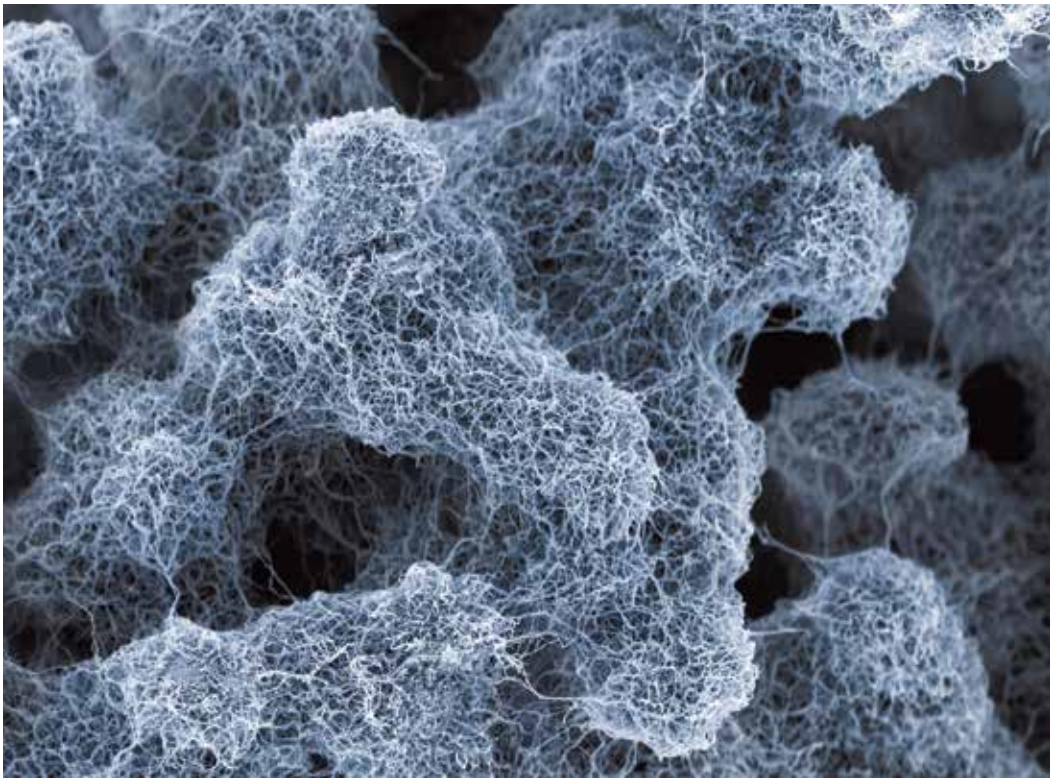
sustainable processes. Technological concepts

developed by one of the consortium partners

had shown that these nanostructured materials can be enveloped in high barrier films to produce VIP systems.

Preliminary experimental studies had shown that these thin and lightweight nano-based vacuum insulation systems can be six times more energy-efficient than commercial counterparts. The project aims to develop the necessary materials (aerogels, nanofoams),

encapsulation/mixing technologies, barrier films, models, life-cycle analysis, demonstration and pilot process technologies to develop robust and efficient VIPs.



Nano-foams as filler material of VIPs

Achievements to date:

- Synthesised novel nanostructured translucent composites of silica aerogels with the polymer PDMS(OH) by a new deposition technique. This is a new material which warrants a patent application
- Developed new open porous monolithic materials. The lowest thermal conductivity of the VIPs reached by using this material is 5.3 mW/m.K.
- Produced high-barrier films with gas and water vapor transmission rates in the range of 10-3 cm3/(m2.d.bar) and g/m2.d (at 23 °C, 85% RH) . The lower permeation rates will result in increased service life making VIPs suitable for use in construction sector
- Finalise the design and specification of VIP production line for the demonstration of a continuous cost-effective VIP manufacturing route
- Selected demonstration sites in Algete, Spain and Warszawa, Poland, in order to demonstrate the significant commercial and market applicability of the insulation materials

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Boosting energy efficiency in our cities

Paul Bevan, Secretary-General of EUROCITIES

Cities are the centrepieces of Europe's bid to become more energy efficient. Though cities account for 75% of Europe's population and 80% of its energy use, it is in urban environments that resources are used most efficiently. Urban concentration of population and buildings means shorter journeys for people and goods: city dwellers can walk, cycle or use public transport. Energy used for heating or cooling is also lower per capita in cities because living more densely requires less heating and ground space per person. If we are serious about moving towards a greener and smarter economy, then it is cities that will lead us there.

Meeting the energy efficiency goal set by the European Union for 2020 of a 20% cut in energy consumption will require a mix of both conventional and innovative solutions. Cities can count on already existing infrastructure to make some inroads. Extending public transport networks and cycling routes is one area which offers further energy efficiency gains. Another is large scale refurbishment of old buildings with proper thermal insulation or energy efficient windows. The installation of solar-thermal or photovoltaic panels allows buildings in cities to become energy producing. Helsinki is among the cities that are using district heating and cooling networks to distribute energy to residential, public, or commercial buildings which would otherwise be wasted.

Yet information and communication technologies (ICT) offer the opportunity for cities to do even more. Technology such as smart metering allows citizens to closely monitor their energy consumption, and allows energy suppliers to more efficiently meet demand. According to the European Commission, the installation of smart meters could account for as much as a 10% reduction in energy consumption. ICT could also enable households equipped with renewable energy generation tools to become net contributors of energy to the grid. It will in turn help create behavioural change when citizens start making real cost savings

from their reduced energy consumption.

Thanks to these solutions, cities are no longer simply keeping up with the general momentum: they are setting the pace of change. The city of Copenhagen for example is attempting to become the first carbon neutral city in the world by 2025.

Cities are learning from one another in collaborative projects through cooperation and the exchange of best practices. One such project is the Green Digital Charter (GDC), originally conceived by EUROCITIES, which commits cities to work together to deliver on the EU's climate objectives through the use of ICT. To date thirty five cities have signed up. Among the project's commitments is a pledge to decrease ICT's direct carbon footprint by 2020 by 30% per city.

The EU-funded NiCE project (Networking intelligent Cities in Europe) promotes and supports the Green Digital Charter by developing ways of comparing performance on ICT and energy efficiency. NiCE also organises networking and learning activities for cities.

Another noteworthy project is CASCADE where cities are learning from each other about local energy leadership. Coordinated by EUROCITIES, the project allows a city like Eindhoven to share its knowledge about biomass conversion projects; or give visibility to its low interest financing mechanism for energy efficiency measures which uses a revolving fund financed by independent providers. Nantes, the current European Green Capital, is sharing its experience of substantially extending the public transport system, while also putting in place an ambitious programme to improve the energy performance of social housing.

Metropolitan Europe has not been idle. Conventional solutions are accompanying innovative ones in improving the energy efficiency of our cities. Collaborative projects are enabling cities to speed up the replication of successful initiatives. How cities engage with the EU's goal of a 20% improvement in energy efficiency by 2020 is clearly vital for Europe's strategy of moving towards a resource-efficient economy. It is a challenge, but it is one that cities have already taken up.

For further information

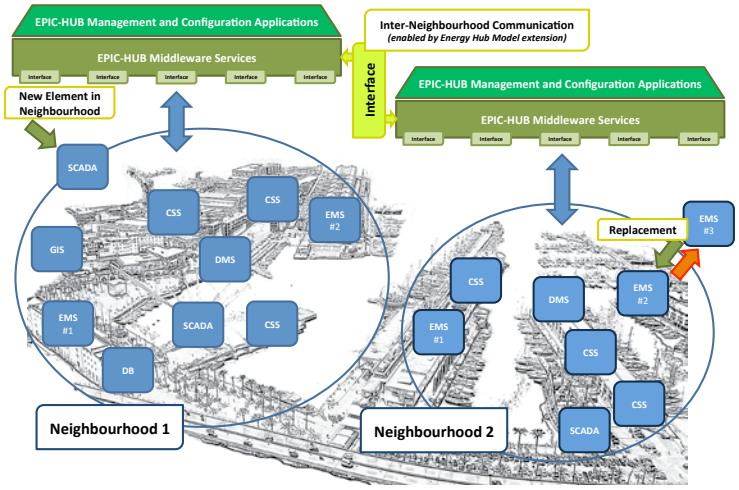
On the Green Digital Charter:
http://www.greendigitalcharter.eu/greendigitalcharter

On NiCE:
http://www.greendigitalcharter.eu/niceproject

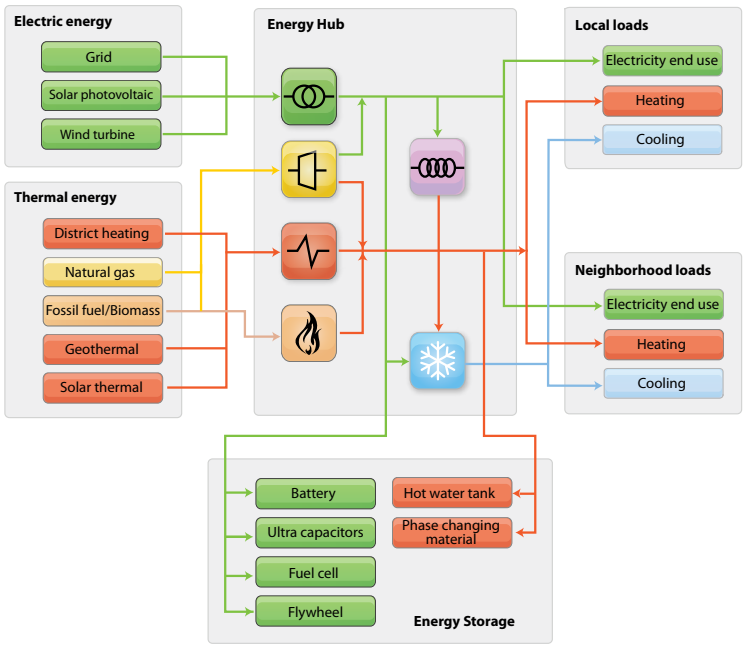
On CASCADE:
http://www.cascadecities.eu/cascadecities/home#.UXgseaKmg60

Energizing the Neighbourhood

Increasing energy efficiency at the neighbourhood-level through innovative approaches is one of the strategic concepts to achieve the EU's energy and climate objectives.However, while the feasibility of energy autonomy has already been demonstrated for isolated, small, or low-density buildings, the implications of this new paradigm on medium and large Neighbourhoods still needs to be assessed.In this framework, the focus of EPIC-HUB project (Energy Positive Neighbourhoods Infrastructure Middleware based on Energy-Hub Concept) is energy efficiency, self-generation, emissions reduction, and novel solutions to exploit the excess energy generated and the unused/unshared storage potential often available at the neighbourhood community level.



Industrial, commercial, and residential consumers require various forms of energy provided by different infrastructures, but the planning and op-eration of today's energy networks typically do not take the interactions of the different energy carriers into account.It is questionable whether this approach will be sufficient for an efficient planning and operation of future systems. Combining different energy infrastructures enables exchange of power between previously decoupled systems, where the couplings and interactions between different energy carriers can be described by means of the Energy Hub concept.The inputs of an Energy Hub are electricity, natural gas, and heat. Within the Energy Hub various technologies can be employed to convert and/or store the different input energy carriers offering a certain degree of freedom in satisfying the electricity and heating/cooling demand at the output.Energy Hubs can be used to model a number of real facilities, such as industrial plants (steel works, paper mills), big building complexes (airports, hospitals, shopping malls), rural and urban districts. An important question during planning phase of such entities is the selection of the appropriate generation, conversion and storage technologies to supply the required electric and heat demand while enabling performance optimization of e.g. costs, losses, or emissions and also taking the interdependence



of the different energy carriers into account.

For instance, it might be possible to avoid consuming expensive electrical energy from the electricity network during peak periods by producing electricity with a micro-turbine consuming cheaper gas.The flexibility, modularity, and scalability of the Energy Hub approach provides significant optimization potential in terms of planning and operation, which is a desirable feature when aiming at the implementation of smart grid management schemes.

Based on the Energy Hub model, EPIC-HUB Middleware aims to define a technological solution for different market demands: EPIC-HUB focuses on the integration and interoperability of the existing ICT systems, thus overcoming problems related to different data formats, reporting schedules, communication protocols, etc. EPIC-HUB Middleware will rely on a solid interoperability and collaboration model, capable of identifying assets, systems, actors and organizations involved in the energy market domains. Such identification will be carried out through a common, open notation, enabling the representation of single entities as well as their relationships within the overall infrastructure.

EPIC-HUB Middleware will enable the development of dedicated services, for the integration of multi-domain and multi-energy carrier resources in a neighbourhood environment featuring:

- An Energy Management cockpit providing energy managers with an integrated vision of their facilities through simple energy indicators aggregating different user interfaces for each supervised/controlled sub-system (e.g. Building Management/Automation Systems and Heating, Ventilation, Air Conditioning).

- An E-trading platform service to manage at distributed level the local energy sources and the connection to the power grid in order to sell or buy energy when necessary.

- A Cloud based service enabling real time analytics of consumption data, including reporting and alerting tools based on advanced algorithms, replacing the current "blind" approach in energy consumption within buildings and neighbourhoods.

The same Energy Hub model will drive the modularity of EPIC-HUB Middleware architecture, enabling a scalable, iterative deployment of new ICT systems within the neighbourhood and facilitating the integration or replacement of legacy systems.The Middleware "service bus" will also allow adjusting the size of the managed neighbourhood infrastructures through a connection interface capable of linking multiple EPIC-HUB systems together (from the neighbourhood to the district and up to the city scale).

The underlying objective of the EPIC-HUB project is to achieve up to 25% of energy saving and 20% GHG reduction by leveraging the potential of energy neighbourhoods to achieve higher performance and efficiency.Such ambitious targets can be reached based on different impact channels that can generate real savings and carbon emission reduction, namely:

- Energy monitoring functionalities capable of providing a real-time view of the status of the energy consumption and carbon emissions at a neighbourhood level.

- Energy compensation schemes apt at exploiting RES generation at district level.

- Re-utilization of existing ICT infrastructures and interoperability of new ones (in order to minimize the overall overhead and integration effort related to ICT solutions).

The adaptability of the EPIC-HUB approach will be demonstrated by the implementation of different pilots with highly motivated communities: Genoa Port (Italy), Belgrade Airport (Serbia) and the Bilbao Exhibition/Fair Centre (Spain) will host challenging pilots, involving their respective neighbourhood use-cases, and demonstrating how critical infrastructures can benefit from innovative Energy Management.

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Are businesses ready to go deep?

A question investigated by The Economist Intelligence Unit in a new survey among building sector and real estate executives

As a follow-up to the global report "Energy efficiency and energy savings – a view from the building sector" published in October 2012, the Global Buildings Performance Network (GBPN) - in collaboration with its EU Hub, the Buildings Performance Institute Europe (BPIE) - commissioned The Economist Intelligence Unit (EIU) to put European industry stakeholders under the spotlight. The global report of over 400 building sector executives had found that over 84% of businesses leaders are ready to cutting CO_2 emissions associated with their business. Executives underestimate the returns but are already implementing efficiency measures in their buildings. They urge more commitment and policy direction from governments.

Investing in energy efficiency in Europe's buildings: A view from the construction and real estate sector: explores now more specifically how companies in the European building sector approach energy efficiency investments, how they perceive the latest EU regulations, and how innovative financing could help them ramp up retrofits to achieve emission reduction targets.

European real estate and construction executives are convinced that European legislation for energy efficiency and energy performance in buildings is a benefit for the building sector, 80% of the respondents surveyed by the EIU view new regulation favourably. While the financial crisis has set a downwards trend to real estate valuations, the renovation of the existing building stock could be a means to reverse this trend.

While many European companies are relatively active in retrofitting buildings (43% say their company investments in energy efficiency is most relevant to renovation), especially in comparison to their international counterparts from the US, China or India, the majority of EU survey respondents (57%) still focuses its efforts on new constructions. However, energy efficiency measures play a very minor role in building renovations as they currently account for only 1% of the retrofitting activity. Hereby, regulatory uncertainty seems to be the main barrier to increased energy efficiency investments, according to the EIU survey. Executives interviewed by The Economist Intelligence Unit said that the very heterogeneous implementation at member state level would not allow reaching the necessary economies of

scale.

The co-existence of various building standards across Europe and administrative burden are also important and very tangible issues.

Despite this situation, many large scale property owners go already for cost-effective energy efficiency measures and start auditing their portfolios. Four lessons have emerged from these audits:

First, the deeper the retrofit, the lower the risk of asset depreciation. Second, a portfolio approach to the management of the stock increases the cost effectiveness of the energy efficiency measures. Third, the approach to retrofitting should be strategic and start from the oldest buildings with deep renovations. Fourth, the scale of investment should determine the renovation speed.

Respondents also highlighted the need for solid energy performance data and financing. Without reliable data on energy performance investments, it will be difficult to attract investors for energy efficiency. Therefore the real estate and construction executives interviewed by the EIU call for private or public super project managers ('project aggregators') able to effectively orchestrate across the value chain the many specialists collaborating on large-scale retrofit projects and able to guarantee the projected performance results.

This report is based on:

- A survey of 96 EU executives in the building sector (69% real estate segment) and 31% of the building construction sector
- Four in-depth interviews with experts and C-level executives in the EU building sector
- Desk research based on the newest data and reports on the topic.

About BPIE

The Buildings Performance Institute Europe (BPIE) is a European not-for-profit think-do-tank, delivering policy analysis, advice and implementation support. Its focus is knowledge creation and dissemination for evidence-based policy making in the field of energy performance in buildings. The Brussels-based institute is the European Hub of the Global Buildings Performance Network (GBPN).

www.bpie.eu and **www.buildingsdata.eu**

About GBPN

The Global Buildings Performance Network (GBPN) is a globally organised and regionally focused non profit network advancing building energy performance best practice policies to help decision-makers develop and implement policy packages that can deliver a Deep Path of energy consumption reductions and associated CO2 emissions mitigation from buildings. It operates a Global Centre in Paris and is officially represented by Hubs in China, Europe, India and the United States.

www.gbpn.org

BPIE is organising a High-Level Policy Conference within the framework of the European Sustainable Energy Week (EUSEW), entitled *From Ambition to Action: How to best deliver European building sector policies on the ground?* The event will take place in Brussels, on June 26 from 2.30pm. To register, visit: **www.eusew.eu**

Glass roofs as an integral component of energy efficient building shells

"Energy efficiency" is the number one topic in modern building: Whether industrial and administration buildings, elegant buildings with aesthetic appeal, or homes – the significance of daylight systems as an integral component of the building shell is undisputed today wherever the task is to make efficient use of energy. The focus is on every single component of a glass roof construction: from the glazing types, through profile and sash systems, to control technologies.

Choosing the right glazing for a building's use is the most important factor in determining the amount of daylight that can enter a building interior to ensure pleasant, natural lighting and help save energy otherwise used for electrical lighting. It is also important to consider the individual balance between the following aspects: natural lighting and transparency, light distribution and light scattering, sun protection and thermal insulation, as well as noise protection and anti-glare protection.

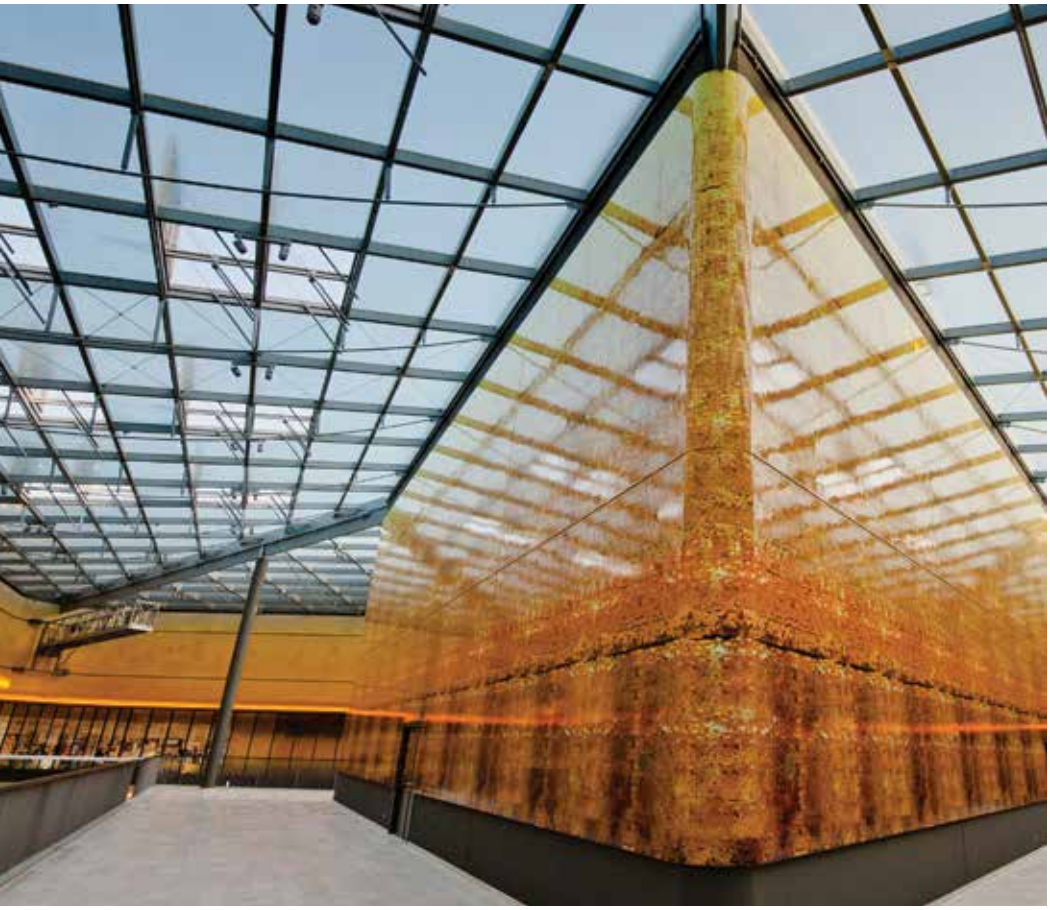
In addition to the energy-saving effects generated by a high level daylight incidence, of course, good thermal insulation also helps to preserve the energy that exists in the building. The best possible glazing here is glazing with what is known as a "warm edge". The spacers between the panes of glass are made of materials with low heat conductivity. Thermally enhanced glazing systems ensure low heat loss from inside the building.

LIGHT AND SHADOW - THE GLAZING

Although daylight incidence and solar heat input – particularly in the winter -in the case of the latter – offer major potentials for managing energy in the building, thus saving the costs of artificial

Daylight systems are becoming increasingly important as an integral part of the building shell when it comes to ensuring efficient use of energy.

It is also important to consider the individual balance between the following aspects: natural lighting and transparency, light distribution and light scattering, sun protection and thermal insulation, as well as noise protection and anti-glare protection.



lighting and heating; of course, none of this can be done without controls. In our glazed roof constructions LAMILUX provides permanent or controllable shade systems for metered heat input and a controllable indoor environment.

There are many options for this: Foils in the glazing, light directing glazing, screen printed glazing, sun protection using surface-mounted louvers and controllable shading by external, internal or pane-integrated roller blinds.

Building automation also plays a central role in intelligently controlling the energy input. Actively networked controls harmonise and interlink all processes. Solar altitude sensors, light intensity sensors and temperature sensors, for example, provide a clock source.

THE PROFILE SYSTEMS - FREEDOM OF DESIGN AND GOOD THERMAL INSULATION

When it comes to profile systems for individually shaped glass roof constructions, it particularly important for the geometry of all main profiles - with the exception of the building depth - to be the same. With the LAMILUX systems, any main profile can be used as a mullion or transom. The result is a highly adaptive system that offers virtually complete freedom of design. The supporting structure consists of high quality aluminium. Additionally, the profile system offers optimised isothermal characteristics to passive house standards, thus reducing the risk of condensate forming on the inner sides of the glazed roof construction.

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INTEGRATED CASEMENT SYSTEMS OPTIMISE THE INDOOR ENVIRONMENT

Regulating integrated flap systems in glass roof and façade structures to provide natural ventilation plays a considerable role in optimising building air conditioning systems and reduces the amount of energy used for cooling in air conditioning units. It has been demonstrated that around 30 percent of energy used to heat and cool buildings can be saved as a result of efficiency-boosting functions in room automation. But also the casement systems themselves have components for excellent thermal insulation of the frame constructions.

SHEVS FLAPS - SAFETY IN FIRE PREVENTION

LAMILUX glass roof constructions also form the ideal design basis for integrated flap systems that provide smoke and heat exhaust ventilation (SHEVS) functions. Reliable trigger and control technologies are essential for this. They are networked with other moving elements of the building shell via control centres and integrate the automation with the building's central control technology.

GENERATING ENERGY WITH GLAZED ROOF CONSTRUCTIONS

Glass roof constructions also offer excellent opportunities for incorporation into alternative energy concepts – simply by integrating solar and photovoltaic systems. The south facing side is the ideal platform for mounting photovoltaic plants. And glazing with built-in photovoltaic cells can be embedded as pane elements in all other roof glazing forms.

ABOUT LAMILUX HEINRICH STRUNZ GMBH

Heinrich Strunz GmbH, whose head offices are in Rehau in Germany's Upper Franconia region, has been producing high-grade daylight systems made of composites, glass and aluminium under the LAMILUX brand name for almost 60 years. Architects, construction engineers, planners and roofers use LAMILUX CI Systems when building industrial facilities, administration buildings and industrial shed complexes as well as private residences. The purpose of these structures primarily consists in optimising the use of natural light and guiding it into building interiors. Fitted with controllable flap systems, they also serve as smoke and heat exhaust ventilation systems (SHEVS) and energy-efficient building systems providing natural ventilation. The unique LAMILUX CI Systems range includes a wide variety of different structures – from rooflight domes and continuous rooflights through to glass roof constructions in aesthetically pleasing shapes. The company also possesses considerable expertise in developing and manufacturing control systems – LAMILUX CI Control – for activating and automating both smoke and heat exhaust vent systems and ventilation and solar protection installations. With 580 employees, LAMILUX generated a turnover of 158 million euros in its two business segments - LAMILUX Daylight Systems and LAMILUX Fibre-Reinforced Plastics - in 2012.

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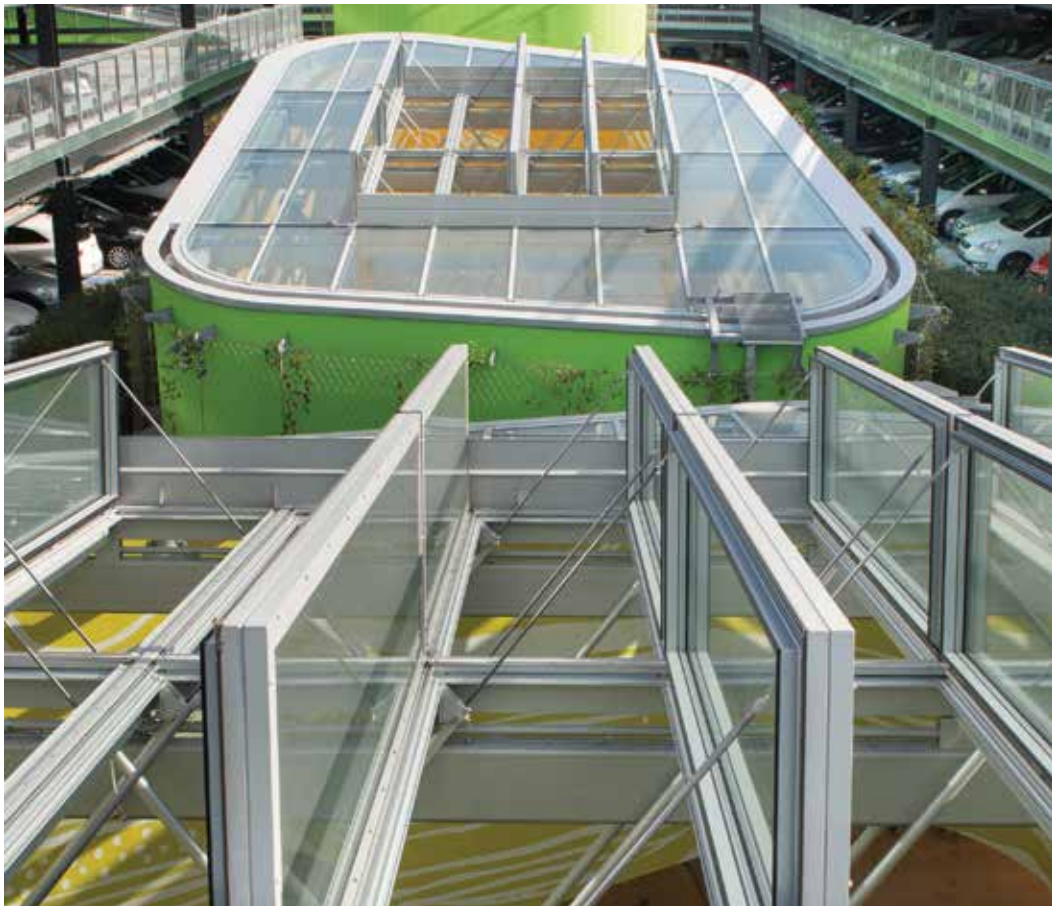


The Electrical Grid

Written by Guillermo Amann, Chairman of T&D Europe's WG "Marketing, Communication, Economics"

The electricity grid is basic to the functioning of modern society. The electrical grid also plays an important role in enabling the use of renewable energies to their full potential.

Europe faces the enormous challenge of expanding and modernizing its power grids in order to satisfy the foreseeable, growing demand for electrical energy over the coming decades in a liberalized energy market; but without jeopardizing the energy security. On top of it, the minimal environmental impact, with a significant reduction of carbon emissions, is another key pillar settled by the European Institutions.

In order to achieve all those targets and to make best use of the many enabling values of electricity in the next few decades, comprehensive modernization and improvements in the European electrical grids are necessary. Therefore investments must be made – and as quickly as possible – despite the current financial and economic crisis. In fact, these investments should be beneficial to the overall economic situation in Europe.

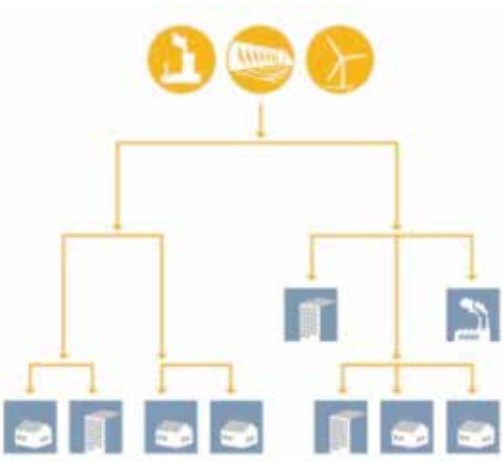
That leads into the already popular concept of "Smart Grid" that is much more than smart metering and more than widespread communication systems -important though these are.

The use of the existing grid must optimize and build upon its installed base thereby contributing to a more sustainable generation, distribution and use of energy. The capacity for both transmission of bulk power and the integration of distributed resources from a variety of renewable origins must be developed.

It must be also taken into account the newer needs of the demand side. Grid must be reinforced and provided of intelligence in order to allow the connectivity needs of technologies such as e-vehicles, intelligent industrial loads, micro-storage systems, etc, and the deployment of new functionalities for the clients such as demand side management.

A genuinely Smart Grid will become a key enabler to achieve the EU policy targets in energy usage by making possible the integration of renewables and distributed generation sources, the connection of which will become widespread. The problems addressed here are both the

Traditional Grid



Smart Grid

absolute capacity of the system and the management of complex and less predictable power flows. This issue is particularly acute in distribution grids.

The new level of complexity of power flow threatens security of supply and therefore depends on a robust physical grid, aided by sophisticated automation solutions and new market models that must also consider the improvement of the energy efficiency of the network by intelligent installation of smart solutions, e.g. load balancing, FACTS devices, Wide Area Management Systems, power factor correction, HVDC (high voltage direct current), etc.

Even the regulatory framework can make use of Smart Grids by taking advantage of the capabilities introduced by the new technologies. By improving the transparency of the physical flows and states of the grid equipment, as well as improving the reliability and technical flow in the grid, these smart technologies help the Regulator to monitor the capacity and the quality of supply and to manage their improvement. However, the Regulators will also need to take an active role in the development of new policies and guidance to utilities.

Much effort has gone into the very necessary European programs for stimulating and funding Research & Development and more recently into planning substantial programs of demonstrator projects. Whilst these are welcome and essential, they must not be the whole story: the complete deployment through all the network must be granted.

In the above comments, much has been said about the central importance of the physical grid. The same is true when it comes to new development of capacity or of the sophistication of the network. The actual investment in the capabilities of the physical grid will determine the true, final value of all the smart developments.

Many of the technologies of the Smart Grid are available in Europe and European manufacturers, whether global, pan-European or SMEs, are recognized leaders in them. Similarly, many of these technologies are already installed and proven worldwide. Support for Smart Grids would build upon this foundation to stimulate employment and the R&D base in Europe.

Smart Grids imply a suite of technologies and related regulatory issues that have high potential to contribute enormously to energy efficiency, as well as several related issues, and therefore should be a major weapon in the armory in our campaign for a sustainable future for Europe (and beyond).

Lisbon
Portugal

SIM2013

26 to 29 Jun

Sustainable Intelligent Manufacturing

International Conference

The International Conference on Sustainable Intelligent Manufacturing, organized by the Centre for Rapid and Sustainable Product Development, Polytechnic Institute of Leiria, and the Faculty of Architecture, Technical University of Lisbon, aims to provide a major international forum for academics, researchers and industrial partners to exchange ideas in the field of sustainable intelligent manufacturing and related topics.
SIM2013 expects to foster networking and collaboration among participants to advance the knowledge and identify major trends in the field.

Conference Topics

Computer-aided green manufacturing
Eco-design and eco-innovation
Design for climate change
Inclusive design
Sustainable construction
e-Manufacturing
Green manufacturing
Green Entrepreneurship
Green supply chain management
Green transportation
Renewable energy technologies
Reuse, remanufacturing and recycling techniques
Sustainable packaging solutions
Smart manufacturing
Reverse logistics and product recovery
Smart and sustainable materials
Life-cycle engineering and assessment
Energy efficiency in manufacturing
Energy and Climate policy
Smart design for sustainability
Sustainable technology innovation
Sustainable factory planning and scheduling
Sustainable business models
Zero-waste production
Nearly Zero-Energy Buildings
Resource Efficient Cities

Invited Speakers

Branko Kolarevic
University of Calgary, Canada

Francesco Jovane
Politecnico di Milano, Italy

Gabriela Celani
UNICAMP, Brazil

Giuseppe D'Angelo
FIAT Research Center, Italy

Joost Duflou
University of Leuven, Belgium

Klaus Sedlbauer
Fraunhofer-Instituts für Bauphysik IBP, Germany

Lawrence Sass
MIT, USA

Marco Santochi
University of Pisa, Italy

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instituto politécnico de leiria

FACULDADE DE ARQUITECTURA
UNIVERSIDADE TÉCNICA DE LISBOA

ICT in energy efficiency – The need for a European effort

Written by Patrizia Toia, MEP

Information and Communication Technologies have, by far, started one of the most important and "drastic revolutions" since the industrial one.

The world has become much smaller in the last decades, we can find anything we want in mere seconds and talk with a friend from the other side of the planet. Doing so is also becoming increasingly cheap.

ICT also allows us to receive and monitor a previously unheard of amount of information. Such information can represent a countless number of opportunities that we are just starting to explore and thanks to new technologies, we continuously find new hidden treasure and new applications to ameliorate our daily life.

Information and communication technologies (ICTs) represent an important sector, not least, in fact, because of the weight they carry in the European economy: they account for 7% of the European labour force and 6% of GDP, thus a significant share of the European economy and of the European productive and labour force too.

ICTs will stimulate European industry and boost the new technologies market. In concrete actions they can represent changes that can lead to a way of producing, living, travelling and consuming in our society: to a second industrial revolution that, for many, will actually characterise the future of social and economic life, not only on our continent but throughout the entire world. ICTs can play a major role in achieving a transition from our economy to a sustainable economy in terms of environment protection and industry recovery.

This major contribution to change our economy and way of life comes from a change into the sector producing communication, microelectronic and other instruments aiming at consuming less energy, and which are thus inherently more efficient.

According to data from the European Commission through the achievement of targets laid down by the 20/20/20 package, ICT can lead to a very substantial reduction in emissions (today, the transport sector consumes 26% of the energy in Europe, and 40% is consumed in homes for heating and cooling, depending on the season) and can realize very high levels of efficiency.

In order to facilitate the transition towards a more efficient use of energy thanks to ICT, to implement existing solutions and develop new ones, there is the need to involve all possible stakeholders, regardless of their nature, governments, the European Union itself, private businesses and research institutions.

Research and development are key elements of our strategy. We must improve existing technologies and support new ones. Making progress in this area will enable to maintain the EU's industrial lead in the world and create jobs.

The current 20% target has given a real push and allowed for real investments. We have paved the way and incentivised companies to make investments, and we want to go further in this direction, looking to 2030.

The European Parliament is continuing to ask for integration and increased investments, but how can we achieve important goals without the resources we need? Cuts on Horizon2020 or the 89% reduction of the budget for the Connecting Europe Facility for ICT raise serious questions.

Our future should be linked to the word growth; and investments in ICTs can contribute in achieving major goals, reducing carbon emissions and improving the quality of life of Europeans.

Laboratory for Manufacturing Systems & Automation

The **Laboratory for Manufacturing Systems & Automation (LMS)** is oriented in research and development on cutting edge scientific and technological fields. LMS is involved in a number of research projects, funded by the EC and European industrial partners. Particular emphasis is given to its cooperation with the European industry, as well as with a number of "hi-tech" firms. LMS is under the direction and technical management of **Professor George Chryssolouris**. For many years, LMS has been involved in the energy & eco-efficiency research in several manufacturing industrial sectors, in cooperation with major European companies, namely the PRIMA INDUSTRIE SPA, CENTRO RICERCHE FIAT SCPA, NEWBURGH ENGINEERING CO LIMITED, GORENJE ORODJARNA, et al.

Recently, LMS manages an EC funded project called ENEPLAN (ENergy Efficient Process pLANning system). The main objective of ENEPLAN (Figure 1) is the development of manufacturing systems that will be highly flexible, and at the same time, closely adapted to the single product. These manufacturing systems require that an engineering tool cover the entire plant operation, from the overall planning, as is the route that the product follows within the plant and the scheduling of the production, down to the individual process programming, namely the process operation, energy efficiency, etc.

ENEPLAN *Energy Efficient Process Planning System*

Figure 1: ENEPLAN logo

Manufacturing processes use one or more physical mechanisms to transform a material's form or shape. The energy required for such operations is considered as an input of the process, which is partially transformed into useful work, embodied into the form and composition of the products, while the rest is transformed into heat lost. Only a small part of the consumed energy is used for the actual value-adding process, while the bulk of the energy is used to creating stable process conditions in peripheral functions too. Energy efficiency becomes a driver of manufacturing industry, since the latter is historically one of the greatest energy consumers and carbon emitters in the world. The manufacturing sector is responsible for about 33% of the primary energy use and for 38% of the CO2 emissions globally. Moreover, the increasing price of energy and the current trend of sustainability have exerted new pressure on manufacturing enterprises that have to reduce energy consumption for both cost saving and environmental friendliness. The challenge for manufacturing companies is that the assumed dichotomy between competitive and environmentally friendly operations, by finding a way to produce "more with less".

The ENEPLAN project (Coordinator PRIMA INDUSTRIE, Partners: CRF, GORENJE, NEW, FINNPOWER, GIZELIS, GIGANT, TEKS, IAM, EXALCO, LMS, VTT, ITIA-CNR, AMRC, CADCAMATION, CASP & IDEKO) will deliver a manufacturing planning decision support tool for the optimization of the plant's operation that will be used from the conceptual phase of the product to its final dispatch to the customer. This network based Meta-CAM tool will promote green and flexible manufacturing by achieving better production line energy & eco-efficiency and a quick response to the market demands.

The key objectives of the project include:

- Environmental footprint reduction in metal components through the selection of a more energy efficient combination of processes among those available in the existing supply chain
  - » 40% lifecycle energy consumption
- Energy efficiency improvement in working conditions
  - » 30% energy consumption
- Multi-process, multi-company distributed control
  - » Use of unique control along the entire supply chain, ability of using the system to adapt work sequences and process routes to the most efficient working conditions

The developed Meta-CAM tool will use a modular approach for its architecture (Figure 2) resulting in higher customisation, adaptability to new conditions and more exploitation options. The Low Level module will deal with the energy consumption optimisation at process level, by means of advanced process monitoring techniques to adjust the developed mathematical process models on-line. The High Level module will then propose an optimised process plan based on the resources available and user requirements. In order for eco-efficiency, to be further increased a weather forecasting module, allowing the Meta-CAM tool to synchronize production with green energy availability, will be integrated.

ENEPLAN will promote breakthroughs on scientific and technical excellence, by moving three industrial sectors (automotive, aeronautics and domestic appliances) and the partners involved in the vertical value chain, towards a multi-objective optimized production (Figure 3).

The automotive business case investigates the production of a seat frame. The Meta-CAM tool will facilitate the evaluation of different technological scenarios and materials, suitable for a targeted volume. The results will provide optimization of the production cost, energy and raw material consumption within the target of a specific production rate at the same product's mechanical performance.

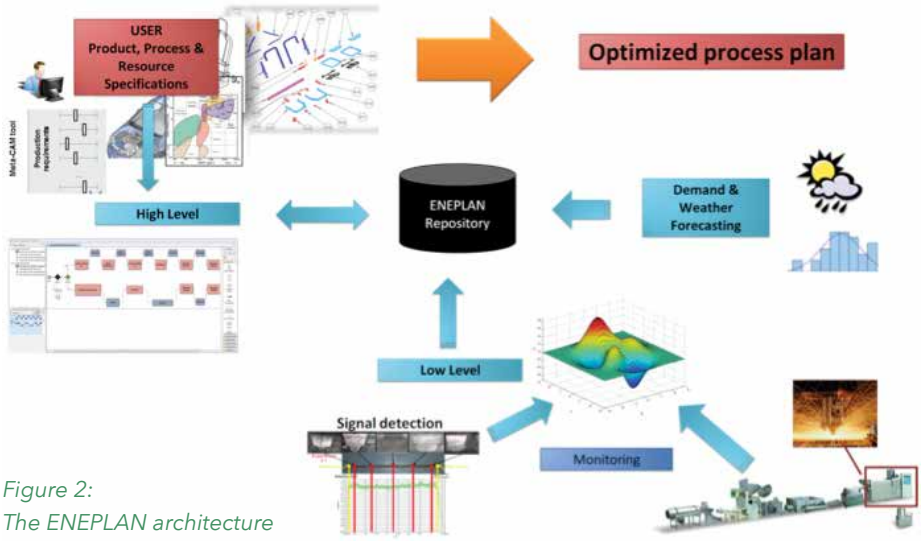

Figure 2: The ENEPLAN architecture

Figure 3: The ENEPLAN business cases

The study of the aeronautics business case is the production of the Loading Ramp Hinge of a military aircraft. Its target is the energy consumption reduction and the improvement in the carbon footprint of the factory.

Finally, the household business case investigates six versions of the refrigerator front door panels. These parts are high quality demanding (visible surfaces without aesthetical faults and all dimensions within tolerances). The tool will assist in formation and evaluation of alternatives towards the reduction of the environmental footprint.

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Moving towards sustainable intelligent manufacturing

Written by Helena Bartolo

Sustainability has been a key concern for government policies, business and general public. In recent years, a growing economic activity has been accompanied by growing concerns about climate change, energy efficiency and the shortage of natural resources, while industries are moving for a more sustainable production. Sustainable development is defined by UN as meeting the needs of the present without compromising the ability of future generations to meet their own needs. With sustainable development arises the huge challenge of combining innovative ideas regarding design, materials and products with non-polluting processes and technologies, conserving energy and other natural resources.

Rising efficiency in resource and energy use and innovation to improve environmental performance can help to create new industries and jobs. The current economic crisis and negotiations to tackle climate change can be an opportunity to shift to a greener economy. Model cities are moving forward towards novel ecosystems, combining environmental, social and economic issues in more inclusive and integrated frameworks.

Advanced manufacturing technologies are bringing about a swift change in the way products are developed, manufactured and sold, which are introducing profound transformations in the global competitive market. A model developed by John Elkington, combining financial profitability, environmental integrity and social equity, is used by the National Council for Advanced Manufacturing to help manufacturers in the U.S. move toward sustainable manufacturing through efficiency to industrial ecology and creating business opportunities within the sustainable manufacturing paradigm.

The US Department of Commerce defines sustainable manufacturing as the creation of manufactured products using non-polluting processes,

economically sound and safe for employees, communities and consumers, conserving energy and natural resources.

Innovation has long been seen as key to economic performance and social welfare, being increasingly recognized as a significant driver of economic growth. The OECD defines innovation as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organization or external relations".

Innovation and research are central for Europe 2020 strategy, prioritizing actions to encourage investments in new technologies, improve the business environment and facilitate SMEs access to markets and finance. Horizon 2020 intends to transform research into industrial innovations, to boost industrial clusters and strengthen regional economic development, advancing sustainable production. This is a major European KET target which will introduce a profound change in regional economies turning them into smarter and more sustainable ones.

The rise of manufacturing intelligence is fuelling innovation in processes and products considering a low environmental impact over the product's lifecycle. Sustainable manufacturing will allow creating business opportunities for manufacturers, reducing negative environmental impacts.

Sustainable intelligent manufacturing is regarded as a manufacturing paradigm for the 21st century, towards the next generation of manufacturing and processing technologies. The International Conference on Sustainable Intelligent Manufacturing (www.sim.ipleiria.pt) conjointly organized by the Centre for Rapid and Sustainable Product Development, Polytechnic Institute of Leiria, and the Faculty of Architecture, Technical University of Lisbon, taking place this Summer, at Lisbon, Portugal, from June 26 to June 29, 2013 is expected to attract worldwide participants with distinct backgrounds, such as engineering, architecture, design and management, all concerned about sustainability issues. The Conference aims to provide a major international forum for academics, researchers and industrial partners to exchange ideas in the field of sustainable intelligent manufacturing and related topics. The conference expects to foster networking and collaboration among participants to advance the knowledge and identify major trends in the field.

Things are looking up

By Eric Dautriat, Executive Director of Clean Sky

Investment in environmental friendly technology is an investment in our future. Clean Sky's mission is to help make that a reality. And despite the economic downturn that trend has not weakened. Global demand in all aviation segments shows resilient growth of more than 4% per annum with an estimated need for 40,000 new aircraft in the next 20 years.

Environmental-friendliness and competitiveness go hand-in-hand in the long run, as regards CO2 emissions, noise and local air quality. Our sector must not only maintain but increase its competitiveness to benefit from global growth in civil aviation. Clean Sky's mission is to develop a substantial share of the cutting-edge technology that will help to achieve the environmental goals of the aeronautics industry. This growth will not only benefit large companies: almost 40% of the winners of our calls for proposals are SMEs. This is essential to the strengthening of the European supply chain.

Clean Sky works on six technological platforms, called Integrated Technology Demonstrators (ITD), each of them co-led by two European aviation industry leaders. All of them: large aircraft, regional aircraft, rotorcraft, engines, eco-design, and systems are achieving concrete results, up to large integrated demonstrators, which are the bulk of the Clean Sky contribution to innovation. The first demonstrators, one large turbofan engine for long-range aircraft, and one Turboshaft for helicopters, are currently being tested. Others, like novel wings, electrical systems, lightweight structures, will follow from now on, up to 2016.

Those demonstrators represent cutting-edge technology developed to help meet by 2000 the four environmental goals set by the Advisory Council for Aeronautics Research in Europe (ACARE). First, 50% reduction of CO2 emissions through drastic reduction of fuel consumption, second 50% reduction of external noise, third 80% reduction of NOx (nitrogen oxide) emissions and forth a green product life cycle including design, manufacturing,

maintenance, disposal and recycling. Our website, www.cleansky.eu, keeps track of them. We also welcome any interested enterprise, policy-maker, researcher and others to attend our info-days and other events to learn about us and be part of our exciting project.

The cutting-edge technology we develop will be on show very soon. In just a few weeks the 50th edition of the Paris Air Show will open its doors to aeronautics professionals and the public at large. Clean Sky will not miss the opportunity to be part of the greatest international air show and the entire team, in close cooperation with ITD leaders and with the support of the European Commission both being Clean Sky founding members.

Clean Sky will be present via its stand and a conference programme built up around Clean Sky 2 and two other important topical themes: The Technology Evaluator and Eco-Design, which are both interesting specificities of our Joint Undertaking when compared to any other aeronautical research programme.

Clean Sky is focused on high technological maturity products, and involves the active participation of the European large aircraft manufacturers, working together. The timescale of the activities must be adapted to the industrial strategies, in order to be ready at the right moment when a new generation of products will enter development. Only a dedicated entity with both public and industrial involvement can manage such a programme, with both the necessary flexibility and a constant concern of keeping the overarching objectives. Today Clean Sky, building on its core of industrial leaders, involves more 500 participants from 24 European countries.

The wide appetite for a Clean Sky 2 programme throughout industry, SMEs, Research Organisations and Academia, is an evidence for the appropriateness of this instrument for research and innovation.

We are working on the continuation of the Joint Technology Initiatives within Horizon 2020, with a new set of ambitious objectives, having in mind that global competitiveness can only be achieved through industrial leadership in Europe and by supporting Europe's knowledge economy. Clean Sky 2 is now approaching a critical phase where the European Commission and industry are building up an agreed scope and funding before it can be formally sent to Council and the European Parliament for discussion and final approval by the Council by the end of 2013. We trust we can soon report the good news.

Get more information about Clean Sky and Clean Sky at Paris le Bourget on **www.cleansky.eu**

Meeting the fuel-burn challenge

For business or for pleasure an average 8 million people - equivalent to the population of Switzerland - are travelling by air every day of the year[1]. Aviation plays a major role in the world economy, contributing 3.5% to global GDP[2], transporting people and goods across the planet.

As air traffic continues to grow to meet the needs of the world's economy, protecting the environment and reducing emissions is a priority for the aviation industry. Combined road, rail and air transport contribute 13 %[3] to global man-made CO_2 emissions and although air traffic contributes just 2%[2] of global man-made CO_2, reducing its impact on the environment through innovation is a key driver for Airbus.

Energy costs are rising and the highest overhead for airlines is the 30-40% of their operating costs that are spent on fuel each year. Across the aviation industry all players are working together to reduce the amount of energy required to meet our global transport needs and whilst aviation has grown by around 4% per year since 2000, fuel burn has only increased at a quarter of that rate.

The good news is that lower fuel burn means less CO_2 emissions – for every tonne of fuel saved, 3 tonnes less CO_2 are emitted. It's in everyone's interest to reduce the energy needs of aviation!

AIRBUS INNOVATIONS LEADING THE FIELD

Airbus invests over 2billion euros annually in Research and Development to improve the performance of its products and ensure that the right aircraft are available at the right time. The last five years have seen the introduction of one hundred of the world's biggest airliners, the Airbus A380, into the worldwide fleet, each offering a demonstrated 20% less fuel- burn and emissions than the aircraft they replace. Airbus has been actively filling the technology pipeline; the A320neo, the world's fastest selling single aisle aircraft, is set to dominate the horizon from its entry into service in 2015, bringing at least 15% reductions in fuel and emissions. The A350 XWB, the new extra-wide body mid to long-haul aircraft and the world's most technologically advanced commercial plane, will deliver a tremendous 25% fuel efficiency improvement and is set to take off on its first flight this year.

Each new generation of Airbus aircraft is cleaner, quieter and more fuel efficient. Airbus is continuously seeking new ways to make energy gains through improvements to engines, systems and airframe technologies. A good example of these ongoing improvements is the recent introduction of Sharklets, large wing-tip devices improving aerodynamics, that are today providing up to 4% fuel-efficiency advantages per aircraft.

BRINGING AIR TRAFFIC MANAGEMENT INTO FOCUS

One key to reducing fuel-burn and emissions is Air Traffic Management (ATM). The International Civil Aviation Organisation (ICAO) has stated that 8% of world aviation fuel is wasted through inefficiencies in current ATM capabilities worldwide. A modern ATM system would save around 10 million metric tonnes of fuel a year and 4 million hours of delays.

Whilst these improvements are available today, they require investment and action on national and international levels. All new Airbus aircraft are capable of using state-of-the-art integrated technologies offering optimised flight plans taking into account air traffic factors such as weather conditions, the best available and the shortest routes, but the technology is a step ahead of the ATM capabilities in place in many parts of the world. Airbus' ATM company, Airbus ProSky, supports the acceleration of performance improvements by offering innovative solutions available today. These solutions cover flights from gate-to-gate and are tailored to meet Air Navigation Service Providers', airlines' and airports' specific needs. They offer increased operational efficiency, optimised use of existing capacity, more direct flight routes and improved airport operations.

Airbus ProSky's experts are involved in many international initiatives to help accelerate and support the implementation

[1] ICAO 2012 Annual Passenger figures (Annual total 2.9 billion passengers in 2012)

[2] Aviation, Benefits Beyond Borders/ATAG 2012

[3] IPCC 4th Assessment Report 2007

of the Single European Sky ATM Research programme, SESAR, working to build the future European Air Traffic Management system, as well as the US Federal Aviation Administration's Next Generation (NextGen) programme. A strong level of support from European institutions and Member States is crucial to allow the Single European Sky to be fully implemented and revolutionise ATM in Europe, saving emissions, costs and time.

FUELS FOR THE FUTURE

For now aviation requires energy in the form of fuel. Alternative drop-in fuels can provide solutions for the industry to reduce its environmental footprint and its dependency on fossil fuels, but costs are high and ensuring a sustainable and affordable supply of alternative fuels for aviation needs the active engagement of all stakeholders and adequate policy and standard making to ensure supply and compatibility with aircraft today and in the future.

In June 2011 Airbus, alongside the European Commission, the leading European airlines and European biofuel producers, launched the European Biofuel Flightpath, committed to the objective of producing 2 million tonnes of alternative fuels for aviation in Europe by 2020. The Biofuel Flightpath members are engaged in supporting and promoting the production, storage and distribution of sustainably produced drop-in biofuels that do not compete with food production, land use or water.

LIFECYCLE COMMITMENT

Airbus is committed at every stage in the aircraft lifecycle to reduce its environmental impact and increase efficiency. Through design, production, operations and end-of –life, Airbus has put into place the guarantees necessary to achieve the highest possible environmental performance. In January 2007, Airbus became the first aerospace enterprise to receive ISO14001 environmental certification covering all of the company's production sites and products throughout a lifecycle approach.

Airbus is actively engaged in investing in sustainable practices through people and innovations for a sustainable future.

environment@airbus.com

Powering the future of flight

By Haldane Dodd, Air Transport Action Group, Geneva

If you had spoken to aeronautical engineers even seven years ago about the prospect of flying commercial aircraft on biofuels, a great many of them would have dismissed the idea. Back then, biofuels were being used for automobiles and were liquid fuels such as ethanol – this cannot be used in aircraft engines, as it freezes easily which is a problem when you are flying at 35,000 feet and many degrees below freezing. But in early 2008, after a short period of testing, a Boeing 747-400 took off from London's Heathrow Airport on an historic flight, the first to use a new type of advanced biofuel in a commercial jet aircraft.

Since then, the prospect of sustainable biofuel powering the world's fleet of aircraft has become a reality. We received certification from standards agency ASTM in 2010 that biofuels using two processing pathways were safe to use in passenger services and in all, over 1,500 commercial flights have taken place so far. We have several advantages in looking at biofuels for aviation:

- **The fuels we are using and researching are so-called 'drop-in' fuels.** They have a very similar chemical structure to the Jet A-1 fuel we use today. Therefore, no new engines or aircraft are needed. We can run on 100% biofuel if needed (and indeed a test flight last year did just that). It also means that we can simply add it to our airport fuel supplies as and when it is available.

Some airlines are already flying commercial services on sustainable aviation biofuel

- **We came to the game late.** We were able to learn from the mistakes made previously. For example, the mandate for automobile biofuels introduced in Europe created a ready market, but also forced

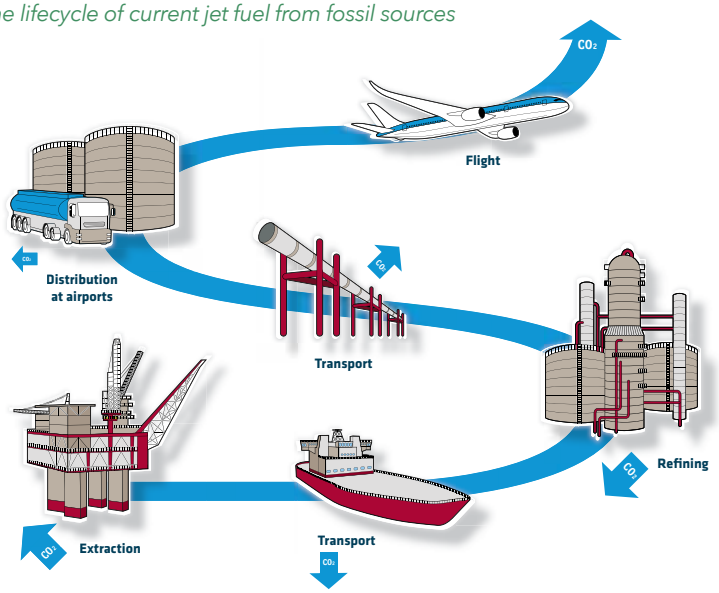
fuel suppliers to find biodiesel and ethanol from any source, including those that had a truly devastating impact on rainforest, water use, land use change and local communities around the world. We can avoid these issues.

- **We have a very condensed distribution system.** Around 190 airports see 80% of the world's civil air transport. Compare this to 131,000 service stations in Europe alone. We also consume around 10% of the liquid fuel used in transportation. So aviation is a prime candidate for an easy transition for one sector to more non-carbon energy sources.

- **It could reduce aviation emissions by 80%.** Based on a full carbon lifecycle assessment, researchers have shown that the right aviation biofuels could reduce emissions from our sector by up to 80% compared to traditional jet fuel. This would help go a long way to achieve our industry driven targets for emissions reduction from aviation – the most ambitious of industry sector worldwide. From 2020, we will cap out net aviation emissions and by 2050, our goal is to reduce aviation emissions worldwide to half of what they were in 2005.

- **It is our only option.** We will be flying on liquid fuels for the foreseeable future. Unlike other transport modes, we cannot use alternatives such as electricity. Therefore we are stuck on high-energy liquid fuels. While we have managed to reduce our fuel consumption impressively – modern aircraft are well over 70% more fuel efficient than the first jets and have a similar per-passenger fuel consumption as small cars – fuel still makes up over 30% of an airline's operating costs.

The lifecycle of current jet fuel from fossil sources



Two of the many potential sources for sustainable aviation biofuel, camelina (top) and algae

Airlines spent around $200 billion on fuel last year, around 30% of their operating costs

There is a huge amount of research and activity happening around the world on this issue. British Airways is working to build a plant in East London to convert the household waste normally destined for landfill into enough jet biofuel to run its operations at London City Airport. SAS is leading a Nordic Aviation Biofuels Initiative which shows great promise in delivering the needed investment in that part of Europe. Airbus is working with Tarom Airlines to look at the whole value chain for an aviation biofuels industry in Romania. Virgin Atlantic have signed up to take the output of a new biofuel process from Lanzatech which will take the exhaust gases of steel production and turn it into jet biofuel. Dutch Airline KLM has already started weekly flights between Amsterdam and New York using biofuel made from used cooking oil through its fuel subsidiary SkyNRG. And these are just the European examples.

While there is a strong desire among airlines to use this new fuel, there remains a big barrier: price. Currently, most aviation biofuel is only made at specialist, one-off batch quantities, which means the price is about three to five times that of regular jet fuel. As production ramps up,

it will come down, but we need to try and kick start this process fast, in order to bring down the price until it is comparable with traditional jet fuel.

We are asking governments for assistance to do this. In particular:

1. **Foster research into new feedstock sources and refining processes:** Policy enablers include establishing funding programmes for academic research through existing or new university, research institution or industrial research projects.

2. **De-risk public and private investments in aviation biofuels:** These incremental upfront capital investment costs are a potential barrier to commercialisation. In this context, governments can play a role in reducing this risk through measures such as loan guarantees, tax incentives, grants and co-financing for pilot and demonstration projects.

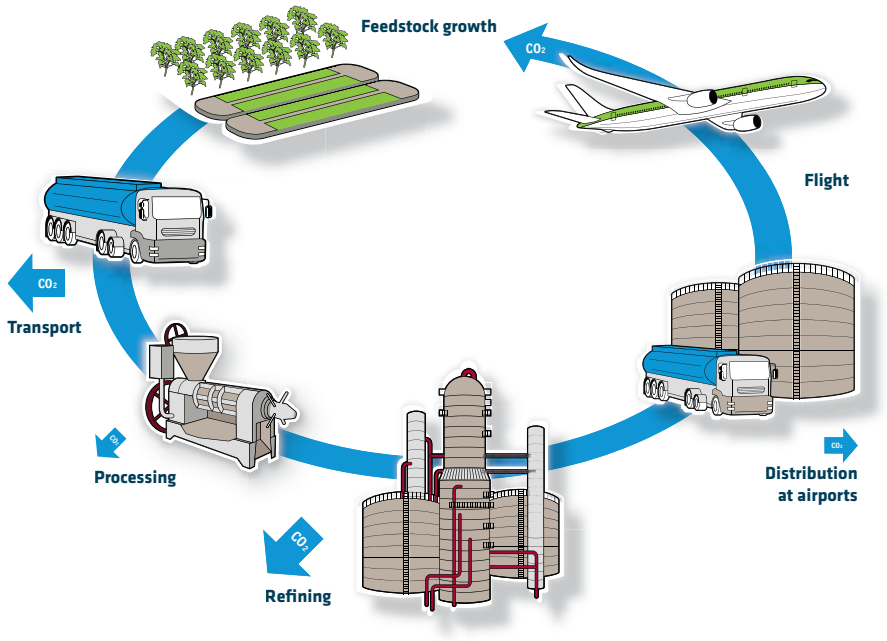
3. **Provide incentives for airlines to use biofuels from an early stage:** Crafting policies that create a level playing field for biofuels vis-à-vis other energy sources, and aviation vis-à-vis other sectors, is a key element in aviation biofuels commercialisation.

4. **Encourage stakeholders to commit to robust international sustainability criteria:** The development of an accepted set of globally harmonised standards will help ensure that investment is directed at biofuels that meet acceptable sustainability criteria, thus minimising this form of risk.

5. **Understand local green growth opportunities:** By bringing the aviation industry, government, biofuel, agriculture and academic expertise together, analyse the optimum opportunities that exist in your country for aviation biofuel production including the most effective feedstock sources and infrastructure requirements.

6. **Establish coalitions encompassing all parts of the supply chain:** Those seeking to better understand potentials for this industry should engage with the processes outlined in this document to understand next steps in each region.

The lifecycle of sustainable aviation biofuels – with a potential to reduce CO_2 by 80%



By following these steps, we can help ensure a sustainable future for aviation, an industry which supports nearly 57 million jobs and 3.5% of the world's GDP, not to mention connectivity and support to exporters and businesses the world over. The aviation industry is committed to bringing down its carbon emissions and biofuels will go a long way to helping us achieve that.

For further information, readers can check www.enviro.aero

The Air Transport Action Group is a coalition of aviation industry leaders working together on sustainability challenges. www.atag.org

The future of engines begins today

The growth in commercial air traffic is continuing unabated. Air travel has become an afford-able and convenient means of transportation for holiday-makers and business people alike. And without air freight, people would have to do without many of the amenities to which they have become accustomed in their daily lives. At the same time, the conscious use of re-sources is becoming ever more important in the aviation industry. This is why future aircraft and engines must be more fuel-thrifty, cleaner and quieter. MTU Aero Engines has for many years been working on innovative technologies to further improve the environmental com-patibility and eco-efficiency of next-generation engines.

The key to success is the geared turbofan™ developed jointly by Pratt & Whitney and MTU. The two companies are building a highly efficient engine that burns 15 percent less fuel, emits 15 percent less carbon dioxide and cuts the perceived noise level in half. With its high-speed low-pressure turbine and parts of the high-pressure compressor, MTU Aero Engines is contributing key components to this new propulsion system. The first engine of this new fam-ily of environmentally friendly engines incorporating MTU technology will make its debut on the Bombardier CSeries jet, followed by the engine for the Mitsubishi Regional Jet. Other business jet manufacturers that have also opted for this eco-efficient powerplant are Embraer and Irkut. The geared turbofan concept is catching on: With more than 3,500 orders received to date, the engine has meanwhile developed into a bestseller.

The idea behind the geared turbofan, or GTF for short, is as compelling as it is simple. A gearbox between the fan and the low-pressure turbine – hence the name "geared turbofan" – permits these two components to rotate at different speeds. The turbine and fan are decou-pled by the reduction gearbox so that they can run in their ideal operating ranges. The fan rotates more slowly and the turbine much faster, the reduction ratio being approximately 1:3. Thus, both components can reach their optimum performance level, which greatly boosts the geared turbofan's overall efficiency. The result is a significant reduction in fuel consumption, emissions of carbon dioxide, and noise. Moreover, the propulsion system is much lighter than a

conventional engine as it has fewer stages, and hence a lower parts count.

An indispensable key component of the GTF is MTU's high-speed low-pressure turbine. Germany's leading engine manufacturer has for many years been specializing in low-pressure turbines and has become the world's technology leader in this field. In spring 2013, the company received two recognitions for its game-changing development: the German In-novation Award 2013 and the German Industry's Innovation Award 2013. In the jurors' opinion, MTU's new high-speed low-pressure turbine is a perfect combination of efficiency and sustainable use of resources. It moreover significantly reduces the emissions of com-mercial medium-haul aircraft. "For the aviation industry, GTF technology marks a tremen-dous leap forward that will benefit manufacturers, customers and airport noise-plagued resi-dents alike," according to the laudatory speech.

But MTU does not sit back and rest on its laurels. The geared turbofan offers even greater savings potential, and the long-standing Munich-based company is already working on its optimization. With its Clean Air Engine (Claire) technology initiative MTU aims to reduce fuel consumption and carbon dioxide emissions by 30 percent by the year 2035. This can be achieved by making thrust generation even more efficient, by the further development of in-dividual components or through the use of a heat exchanger. MTU Aero Engines will cer-tainly not run out of ideas on how to successfully attain the goals it has set for itself. ●

Grey fades into Green: from fossil fuels to renewable fuels

Mr Luc Tytgat, Director Single Sky

THE CONTEXT

Emissions from aviation contribute to 3.5% of the total CO2 emissions in Europe. If this ratio is low, it could nonetheless potentially have a major impact on global warming as aviation emissions are expelled at high altitudes. Besides, there will be more of them in the future as air traffic is expected to grow at around 3% per year[1].

Reducing aviation's emissions impact features prominently in the high level objectives contained in the European Commission's Transport White Paper[2] and the Flightpath 2050[3] report, which outlines air transport's perspective for sustainable growth and potentially reliable energy supplies, while boosting European competitiveness on the global market.

To reach all those objectives, Europe takes the position that there is no single solution but a set of mitigation strategies that should be implemented simultaneously. These strategies include:

- R&I (research and innovation) on aircraft efficiency (Clean Sky)[4] and on ATM (SESAR)[5];
- Improved operational procedures, optimisation of traffic flows and airspace reorganisation;
- The promotion of effective regulatory landscape and sound emission standards;
- R&I on new pathways and the deployment of jet biofuel;
- Market-based instruments for emissions (European Emission Trading Scheme-EU ETS);
- Incentive policies (financial instruments);
- Promotion of alternative transport modes.

The undeniable social and economic benefits that aviation provides could be threatened by high and volatile fossil fuel prices and the fact that some energy sources are finite. This is reflected by airlines' energy expenses, which currently make up to 30% of their operating costs; this has triggered airline's pleas for the immediate deployment of alternative fuels.

However, taking aviation's physical and chemical requirements for fuel into consideration, the sector can only rely on alternative liquid fuels; ground transport has more low carbon alternative options. This makes renewable jet fuel the only one that can effectively lower carbon emissions and reduce the economic impact of increasing and fluctuating oil prices.

BARRIERS TO THE RISE OF ALTERNATIVE FUELS

As they use renewable feedstocks to replicate the composition of conventional kerosene, alternative fuels are considered to be renewable and fit for purpose. As such, their properties make them fungible with conventional kerosene and associated infrastructure.

Despite a strong demand for renewable jet fuels, deployment is still a challenge, due to a number of factors:

[1] http://www.eurocontrol.int/documents/eurocontrol-long-term-forecast-flight-movements-2010-2030

[2] http://ec.europa.eu/transport/themes/strategies/2011_white_paper_en.htm

[3] http://ec.europa.eu/research/transport/publications/items/vision2050_en.htm

[4] Clean Sky is the EU research project leading an earlier introduction of new and radically greener air transport products

[5] SESAR as Single European Sky Air Traffic Management (ATM) Research is the EU collaborative project that is intended to completely overhaul the European airspace and its Air Traffic Management (ATM) system.

Emissions	
2012 SITUATION	→ CO_2 emissions by aviation represent 3.5% of total CO_2 emissions
Improved management of air traffic flows and air navigation services will reduce CO_2 emissions by aviation by 6% in the medium-term	Continuous performance improvements
Improved airspace management will reduce CO_2 emissions by aviation by another 2% in the medium-term	
R&I in air traffic management (SESAR programme) will further reduce CO_2 emissions by aviation by 10% in the medium to long-term (2030)	
IN THE LONG-TERM *(at 2013 traffic level)*	→ CO_2 emissions by aviation will represent 3% of total CO2 emissions
Traffic	
Long-term (2010-2030) traffic forecast: a challenge for emission reduction	→ 3% annual traffic increase
Biofuel versus fossil fuel	
Airlines' energy expenses: 30% of operating costs	→ Insufficiently competitive cost ratio of 2:1 (2012) between biofuel and fossil fuel

- The biofuel value chain is not yet competitive compared with fossil fuels (the cost ratio is estimated at 2:1) and has consequently not yet been commercialised on a large scale;
- There is a lot of competition for feedstocks between transportation sectors;
- The EU policy landscape is evolving: the recent revision of ILUC[6] potentially excludes some possible raw materials;
- The regulatory regime is fragmented (EU ETS mainly operates in the EU member states; there are variable geographic/regional requirement for sustainability criteria[7]);
- Carbon prices have fallen to a record low, prompting stakeholders to question the pertinence of the EU ETS instrument.

AN INTERIM WAY FORWARD

While large-scale deployment of renewable fuels cannot be envisaged as contributing to the reduction targets in the short-term, Europe can still rely on some present-day initiatives that reduce fuel consumption:

Performance scheme regulation

The performance scheme is a central element of the SES (Single European Sky) regulation which aims at ensuring more sustainable, better performing aviation and at de-fragmenting the European airspace.

It covers en-route and airport/terminal flight phases and the focus is on flight efficiency (reduction of fuel consumption and therefore CO2 emissions) by improving Air Traffic Flow Management (ATFM) and Air Navigation Services (ANS). In this context, increased flight efficiency will reduce the 3.5% aviation part of the total European CO2 emissions by 6%. Some 20% of this figure is related to airborne holding, around 12% to taxi-out phase and the remaining share of 68% to en-route legs.

Civil/Military coordination, the Flexible Use of Airspace (FUA)

"About one third of European airspace is designed for military use. The basis for the FUA concept is that airspace is no longer designated as either "military"

[6] Indirect Land Use Change (ILUC). When biofuels are produced on existing agricultural land, the demand for food and feed crops remains, and may lead to someone producing more food and feed somewhere else. This can imply land use change (by changing e.g. forest into agricultural land), which implies that a substantial amount of CO2 emissions are released into the atmosphere.

[7] The Directive 2009/28/EC sets out sustainability criteria for biofuels in its articles 17, 18 and 19. These criteria are related to greenhouse gas savings, land with high biodiversity value, land with high carbon stock and agro-environmental practices.

or "civil" but is viewed as one continuum and used flexibly on a day-to-day basis. Consequently, any necessary airspace reservation for exclusive military use is only of a temporary nature, so allowing civil airspace users to use this airspace at other times," says Director General of EUROCONTROL, Frank Brenner.

The implementation of FUA should contribute to flight efficiency and, combined with the de-fragmentation of European airspace, opens up new possibilities for more direct routings. As such, it is estimated to potentially reduce emissions by 2% per year.

SESAR and Clean Sky European research programmes

Optimised Air Traffic Management in Europe by SESAR has the potential to reduce fuel consumption and emissions by about 10% per flight. Moreover, the European industry has committed itself to reducing CO2 emissions by 50% between 2000 and 2020. This means that new solutions will have to be developed for the design of aircraft, materials, engines and control equipment of actuators such as pneumatic, hydraulic and electric, most of this under the umbrella of the Clean Sky research programme.

RECONCILE

The complexity of the emission mechanisms makes it difficult to address them effectively and impose trade-offs between individual pollutants as well as between emissions and noise.

Emission mitigation must take also into account the reduction strategies, how they interlink and their potential impact on aircraft design. As a recommended solution, policy makers - in cooperation with all stakeholders - should adopt a holistic approach in meeting the requirements of future commercial aircraft, which should fly slower, lower and greener by 2050; they should do this in tandem with the evolution of the ATM performance regulation.

The role renewable fuel plays in green aviation is essential in tackling global warming while improving the competitiveness of the European aeronautic industry, without prejudice to the ATM system's performance.

Research and innovation: 2 key factors for the benefit of the environment

By Francis Couillard, Chairman of the ASD Environment Committee

The Aviation industry is committed to sustainable growth and will continue to bring benefits to citizens for decades to come. It provides close to 9 million skilled jobs in Europe, directly and indirectly, and contributes 600 billion euros to Europe's Gross Domestic Product (source ACARE).

Aviation is vital for the world economy and is growing, particularly in developing economies, but it is also essential that the aviation industry continues to strive to reduce its environmental impacts.

For many years, the aviation industry has invested heavily in research and development to get to where it is today with aircraft much more efficient, and quieter, than those of even a decade ago. Aviation fuel consumption, as well as CO_2 emissions have been reduced by 70% in the last 40 years, while emissions of NOx were significantly reduced at equivalent thrust levels and other pollutants, such as smoke, virtually eliminated. Noise has also been reduced by around 75% in the past 40 years. **And this progress is continuing.**

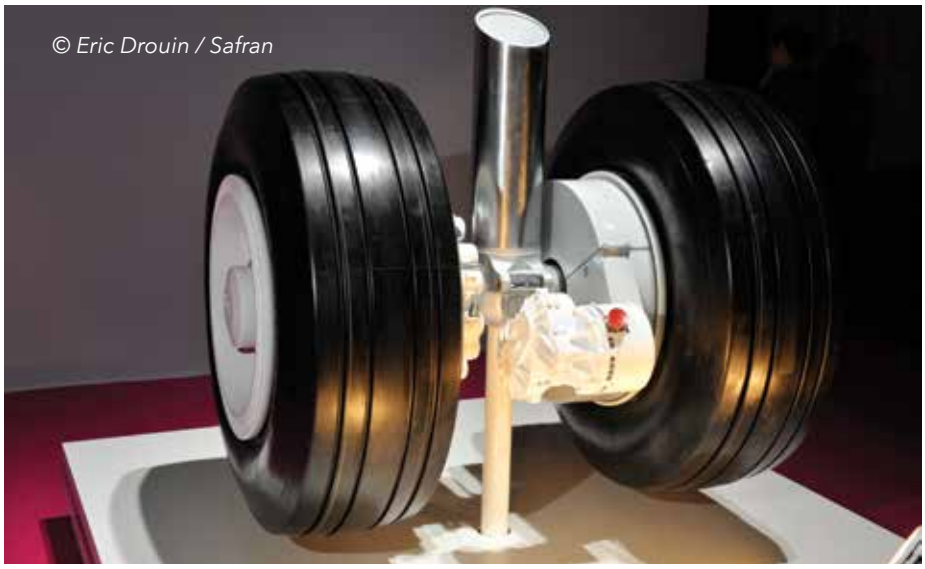
The aviation industry has set its own, global, CO_2 emissions reduction objectives based on the 4 pillars of: technology; operations and infrastructures; air navigation services; and global market based measures. This will enable the sector to lower emissions by 1.5% per year until 2020, reaching carbon neutral growth around 2020 and aspire to a net reduction, by a factor of 2, of these emissions by 2050 relative to 2005 levels.

The European Commissions "Flightpath 2050" vision for aviation has set targets for the following achievements by 2050: CO_2 emissions per passenger–kilometre to be reduced by 75%, to support industry objectives; NOx emissions reduced by 90%; and reductions in perceived noise of 65%, again all relative to the year 2000. In addition, these goals also include aircraft movements being emissions free when taxiing and air vehicles being designed and manufactured to be recyclable.

Aviation is on track to meet these objectives, but a lot still remains to be done for the future. The next generation of aircraft which will enter into service in the middle of this decade will see reduced noise, engine fuel consumption reduced by 15%, airframes also featuring many innovations such as improved wing-tip devices called 'sharklets'. Already, advances in airframe technology, such as the extension of the use of composite materials in the fuselage and wings, are making an important contribution and will continue to do so (e.g. the Airbus A350 XWB will be a 50% composite aircraft).

Better operations, thanks to a more coordinated air-traffic management system and better infrastructures, are also expected to bring their share of improvements. SESAR (Single

Francis Couillard



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European Sky Air Transport Management Research) should bring another several per cent reduction in air transport CO_2 emissions due to the better availability of optimised routes and reduced delays.

Airframe and engine manufacturers are actively helping development of sustainable biofuels. They have already participated in the certification of 'drop-in' biofuels from Fischer-Tropsch and HEFA process, for use in blends, of up to 50%, with oil derived kerosene. Industry is also participating in the initiatives aimed at developing these new sustainable biofuels based on resources containing sugar, not used for food or Algae which also offers potential and provides a much better life-cycle carbon balance.

Other improvements such as the use of more electrical power on aircraft are also very promising: for example, 'Green taxiing' technology which uses electric motors mounted within the aircraft wheels is being developed. This has the potential to reduce CO_2 emissions by around 4% as well as reducing NOx, particulate matters and noise around airports. There are also other advantages such as reducing the use of brakes during ground operations.

Technology evolution must follow careful steps as safety remains the number one priority of manufacturers and regulators. Huge investments in R&D are necessary, and European Commission public – private partnerships should allow the implementation of important research programs such as the Cleansky Joint Technology Initiative which, while it remains work-in-progress, has already started to deliver encouraging results.

Research is still on-going to further reduce aircraft fuel consumption, by using revolutionary engine concepts such as open rotors which could bring an additional 10% improvement in fuel consumption by 2030 compared to the generation of engines entering into service in 2015 / 2016.

Manufacturers work together under the organisation called the International Coordinating Council of Aerospace Industry Associations (ICCAIA) which works closely with the International Civil Aviation Organisation (ICAO) to help develop agreements on new environmental regulations and standards. ICCAIA supports the work of ICAO CAEP (ICAO's Committee on Aviation Environmental Protection) for advancing standards, which reflect improvements in emissions and noise capability, and now in developing new metrics and standards for aircraft fuel efficiency. This is essential in recognising the need that, for a global business, it is of utmost importance to have global solutions.

Aviation is committed to deliver significant progress to meet society needs in noise reduction; to reduce climate change impact limiting CO_2 emissions; and improving local air quality by reducing pollutants and particulate matters emissions. This will be done thanks to heavy investments in research and development.

5th EUCASS will take place in July

The fifth European Conference for Aeronautics and Space Sciences (EUCASS) will take place in Munich, Germany, 1-5 July 2013

Eucass is dedicated to cutting edge technology and covers the latest breakthroughs in the enabling sciences. To learn about Europe's R&D programmes and discover the revolutionary ideas that will fly 20 years hence, join us there.

EUCASS (**www.eucass.eu**) is the forum for all aeronautic and space research players in Greater Europe, including Russia. EUCASS also is the natural venue for decision makers; it offers an opportunity for young scientists to meet their peers, senior scientists and industry leaders. The conference reviews the state of the art in aeronautic and space sciences, focuses on advances and innovations, facilitates assimilation of scientific breakthroughs by industry, fosters the cross-fertilisation between aeronautics and space, between academia and end users, and finally offers agencies and industry the opportunity to present their programmes and generate interest from academic labs and Research Establishments.

The very first EUCASS was held in Moscow, Russia, in 2005, followed by Brussels, Belgium, in 2007, Versailles, France, in 2009 and St. Petersburg, Russia, in 2011. This year, it visits the Bavaria state capital Munich, which is an important centre of German air and space industry.

The conference is jointly organized by the Technical University of Munich (TUM) and EADS Astrium under patronage of the Bavarian State Ministry of Economic Affairs, Infrastructure, Transportation and Technology (BStMWIVT) and supported by local and international partners along with the European aerospace societies associated in EU's E-CAero project **http://www.e-caero.com**.

EUCASS 2013 will host within its five symposia "System Integration", "Flight Physics", "Flight Dynamics/GNC and Avionics", "Structures and Materials", and "Propulsion Physics" more than 600 technical papers in 14 parallel sessions over four full days. Its multidisciplinary character is a great added value for those

Munich Frauenkirche in front of Alps
Photo by Reinald Kirchner, CC BY-SA 2.0

curious of what takes place in the fields other than theirs. The "System Integration" symposium will address, among other subjects, environmental issues, multidisciplinary optimisation, energy and power systems, while "Flight Physics" topics of general interest like flow control, heat transfer, transition, shear layers and real gas effects will be covered. Alongside control and avionics, advanced air traffic management and optimization will be discussed in the "Flight Dynamics/GNC and Avionics" symposium. Within "Structures and Materials" focus will be set on e.g. cryogenics, structural dynamics, ceramic and polymer composites and thermal protection systems. The "Propulsion Physics" symposium is one of the most comprehensive forums worldwide and obviously a gathering place for the European Energy Innovation community. Emphasis is placed on cooling, combustion stability, green propulsion and environmental impacts.

In addition to the technical papers, on each day two plenary lectures will be provided where designated representatives from industries and agencies will present their vision on requirements and technical challenges of the future. Lectures on materials for aeronautics and space, electric propulsion, and EU and Russian launcher and mission space programmes will be given. Noteworthy are the sessions on green propellants and the plenary on Clean Sky, a public private partnership between the European Commission and the aeronautical industry, presented by Eric Dautriat.

The conference will be inaugurated on 1 July 2013 by Tom Enders, CEO of EADS, Jean-Jacques Dordain, Director General of ESA, Johann-Dietrich Wörner, Chairman of German Aerospace Center (DLR), Martin Zeil, Bavarian Minister of State, and yet other major players from Europe, Russia and the USA.

EUCASS 2013 is an international conference open to participants and speakers of all nationalities without any restrictions or reservations. International participants and speakers are highly welcome. For details concerning the venue, the registration and the programme, please consult the conference website **www.eucass2013.de**

Key conference information at a glance

Venue:
Holiday Inn Munich - City Centre
Hochstrasse 3
81669 München
Germany.

Key Dates:
May 31, 2013: Early Bird Registration Ends
July 1-5, 2013: Conference

Fees:*

	Regular	On-Site
Regular Fee	€950.00	€1050.00
Student Fee	€400.00	€450.00
Extra Tickets	€70.00	€70.00

* for details and payment, please consult website

Contact for Registration Requests:
Congress, Meeting & Event Management AG
Landsberger Straße 155
80687 München
Germany
www.interplan.de
T +49 (0)89 548234-62
F +49 (0)89 548234-43

Germany: Five Key Facts

Size:	357,022 sq km
Population:	81,147,265 [1]
Total primary energy supply (Mtoe):	329.7 [2]
Total CO_2 Production:	748.5 Mt [2]
Proportion of electricity from renewables:	8.2% [3]

[1] CIA World Factbook (July 2013 est)

[2] US EIA (2011)

[3] Eurostat (2011)

Harmonious Energiewende – in the Heart of Europe

By Stephan Kohler, Chief Executive of the German Energy Agency (dena)

Germany's Energiewende (energy transformation) requires the fundamental reorganisation of the energy system. It is a multi-faceted, general co-operative project with a time-frame of 40 to 50 years. For its realisation each of us is responsible: policy-makers, who set goals and create the right framework, industry and business, which possess the appropriate know-how; and also each individual energy-user, be it a medium-sized enterprise, the public sector or a domestic user.

We can report an interim result: that development of photovoltaic and wind energy has exceeded all previous forecasts. But there is a large deficit in the energy grid infrastructure, in the development of storage technology and creation of an intelligent grid. The development of energy efficiency potential is also trailing far behind the goals set by the government.

There is a considerable shortfall in the expansion of reliable power station output, especially in southern Germany where approximately two thirds of nuclear power stations will have been decommissioned by 2022. The building of new, conventional power stations capable of producing around 10,000 MW, needed by 2022, however, is not seen a feasible in the current market situation. Even worse, while no one wants to build new power stations, old ones are shut down, because operating them no longer pays off.

What should be done? Firstly, we must learn to think and act methodically. In future, individual German regions cannot be allowed to plan their own Energiewende. The only sensible way forward is a nationally agreed joint plan of action, embedded in a European energy market. Germany lies at the heart of Europe, which has voted for a common European energy market. This we should use as an opportunity to connect up the varying potential for energy generation and storage in Europe in the best way possible.

Germany needs European-wide energy trade. Even now, at certain

Stephan Kohler

times Germany exports energy because it has too much for its own domestic needs: in times of weak demand or high energy production through sun and wind, for example. In coming years this will increase substantially, since by 2020 around 110,000 MW of capacity from photovoltaic generators and wind turbines will have been installed. Simultaneously, Germany will also import energy from abroad, since, following the order of merit, the most cost-effective power stations will take precedence in feeding into the grid when sun and wind generated energy, for example, is not available.

In particular, we must address the task of developing the grid and energy storage on a national level. This means that the extension of photovoltaic and wind farms must be synchronised with the building and development of the energy infrastructure.

It makes no sense to build wind turbines that have to be shut down in times of strong wind because of a lack of grid transmission capacity. This synchronisation will be determined as a result of the National Grid Plan. By building on this we can then determine where, and how much, new capacity should be installed, and in which region. Therefore new economic regulatory instruments for energy should be established within the Renewable Energy Legislation.

A further task is the development and application of a new market model for guaranteed power supply, the so-called capacity market. An invitation to tender for guaranteed supply must be based on demand forecasts, and must

enable both old and new power stations to be involved, as well as power stations further afield in Europe. The most competitive tenders will win the contract for the provision of supply capacity, and will receive payment for this service regardless of how much electricity will actually be demanded later on.

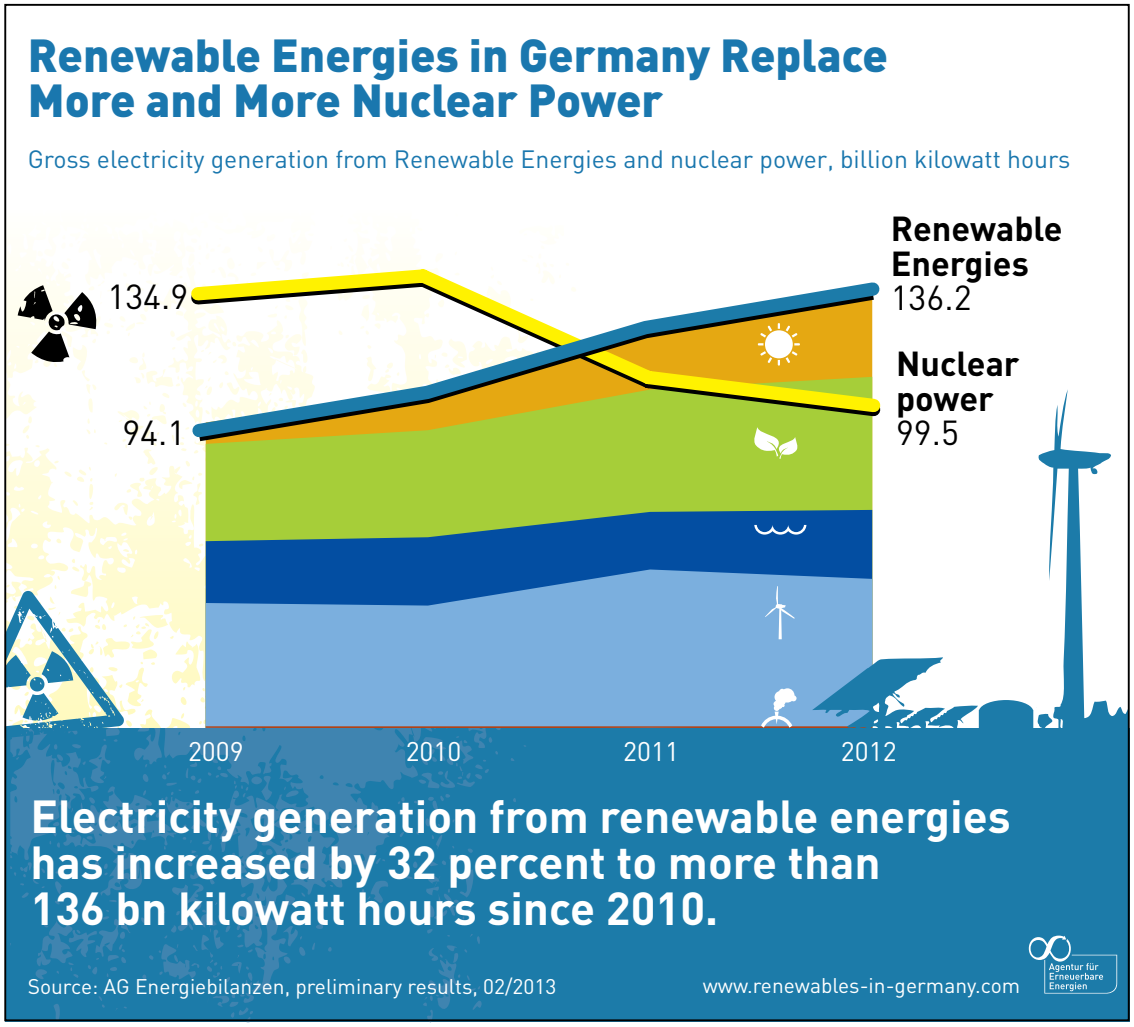
Practical energy saving is everyone's duty all the time. We should use our electrical appliances mindfully, choose new purchases based on the best efficiency-rating and install energy-efficient systems when renovating older buildings. To achieve ten per cent less energy consumption by the year 2020 means that the latest technologies must be brought into play in domestic as well as commercial and industrial contexts. Therefore we need fully functioning efficiency markets, consisting of customer-specific financial incentives and mechanisms. Financial mechanisms are necessary in order to overcome investment hurdles, particularly for low-income households.

Finally, a successful Energiewende requires broad acceptance by consumers and intensive support from Europe. This will mean a great deal of open negotiation and communication, and much debate about the right way forward. It is not a short-term perspective and we should grant ourselves some time to do this. Furthermore if Germany as an industrial nation is competitive through the Energiewende and thereby creates employment, it will also be in a position to convince its neighbours of the rationale and necessity for a far-reaching energy transformation.

Renewable Energy in Germany

On the way to a low carbon, safe and in the long term favourable energy supply

Two years after the nuclear catastrophe in Fukushima, Japan, the energy production basing on nuclear and fossil resources is becoming a phase-out model in Germany. Today electricity generation from renewable energies has increased by 32 percent to more than 136 billion kilowatt hours since 2010. At the same time the gross electricity consumption has decreased by 3 percent to 595 billion kilowatt hours. Both developments – the progress of renewable energy and energy efficiency – were able to compensate the fact that nuclear power generation has decreased by 30 percent to 99,5 billion kilowatt hours since 2010. In total, 12 percent of Germany's energy production are based on renewable energy. With its so called Energiewende Germany is on its way to a clean and low carbon, safe and in the long term favourable energy supply, because renewable energies are of threefold importance to the German economy. They offer climate protection, give incentives for growth as well as job creation and provide an increasing independence from energy imports. The government's goal is that by 2020, renewable energy will provide 35 percent of the electricity generation and 14 percent of the heating generation.



The success of renewable energy in Germany to date is especially based on the electrical power production. Its development is much more dynamic than that of the heating or transport sector. The reasons are different support policy performances. The electricity sector is the only one in which a constant support policy has existed since the year 2000. The feed-in-tariff-system of the Renewable- Energy-Act stimulates not only capacity growth but also technological progress of wind turbines, solar panels or bioenergy. Today the production cost of one renewable kilowatt hour is half as expensive as it was at the start of the green energy path. By 2030, at the latest, electricity production from renewable sources will be cheaper (0,08 Euro /kWh) than from fossil sources (0,09 Euro/ kWh). These figures show that the support system is paying off. In 2050 the economic benefits of a renewable energy system will be five times higher than the investments. Until 2050 renewable energy will save 570 billion euros compared to an energy system still based on nuclear and fossil fuels. Because of these prospects and the efficiency to date the feed-in system for renewable technologies found many international copies. Around the world there are more than 90 states and regions with a similar support system. For instance, since the nuclear catastrophe in Fukushima, Japan is using a feed-in tariff scheme to support the development of renewable energy.

The energy turnaround in Germany is a major challenge, a huge opportunity and moreover a very complex process which involves a lot of stakeholders. Active players of the process are not longer only politics and economy but also every citizen. On the one hand renewable energies enable everybody to take part in the production of energy. On the other hand, their daily life which is influenced by the energy turn around. Local citizens have been the major drivers of the Energiewende in the past, and citizens will continue to play an important role as investors, political stakeholders and local change agents. The fact that more than 580 German energy cooperatives exist gives an idea about the citizen's influence on the Energiewende. In recent years, this particular form of organization has enjoyed increasing popularity in the renewable energy sector. They are not just a model for active participation in the energy sector, but they also facilitate a clean and decentralised power supply on-site. The vast majority of energy cooperatives can be found in Bavaria, Baden-Württemberg and Lower Saxony, which are among Germany's biggest regions. However, the trend to set up and join energy cooperatives is not limited to certain regions.

The German Energiewende is not only "of similar importance as German unification, giving identity to a whole generation," as Germany's minister of environment, Peter Altmaier, underlines. If Germany succeeds in basing its economy on renewable energies and efficiency technologies, it embraces the potential to significantly contribute to global climate protection.

More information about renewables in Germany:

German Renewable Energy Agency
www.unendlich-viel-energie.de/en/

On the Energy Transition Path

Dr. Andreas Fischer, Helmholtz-Gemeinschaft Deutscher Forschungszentren

The population grows, the demand for energy is rising and the generation of energy from fossil fuels puts an increasing strain on the climate. Add to this the fact that the fossil fuel resources will be exhausted at some stage. The German federal government has therefore set the goal of changing the energy supply in Germany to include 80 per cent energy from renewable sources by 2050. This so-called energy transition is one of the greatest challenges of the twenty-first century. The successful implementation of this transition requires ground breaking progress in the fields of energy generation, energy storage and efficient utilisation of energy.

The Helmholtz Association, the largest research organisation in Germany, is taking on these challenges. How can we improve our utilisation of renewable energy sources such as solar radiation, wind power, geothermal energy and plant matter? How can we efficiently store the thus obtained energy and transport it to the people? Which other, new sources of energy can we develop and exploit? And where can we lower energy consumption? These are the questions researchers from the Helmholtz Association and other research organisations intend to provide answers for.

Some examples serve to illustrate what this involves:

In a single day, the passenger planes at the Frankfurt Airport consume 44 metric tons of kerosene just by keeping their engines running during the taxi between the runway and the passenger-loading gates. In collaboration with Airbus Deutschland GmbH and Lufthansa Technik AG, researchers from the German Aerospace Center (DLR), a member of the Helmholtz Association, have developed an electrically powered nose wheel that is capable of driving the aeroplane forward whilst the turbines are switched off. The electricity

Construction of one of the five parts forming the exterior vessel of the Wendelstein 7-X fusion device currently being built at the Max Planck Institute for Plasma Physics. Photo: IPP/W. Filser

Battery cells being tested under controlled temperature conditions. Photo: KIT

powering the nose wheel comes from a hydrogen fuel cell. This idea contributed by Helmholtz researchers would not only help airline companies reduce the cost of expensive fuel, but would also result in reduced noise and air pollution from exhaust gases. Moreover, engine operation time could be reduced by up to 900 hours per year, thus allowing for maintenance intervals to be extended. The idea has further development potential: if in future fuel cells were to provide all on-board power, the water resulting from hydrogen conversion could be fed into the on-board tanks. Less water would have to be pumped into the tank on the ground and the take-off weight would be reduced, resulting in additional fuel savings.

In order to lower the consumption of fossil fuels and hence the emission of exhaust gas pollution damaging our climate, it is important not only to save energy, but also to be able to efficiently store it. To operate properly and efficiently, numerous mobile devices and electrically powered vehicles require sufficient power supply from their batteries. So-called lithium-ion batteries are the most powerful battery systems currently available. However, their storage capacity has very much reached its limits, therefore rendering them insufficient for many applications. This has prompted scientists from the Karlsruhe Institute of Technology (KIT), another member of the Helmholtz Association, to develop an entirely new concept; they use innovative composite electrodes in which the cathode releasing the charge carriers consists primarily of a metal-fluoride compound. The main component of the anode – the receptor of the charge carriers – is a metal. The result is a fluoride battery that can store more energy than today's lithium-ion batteries whilst at the same time being more compact in build. The composite electrodes allow for electricity storage of up to three times the amount of a lithium-ion battery and, in theory, the energy can be stored ten times more densely. Although the basic principle of fluoride batteries already works, the researchers still have a lot of development work ahead of them. They need to improve the initial capacity of the battery system, its operating life cycle and its performance stability. Another concern is the fact that the solid electrolyte enabling the charge to be transferred between electrodes works only at elevated operating temperatures. So now the researchers need to develop innovative electrolytes to render the battery usable also at room temperature.

The sun generates its energy from the fusion of atomic nuclei at extremely high temperatures. Helmholtz researchers are working to exploit just this energy source, nuclear fusion. Wendelstein 7-X, now being built at the Max Planck Institute for Plasma Physics (IPP), an associate member within the Helmholtz Association, will be the world's largest fusion device of the stellarator type. Initially, it will be used as a model for researchers to test the suitability of this type of design for a power plant. In order to harness energy from the fusion of atomic nuclei, the scientists will have to enclose hydrogen plasma within magnetic fields and heat this to temperatures of above one hundred million degree Celsius. In the meantime, the assembly of Wendelstein 7-X has been almost completed. The facility is constructed from five near identical modules, each weighing about 120 metric tons. Wendelstein 7-X is to commence operations in 2014.

In its capacity as the largest German research organisation, the Helmholtz Association pursues national research interests. Some 34,000 employees at 18 different Helmholtz centres work in a total of six research fields. Strategically aligned programmes ensure the relevance of the individual research projects in pursuit of the overarching aim of making a significant contribution towards solving the urgent issues confronting society, science and the economy today.

Smart Solutions Forum

Smart Integration of Photovoltaic & other Renewable Energy Systems into the Network for a Sustainable Growth

The forum Smart Solutions is a parallel event organized in the framework of the 28th EU PVSEC in Paris, France on 1st October 2013. The forum will consist of two sessions related to the smart integration of Photovoltaic systems into the network by highlighting the use of Information and Communication Technologies (ICT), Storage and Smart Integration Solutions. All sessions will cover examples on technical solutions, an overview on market and economic issues and their benefits. The target group are industrial representatives from the ICT sector, storage, transmission and distribution grid operators, consultancies, RTD research and those who are interested for integrating Photovoltaic in a smart way into the electrical grid, building sector and cities.

Session I
Storage & Micro Grids

Session II
Smart Buildings & Cities

1st October 2013
Parc des Expositions
Paris Nord Villepinte, Paris, France

For more information, please visit
www.smartbuild.eu
www.photovoltaic-conference.com/parallel-events

Organized Jointly by
WIP / EU PVSEC and EU Photovoltaic Technology Platform

EU PVSEC 2013

PhotoVoltaic TECHNOLOGY PLATFORM

Clean Energy Partnership
CEP

A lighthouse project within the National Hydrogen and Fuell Cell Technology Innovation Program (nip)

Hydrogen mobility

Claudia Fried, Clean Energy Partnership Spokesperson, Berlin

SOON WE WILL ALL BE TRAVELING IN QUIET, ZERO-EMISSION VEHICLES WITH HIGH CRUISING RANGES. THAT IS THE VISION LEADING INDUSTRIAL COMPANIES ARE WORKING TOWARDS WITH THE SUPPORT OF THE GERMAN GOVERNMENT, IN EUROPE'S LARGEST DEMONSTRATION PRO-JECT FOR HYDROGEN MOBILITY: THE 'CLEAN ENERGY PARTNERSHIP'.

The CEP's hydrogen vehicles have covered nearly 2 million km to date, with 13.500 tanks of hydrogen. The systems have been improved, the 700 bar tank technology is now mature, and the efficiency and costs of the fuel-cell system have been continu-ously improved over years. Now the time has come to take fuel cell technology to mar-ket readiness. At the beginning of the year, new alliances were signed between automakers for this purpose. BMW and Toyota will jointly develop a basic fuel-cell vehicle system by 2020. Daimler, Ford and Renault-Nissan will also work together to develop a fuel-cell system that will form the heart-piece of competitive hydrogen cars starting in 2017. Hyundai already began with the production of its first small series in January. Toyota and Honda plan to unveil their first production models beginning in 2015. The alliances among automakers are designed to foster higher production vol-umes and economies of scale, so that consumers can be offered affordable hydrogen cars.

Since 2002, the Clean Energy Partnership has been working to steadily improve the systems and processes. The goal is not only to develop reliable, affordable vehicles but also to establish a network of hydrogen filling stations, customer-friendly technol-ogy at the pump, and "green hydrogen".

The expansion of the hydrogen filling station network has already been decided. By the end of 2015, there will be 50 hydrogen filling stations across Germany. This means that Germany will be the first country in the world that has a basic supply network. Various CEP working groups, as well as workshops with our international partners, the California Fuel Cell Partnership and the Scandinavian Hydrogen Highway Partnership, are exploring ways to further improve the reliability and customer friendliness of the systems. Among other things, we are working on the calibratable volume measure-ment of hydrogen. In the long term, the hydrogen infrastructure must be developed across country borders. Several European initiatives have set themselves this goal.

Half of the hydrogen dispensed at CEP hydrogen filling stations is already produced using energy from renewable sources. We plan to further increase this share, as driv-ing with fuel cells is only CO2-free if 'green' hydrogen is used. The project is testing two production paths: water electrolysis, and production from biomass. Electrolysis in particular could play an important role in Germany's "Energiewende" (energy transi-tion) as it enables volatile wind and solar power to be stored long term in hydrogen. Ideally, the hydrogen is then used as fuel in vehicles, but it can also be turned back into electricity during times of low wind or sunlight. This makes it possible to decouple the timing of the electricity supply and demand. Hydrogen takes us further!

The German "Energiewende" - Achievements and way ahead

Written by Jürgen Creutzmann, MEP

It has been almost exactly two years since in May 2011, in the wake of the Fukushima nuclear disaster, the German federal government made the decision to phase out nuclear energy production by 2022 – a bold but maybe also overhasty decision. While critics persists, one needs to acknowledge that there seems to be broad consent in the population. However, we now face the challenge of implementing the decision made.

The nuclear phase out is one piece, though an important one, in the puzzle of the German "Energiewende", the transformation of energy production towards a decentralized and supply-oriented system based on renewable energy sources. The German plans are bold, especially for the 4th biggest industrial nation in the world, to achieve a 35% share of renewables in gross energy consumption by 2020. However, as the latest reports show, there is a good chance that we will even reach this target by 2016.

While the progress made is certainly promising, obstacles become apparent: subsidy schemes for renewable energy sources, in particular the guaranteed feed-in tariffs might become victim of their own success. The costs have

risen and start to become an increasing burden for all energy users. In addition, maybe even more worrying, they undermine support among citizens for the Energiewende due to a political trade-off: on the one hand the government seeks to avoid compromising global competitiveness of its industries through exemptions for heavy energy users. This, in turn, means higher costs for the rest of the population and for many small- and medium-sized companies. This is why the reform of the so-called renewables act will be one of the pressing issues for the next parliamentary term.

The Energiewende means a turn away from the traditional base-load production to more flexible energy plants. Wind does not always blow and the sun does not always shine, which casts doubt on the reliability of energy supply. This is why regulatory frameworks are necessary providing capacity when it is needed and ensuring better coordination among producers. A prerequisite for a decentralised production is, however, an overhaul of the existing, 35000 km electricity grids. In particular new high voltage lines are needed for which in the past the authorization and planning stage took up to 10 years – too long for our projected needs, which is why new laws aim to cut this to a mere 4 years. Naturally, this requires better involvement of the local population and more efficient court procedures to deal with objections. The next years will show whether the streamlining of procedures is indeed successful.

It should be underlined, however, that a Germany-centric view is to be avoided. While many of the detail decisions have to be taken at national, regional or even local level, the general framework needs to be set at the European level. Germany's system of feed-in tariffs, as well as other measures to support renewables uptake, have been a successful "export", however we need to make sure that other EU Member States do not equally copy Germany's past mistakes. Therefore an exchange of best practices and more coordination – carefully respecting the national prerogatives in the energy mix – should be encouraged. We need to better allocate resources in Europe in the energy area, in particular when it comes to renewables. While it is laudable that more and more rooftops in Germany are equipped with solar panels, we need to admit that they would probable serve better in southern regions of Europe. In future, we should strive for a common European framework in the renewables promotion though this is rather a medium to long term goal.

The Energiewende is one of the biggest challenges Germany has faced so far and it is a common, societal challenge for all players involved, be it the producers, the industrial or private consumers. The goal is clear: sustainable energy production that is both reliable and affordable. With its fast-track nuclear phase out decision, the German federal government has considerably increased the pace of the Energiewende and, admittedly, affronted its European partners as the repercussions are not limited to Germany. So far, we seem on track but a lot of work lies ahead of us, for much of it we need to cooperate better at the European level.

European Environmental Product Declarations as an orientation aid

Dr. Burkthart Lehman, Managing Director Institut Bauen und Umwelt e.V.

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION PASSED A NEW REGULATION SPECIFYING HARMONISED CONDITIONS FOR THE MARKETING OF CONSTRUCTION PRODUCTS ON 9 MARCH 2011. REGULATION (EU) NO. 305/2011 SHALL REPLACE COUNCIL DIRECTIVE (89/106/EEC) AS OF JULY 2013. NEW FOCAL ISSUES INCLUDE A COMMON TECHNICAL LANGUAGE SUPPORTING SPECIFICATION OF HARMONISED CONDITIONS FOR PLACING CONSTRUCTION PRODUCTS ON THE MARKET AND UNAMBIGUOUS CONDITIONS CONCERNING ACCESS TO CE MARKING.

The EU Construction Products Regulation (CPR) effective in full as of 1 July 2013 replaces the previous 20-year old Construction Products Directive (CPD) and links the marketing of construction products in Europe to seven basic requirements on construction works. Unlike the CPD, the CPR includes a new basic requirement – No. 7 "Sustainable use of natural resources".

This new basic requirement aims to ensure that construction works are designed, built and de-constructed in such a way that the natural resources are used sustainably, ensuring in particular that the construction materials and components can be re-used or recycled after de-construction. Furthermore, the durability of the construction works and the use of environmentally-compatible raw materials and secondary construction materials are to be ensured. The extended basic requirement No. 3 "Hygiene, health and environmental protection" also exceeds the scope of the CPD, which refers to the entire life cycle for the first time. The release of gases of climate relevance into the atmosphere as well as hazardous substances into drinking water are also to be taken into consideration.

The basic requirements on construction works form the basis for developing harmonised technical specifications for construction products in which the respective essential product features are then specified and their performance declared by the manufacturer within the framework of a declaration of performance.

Consideration of the new and/or extended basic requirements in harmonised technical specifications assumes that a member state makes the corresponding statutory requirements on the construction product. Specific legal requirements with reference to the new basic requirement 7 and/or extended basic requirement 3 have not come into force in any EU member state to date. Nevertheless, initial legislative initiatives have already commenced in several member states.

In order to avoid duplication of work and minimise any future harmonisation requirements, national implementation plans should already be oriented towards the results of European standardisation on the sustainability of construction works. With its 24 environmental indicators, the CEN standard for Environmental Product Declarations (EPDs) for construction products EN 15804 offers a uniform European framework for all construction products enabling assessment of the sustainable use of resources and environmental compatibility of construction works with regard to the basic requirements 3 and 7 outlined in the CPR. Not without reason, the recitals for the CPR already specify that where available EPDs should be used for assessing the sustainable use of resources and evaluating the impact of construction works on the environment.

Institut Bauen und Umwelt e.V.

As a manufacturer initiative comprising manufacturers of construction products, Institut Bauen und Umwelt e.V. (IBU) operates an internationally co-ordinated, cross-sector range of declarations outlining the environmental performance of construction products (ISO 14025/ EN 15804: Environmental Product Declarations, EPDs). EPDs are examined in the IBU system by an independent third party; they supply comparable, accurate and unambiguous details on the environmental aspects of construction products, provide a scientifically-sound data basis for environmental building evaluation, support buyers and users in making an educated choice and contribute and contribute towards a market-oriented, continuous improvement of products from an environmental aspect.

www.bau-umwelt.com

Institut Bauen und Umwelt e.V.

Germany and 'Energiewende'

Written by Norbert Glante, MEP

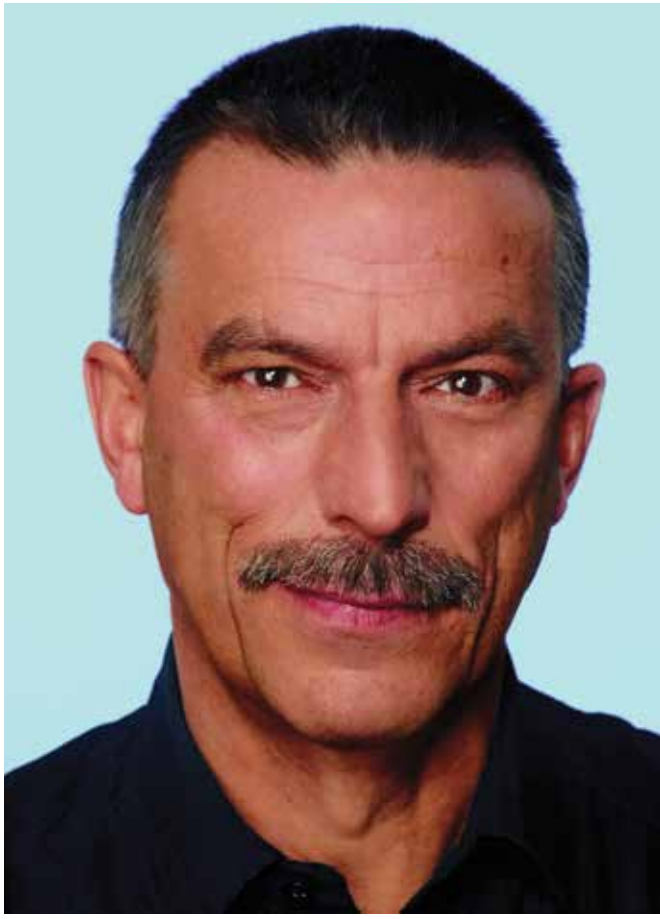
The European Union is committed to reducing its greenhouse gases by 80-95 per cent between 1990 and 2050, in order to limit the global rise in temperatures to a maximum of two degrees. A reduction in carbon dioxide emissions is to be achieved through an increase in low carbon energy sources, and greater use of renewable energies, as well as increased energy efficiency. Consequently Germany has introduced 'Energiewende' (Energy Change) to its energy policy and elaborated numerous measures with varying degrees of success.

Even if renewable energy is currently at the centre of debate, the world will by unable to do without conventional energy sources in the coming decades. In view of rising energy requirements which will probably be satisfied for the most part via fossil fuels, a prompt introduction of Carbon-Capture and Storage (CCS) is necessary to limit CO_2 emissions. With the help of this technology the climatic consequences of fossil fuel usage can be limited. Therefore not only should energy producers be encouraged to invest in clean carbon technology through CCS, but also CCS can play an important part in the energy-intensive industries of steel, cement and aluminium.

The comprehensive introduction of CCS in Germany is, however, not envisaged. In fact from 24th August 2012, after several years of discussion, the deployment of CCS technology is statutorily regulated nation-wide, and up to 4 million tonnes of CO_2 may be stored annually. However, the German States themselves may decide on the use or prohibition of CCS in their own territory. By reason of the strong objections by many to CCS, the search for suitable storage facilities has not made much headway. Because of the antipathy to a CCS law in Germany, the consequent planning uncertainty and the low prices for carbon trading, the latest plans for a flagship CCS power station largely came to a halt at the end of 2011.

The German Renewable Energies Policy (REP) is cited regularly as a good initiative for the promotion of renewable energy. In fact, this policy, because of its success and the strong growth in photovoltaic installations, is increasingly pushing the boundaries. Costs arise through the promotion of energy from renewable sources in the REP framework which will be passed on to energy users. In 2011 the REP feed-in to the Grid amounted to approximately 91.2 terrawatt hours, and the resulting additional costs were in the region of 12.1 billion Euros.

With a growing share of energy production, the REP is influencing on a regional, country and European-wide basis transmission of generated power to the Grid. Since a particularly large amount of wind energy is produced in North Germany, whereas there



is greater energy demand in the South, and because of the hitherto lack of distribution channels across the internal Grid, power has to be transported to neighbouring countries. According to the Polish Grid operator, PSE Operator SA, the surplus energy flow from Germany to Poland currently reaches over 1,500 megawatts at peak periods. This is more than three times the normal energy trade between the two countries. Electricity from North Germany is transferred sporadically across Poland, the Czech Republic and Hungary to Austria and from there back to South Germany, creating ever greater strain on the maintenance of Grid stability. As a result, the Grid operators in our neighbour States would like to build phase-converter transformers at the borders, by which excessive cross-border power flows can be blocked. Poland and the Czech Republic want to halt excess electricity from German wind and solar power farms at the border in future. Likewise the Netherlands is planning to take similar steps. This demonstrates that Germany has driven Energy-Change forward without dialogue with its European partners and without the necessary development of the Grid. Hereafter the REP must be urgently reformed in order to prevent a further explosion of costs.

In contrast, in energy efficiency matters we are making good progress. Between 2008 and 2016 Germany must reduce its energy usage by a total of nine per cent, and is well on the way to achieving this goal. Because heating of buildings in particular uses a lot of energy, support is offered, for example, through incentives worth in the region of 1.5 billion Euros, and tax allowances against the costs of energy-efficient building renovation. Every Euro invested here remains in Europe rather than flowing into the coffers of non-EU gas or oil suppliers. Furthermore such public funding brings with it binding energy efficiency criteria. Only products and services of the highest efficiency rating obtain a contract.

By the end of June 2014 the third Energy Efficiency Action Plan should be in place, in which further measures will be brought forward. If Germany wants to move Energy-Change forward, it cannot do so with national blinkers on, but should consider the impact on the rest of Europe. Without co-operation with its EU partners German Energy-Change cannot be successful. A reconciliation of the supply and demand system for renewable energies in Europe is therefore necessary.

"Give no decision till both sides thou'st heard."

- Phocylides

Written by Mike Edmund

As he opened a recent business summit, European Council President Herman Van Rompuy sounded a warning about Europe's "Energy Dilemma", observing that within little more than 20 years, Europe will have to import over 80% of its oil and gas requirements. He added: "Eventually Europe may well be the only continent in the world to depend on imported energy," suggesting that this situation would affect not only the competitiveness of European industry, but its economy as a whole.

As part of a series of articles for this magazine, Commissioner for Energy Günther Oettinger has written about the requirement for a European energy strategy. He has suggested the need to invest one trillion Euros over the next 20 years, to be spent on the development of new energy sources, expansion of supply networks, increasing the use of renewable energy and reducing overall energy consumption. Commissioner Oettinger has also outlined the requirement for integration of the European energy market, whose size and scale would ensure access to resources. In view of President Van Rompuy's comments, this of course means access to oil and gas. But, of course, a significant market generates significant demand. And that may bring significant vulnerability with it.

WHY IS EUROPE IN THIS POSITION? WHERE DOES IT GO FROM HERE? A BRIEF EXAMINATION OF THE FIRST QUESTION MAY OFFER INSIGHTS INTO THE SECOND.

Why does Europe expect to import so much of its energy?

This question itself breaks down neatly into two parts: how much energy does Europe produce; and how much does it consume?

According to Eurostat, production of primary energy in the EU-27 rose by 17.2 Million tonnes of oil equivalent (Mtoe) in 2010 to a total of 830.9 Mtoe. This increase followed a steady decline in production over the previous decade, partly attributable to exhaustion of gas reserves in the North Sea.

The most important primary source was nuclear (28.5% of the total). Solid fuels (largely coal) accounted for 19.6 %, followed by natural gas (18.8 %) and crude oil (11.7 %). However, the 20-20-20 objective of 20% of primary

energy from renewable sources was met.

Meanwhile, Eurostat records that gross inland consumption of primary energy within the EU-27 in 2010 was 1,759 Mtoe. Consumption remained relatively unchanged during the period 2003 - 2008, before decreasing 5.4 % in 2009 and rebounding 3.3 % in 2010. This pattern is thought to reflect the financial and economic crisis rather than any structural changes in energy consumption. Nevertheless, consumption of primary energy in the EU-27 rose, on average, by 0.2 % per annum over the period 2000 - 2010.

Therein lies the answer. Europe produces less energy than it consumes. Without action, this situation will deteriorate because energy production is declining and consumption is rising.

Europe's main supplier of crude oil (34.5 % of EU-27 imports), natural gas (31.8 % of imports), and hard coal (27.1 % of imports) is Russia. Moscow has been seeking to consolidate this position with the Nord Stream gas pipeline into Germany, and latterly through the South Stream pipeline into southern Europe. Controversy exists over the desirability of this alternative to the Nabucco pipeline, which would carry gas from Iraq, Azerbaijan, Turkmenistan and Egypt through Turkey into Austria.

There is another factor. The reduction in energy consumption caused by the recent economic crisis has affected in turn the price of carbon emissions under the EU-ETS carbon-trading scheme. One consequence is that American coal, displaced by the boom in shale gas production, has been cheaper to burn here than natural gas. American energy is now relatively cheap and its emissions are falling, while European energy is relatively expensive and its emissions are rising. There are clear consequences for the competitiveness of European industry, the very engine of economic growth. However, Europe too has extensive shale gas reserves, though these may not be as accessible as those in the US. Yet a tonne of CO_2 emitted in Washington DC has the same environmental impact as one emitted in Brussels: Europe may not be able to disdain its shale gas for long.

The solutions to Europe's energy dilemma are easy to see: either produce more energy or consume less. (Notwithstanding a third option, that of some combination of the first two). Unfortunately, environmental concerns obscure these solutions somewhat, and economic factors somewhat more, while political considerations make them almost invisible. But solutions must be found: perhaps a perceived over-reliance upon energy imported from one or two suppliers might provide signposts for the Energy Roadmap that Commissioner Oettinger has proposed.

INNOVATION FOR A BETTER HEALTH AND CARBON FOOTPRINT

In Belgium, gas infrastructure company Fluxys pushes ahead with partners to develop the infrastructure allowing cars, trucks and ships to fill up with natural gas. Why? Because switching from petrol, diesel or heavy fuel oil to natural gas brings immediate improvement in air quality and health:

- 20% less CO_2 on average;
- at least 50 to 60% less nitrogen oxides;
- the amounts of sulphur and fine particles released are negligible.

ROAD TRANSPORT

Compressed natural gas (CNG) is the alternative by excellence to traditional fuels for cars, vans, buses and commercial vehicles such as refuse trucks. As the CNG market in Belgium is scarcely out of the egg, Fluxys examines with local distribution operators the best approach to invest in CNG filling stations.

For long-distance haulage trucks, in turn, the alternative to diesel is liquefied natural gas (LNG). The market, though still limited, is expanding swiftly and Fluxys is working on a pilot project with a haulage company to build a first LNG filling station in Belgium. At the Fluxys Zeebrugge LNG terminal, tanker trucks can already load up with LNG to supply ships and LNG filling stations for trucks.

SHIPPING

At present, the use of LNG as fuel for ships is largely confined to Scandinavia. However, it is likely to spread Europe-wide in the near future as sulphur emission standards in shipping from 2015 are to become very sharp in some seas, including the North Sea, the English Channel and the Baltic Sea.

Against this backdrop, Fluxys is building a second jetty at its Zeebrugge LNG terminal to make it further develop into a hub for the supply of LNG for ships. As from 2015, the facility will be able to receive small bunkering barges and feeder ships for loading LNG. From Zeebrugge, they can ensure refuelling of LNG-powered ships and intermediate storage sites in all ports in Belgium and the major ports in North-Western Europe. Fluxys is also willing to co-invest with partners in additional infrastructure in order to further develop the logistical supply chain.

FLUXYS

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Europe's eyes on Wave and Tidal potential in the Atlantic Arc

THE STRATEGIC INITIATIVE ON OCEAN ENERGY – SI OCEAN
Sian George, CEO European Ocean Energy
Gema San Bruno, SI OCEAN Coordinator

"IN 1980, THE GLOBAL INSTALLED CAPACITY FOR WIND POWER WAS 10MW; TODAY IN EUROPE ALONE IT HAS EXCEEDED 100GW[1]. THIS HAS HELPED MAKE SURE EUROPE WILL MEET ITS 20% CARBON REDUCTION TARGETS FOR 2020. EUROPE NOW HAS A TARGET OF CUTTING CARBON BY 80-95% BY 2050. TO DO THIS, IT WILL NEED TO SET INCREASINGLY PROACTIVE REGULATORY AND MARKET SUPPORT POLICIES TO BRING NEW RENEWABLE ENERGY TECHNOLOGIES ONLINE. IN THE CONTEXT OF GROWTH IN OTHER SECTORS AND FUTURE TARGETS – AND WITH STRONG ECONOMIC PRICE SIGNALS – THE OCEAN ENERGY SECTOR BELIEVES EUROPE CAN EXPECT TO INSTALL UP TO 100GW OF OCEAN ENERGY PROJECTS BY 2050"[2]

As a new industry, the European ocean energy sector is making positive progress. Several European utilities and engineering giants from Europe, the US, Japan and Korea have all invested in SMEs, testing programmes and early project development in Europe. This clearly points to growing confidence in the viability of these technologies. So far the **UK** is leading European development. However, other Atlantic Arc countries are keen to replicate the conditions which have successfully stimulated inward investment and seeded a project development pipeline which could deliver over 1.8GW of installed capacity by 2030. **France** and **Ireland** are gearing up to ensure that ocean energy arrays are installed in their waters before 2020. **Spain** and **Portugal** may be more risk averse in austere times; but they do have some of the most economic wave power resources in Europe, making mass-market deployment off the Iberian coastline post 2020 not just attractive, but inevitable. **Denmark, Norway** and **Sweden** have all recognised the strategic importance of securing supply chain benefits. For example, over 35 Swedish organisations, spanning industry and the research community, have just launched a Strategic Innovation Agenda for wave and tidal energy with support from the Swedish government. The supply chain benefits will extend far beyond the Atlantic Arc. Research into the supply chain emerging to support the sector demonstrates that the ocean energy supply chain is pan-European. Economic returns will flow to several Member States and not just those with ports, harbours, ocean energy resources and a traditional maritime skills base.

However, these are early days, and three key **challenges** prevent the wide-scale commercial success of wave and tidal technologies: technology, pipeline & market and finance. In addition to developing a suitable pipeline of sites ready for mass deployment in the future, device readiness and financial backing remain as barriers. Like any new technology pioneers, wave and tidal developers need on-going capital support to navigate the stages of device development and deployment, and understandably, investors like to be assured they're backing a winner.

The European Commission has invested in a range of **projects** focused on developing technologies and improving research and industry collaboration. Significant funding support for wave and tidal demonstration projects has been provided under Framework Programme 7 Energy and NER300 (finance for innovative renewable energy technology) while future funding will be available from 2014 via Horizon 2020, the Commission's new research and innovation funding mechanism.

In the last seven years, EC investment of about €80m has been boosted by private sector investment of about €600m – demonstrating market confidence in the sector. In recent years the sector has been strengthened by the entry of **leading industrial organisations**, including Alstom, Siemens, Andritz, Voith and ABB. Energy utilities, including EDF, E.ON, Iberdrola, RWE, Scottish and Southern Energy and Vattenfall have also pursued an active role in ocean energy. The increasingly strong presence

[1] IEA-RETD (2011)

[2] Industry Vision Paper – European Ocean Energy Association (2013)

of these and other companies has sent a strong signal that ocean technologies are a key component of Europe's future energy mix. However, significant challenges remain if we are to bring these technologies into the mainstream mix.

This hive of activity across Europe prompted the Commission's **Intelligent Energy Europe (IEE) programme** to fund the development of a sector-wide strategy that would unite Europe's wave and tidal sectors and drive market growth from 2020 to 2050. Led by the Ocean Energy Association; the Strategic Initiative for Ocean Energy (SI Ocean) was conceived to:

- Strengthen Europe's ocean energy networks,
- Enhance collaboration across research and development and
- Build on existing knowledge of technological, financial and policy barriers to identify solutions that will accelerate deployments of wave and tidal technologies.

SI OCEAN – BUILDING A COMMON AGENDA FOR COMMERCIAL SUCCESS

IEE supports 'intelligent energy' projects, with a focus on low-carbon, sustainable and efficient energy solutions. SI OCEAN will deliver a **European Market Deployment Strategy** for the wave and tidal potential identified in the "Atlantic Arc" region. Its focus on industry and government is a key strength, and it is fast becoming one of the primary avenues for dialogue on marine renewable energies between the European Commission and industry.

EC and national government support for Europe's ocean energy sector is crucial for enhancing the competitiveness of wave and tidal technologies. The clear view from industry is that marine renewables will require government support and a range of supporting policy, planning and legislative mechanisms. SI OCEAN has produced a **Policy Analysis Report**[3] on the political and legislative framework for the deployment of wave and tidal energy. An intensive consultation process with governments and industry will lead to recommendations and solutions to overcome the current gaps and barriers to commercialise this sector as rapidly as possible. There is a real risk that without appropriate and timely support, the European opportunity to become the world's leading ocean technology supplier could be lost to competitors from the Americas or Asia.

Through engagement with both industry and government, SI Ocean will build a guide to existing national regulatory systems, and encourage reforms that will improve **investor certainty** when it comes to developing a sustainable pipeline of suitable sites for ocean energy projects across Europe.

Like any new technology, achieving the right balance of technology push (capital grants) and market pull (revenue support) mechanisms is important for achieving cost competitiveness. While positive steps towards commercial viability are being demonstrated across Europe, the pre-commercial nature of most wave and tidal technologies and the high costs of device development means that technology developers are reliant on a steady stream of both public and private funds. SI Ocean seeks to build the case for investment in the face of financial adversity to ensure the extensive human and financial **resources committed to date do not go to waste**. With such strong wave and tidal resource potential throughout Europe, governments are encouraged to focus on the longer-term prizes of domestic clean energy generation, job creation and reducing reliance on energy imports.

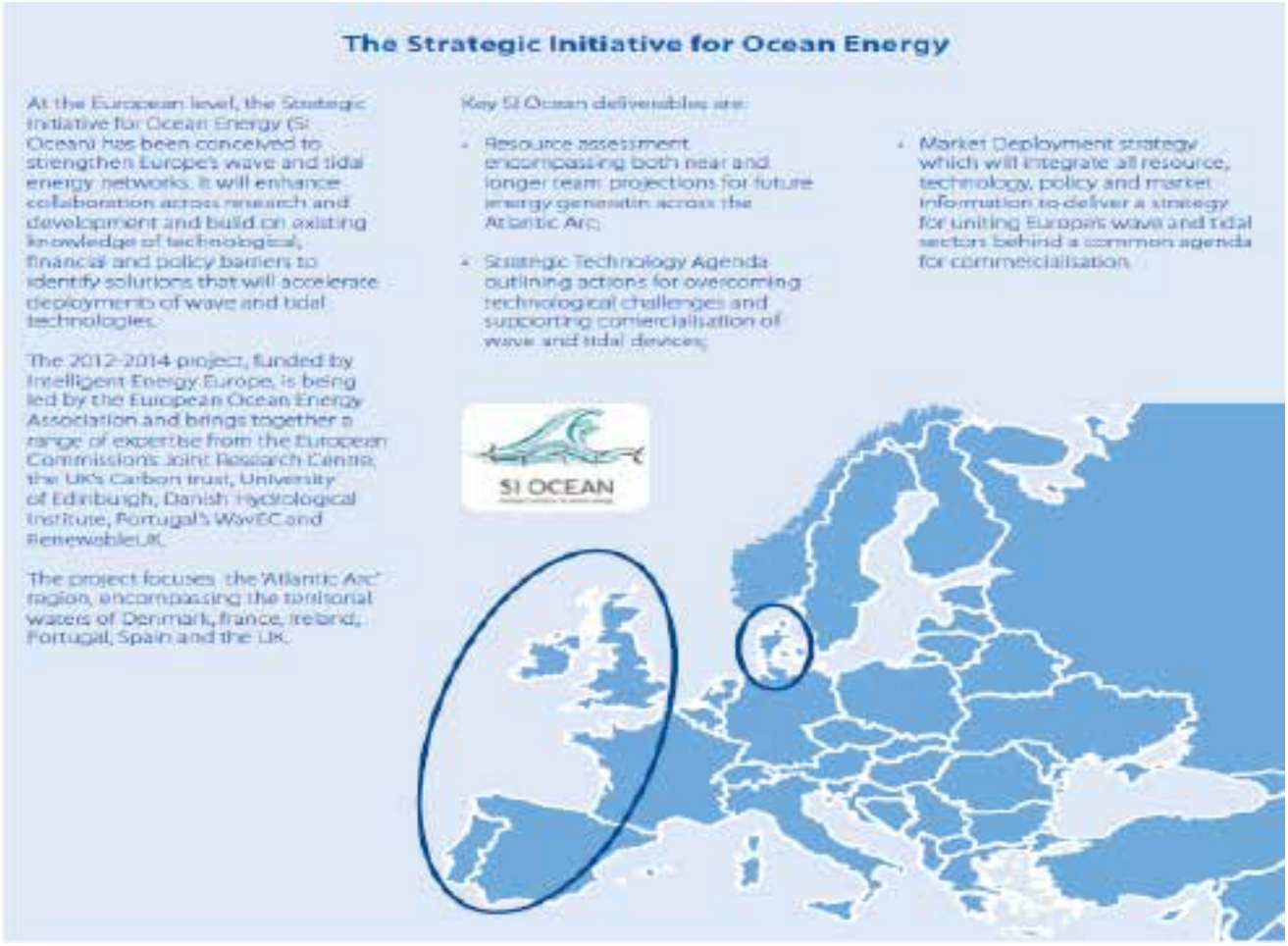
Infrastructure challenges vary throughout Europe according to location and the nature of the ocean resource. However, **grid connectivity and port and supply chain infrastructure** are key concerns for the industry. There are a number of synergies between the operating environments of offshore wind and wave technologies and certainly a range of transferable skills that can be applied to ocean technologies from offshore oil and gas. Nevertheless, the challenges being experienced by the wave and tidal sectors are distinct from one another, let alone other industries.

[3] Atlantic Arc Policy Analysis Report, RenewableUK (2013)

SI Ocean's examination of policy and market conditions is complemented by technical analysis of the practical wave and tidal resources that could be harnessed for electricity generation. Building knowledge around where and how resources can be exploited is fundamental for developing an effective **industry strategy**. For example, Ireland, Portugal, Spain and Denmark have strong-to-medium wave resources; France has good wave power resource and strong tidal resources, while the UK is endowed with strong wave and tidal power sources. Based on mapping exercises across the Atlantic Arc, SI Ocean's resource assessment will develop both near and longer term projections for future energy generation.

SI OCEAN has produced a Technology Assessment Report[4] analysing the current status and characteristics of the technology available. In addition, a Cost Assessment Report (Carbon Trust) will put together barriers and gaps for technology development with the goal of delivering a concrete **Strategic Technology Agenda** (JRC) for the sector. This Strategy will serve as stepping stone towards developing a clear Technology Roadmap which will provide information for future decisions under the Horizon2020 and SET-Plan EC initiatives by clearly stating the priorities for R&D and investment in this area.

Wave and tidal technologies have the potential to provide Europe a clean and secure source of electricity generation. All the essential elements are in place – technical knowledge, industry interest, political



[4] Technology Status Report –SI OCEAN (2012)

support and importantly, the need to develop a new low-carbon energy solution that will power Europe into the future. SI OCEAN represents a transparent platform for discussion; knowledge transfer and experience sharing between the industry, policy makers and the R&D community. For further information, contact the SI Ocean project coordinator: ***g.sanbruno@eu-oea.com*** *or visit the project website:* ***www.si-ocean.eu***

Ocean Energy for Europe

The European Ocean Energy Association is a fast-growing membership organisation set up – with Commission support - to represent the sector to the European Commission, Parliament and Council of Members.

We act as a hub for information and networking. Our goal is to unite the key European players behind a common plan for commercialising ocean energy technologies, which can be used to leverage strategic investment from the private and public sectors between now and 2020. We will also work closely with the Commission and member state governments to promote a level playing field for ocean energy developers in the single European market.

On the industry front members include 10 large utilities such as **E.ON, EDF, EDP, SSE** and **Iberdrola**. We also count 8 large international engineering and manufacturing firms such as **Alstom, SIEMENS, DCNS, Voith Hydro** and **Andritz Hydro**; together with 16 of the world's leading SME technology developers in our membership. Between them our members have made significant progress in recent years:

- **€600m private sector investment** in the last 7 years
- **EU installed capacity has tripled in 4 years:** representing significant technical progress; with over 10MW of operational devices installed today, compared with 3.5MW in 2009. Many of these devices have rated capacity of over 1MW.
- **2GW of projects in the planning pipelines of Europe's largest utilities** and renewable energy project developers. Capitalising on this progress will, however, depend on creating the right market and investment conditions across Europe in the future.

National trade associations and development agencies from Spain, Ireland, Norway, Scotland, the UK, France, Portugal, the Netherlands, Denmark and Sweden are also members. They believe Ocean Energy will play an essential part in meeting

clean energy targets; as well as securing national export revenue and inward investment. Our members also represent experts from engineering departments at leading European Universities.

We promote all technologies designed for extracting energy from the ocean:

- **Tidal power** - tidal streams and currents offer a consistent source of kinetic energy caused by regular tidal cycles influenced by the phases of the moon. Tidal barrages exploit the rise and fall of tides in estuaries and bays to produce electricity.
- **Wave power** – devices are located different distances from the shoreline, either on the sea-bed or surface floating. All derive energy from the movement and power of ocean waves.
- **Ocean thermal energy conversion – OTEC** – devices exploit the temperature difference between deep cold ocean water and warm tropical surface waters. OTEC plants pump large quantities of deep cold seawater and surface seawater to run a power cycle and produce electricity.
- **Salinity Gradient** - power generation from salinity gradients utilizes the difference in salt content between fresh water and seawater to provide a steady base load of electricity from plants located close to the end consumer.

The Importance of Marine Renewables

Max Carcas, External Liaison, EMEC

A decade is a long time in ocean energy. Just over ten years ago I attended a renewable energy conference in Portland, Oregon. At the conference a university was hosting a poster session, the aim of which was to show the renewable energy resources of the USA's western most states. Detailed maps had been produced for each renewable depicting the geographical intensity of the wind, biomass, hydroelectric, solar and geothermal resources. On each of these maps was a large blue area to the west. I asked a researcher why this large area of blue hadn't been included in the assessment. He was genuinely bemused, since he had not appreciated that the Pacific Ocean could be a major renewable energy resource.

Thankfully today that situation has changed. Not only is it now widely recognised that ocean energy has the potential to be a major component of the energy mix in the future but it is also becoming obvious that a number of significant steps have been made over the past decade towards making this vision a reality.

That said ocean energy (in this context principally wave and tidal power) still suffers from a policy perspective from its relative immaturity compared to more established technologies such as wind, hydro and solar. National and international policies for renewables have a tendency to be formulated with a focus on shorter term priorities rather than the end result being sought. Often it can be the case that ocean energy is recognised as being a large scale - indeed necessary - contributor to the future energy mix but that "it won't happen until the next decade". The danger is that this becomes a self-fulfilling prophecy – a relatively small number of MW forecast to be deployed in a given period leads to a lack of policy prioritisation and hence reduces progression in the sector, leading to missed targets. A more intelligent strategy is to recognise the ultimate objective for ocean energy and implement policies that seek to accelerate this potential. Whilst there are undoubted technical and commercial challenges to be overcome these are by no means insurmountable. An analogy can be drawn with the European strategy on aerospace; the objective was to

produce a European champion to compete with Boeing and its dominance of the global jetliner market - it was recognised that this wouldn't happen in a vacuum but would require a concerted effort and strategy to produce the outcome desired.

The other part of the equation is to recognise that for ocean energy to achieve its potential requires the same policies and processes that have brought all other energy technologies to market in the past. In particular investment from the private sector needs to happen. To enable this, a premium market must exist to enable investors in technologies and projects to make a return comparable with other similar investment opportunities. Because energy is a commodity the only way this can happen is with political intervention since the free market price for electricity does not price in the value of creating future energy options. Acceleration can also be achieved by the public sector providing support to de-risk these investments whether that be in terms of the capital costs and infrastructure required, in encouraging the sharing and implementing of 'best practice' or in reducing the risks associated with permitting projects. The pay-off in doing this is not only the ability to harness a new large scale sustainable energy resource but the creation of a new industry.

Part of the evidence of this can be seen at the European Marine Energy Centre (EMEC) in Orkney, Scotland where we are celebrating our tenth

anniversary this year. EMEC was established with the aim of emulating the Risø wind turbine test centre in Denmark which helped establish the standards and protocols that underpinned the growth of wind to being a €50bn+ market today. From one client in 2004 EMEC now has a total of fourteen full scale grid connected test berths contracted to different organisations. Tidal clients include: Openhydro, Tidal Generation Limited, Atlantis Resources Corporation, Andritz Hydro Hammerfest, Voith, Scotrenewables Tidal Power, Bluewater and Kawasaki. Wave clients include: Aquamarine Power, E.ON, Iberdrola/ ScottishPower, Wello, Seatricity and Vattenfall.

A total of 250 people are currently working within the marine energy supply chain in Orkney alone – a significant contribution to the local economy and part of a Europe-wide 'cluster' in ocean energy that through innovation and experience can produce the technical solutions required. What is particularly encouraging is seeing technology developers collaborating with major utilities and significant industrial players from all across Europe who together share global ambitions in ocean energy.

The key to realising the vision for ocean energy will be for national governments to build on and implement 'best practice' in market enablement mechanisms and at the European level a focus to put ocean energy at the heart of its strategy to achieve a sustainable energy system that can also drive economic growth.

Marine Energy in the Basque Country

By Javier Marqués, Director of Renewable Energy and Investment Promotion (EVE)

Interest in the development of alternative energy sources has grown in recent years. The ever-increasing world population and demand for energy, the constant rise in the price of oil and global warming are all factors driving the development of renewable energy. Some renewable forms of energy, such as wind and solar thermoelectric, have evolved spectacularly in recent times, whilst the full potential of others, such as marine energy (wave, current, etc.) has yet to be tapped.

The commercial non-viability of marine energy to date can be attributed to high generation costs and low reliability levels, a consequence of immature technology. Many devices are currently being developed in an attempt to meet the challenge of devising a technology capable of tapping energy and proving the functionality and reliability of these devices at sea. Though these technologies are currently under development and cannot, as yet, compete economically with other, more mature renewable forms of energy, increasing government and industrial interest is speeding up their development.

The first common energy policy of the European Union (the 20-20-20 Plan) was approved in December 2008. On the basis of this, the different EU member states and regions drew up their own energy strategies aligned to the related European guidelines, with energy saving, efficiency and renewable energy as core issues within these plans.

In this respect, and as part of its 3E2020 Energy Strategy led by EVE (the Basque Government Energy Agency), the Basque Country has drawn up a sub-strategy for technological and business development entitled EnergiBasque. Within this wider European and global context of developing low-carbon technologies, EnergiBasque is designed to address these important challenges in the field of energy whilst simultaneously providing and promoting business opportunities for the industrial and technology sectors of the Basque Country.

These challenges provide the backdrop to the general objectives of EnergiBasque, one of which is to develop business activity in new and emerging

fields of energy such as marine energy.

The characteristics of the Basque Country coastline offer considerable potential for harnessing marine energy, mainly wave and offshore wind. Furthermore, the established industrial fabric and consolidated players in the field of science and technology in the Basque Country provide the sector with a solid technological base and strong starting point.

Two marine energy-related projects of worldwide importance are currently being developed in the Basque Country. The Mutriku wave energy plant, developed by Wavegen (Voith-Hydro Group) and based on OWC technology, is the first of its kind in the world, and is the only plant with a multi-turbine arrangement. All the electricity generated is fed into the power grid. The plant has been operational for over a year.

Additionally, the bimep (Biscay Marine Energy Platform) facilities are designed for research, testing, demonstration and operation of energy converter systems in open sea conditions. The facilities will enable wave energy converters and offshore wind platforms to be installed and tested on-site. The immediate objective is to attract developers and technologists to test their devices in bimep, whilst the longer term objective is to activate the economy and industry of the marine energy sector. The plant will be located in the village of Armintza-Lemoiz, and is currently at the construction stage. Estimated investment costs stand at 20 million euros. The plant, due to be commissioned in late 2013, will be operated by bimep S.A., a company jointly owned by EVE (80%) and IDAE (20%), the Spanish Institute for Energy Diversification and Saving.

Marine renewable energy forms are expected to contribute significantly to power generation. Consequently, a specific industry, science and technology field and value chain will need to be developed and take root if full benefit is to be made of the driver effect of projects such as Mutriku and bimep.

By following these steps, we can help ensure a sustainable future for aviation, an industry which supports nearly 57 million jobs and 3.5% of the world's GDP, not to mention connectivity and support to exporters and businesses the world over. The aviation industry is committed to bringing down its carbon emissions and biofuels will go a long way to helping us achieve that.

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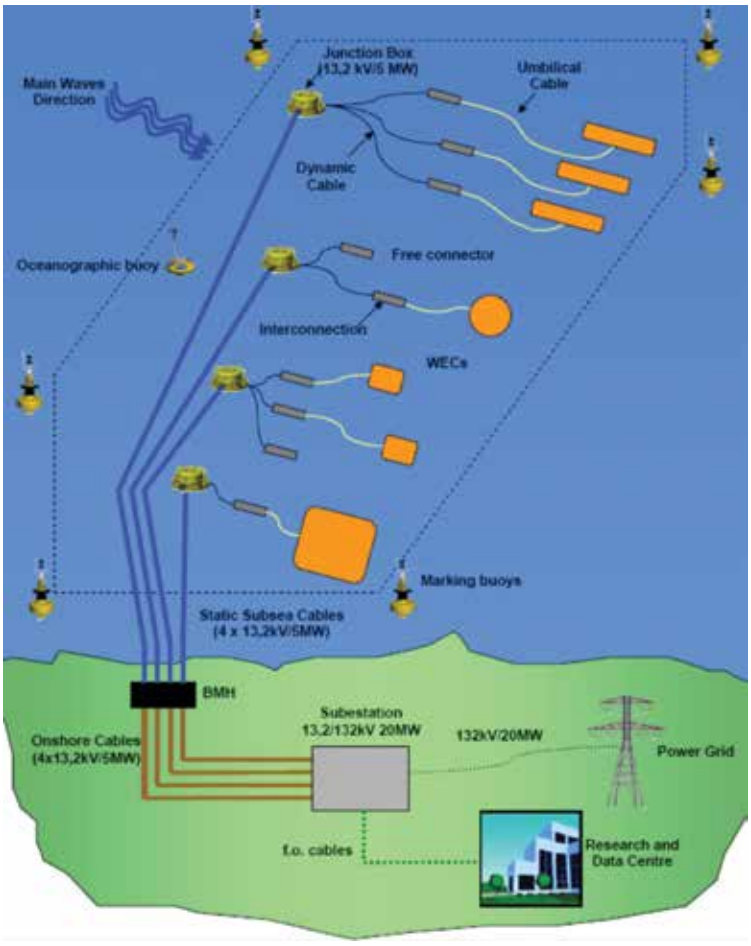

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