



European energyinnovation



Gas

Wind

Finland

Energy Efficient Buildings

**Special Electric
Vehicle supplement**

E-Mobility

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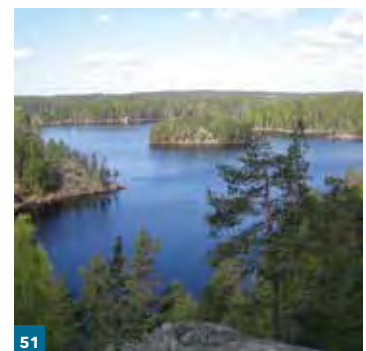


Photo by Huawei staff: Xu Yufeng at Habiriga, Inner Mongolia, China



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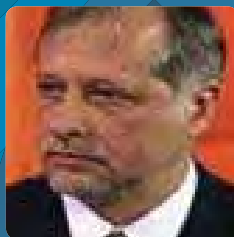
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Foreword

Finance, savings and investment no doubt feature strongly in the minds of those involved with current EU budget discussions; just as they feature strongly in this issue as we keep one eye firmly on the future.

A thoughtful article from Jacques de Jong explores the future of Europe's gas supply. He illustrates the complex relationship between investment and security of demand and of supply to pose the question: is gas to be a fuel of destination, a fuel of transition or a fuel of consequence?

In reminding us of Europe's pre-eminent position in wind energy, Julian Scola argues for a framework to succeed the current 2020 objectives, which he calls "one of the European Union's most successful legislative policies". He suggests a 2030 framework and a supportive policy, against which investment decisions can be made.

A technology that is not understood by its stakeholders is unlikely to succeed. Hans Nilsson explores the importance of Demand Side Management, illustrating his point with an example relating social norms regarding energy-saving behaviour.

We take a more in depth look at energy efficiency in construction. According to Antoni Hidalgo of Eurima, Europe's building stock has economic, environmental and social importance. He offers a ten-point checklist, highlighting factors such as a higher ambition over a longer period. Meanwhile, Adrian Joyce of EuroACE puts figures into this timeframe. Using the energy performance of existing buildings, he explains the benefits of renovating Europe's housing stock, but that meeting this challenge by 2050 will require a near-tripling of the current rate of renewal. Luc Bourdeau and Stefano Carosio of E2BA discuss public-private co-operation and the development of a strategy for the entire value chain, from design and commissioning through to end-of-life optimisation, while Dr. Peter Palensky reminds us that some 40% of final energy use in the EU is in buildings, and that the energy systems of tomorrow's smart cities will look beyond smart building design, towards two-way "building to grid" communication.

We are delighted to feature two contributions from Finnish MEPs in our country focus. Satu Hassi argues that Finland's nuclear policy has affected its renewable energy strategy. Citing difficulties during the development of the Olkiluoto 3 nuclear facility, she suggests that the best policy would be to accelerate the development of the domestic market for new energy technologies and appliances. Meanwhile, Hannu Takkula sounds a clear message that Finland is committed to a carbon-neutral future. He discusses the need for innovation, consistent policy – and appropriate finance.

And so you have it: finance, savings and investment.

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

Michael Edmund

Editor

Shale Gas: Separating fracked from fiction

By Mike Edmund

There have been suggestions that America's development of shale gas offers a model for investment in renewable technologies elsewhere. Sensitive ears may have detected a whiff of triumphant jingoism in an election year; others may have heard the grating sound of slick Industry PR machinery and determined journalism rubbing against each other. Meanwhile in Europe, hope has been expressed in Poland that her shale gas reserves might finally decouple economic growth from pollution. And, it must be said, at the same time reduce her dependence upon energy imported from

Russia. Elsewhere, tremors beneath England forced a temporary halt to prospecting, while France has outlawed it altogether.

Confident assertions have also been made that the US will be completely independent of imported oil by 2030; these have been amplified by extravagant claims of an energy resource that is 'effectively infinite'. One European commentator has observed that we may not actually be running out of oil at all: "the problem facing us", he sorrowfully states, "may not be that there is too little oil, but that there is too much". Meanwhile, talk of "enough oil to deep-fry humanity"; of poisoned drinking water; and of "much of the Earth becoming uninhabitable

and billions of people displaced" together offer a much less

optimistic vision of the future. YouTube videos of flames shooting out of kitchen taps do little to dispel this apocalyptic image.

What implications are there for Europe's carefully-constructed energy strategies? And for her still-fragile economies? Does shale represent a new era of cheap, plentiful energy, a Promised Land if you will; or is it the gateway to Armageddon?

Energy and climate are clearly both too important as issues to be dominated by incendiary rhetoric. Truth invariably lies somewhere between two extreme positions, and we thought it was time to examine some of the facts.

WHAT IS IT AND HOW MUCH IS THERE?

At the centre of the debate is shale, the commonest sedimentary rock on Earth. Shale is composed originally of mud, deposited over millions of years in very slow moving waters such as lakes, lagoons or river deltas. Normally grey, the rock may be black where significant quantities of organic matter have also been deposited; this of course may offer a clue to the presence of economically-useful hydrocarbons. An important physical characteristic of shale is that it may break along parallel planes within the structure, a property known as fissility. These so-called bedding planes arise from the orientation of the mineral



flakes within the rock, and from the existence of layers whose composition differs slightly according to variations in the mud originally deposited.

Hydraulic fracturing, or fracking, uses pressurised fluid to create and propagate fractures in the bedding planes to allow the release of trapped hydrocarbons. The new technology unlocks enormous quantities of gas, and makes shale one of the most important natural resources upon the planet. This is no exaggeration: there are over 6,500 trillion cubic feet of shale gas on the planet, according to the best current estimates. China's shales alone are thought to contain some 1,275 trillion cubic feet; those in America over 850 trillion cubic feet; according to one estimate, this could supply the US for over a century. For comparison, Russia possesses the largest known conventional reserves of natural gas, some 45 trillion cubic feet.

If these figures are impressive, those for oil are truly staggering. A great deal of the current American enthusiasm stems from the oil being extracted from the Bakken Shale in North Dakota and the Eagle Ford Shale in Texas: there may be in excess of 400 billion barrels there, though the amount recoverable with current technology may be less than 10 billion barrels. However, these figures are dwarfed by those for the Green River formation in Wyoming. It is estimated to contain about 3 trillion barrels of oil, of which half may be recoverable, depending on available technology and economic conditions. Saudi

Arabia currently holds the largest known conventional reserves of crude oil, some 263 billion barrels. However, although Green River is a shale formation, the oil it contains is not amenable to fracking. It must instead be pyrolysed: in effect to be "cooked", to release it.

Clearly, there are considerable economic and geopolitical implications of a possible shift in hydrocarbon production from the Middle East and Russia to the United States.

HOW CLEAN IS IT?

There are environmental implications too: gas is a 'cleaner' fuel. According to figures from the US EPA, generating electricity from gas produces less than half the CO₂, while reducing SO₂ emissions by over 99% and NOx emissions by two thirds. However, these advantages must be balanced against other potential environmental issues associated with the production of shale gas. The fracturing wells require large amounts of water, which may affect availability for other uses, particularly in relatively dry regions. It may also affect aquatic habitats, while both the gas that is not collected for consumption and the chemicals used in the process may leak into the surrounding rocks, or even affect the water table.

DOES FRACKING CAUSE EARTHQUAKES?

38 seismic events associated with fracking in British Columbia were detected by Natural Resources Canada. They ranged between magnitudes 2.2 and 3.8 on the Richter scale. In an area being test drilled in England, one event

of magnitude 2.3 was followed seven weeks later by a second of magnitude 1.4.

Globally, there are over one million naturally-occurring events in the Richter range 2.0–2.9 per year. They are classed as minor, and may be felt by few to many persons up to several miles or kilometers from the epicentre. There are over 100,000 natural events in the range 3.0–3.9; they are also classed as minor, and are likely to be felt by many to all persons in the area, but very rarely cause damage.

Behind all this is one overarching observation. Apart possibly from the odd atom in nuclear reactors, there is exactly as much carbon on the planet today as there has always been: fossil fuels comprise a colossal natural carbon capture and storage system. And in the case of the Bakken Shales, that carbon has been sequestered away for over 350 million years, since the Devonian Period. The earth's average temperature during that time was approximately 6 degrees higher than the pre-industrial period, atmospheric CO₂ at 2200ppm was 8 times the pre-industrial level, and mean sea level was over 100 metres above that of today.

Shale Gas may well offer short-term economic advantages, while its exploitation probably causes no more environmental damage than current mining technologies. But burning it will surely exacerbate long-term anthropogenic climate change. When looking into our Devonian past, we surely do not wish to see a reflection of our future. For climate change is surely more than fiction. ●

BIOCORIN:

New biocoating for corrosion inhibition in metal surfaces

The project BIOCORIN “New biocoating for corrosion inhibition in metal surfaces”, is a collaborative project funded by the European Commission in the framework of the Environmental Theme, Topic ENV.2011.3.1.9-1 Eco-innovation. This European initiative aims to research and development of novel eco-efficient environmental technologies whose use can sustainability contribute, directly or indirectly to the reduction of materials and resource use, energy consumption, pollution emission.

Actually, according to the World Corrosion Organization (www.corrosion.org), the annual direct cost of corrosion estimated

worldwide exceeds €1.32 billion which means approximately between 3 to 4% of the Gross Domestic Product (GDP) of industrialized countries. Different types of corrosion can appear in structures or systems made of metal depending on the environmental conditions and type of metal involved.

Microbial Induced Corrosion (MIC) is a very aggressive form of corrosion with many proposed mechanisms for its prevention but as yet there is no internationally agreed mechanism against it. In the past, antifouling coatings most commonly used to protect structures from MIC corrosion were based in Tributyltin (TBT) compounds, which were banned in 2008. Other existing

solutions of antifouling and biocides include compounds and techniques such as epoxy coatings, steel treatments, copper and silver ions. Nowadays, latest research has begun to focus on environmentally friendly replacements, but up to now, with low environmental performance and durability ratios.

BIOCORIN project aims at developing a green alternative to the coatings and solutions used up to date for microbial induced corrosion (MIC) protection and prevention in infrastructures. As the concept of the project is the identification of anti-fouling microorganisms, their later integration in a sol-gel coating and finally the monitoring of the coating performance, latest technologies, solutions and methods related to those fields will be analysed.

WHAT'S MIC

MIC refers to the influence of microorganisms on the kinetics of corrosion processes of metals caused by their adhesion to the interfaces of the metal (usually called biofilms). These biofilms are the first stage of the biofouling generation which refers to the accumulation of unwanted material on solid surfaces, most often in an aquatic environment but also in terrestrial environment with high rates of moisture.

MIC is caused by bacterial microorganisms in combination

Microbial induced corrosion in steel surfaces





with four other environmental conditions: metals (host location), nutrients, water, and oxygen (although some bacteria need only very small amounts of oxygen). Some of these microorganisms are capable of producing metal dissolving metabolic by-products such as sulfuric acid, and are often identified within a classification termed sulfate reducing bacteria, or SRB.

BIOCORIN SOLUTION

BIOCORIN project proposes an innovative method for tackling MIC corrosion in different environments based on biotechnology. The project's concept is to tackle the microorganisms that perform the major role in MIC corrosion in the different environments and conditions selected by identifying and selecting the corresponding "antifouling" microorganisms whose secreted compounds inhibit the action of the main bacteria involved in MIC.

Then, a coating based on sol-gel technology will be designed to immobilize the living microorganisms that will prevent MIC corrosion. The sol-gel system developed will have to be highly biocompatible with the microorganism identified, allowing to incorporate living cells and very sensitive biomolecules. In addition, the design and formulation of sol-gel coatings will also have to be compatible with the defined metal surfaces and must show very good adhesion to the metal surfaces, too.

The microorganisms with anti-MIC properties will be embedded within a stable matrix system in sol-gel coatings specifically

designed for assuring the viability of the anti-fouling microorganisms during the service life of the coating (increasing the coating service life by 30% with respect to other existing anti-corrosion coatings). This biocoating will be expected to prevent the microbial influenced corrosion and biofouling in metal surfaces for civil engineering structures, increasing the durability and performance of these structures and therefore resulting in important economical savings.

The technology will be demonstrated and validated by means of three case studies with different environmental conditions:

- Marine demonstrator at the North Sea (Port of Harlingen, The Netherlands)
- Marine demonstrator at the Atlantic Ocean (Pontevedra, northwestern coast of Spain)
- Marine and terrestrial demonstrators at Mediterranean Sea (Naples, Italy)

BIOCORIN technology arose as an innovative biomimetic and eco-efficient environmental coating for metal surfaces of civil engineering structures in marine and terrestrial environments such as highway bridges, gas and liquid transmission pipelines, waterways and ports, airports and railroads. Considering MIC as 10% of total corrosion, the potential impact of this technology at the European level could mean saving about 600,000 million euros in the maintenance of these structures. ●

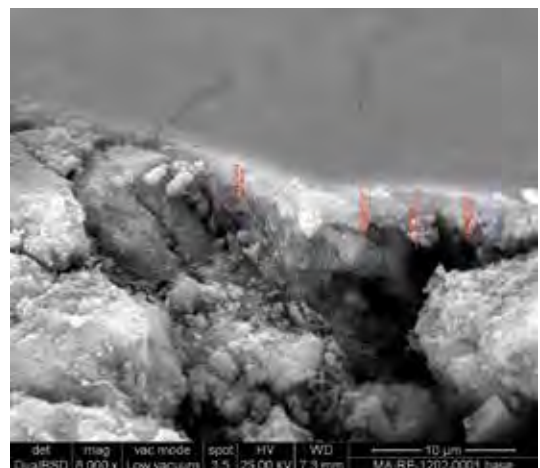
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(Above) Synthesis of sol gel at laboratory scale

(Below) Micrograph of sol-gel





Solar roads

A greener, safer future?

In 2010, according to Eurostat, a little over three quarters of the total freight that moved across the EU-27 did so by road. The importance of the network is shown even more clearly when it is affected by accidents, or by winter snow and ice. It would however be fair to point out that, apart from performing this vital role as Europe's transport arteries, major roads are not much use for anything.

Not, perhaps, until now. An electrical engineer from Idaho believes that the roads of the future can generate electricity, and from this can be made to perform many more functions. Step forward, Scott Brusaw.

According to Brusaw, tarmac and concrete carriageways can be replaced with an appropriately strengthened heat-absorbing glass, within which are embedded photovoltaic cells: effectively, he is proposing to convert roads into gigantic linear solar panels. The electricity

would power embedded heating elements, which could melt snow and ice in winter, keeping traffic moving and reducing accidents. Fewer potholes and ruts would be likely, reducing maintenance costs. It could illuminate the carriageway at night, further contributing to safety, particularly where no street lighting exists. It could recharge electric vehicles continuously, removing concerns over their range. And Brusaw's idea goes even further: his design can incorporate microprocessor-controlled pressure sensors and coloured LED lights, making the road surface interactive. A 4 metre square prototype panel of the material can be made to flash the words "SLOW DOWN" remotely, in response to pedestrians crossing a pressure-sensitive pad.

There are, as always, issues to resolve. The new surface is expensive. The properties of the glass need to be refined and its acceptability established (the English often use the phrase "like

driving on glass" when a road surface is frozen and dangerous). But a series of intermediate steps, such as replacing car parks or driveways could surely provide critical experience; and generate useful electricity.

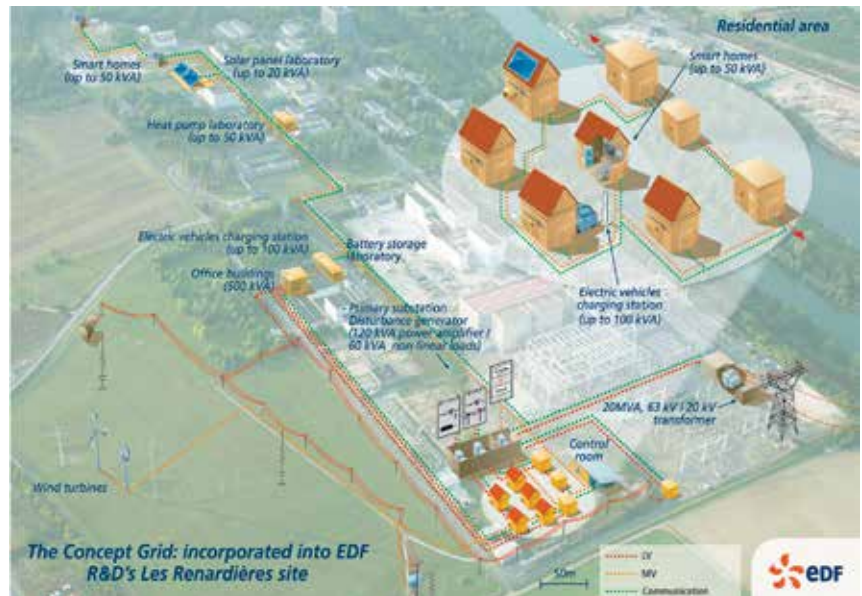
And so to cost. According to Brusaw, the price of tarmac rose sixfold in the period 2007-2010. He also calculated in 2010 that replacing the 25,000 square miles [64,750 square kilometres) of tarmac within the lower 48 States* with his material could generate three times the electricity required by the US; or almost satisfy the entire global demand. This magazine suggests that a small proportion of the current investment in renewable technologies might help bring this innovation into production; and on to Europe's roads. Putting aside the colossal potential it represents, one cost that cannot be quantified is that of the lives it might save. ●

*The United States of America, excluding Alaska and Hawaii.

CONCEPT GRID: shaping the future

To meet Europe's carbon commitments, bolster energy efficiency and improve security of supply, electricity grids must be transformed.

Smart grids leverage the latest in communication and information technologies to give all players real-time information about energy usage and traffic. With smart grids Europe will better integrate variable renewable energy sources, use energy more efficiently, improve prediction and protection against interruptions in supply, empower consumers to take control of their energy management, and give the energy industry a vital tool to deliver carbon reductions and optimise the quality of the service they provide.



EDF'S CONCEPT GRID

The Concept Grid is a large-scale scientific facility linking up laboratories, smart homes, renewable generation sources, heat pumps, low- and medium-voltage lines and recharging stations to a command-and-control centre. It enables researchers assess how the range of generation, transmission, storage and end-use technologies can be integrated into one efficient, flexible and responsive system. Because it is self-standing, researchers can explore failures and complex relationships of variables that would be impossible to replicate on a grid in operation.

A step forward. The Concept Grid integrates multiple innovative features:

- Laboratories to measure the effects of every technology connected to the grid

- Simulation of failures and their impact on the system and each of its component parts
- In the near future, the Concept Grid will enable assessment of how current protection systems will perform with smart grids, giving us vital information on how to integrate new infrastructures into the existing grid architecture.

A bridge between research and the market. Bringing together researchers and industry experts, the Concept Grid aims to develop and evaluate promising new technologies and systems and bring them to the highest standards of quality, safety, security and cost-effectiveness.

A comprehensive approach. The Concept Grid draws on expertise from a range of stakeholders, to better understand what smart grids can offer to everyone, from energy suppliers to appliance manufacturers and beyond.

A process in evolution. Throughout the project we are integrating new features and ideas into the system. A multi-terminal direct current connection is being developed and we are studying possibilities for large-scale storage.

A collaborative platform. When it is put into operation early in 2013, the Concept Grid will be open to our partners and academic institutions in Europe.

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Roadmaps for building renovation: 10 key factors for success

By Andoni Hidalgo, Public Affairs and Communications Manager at Eurima, the European Insulation Manufacturers Association

Over the last few years there has been a growing consensus that a strategic and co-ordinated renovation of the building stock is an economic, environmental and social imperative for the EU.

- On the **economic side**, the recovery of the construction sector - which generates almost 10% of the EU's GDP but that has been most hard hit by the economic crisis- will be crucial to boosting economic activity across Europe. In addition, the building stock is responsible for 40% of the EU's final energy consumption,

accounting for much of the more than €400 billion in EU energy imports in 2011.

- On the **environmental side**, the building stock accounts for 36% of the EU's CO₂ emissions. If the EU is serious about its medium and long-term targets for climate change mitigation, this sector must be addressed properly.
- On the **social side**, building and infrastructure works fell by 16 % between January 2008 and November 2011 across the EU-27¹, and unemployment levels have dramatically risen in this

sector. As well as putting people back to work, building renovation will alleviate fuel poverty, an increasing problem for more and more EU citizens, which without serious action will be aggravated by increasing energy prices.

The need for bold action on building renovation has been recognised in the newly adopted Energy Efficiency Directive (EED), under which all 27 EU Member States must establish long-term strategies (or Roadmaps) for mobilising investment in the refurbishment of their national building stock (public and private, residential and commercial) by April 2014.

Building renovation Roadmaps offer European countries a unique opportunity to tap into the massive potential of buildings. This will require thorough planning and innovative approaches in policy-making: Member States will need to systematically and thoroughly assess the performance of the national building stock, to implement and coordinate programmes, policies and measures that deliver ambitious results in the short, medium and long term and they will need to work with new stakeholders, particularly the finance sector, to develop the necessary structures



to mobilise and channel investments.

Renovation strategies can appear rather daunting undertakings for many national authorities. However, this *Roadmapping exercise* is not only feasible, but also indispensable if Member States want to re-launch their economies, create jobs and make huge energy savings. At Eurima we believe that successful building renovation roadmaps require 10 basic elements:

1. **High ambition level covering a longer period of time**, long enough for sustainable change to become visible and materialise. A horizon 2050 would be the best option
2. **Clear targets, including intermediate milestones**: research has demonstrated that, by 2050, the EU building stock can reduce its final energy consumption for heating and cooling by 80%, with a reasonable yearly rate of renovation. This goal should be accompanied by clear intermediate targets (for the years 2040, 2030, etc.)
3. The need to **address the whole building stock**, encouraging the public sector to play a leading role, while applying a holistic or deep approach at individual building level
4. **Integrate energy performance with broader societal goals**, including employment
5. Be based on **sound analysis of the status quo**, identifying existing barriers and ways to overcome them
6. Gather **support from all levels of Government**, market actors and stakeholder parties
7. Take into account **changes in society**, demographics and housing needs
8. Include **flexible, creative thinking** beyond what has been tried before
9. Include **robust monitoring and evaluation** processes
10. Address the **need for immediate action**: if significant results are to be achieved, the work must start now.

An overarching principle to all those elements is the uniqueness of each intervention: in order to avoid waste of money and resources, a building refurbished today will not be renovated again for at least 30-40 years. This means that -if we want to fully tap into the potential benefits of buildings- we only have one chance to do it right or wrong. Strategic, innovative Roadmaps for building renovation -integrating the elements above- are an essential starting point to make the right choices. ●

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HEAT4U Project

Energy Commission opts for gas absorption heat pumps and renewable energies for European existing residential buildings

HEAT4U is one of the most important research projects funded by the European Commission with the purpose of developing an indoor heating solution that can provide a significant contribution to the use of renewable energies and to rational energy consumption. The European Commission supports a Consortium of 14 companies gathered under the HEAT4U project, whose goal is to further develop the gas absorption heat pump technology so as to make it available for existing small-size residential buildings, which are the main contributors to polluting emissions in the Old Continent.

THE CONSORTIUM

14 among the most important European organizations in the energy, industrial, and research fields are involved in HEAT4U Project, namely Robur - which is the project coordinator, - Pininfarina, ENEA, Polytechnic University of Milan, D'Appolonia and CF Consulting from Italy; Bosch Thermotechnology, E.ON and the Fraunhofer Institute research centre from Germany; GDF Suez and Gas Reseau Distribution France from France. The consortium also includes UK-based British Gas, the Polish Flowair, and the Slovenian company ZAG. The overall investment for such effort amounts to close to Euro 10 million.

*HEAT4U Project
 launching
 conference on
 26th January
 2012, Milan.
 Roundtable*

THE CHALLENGE

The challenge for this project, which shall continue through to 2014, is to implement the gas absorption heat pump technology, currently used for heating condominiums, commercial and industrial buildings, and public administration facilities. Also in the area of single-family detached residential homes. In particular, in existing buildings, which, according to recent studies carried out by the European Union, account for approximately 49% of the overall energy consumption in terms of primary energy, and for 36% of greenhouse-gas emissions. Gas absorption heat pumps shall also be presented as a means for improving the heating efficiency

of the existing residential building stock, which, by itself, accounts for over 60% of the built environment in enlarged Europe.

USE OF RENEWABLE ENERGY

Used in existing buildings, the gas absorption heat pump technology would increase the energy efficiency by over 40% thanks to the use of renewable energies derived from the environment (air, ground, water). Each gas absorption heat pump used in a single-family detached residential home would bring about an annual saving of 0.8 tons of oil equivalent and would prevent the emission of 2.1 tons of CO₂, which equals the amount that is absorbed by 300 trees. By using this technology, each household



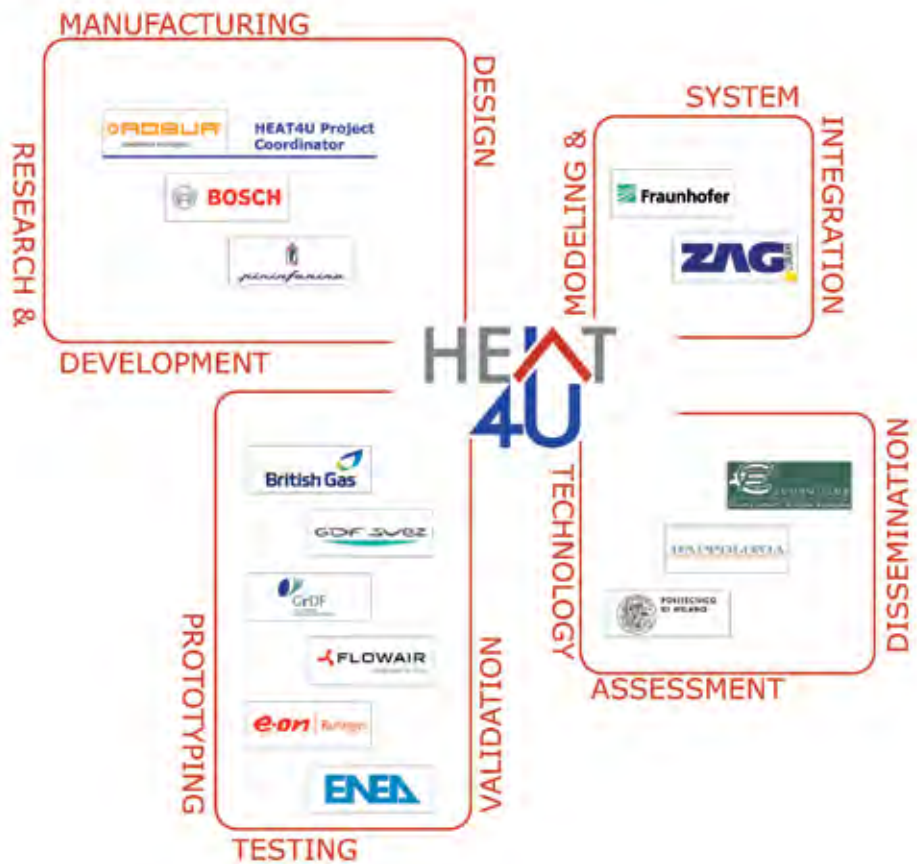
might compensate for the CO₂ emissions produced by their car. This technology would also enable to use the current heating units (radiators) and the existing gas grid, to maintain high levels of efficiency also under extremely low outdoor temperatures, as well as to provide domestic hot water.

TECHNOLOGY AVAILABLE ON THE MARKET WITH PROVEN RELIABILITY

The benefits of the gas absorption heat pump technology have already been broadly certified in the existing version developed for the light-commercial market. Over 7,569 gas absorption heat pumps currently installed in Europe allow to save 12,153 toe (tons of oil equivalent) every year and to prevent the emission of over 31,904 tons of CO₂.

FIRST PROMISING RESULTS OF THE PROJECT

A first important result is the analysis on market opportunities and value chain of Gas Absorption Heat Pumps for existing residential buildings and the development



of the technology, in particular the optimization of the capacity modulation, reducing power consumption and sound pressure.

Moreover, construction of test laboratories at the Politecnico di Milano and at the Fraunhofer Institute was started according to EN12309 protocol. The first prototypes have fully confirmed the performances expected and the solution of the technological challenges posed by this project, namely bringing the Gas Absorption Heat Pump technology into the typical power range of single-family detached residential homes and reaching an estimated global efficiency on primary energy of 150%. Mr. Pininfarina Project Partner focused on the development of design and aeroacoustic optimization. The work began with an analysis of aeroacoustic benchmark with equivalent heat pump units. Then, different design solutions have been carried out. Styling, functionality, innovative, user friendly, robust: these are the

keywords of the design work.

According to the goals of the HEAT4U project, the investment required for each heating unit for the residential building market shall make the gas absorption heat pump technology one of the most competitive solution on the heating market. ●

Gas Absorption Heat Pump + air source renewable energy already available for light commercial, industrial and residential central heating market.



Heat4u Project Consortium Kick off Meeting on 27th January 2012, Milan



Meeting the renovation challenges in the EU by 2050

By Adrian Joyce, Secretary General of EuroACE



One of the great challenges of our time is how to reduce the energy demand of our building stock in a timeframe that will have positive effects on the EU economy, on EU society and on the global environment. This challenge must be met if the EU is to achieve its long-term goals of moving to a low-carbon economy¹ by 2050.

At the present time, a full 40% of all energy is consumed in buildings and that use is, in turn, responsible for about 36% of the CO₂ emissions of the EU. Unless this very high level of consumption is addressed, the EU has no chance of reaching its 2050 goals.

The Renovate Europe Campaign² that was initiated in 2011 by EuroACE³ is a political communications campaign that is increasing knowledge and



awareness of the multiple benefits of investing in the energy efficient renovation of the EU building stock, thus opening political space for the adoption of stable, long-term policies and legislation that will drive a transformation in the construction sector such that the energy demand of the EU building stock will be reduced by 80% by 2050 as compared to 2005 levels.

To achieve this objective, it will be necessary, over the period to 2020, to increase the renovation rate in the EU from the current annual average of 1.2% of the

building stock to 3% of the building stock per year. Delivering this transformation will require a great coordinated effort across several policy fields and areas of activity and the actions required will need to be undertaken at all levels of governance.

The rewards will, according to a new study by Copenhagen Economics⁴, be significant for both society at larger and for public finances in particular. In fact, investing in ambitious energy efficient renovation of the EU building stock could give up to €175 billion in benefits to

society in 2020, with a possible doubling of this amount by 2030 if investment continues. In the interim, such investments will speed economic recovery in the EU and will deliver up to €291 billion in additional GDP in the period up to the return of the EU GDP to its structural level.

The energy efficiency in buildings sector already has well developed technologies at its disposal, but there is a strong on-going need to invest in research, development and innovation in this sector - a need that is made more urgent if we are serious about achieving the targets outlined above. However, most of the serious barriers to growth in the sector still have to be addressed: financing, training, capacity building and articulation of short and long term targets for energy efficiency in the sector.

For such challenges, Intelligent Energy European (IEE) is one of many EU programmes that addresses the research, development and innovation needs of the sector. It is ideally structured for the promotion of innovation and it has already delivered many positive results in the field. EuroACE has noted that the added value of projects under the IEE Programme is of a more long term nature than pure research and development projects in the technology field. It is therefore concerned to hear persistent rumours about the intention of the European Commission to discontinue the IEE Programme as a stand-alone programme during the next funding period (2014 to 2020).

In our view, plans for the



future IEE Programme should encourage continuity, best practice sharing and training in order to upgrade skills in the context of the societal challenge faced in the energy efficiency of buildings sector. It should also foster training across the full construction value chain from design professionals to tradesmen on sites across the EU. Capacity building in the public sector would also be highly relevant as the implementation of the recently adopted Energy Efficiency Directive will require all Member States to renovate 3% of their central government buildings each year from 2015 onwards.

Reaping the multiple benefits of energy efficient renovation of the EU building stock will require better integration of energy efficiency measures and policies into the wider EU energy policy and innovation agendas, thus improving the understanding of the role and impact the building sector can have in meeting EU economic, climate and energy 2050 objectives. ●

The Renovate Europe Campaign held its annual conference at the Thon Europe Hotel in Brussels on the 11th October 2012. This venue was chosen as the building is an example of a deep renovation, thus proving that the ambitions of the Campaign can be achieved. The energy consumption of this building before renovation was in the region of 260kWh/m²/year and it is now in the region of just 60kWh/m²/year - a better than Factor 4 improvement!

EuroACE
 THE EUROPEAN ALLIANCE OF COMPANIES
 FOR ENERGY EFFICIENCY IN BUILDINGS

RENOVATE EUROPE
 A Campaign of EuroACE

- 1 See: http://ec.europa.eu/clima/policies/roadmap/documentation_en.htm
- 2 See: www.renovate-europe.eu
- 3 See: www.euroace.org
- 4 See: www.renovate-europe.eu/Multiple-Benefits-Study
- 5 See: <http://ec.europa.eu/energy/intelligent/>

LEEMA: Novel insulation materials With low embodied energy

The project “Low Embodied Energy Advanced (Novel) Insulation Materials and Insulating Masonry Components for Energy Efficient Buildings” also known as LEEMA is a project funded by European Commission in the framework of FP7 thematic priority area “Energy-efficient Buildings (EeB)”. LEEMA aims at the development of a new generation of inorganic insulation materials and building insulation masonry components, that will have more than 50% lower embodied energy and at least 15% lower total cost, than the currently available insulation materials and existing solutions. Additionally, the new insulation materials will have good and stable thermal and acoustical performance, will be incombustible, not degradable, will not shrink or settle over time, will be and remain lightweight over service life, will be safe during handling and installation

and will not pollute the indoor building environment. The above objectives will be achieved through the development and application of innovative technological routes for the production of the proposed insulation materials, combining a. novel synthesis processes, b. integration of appropriate wastes in the production cycle, and c. intelligent utilisation of the chemical and mineralogical properties of the raw materials.

The project is coordinated by S&B INDUSTRIAL MINERALS S.A. (Greece) which constitutes a Group of companies, with a strong international presence providing mineral-based solutions in different sectors, like construction, metallurgy, foundry etc, in more than 60 countries worldwide. The whole consortium comprises 14 partners, including two universities (National Technical University of Athens and UNIVERSITAET STUTTGART), two

research institutes (BAUHAUS-UNIVERSITAET WEIMAR and Centre Scientifique et Technique de la Construction), six large industries (S&B, Redco N.V, SCHLAGMAN BAUSTOFFWERKE GmbH & Co KG, Thermal Ceramics de France S.A.S, FIBRAN S.A, Morando S.r.l) and two SMEs construction companies (Imprima Construction Cz a.s and FENIX TNT SRO). LEEMA started on January 2012 as a four years project. The total budget of LEEMA is 8.118.296€, from which 35% is dedicated on demonstration activities where the new products will be produced at appropriate quantities/dimensions and will be used for field tests to assess their mechanical, thermal, acoustical and environmental properties under conditions simulating their application in a building. Moreover, the test results will be used for providing certification modules.

BACKGROUND: ENVIRONMENTAL FOOTPRINT OF CURRENT INSULATION MATERIALS

The recent years the European citizens become increasingly familiar with the concept of energy in use - that is the energy required by the occupants of an existing building, primarily for space heating, water heating and lighting - and of the need to reduce it. However they have not yet realized that energy is needed not only to run a building





but also to create the building products and the building itself. The embodied energy of a building, defined as the total energy required to produce the building components, to transport them in place and to construct the building, is a significant component of its lifecycle impact and can be the equivalent of many years of operational energy. An average household contains about 1,000 GJ of energy embodied in the materials used in its construction, which is equivalent to about 15 years of operational energy consumption. Therefore, the development and use in construction works of building materials of low embodied energy will directly reduce the overall environmental impact and improve the sustainability of the building sector. However, it has to be stressed that the development of low embodied energy building materials should be achieved without compromising technical, health and environmental standards and, in parallel, should be aligned with the effort to improve their thermal and acoustic properties and energy efficiency and performance of the whole building envelope. Moreover, under the current situation of global financial recession the cost element should be definitely taken into account in such an effort.

LEEMA SCIENTIFIC APPROACH AND END PRODUCTS

Within LEEMA project a range of new insulation products will be developed that will be suitable for applications both in new and retrofitted buildings. At the

end of the project different fully operational components will be delivered: loose filling insulation materials, foam boards, innovative boards that will replace Fresco and fibre boards and innovative bricks with advanced insulation properties. The production of the new insulation materials will be based mainly on three routes. The first one is the intelligent use of appropriate, inert, natural alumino-silicate raw materials originating from "zero-embodied energy" wastes of industrial mineral exploitation (i.e. perlite, bentonite, amorphous silica and other volcanic minerals) and other industrial wastes. The second route is focused on the application of novel very low energy consuming synthesis processes based on inorganic polymerisation and thermal expansion that taking advantage of the unique and favourable chemical and mineralogical composition of the above wastes enables the synthesis of the new insulation materials at significantly milder conditions.

Their compliance with technical, safety, health and environmental performance will be tested according to all relevant EN standards and will be ready to be certified by internationally recognised certification organisations in Europe. The assessment of the environmental sustainability of each one of the new insulation components will be performed with life cycle assessment studies carried out according to the International Reference Life Cycle Data System (ILCD) Handbook. ●

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Preparing the ground for low energy Central and Eastern Europe

The Building Performance Institute Europe (BPIE) has researched ambitious definitions and roadmaps for Romania, Poland and Bulgaria which will help these countries progress towards the nearly zero-energy standard and thereby help to dramatically reduce energy consumption levels. The recommended approach -delivering important environmental and economic benefits- is a holistic one, combining policy with support measures and advising governments to make buildings part of their overarching energy strategy.

PREPARING THE GROUND FOR nearly ZERO-ENERGY BUILDINGS IN EUROPE



www.bpie.eu



Photo: Sapphire Ventures Sp z o.o.



European legislation on buildings (EPBD) and energy efficiency (EED) requires European member states to develop strategies on how to transform their national building stocks into more climate friendly constructions. Indeed, very low energy performance standards, so-called 'nearly Zero-Energy Buildings' will

become mandatory for all new constructions from 2020 onwards. To facilitate this process and to demonstrate the technical and economic feasibility of ambitious approaches to low energy buildings, the BPIE has undertaken a technical and economic analysis of the situation in three Central and Eastern EU countries - Poland, Romania and Bulgaria.

buildings in



Photo: SolAir Ltd

as the integration of renewable energy sources) hold true for Romania, Poland and Bulgaria. The analysis is based on national building data, economic conditions and existing policies. Different technological solutions -using variants of improved thermal insulation, energy efficient equipment for heating, cooling, ventilation and hot water and considering renewable energy generation- were simulated for optimizing the energy performance of three building categories: offices, single-and multi-family houses. The results of the study, which BPIE sees as 'food for thought' more than a 'doctrine', illustrate that implementing state-of-the-art technologies can bring considerable energy and CO₂ savings and thereby reduce the energy bill. However, taking into account the high upfront capital necessary to bring the building's energy demand to the required nearly zero-energy levels, even the best case scenarios do not lead to a full return on investment. From a micro-economic perspective this simple fact underlines the need for substantial supporting measures in form of attractive financial or fiscal incentives - if nearly Zero-Energy Buildings are to become a reality. From a macro-economic and societal perspective, nearly Zero-Energy Buildings will generate important benefits by creating numerous jobs in the construction sector and supply chain industry and by improving the living conditions of especially low income populations. Political will to realize the potential of nearly Zero-Energy Buildings will be the key if we want our habitat to be 'green' in the very near future. ●

The three studies entitled 'Implementing nearly Zero-Energy Buildings, Towards a national definition and roadmap' build on the previous BPIE report Principles for nearly Zero-Energy Buildings and evaluate through simulations whether the assumptions and recommendations made earlier (specifically on acceptable energy demand and CO₂ levels as well

BPIE LAUNCHES THE FIRST OF ITS KIND DATA HUB FOR BUILDINGS PERFORMANCE IN EUROPE

The Buildings Performance Institute Europe (BPIE) launched this week its data hub for buildings performance and related policies in Europe, www.buildingsdata.eu. The comprehensive open data portal presents facts and figures collected for 'Europe's Buildings under the Microscope' study released end of 2011. It includes a wide variety of technical data never collected EU-wide before.

The data hub has been created to assist policy makers at EU and Member State level, technical experts, building professionals, researchers, academics, consultants, NGOs and the broader energy efficiency in buildings community by giving them the possibility to access country profiles, search specific parameters, generate overviews and graphs as well as screen the underlying data. The tool allows for cross-country comparisons and cost free downloads. Only the access to the original data requires prior registration. Suggestions for data updates and corrections will be possible through online forms.

The BPIE data hub has the ambition to become an in-depth source for anyone interested in energy efficiency in European buildings. The data will be improved on an on-going basis and over time, the hub will get enriched with additional topics and information generated through data exchange projects and research partnerships. BPIE is inviting other relevant organisations to contribute their data and to join BPIE in increasing transparency about the energy performance of the European building stock.

Download the reports on the BPIE website at www.bpie.eu

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 lays on knowledge creation and dissemination in the field of energy performance in buildings. The Brussels-based institute, in operation since February 2010, is the European Hub of the Global Buildings Performance Network. Visit www.bpie.eu



Sustainable retrofitting

Saving energy, saving money and improving indoor comfort

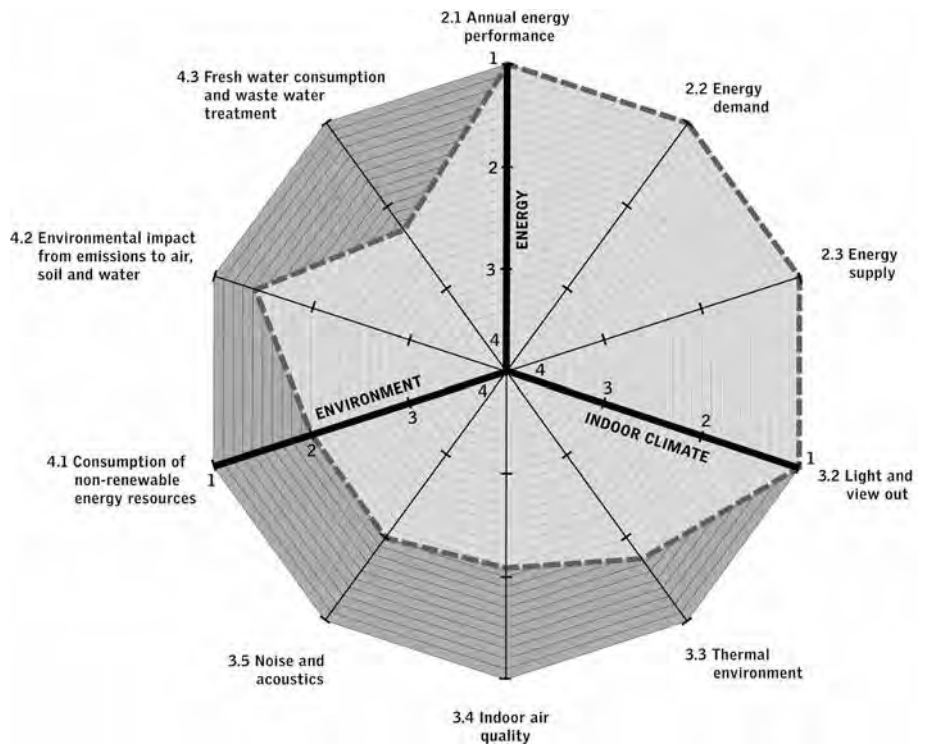
It is still a widespread belief that sustainable retrofitting in the building sector comes at a high cost. The VELUX Group work actively to demonstrate that sustainable buildings - new as well as retrofitted - are competitive seen through the complete life cycle. Greater comfort and benefits in terms of health, learning capabilities and

productivity are among the most important economic effects of sustainable buildings.

The VELUX Group works actively to promote sustainable living in buildings. We believe that the quality of people's lives and the quality of the environment are closely interlinked. Under the credo Sustainable Living we want

to inspire buildings that give more than they take, i.e. buildings that combine high energy efficiency with good indoor climate and make use of renewable energy sources.

The potential in sustainable retrofitting is huge. By 2050, 90 per cent of the existing buildings in Europe will still be there, and



The Active House radar measurement of the German Model Home project "Lichtaktiv Haus" shows the effect of the holistic approach, balancing ten parameters of sustainable building design.

In 2012, Model Home 2020 by the VELUX Group was admitted to Sustainia 100, a global catalogue of sustainable solutions that serves as inspiration for future sustainable living in buildings.



even today many buildings are long due for upgrading and modernization. As part of the Model Home 2020 experiments conducted by the VELUX Group in five European countries, the opportunities for sustainable retrofitting have been explored.

In Germany a typical settler's house from the 1950s was converted into a carbon-neutral home with focus on optimum livability, fulfilling the European 2020 targets for energy savings. The house uses solar energy,

passive solar gains from plenty of roof and façade windows and natural ventilation to ensure a pleasant indoor climate with plenty of fresh air and ample daylight in every room.

Succeeding with sustainable living is therefore no longer a futuristic dream. Carbon-neutral buildings with plenty of daylight and fresh air can be designed and constructed at competitive prices, using materials, building components and technology already available today. ●

About the VELUX Group

The VELUX Group creates better living environments with daylight and fresh air through the roof. The VELUX product programme contains a wide range of roof windows and skylights, along with solutions for flat roofs. The VELUX Group represents one of the strongest brands in the global building materials sector and its products are sold in most parts of the world. For more details on sustainable living, visit www.velux.com/sustainable_living

European innovation development strategy towards energy-efficient buildings

By Luc Bourdeau, Stefano Carosio (E2BA), Belgium

A PUBLIC PRIVATE PARTNERSHIP (PPP) BETWEEN INDUSTRY AND THE EUROPEAN COMMISSION

The key objective of the Energy Efficient Buildings Association (E2BA), representing a large set of stakeholders of the construction

sector and associated technology sectors, is to promote the creation of an active industry for the production, supply/distribution of advanced systems, solutions and added value services with a view to satisfy the needs on energy efficiency for the built environment.

The Association is engaged since 2009 in a Public-Private Partnership (PPP EeB) with the European Commission (EC) to develop and deploy a full Research, Development and Innovation (RDI) program at EU level. As a matter of fact, buildings provide a large untapped cost effective potential for energy savings, but in order to speed up the deployment of key technologies at least cost, it is crucial to increase innovation in the fields of energy efficient construction processes, products and services.

THE RUNNING PPP EEB

The PPP EeB was launched as part of the economic recovery plan in 2008. The PPP EeB uses existing FP7 mechanisms whilst providing a midterm approach to R&D activities. It brings together various Directorates Generals (DGs): DG Research and Innovation (Nano, Materials & Processes, and Environment priorities), DG Energy, and DG Communications

Networks, Content and Technology, in close dialogue with industry.

AN OVERALL VISION TILL 2030

The E2BA ambition is to drive the creation of an innovative high-tech energy efficiency industry extending the scope of the running EeB PPP beyond 2013. Connecting construction industry to other built environment system suppliers will be the decisive step for Europe to reach its economic, social and environmental goals, contributing to the objectives of the Innovation Union. By creating and fostering this paradigm shift, EU companies will become competitive on a global level in the design, construction and operation of the built environment while sustaining local economies across EU-27 through job creation and skills enhancement, driven by the vast majority of SMEs active in the value chain.

In line with the ambitious 2050 targets, it is expected that already in 2030 the entire value chain will produce advanced systems, solutions and high value services for intelligent and sustainable buildings and districts.

A RESEARCH AND INNOVATION STRATEGY

The innovation rationale proposed by industry is to



Luc Bourdeau, E2BA Secretary General

develop and validate a set of innovative integrated to novel tools, technology and process components covering the whole value chain.

A systemic approach will reinforce the value chain optimization approach initiated in the PPP EeB. It will require more dedicated R&D and innovation activities covering each of the following components of the value chain:

- **design and commissioning** with novel approaches to narrow down the gaps existing between performance by design and performance when built
- **structural parts** where material processing innovations will allow further reducing the CO₂ embodied footprint of the structural components over the life cycle of new buildings
- **building envelopes**, which protect the build environment from external aggressions while reducing space heating/cooling demands by a smart use of renewable energies with the help of thermal storage
- **energy equipment** (heating, cooling, lighting, ventilation) and their control systems which have to be sized down since energy demand is lowered, but must also be user centric to optimize in real time energy demand and supply
- **construction processes** where combining pre-manufacturing of critical

components and self-inspection/automation of construction tasks increases quality and productivity of construction workers

- **building energy management systems** able to optimize supply and demand according to price

signals sent to consumers, but also energy cooperation between buildings at district level

- **end of life optimisation** in view of recycling/reusing demolition wastes. ●





The Smart Build Project

Implementing Smart Information and Communication Technology (ICT) concepts for energy efficiency in public buildings

The public building sector is of prime importance for achieving the ambitious energy savings targets set by the European Union for 2020.

The need for innovative methods and technologies to measure and monitor energy efficiency in public buildings is one of the specific problems addressed by the Smart Build project. The goal is to create an integrated monitoring and control system able to communicate with ICT devices. This allows to keep track of the energy flows in the building and also to integrate micro-

generation from renewable energy systems and storage, in an intelligent and sustainable way. Users' necessities are satisfied while keeping energy consumption to a minimum.

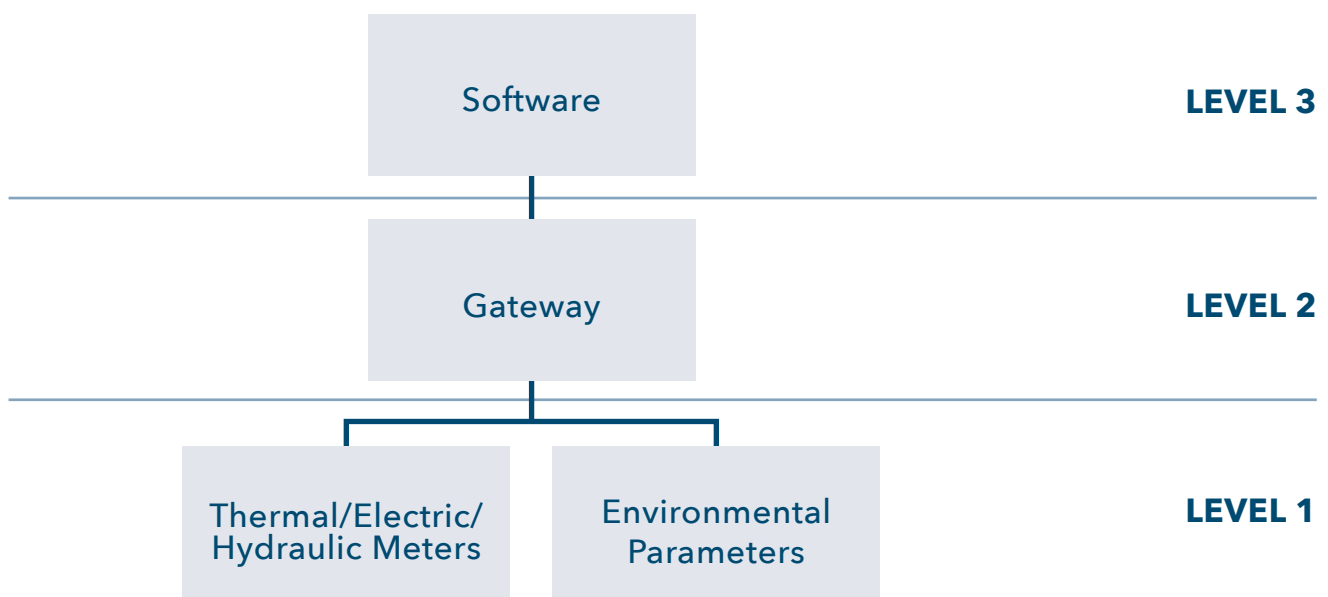
TECHNICAL SOLUTION

The Information and Communication Technology (ICT) consists of an energy control and management solution constituted by different off-the-shelf devices and components.

1. The control system collects information in real time using sensors, counters and meters (Level 1).

2. The data is sent to an electronic gateway (Level 2) and reaches a remote server for information storage and processing.
3. The software aggregates and elaborates data for energy analysis and energy efficiency and saving actions scheduling (Level 3).

The total estimated energy savings to be obtained with this control system and ICT device are approximately 20 to 35%, depending on the building's characteristics and on the control functions implemented.



IMPLEMENTATION

The Smart Build project will implement this system in nine existing public buildings in Italy, Slovenia and Greece, comprising hospitals, schools and administrative buildings. The aim is to reduce annual energy consumption levels, generating socio-economic benefits both to users and distributor network operators. The target users include building owners (public authorities) or tenants, who pay the energy bills, and final users who are exposed to the indoor environmental conditions of the edifice.

Unlike other energy modelling systems, the Smart Build project creates models based on the real data and the real use of the architectural and electric/thermal/hydraulic building drivers. ●

The Smart Build project is supported by the European Commission DG Information, Society and Media, ICT PSP under the Competitiveness and Innovation Framework Programme.

Project website: <http://www.smartbuild.eu/>

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Business model development for customer-oriented housing renovation

By Erwin Mlecnik, Passiefhuis-Platform vzw & OTB TU Delft
Irena Kondratenko, Passiefhuis-Platform vzw, TROND HAAVIK, Segel AS



<http://www.b2match.eu/businesszoo>) to explore business development opportunities and barriers together with Belgian and international enterprises. The working groups detected various opportunities and barriers for business model development for integrated housing renovation as a client-oriented service. They developed initial business model canvases for integrated housing renovation, exploring the collaboration between various market actors and targeting various customer segments.

There is a big potential for energy savings in existing single family houses, and today the homeowners are faced with a variety of single renovation measures promoted by policy makers (subsidies for individual measures) and a range of various suppliers. Processes for ambitious energy-efficient housing renovation are at present often too fragmented between many SMEs and clients have difficulties handling all information. This brings communication, planning, coordination and execution problems.

It is also difficult for customers to find single responsible parties offering integrated housing

renovation as a service. Since innovative client-oriented services are already emerging in various European countries, enterprises should explore business development opportunities for more client-oriented housing renovation.

The potential for so-called "One Stop Shops" that unburden the customer was explored in a European project (see: <http://www.one-stop-shop.org>), which led to defining tools for business modeling of customer-oriented integrated housing renovation services. The developed tools and new networking methods were recently used in the international "Business Zoo" workshop (Antwerp, 18 April 2012, see:

The experiences showed that lead actors for One Stop Shop development are not necessarily contractors. Depending on the targeted housing segment, new business development ideas also emerged from various categories of actors. From the demand side, various working groups identified important customer values for business development like better communication, speed, quality, improved comfort, energy performance guarantee and having one single contact point for the renovation. From the supply side, critical success factors for business model development were identified such as good planning and communication, education of the work force, integrating

quality assurance, and carefully organized collaboration with partners.

Business developers should keep in mind that a main barrier why renovation is not happening as much as needed for reaching climate mitigation goals, is that homeowners see renovation as a burden.

Many 'traditional' companies are still not used to thinking client-oriented and their business activities do not aim at unburdening the client in the process of house renovation. The working group experiences showed that lead actors might also more readily address customer values. Depending on the targeted housing segment, promising lead actors might be prefab-oriented companies, consultants, architect/managers or network actors.

Specifically, various types of customers value quality assurance and guaranteed energy performance, but various supply side actors have difficulties with obliging these customer values. Supply side actors think they can more readily accept responsibility for these issues when they engage in training and capacity building, when they explore high-quality examples and create customer confidence. Also, various additional customer values were detected like having a single responsible person as contact, having a better comfort, integrating quality assurance, guaranteeing energy performance and communication throughout the renovation process. The business approach may be different when targeting specific single-family ownership

sub-segments like empty-nesters or young starters.

One Stop Shop frontrunners tend to think beyond the usual communication channels and trust-based relation structures. To achieve business development, various costing, revenue and collaboration structures were imagined. However, skilled work force and careful planning and communication are always recognized as essential elements in achieving integrated renovation. A One Stop Shop should clarify beforehand the responsibility of each collaboration partner and how each of the involved partners will assure quality of their work during the process. A system and functions for communication and quality assurance during (and in some cases also after) the renovation must be a part of the One Stop Shop.

Business developers should think about how to develop One Stop Shop services for integrated renovation, particularly since quality-oriented, speedy and energy efficient renovation are serious customer values for various types of customers. Now regional examples of emerging One Stop Shops business developments are needed. Existing One Stop Shop businesses in Norway and Finland already show the way forward for innovation and for collaboration in the home renovation value chain. The Business Zoo was a first event of its kind, very interactive and focusing on the concept of integrated housing renovation and the actors involved. We intend to continue such events and help companies

with developing One Stop Shop innovations. Based on the experiences with this first edition, we think that future editions of the Business Zoo should use real case studies defined by clients and procurers. This framework is expected to more effectively lead to engagement of businesses in developing real opportunities towards business models.

Enterprises who want to engage in a One Stop Shop development can consult various detailed research reports and guidelines on the website of the ERANET-Eracobuild project 'From demonstration projects towards volume market: innovations for one stop shop in sustainable renovation'.

www.one-stop-shop.org ●

One Stop Shop Project partners :

- Passiefhuis-Platform vzw (PHP), Belgium
- Belgian Building Research Institute (BBRI), Belgium
- Segel AS (consulting company), Norway
- Danish Technical University, Building Physics and Services (DTU), Denmark
- Technical Research Centre of Finland (VTT), Finland
- Flemish Construction Federation (VCB), Belgium

This project was financially supported by:

- IWT (www.iwt.be) PHP and BBRI
- NIC (www.nordicinnovation.org) Segel and DTU
- Tekes (www.tekes.fi) VTT

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Window is more than a view

MSORA can manufacture the most demanding custom-made window or door. Modern machinery and computer software enable us to produce windows and doors of superb European quality using the best materials available. Last but not least: our products are both modern and homey.

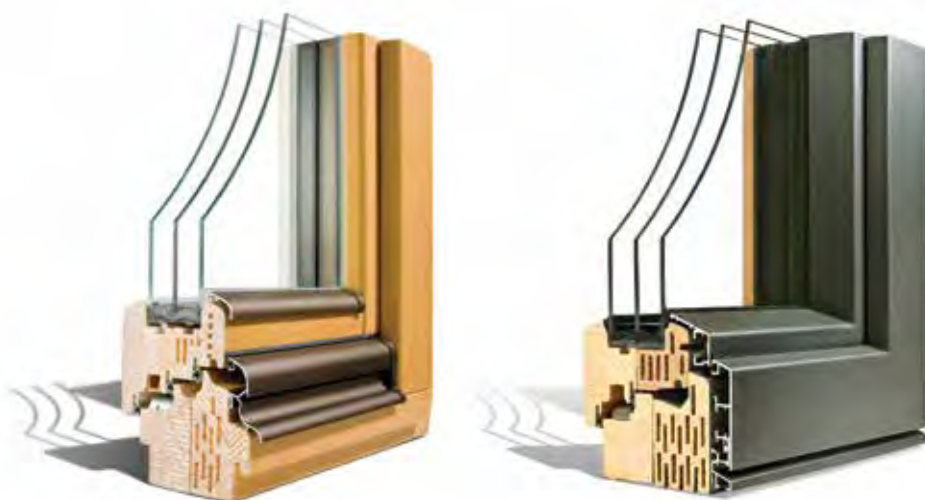
On top of that we can satisfy the needs of the most discerning customer. We can manufacture windows conforming to the highest acoustic and heat insulation standards. Over 60-years of tradition led us to become specialist in wooden windows and now-days we have more than 15 different low-energy window types. In order to reduce the ecological

impact of low-energy windows, we have invented the insulation that we can use for them. Wooden window insulation with air holes inside (called ECO-S insulation) is comparable to XPS or EPS insulation.

Due to the innovative and ecological aspect of ECO-S insulation, we have successfully applied to the EU call Eco Innovation. The aim of the project is to market and replicate our ECO-S products throughout the Europe and wider. Project has started in November 2011 and will last three years. Our supplier of aluminium profiles GS Stemeseder GmbH is also our important partner in the project. With him we are searching for solutions to manufacture ECO-S insulation for other wooden

window producers. Our research group is working on applying ECO-S insulation to many different products such as: doors panels, facade systems, conservatories, ... In the first phase of the project we have prepared our production for vast ECO-S production, now we are concentrated in marketing and advertising our products and in searching for distributors in different countries. Every year we exhibit on major EU window fairs (Fensterbau/Frontale, Bau, International Passivhaus Conference and many others) and we participate on window conferences (Passivehouse Institute, IFT Rosenheim).

We want to become the best window manufacturer, attaching great importance to natural materials and striving to satisfy each and every customer. With the help of Eco Innovation project the way to achieve that is much wider and shorter. To know more about us or about our products visit our web-site or contact us directly. ●



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Cognitive Lighting for energy efficient buildings

Sajol Ghoshal, Director Sensor Driven Lighting, Opto Sensor and Lighting BU, ams

INTRODUCTION

Environmental sustainability has become an increasingly important consideration in building design, construction and maintenance in recent years. According to the U.S. Department of Energy, worldwide energy consumption will increase approximately 40 percent by the year 2035. To help offset this dramatic trend, governments around the world are increasingly implementing mandates to ensure the reduction of energy consumption and related greenhouse gas emissions. Additionally, utility companies in the United States, and across the globe, often offer rebates and incentive programs for high-efficiency retrofits and new installations.

Cutting energy use can take a bite out of a facility's maintenance and upkeep budget, which makes up approximately 80 percent of the overall lifetime cost of the average building [1]. But what do building owners and facility managers do with their current lighting systems? Is there a way to make the light "intelligent" such that, in essence, it becomes similar to the human eye and adjusts to the users according to the many light sources - and differing elements - in a room?

There is; and the unique approach that luminaire designers will need to take at the electronics level is

to focus on the light not on the power supply. The coming wave of Cognitive Lighting will demand independent smart sensors that are 'environmentally aware' in order to provide not simply data on the surrounding environment, but answers to how best to respond, both to save energy and enhance lighting quality.

COGNITIVE LIGHTING

Just what do we mean by Cognitive Lighting? Lighting fixtures and systems available today are relatively un-intelligent and require user input to adjust [the lighting] to specific requirements, if they can be adjusted at all. Unfortunately, the path of least resistance is simply to keep the lights on most of the time and at the lights' highest intensity - irrespective of the occupants' actual needs.

However, sensor-driven lighting that is easy-to-use is key to adopting more optimized and energy efficient lighting. Ambient light sensors combining photopic, human-like sensitivity with wide dynamic range are enabling a new generation of lighting controls that may be built directly into replacement lamps and luminaires to shift more of the interior lighting burden onto the available daylight.

In a facility with skylights, windows or sidelights there is typically

available daylight, which varies according to time of day and weather conditions. Areas that get light from those sources don't necessarily need much artificial light - at least not during a bright day - but areas farther from those sources do. The problem comes in a large site with thousands of square meters of space, where the desire is to manage each fixture's light output to compensate for the changing amounts of ambient light during the day presenting an enormous challenge that is impossible to do manually.

Some facility managers taking advantage of daylight have looked to external daylight harvesting sensors that attach to groups of lights. These after-market offerings can provide incremental energy reductions, but still leave substantial savings on the table and have a number of performance issues that result in over- or under-lit areas and jarring jumps or drops in light levels.

THE INTEGRATED SENSOR

A sensor built into the luminaire that automatically responds to its environment - whether it's occupancy, available daylight, time of day or other variables - and delivers just the right amount of light - when and where it is needed, is the perfect solution for reducing energy consumption

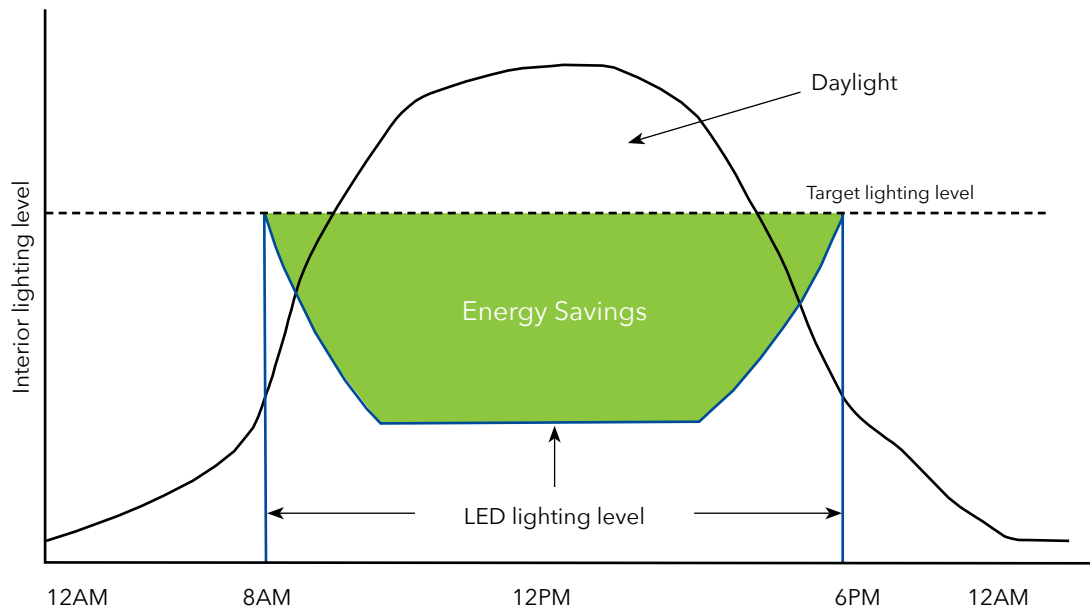


Figure 1: Daylight Harvested driven energy savings for lighting

and costs. Rather than applying controls as an afterthought this built-in approach maximizes energy efficiency.

By supplementing the working space with only the amount of light needed to maintain a uniformly lit environment, tremendous energy savings can be realized when compared to existing installations, which do not respond to changes in ambient light. Overall, smarter lighting controls can save over 50 percent of energy while providing adequate lighting.

Being fully aware of the lit environment also allows optimization that extends beyond energy savings. In integrated building management and control systems, the combination of proximity/motion and light sensing provides an abundance of data concerning the interior environment. Additionally,

daylight sensing/harvesting combined with precise control mechanisms enable the lighting system to deliver not just the needed amount of light, but also offers the ability to tune the type of light to suit the activity and users in a particular space.

AUTONOMOUS LIGHT CONTROLS INTEGRATED WITH BUILDING MANAGEMENT

Although previous smart lighting controls were always centralized, today's technology can enable lights that think for themselves. With ambient light sensors built into each lighting instrument, on-the-spot decision-making can take place based upon the amount and type of ambient light that is present. With low-cost and low-power wireless networking (such as ZigBee), or wired networks (DALI), group intelligence - semi-autonomous controls aware of what each other is doing and able to self-organize

the most efficient lighting plan for each moment - tying in to centralized control systems can be readily implemented. What is critical is a sensor system that connects to today's existing building management structure like Bacnet, KNX, LONmarks.

INTELLIGENT LIGHTING MARKET DRIVERS

In the United States, the market for lighting controls in construction projects will be driven by a new federal requirement that by October 2013 all states adopt building codes that are at least as stringent as the most recent American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) building code (90.1-2010). That code requires automatic shutoff and dimming in many space applications, and will encourage numerous construction projects to go further and connect lighting systems to

building management systems.

European 2020 energy targets will drive adoption of lighting controls among EU member states. All new public buildings must have net-zero energy consumption by 2019 and private buildings must follow suit two years later. Intelligent lighting controls will be a must to meet this strict target.

China's 12th Five-Year Plan (2011-2015) sets strong targets for energy efficiency projects involving the citywide control of street lighting that are already ramping up. A similar expansion building lighting control is expected.

CONCLUSION

A smart-sensor driven lighting system that is aware of the immediate environment, and is able to intelligently adapt to user and facility requirements with autonomous local- or centralized-control, is critical to meet world-wide government mandates to reduce energy consumption and lessen greenhouse gas emissions. This next wave of Cognitive Lighting systems will finally make use of the abundance of data available in the light and autonomously adjust the environment to enhance comfort, productivity, safety and efficiency at the same time. ●

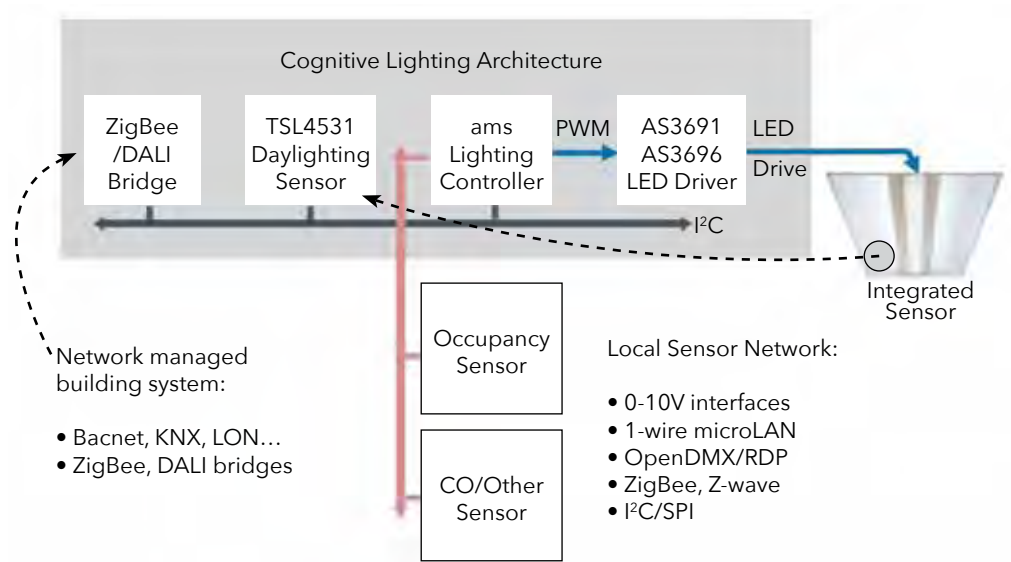


Figure 2: An integrated building managed Cognitive Lighting system

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9 CASH policy recommendations

TO MAKE THE BEST USE OF THE NEW STRUCTURAL FUNDS 2014-2020 FOR SUSTAINABLE SOCIAL HOUSING

CASH - Cities' Actions for Social Housing- is a network of 11 partners led by the city of Echirolles in France (10 cities: Bridgend-UK, Brindisi-Italy, Echirolles-France, Eordea-Greece, Frankfurt-Germany, Les Mureaux-France, Sonderborg-Denmark, Tatabanya-Hungary, Utrecht The Netherlands, Yambol-Bulgaria and 1 region: Rhône-Alpes Regional Council-France).

The ambition of the CASH project is to propose new solutions and promote new policies for the sustainable renovation of social and affordable housing in the European Union. From 30 months of exchanges on good practices and from the analysis of barriers on technological development, legal framework, financial engineering, citizens' involvement, energy production and systemic project management, the CASH network has proposed the following 9 key policy recommendations -under 4 categories- in support of the EU work done in the frame of the Cohesion Policy 2014-2020 to make the best use of the new structural funds to favor the "greening" of social housing:

BETTER MONITOR THE LOCAL NEEDS AND RESOURCES

Recommendation 1: Adapt the energy production systems to the local specificities and favor green solutions

Legal or political requirement

The implementation of the Energy efficiency Directive by the Member States (article 3a on the plan for the energy efficiency roadmap and article 4 about the exemplary role of public social housing) should take into account the effectiveness of some specific technologies such as the Green Combined Heat and Power (CHP) providing 'decentralized power' and favor diversified local green energy sources. Regions and cities must be free to choose the most cost effective technological options but incentives should be given to use the greenest option, locally available and to promote the development of green Strategic Energy Plans.

Recommendation 2: Make affordable green social housing the core of local energy production and distribution grids.

Legal or political requirement

European directives about energy performance of buildings (EPBD) and energy efficiency

(EED), should take into account, that social housing building blocks and areas which need to be modernized may be the nucleus of local energy distribution grids, thus giving better practical and economic conditions for the implementation of green cogeneration units and transforming the supply from fossil fuels to renewables.

Recommendation 3: Strengthen the local human capital and favor a systemic energy efficient renovation approach

Political or legal requirement

Managing Authorities should use a significant part of the European Social Fund to support projects whose main or ancillary activities consist in training workforces on sustainable energy related professions (installers, certifiers, engineers, workmen able to carry out deep retrofitting of building etc.). Managing Authorities' criteria should favor adequate technology which can be used on large scale operations, easy to maintain and to use, which can ensure sanitary conditions.

DARE CITIZENS' EMPOWERMENT!

Recommendation 4: Strengthen the participatory approach within the Cohesion Policy

Legal or political requirement:

Member States and members of the European Parliament should agree on article 5 of the draft Common Provisions Regulation about the partnership principle which requires Member States to involve relevant partners at all levels of programming. The European Commission should support the development of a database for good practices and guidance to help Member States and Managing Authorities in that field.





Recommendation 5: Use EU funds to enable the participation of tenants in sustainable social housing programs

Legal or political requirement:

EU regulation and Managing Authorities' criteria should favor citizens' involvement in the co-conception of the social housing energy efficient renovation (SHEER) to ensure a design coherent with the cultural behavior and the optimal use of the EE equipment and systems by tenants, thus favoring the optimum functioning of renovated buildings and the reduction of energy consumption. Dedicated funding for citizens' involvement should be secured.

PROVIDE CLEAR AND STABLE FINANCING OPTIONS

Recommendation 6: Set-up long-term large-scale energy efficiency funds accessible at local levels

Legal or political requirement:

Member states and members of the European Parliament should support the mainstreaming of financial engineering instruments as proposed by the European Commission (art. 56 of the Draft Common Provisions Regulation), as well as the development of innovative local / regional financial instruments. Consequently part of the ERDF technical assistance funds should be dedicated to setting up those instruments, in particular, the revolving funds similar to JESSICA urban development funds. Long-term, flexible financial instruments designed for large scale renovation operations should be favored.

Recommendation 7: Create intermediary bodies that will coordinate energy efficiency renovation programs

Legal or political requirement:

As recommended by the CASH network, within the framework of the implementation of the Energy efficiency directive, independent third party managing entities should be created to manage technical, financial and organizational aspects and the monitoring of measures. They would act as facilitator between social landlords/co-properties' owners and tenants. The role can be taken by local/regional funds/ foundations or energy service/ supply companies or even tenants organizations.

STRENGTHEN THE SKILLS OF LOCAL AUTHORITIES

Recommendation 8: Use EU structural funds to provide technical assistance to develop long-term sustainable social housing programs

Legal or political requirement

Member states and members of the European Parliament should support the proposal of the European Commission about the widening of activities for which technical assistance possibilities are foreseen in the draft common provisions regulation (article 51). Managing Authorities should receive appropriate technical assistance to develop capacity to write relevant calls for proposals in the field of SHEER, whereas, municipalities and other key stakeholders should receive support to make their projects ready for funding under the new structural funds.

Recommendation 9: Create local clusters on sustainable social housing

Legal or political requirement

The future EU strategy on low energy buildings, which will be launched in the autumn 2012,



should support the creation of clusters, using the Intelligent Energy Europe program for pilot clusters based on transnational experience and Structural Funds to scale them up.

Those recommendations are addressed to the **Managing Authorities** of new EU structural funds but also to **EU policy makers** in the fields of energy, housing and urban renewal. Member States and Regions will indeed prepare their Partnership agreements and Operational Programs from early 2013 onwards in the frame of the Cohesion Policy 2014-2020. They should rely on the expertise of cities involved in EU initiatives such as URBACT II or the Covenant of Mayors, in particular in the ground know-how from CASH partners, to articulate programs and projects on green social housing. ●

... INTERESTED IN KNOWING MORE

<http://urbact.eu/cash> and
<http://www.ville-echirolles.fr/developpement-durable>

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 CECODHAS Housing Europe

Grid-friendly buildings and complex energy systems

By Dr. Peter Palensky, Principal Scientist, Complex Energy Systems, Energy Department, AIT Austrian Institute of Technology

Buildings are responsible for some 40% of final energy use in the European Union. Improved energy efficiency in this sector can therefore contribute to substantially cut energy consumption and greenhouse gas emissions. Much progress has already been made in low-energy building design, as reflected in the passive house standard which is increasingly being adopted in European housing projects. It must be noted, however, that the high level of energy-intensive systems in modern buildings such as HVAC or lighting account for the majority of energy costs and emissions over the entire life cycle of the building. In future a stronger focus will therefore lay on efficient operation, which can be achieved by modern controls and grid-friendly buildings that take the entire energy system into account.

The electrical and thermal systems of buildings often operate inefficiently because they run at part load or in the wrong temperature range, consuming substantially more energy than necessary. Smart building automation and controls can be

used to monitor these systems to ensure that they are continuously kept at their optimum operating point. Such smart controls are expected to reduce the amount of energy required for heating and cooling by about 20%. The EN 15232 standard is a valuable tool in this context, as it quantifies how building automation increases the energy performance of a building, thus providing a sound basis for planning and investment decisions.

But energy-efficient buildings alone will not be sufficient to meet the ambitious sustainability goals of the future. Great potential for achieving maximum benefit with minimum investment lies in the flexible use of energy by two-way communication between buildings and the electrical and thermal networks. In this "building-to-grid" approach, buildings also act as virtual energy storage units that prioritize or delay peak-time energy demand for heating, cooling and ventilation. Flexible, grid-friendly buildings can ease the burden on the grid caused by the increased share of distributed, renewable energy sources and tighter transport capacity in



electrical networks and thus reduce or delay grid investment costs. This will be one of the enablers for shifting the power mix towards renewable forms and reduce the need for additional power plant capacity.

Smart automated controls and grid-friendly buildings will also need to be complemented by efforts to involve occupants to a greater extent in the operation



of buildings. The reasoning behind this “human-in-the-loop” approach is to tap the creativity of people and enable them to have an impact on the energy performance of the building. This can be achieved for example by developing appropriate incentive schemes, such as price reductions for the use of off-peak power, or by keeping end users informed about their current energy consumption and

benchmarks via an app on their mobile phone.

The energy system of tomorrow’s smart cities will comprise a wide range of new players as a result of the growing integration of renewable energies, electric mobility, intelligent buildings and smart grids, and will additionally be linked to other systems and agents such as energy markets. We can only increase the efficiency of the

whole system if we achieve a better understanding of the complex mutual dynamic interactions between its individual components. The “Complex Energy Systems” research group at the AIT Austrian Institute of Technology takes up this challenge by working on tools and methods to describe, model and simulate these interactions to be able to design sustainable and highly efficient energy systems in the future. ●



Cost-effective strategies for solar control through retrofitting

The example of window film

European Union leaders remain committed to decrease their countries' primary energy consumption by 20% by 2020. A portfolio of legislation has been put forward to increase efficiency at all stages of the energy chain, be it at generation, transformation, distribution or final consumption.

The building sector has potential for significant reduction of CO₂ emissions. The recent Energy Efficiency Directive and the recast Energy Performance of Buildings Directive (EPBD) will play a substantial role in leading public authorities to proceed with renovation works that improve the energy efficiency of existing buildings. The Window Film industry is positioning its product as a cost-effective and environmentally friendly retrofit solution for use in such building renovations. Retrofitting of glazing with Window Film technology is proven to improve the overall energy performance of existing buildings across all European climate zones.

WHAT IS WINDOW FILM?

Window Film is polyester film with an optically clear

pressure-sensitive adhesive that is applied to the inside or outside of existing glass windows to modify and enhance their properties. Application is non-disruptive and typically carried out during normal working hours. In simple terms, Window Film changes the way that a window reflects, absorbs and transmits the different parts of the solar spectrum.

Just like windows themselves, there are many different types and styles of Window Film, each with their own unique benefits. From virtually clear to tinted or decorative films, there are multiple options available to suit any need, whether for thermal comfort, UV protection, safety or decoration.

THE ROLE OF WINDOW FILM IN ENERGY EFFICIENCY

The Energy Efficiency Directive has imposed an annual target for Member States to renovate 3% of existing central government buildings and requires that they make long-term strategies for more expansive renovations. When calculating the energy performance of glazing and shading, the European Commission specifies that commercial buildings must take into account solar heat gain reductions. Window Film is a "technically, economically and functionally feasible" technology to provide such reductions in line with Article 7 of the recast EPBD:

- Window Film can stop up to 80% of all solar energy coming through windows, significantly

reducing solar heat gain.

- By reducing solar heat gain, Window Film can reduce energy use associated with cooling costs by up to 30%.
- Window Film helps reduce lighting and air conditioning use, plus associated energy costs. Because it blocks heat and reduces glare, building occupants can keep blinds and curtains open to better utilize natural light and reduce the need for artificial light sources.
- Installation time of Window Film is far less than that of new windows, leading both to lower costs and less downtime.
- The installation of Window Film on an existing window has a much lower environmental impact over the entire lifecycle than complete window replacement.

In light of the regulatory pressure to increase building renovation rates across the EU, Window Film is one of the cost-effective and environmentally friendly retrofit solutions to be taken into account by property owners, public authorities or any other actor looking to improve energy efficiency of buildings. ●

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More than 100 years old and still innovative!

Heating, cooling and hot water production with heat pumps

Thomas Nowak, Secretary General, European Heat Pump Association (EHPA)

Today, most people in Europe use heat pump technology in their home, some even own more than one device. Fridges, (car) air conditioning, tumble dryers and heat pumps provide living comfort based on a shared technical principle, i.e. the refrigeration cycle. Its origin and first experimental applications date back from the early 19th century. Heat pumps for residential heating entered the market in the early 20th and it took nearly another hundred years for the technology to achieve meaningful market shares. In 2011, more than 771 000 units were sold in Europe adding to a stock that exceeds 4,55 mio units. Markets like Sweden and Switzerland are maturing.

THE OPERATING PRINCIPLE

Heat pumps transform renewable energy from air, water and ground (ambient energy) as well as waste energy into **useful heat** (see fig. 1). They provide heating, hot water and cooling. A heat pump system consists of a heat source, a heat pump unit and a distribution system. A transfer fluid (refrigerant) transports the heat from a low-energy source to a high-energy sink by means of heat exchangers and a compressor. Auxiliary energy (e.g. electricity/gas) is needed to run

the unit. As heating and cooling can be provided at the same time, heat pumps are particularly efficient if both services are used. They can be employed in residential and commercial buildings (e.g. schools, hospitals, swimming pools) as well as in industrial applications (e.g. food processing industry).

The benefits: comfort, lower emissions, higher efficiency, more renewables and grid-balancing

While heat pumps reliably provide heating and cooling services their use has positive

side effects to the environment and society:

1. Heat pumps contribute to the three EU 2020 targets at the same time giving them a unique “eco-triple dividend”:

- a. an increased share of **renewables** in primary and final energy demand
- b. an **efficient use of energy**, thus lowering (non-renewable) primary and final energy demand
- c. reduced particulate matter and

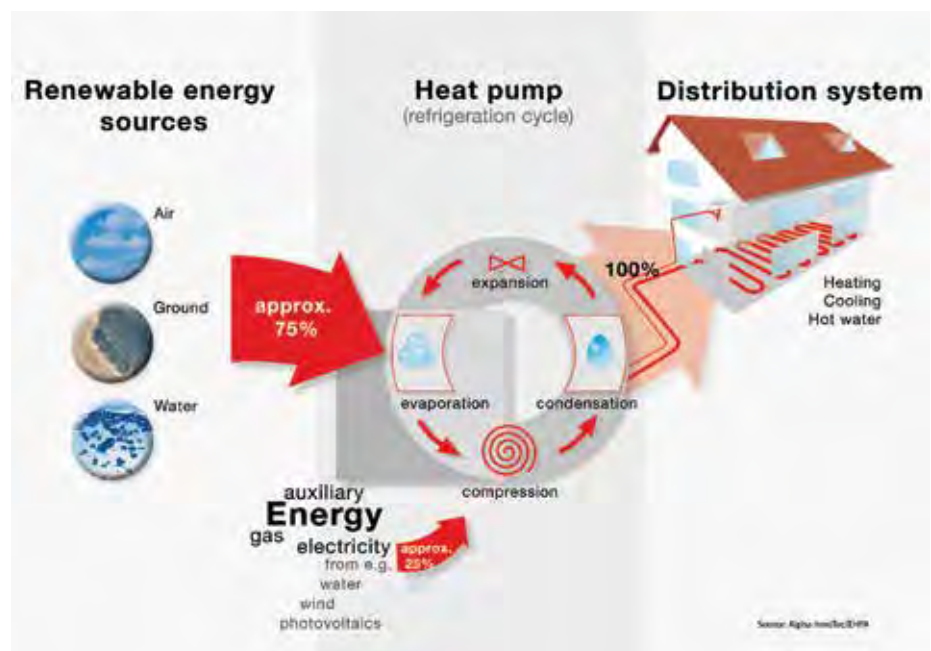


Fig. 1: The heat pump system. Source: Alpha-InnoTec/EHPA

Fig. 2: Smart heat pumps in the Bornholm context. Source: <http://www.eu-ecogrid.net>



greenhouse gas emissions

(zero emission systems are possible when clean auxiliary energy - wind, PV, hydro, biogas - is used).

2. Heat pump based systems can store thermal energy - either in a hydronic storage, a hydronic heating system, the ground or the buildings core. As the majority of today's heat pumps need electricity as auxiliary energy source, running them in times of electricity surplus releases stress on electric grids. In times of low electricity supply the heat pump can be switched off and

Integrating heat pumps in buildings and bridging the differences in supply and demand of both electricity and thermal energy in cities/agglomerations is the real challenge for today. This is where innovation comes into play. Additional research and development is required to identify:

- the savings potential on both the end consumer and the utility side. What are the cost to realize heat pumps in smart grids or better: is there a business case?

the system will still provide the required service to the end user by using the stored thermal energy. Properly designed and connected, this allows for the balancing of supply and demand in electric grids by the use of thermo-technology. Thus heat pumps are an ideal match to increasing capacity from distributed renewable electricity generation.

- the comfort requirements of the end user, both with regards to living comfort and simplicity of service offering

On a concept level, it is clear that heat pump applications are an integral part of the future energy infrastructure. Joint efforts by all stakeholders are required to turn this concept into reality. Policy makers and stakeholders alike are called on to support the technology and market development of heat pumps to unleash this potential.

Heat pumps stand ready to fulfil this requirement!

CASE: THE 'SMART ISLAND' OF BORNHOLM (DK)

The idea of smart cities is getting increasingly popular: The European Commission addresses the issue in the smart cities "track" of its SET plan. Several other stakeholders are working to identify the obstacles towards a more effective and efficient production of energy and are developing solutions to bridge temporal, spatial and temperature level differences in energy supply and demand. One of the most comprehensive approaches is taken by the Danish Energy agency on the island of Bornholm.

This Danish island with its 10.000 inhabitants was picked by the Danish Energy Agency as a unique testing site. In the EcoGrid project a number of technologies is integrated into the electric grid to understand the implications. One of the sub-projects focuses at intelligent heat pumps. They are installed in 300-400 buildings with new controls that enable their automated operation based on price signals and weather data. ●

Impact of heat pumps (all data applies to sales of units in 20 European countries in 2011)

Sales of heat pump in 2011 (units): 771 469
Market value (incl. VAT): 6 174 million Euro
Total useful energy provided by heat pumps (Q_{usable}): 8,45 TWh
Energy savings
Final: 7,32 TWh, Primary 3,37 TWh
Renewable energy produced: 5,72 TWh
Greenhouse gas savings: 1,33 Mt

For statistical details consult the "EHPA Outlook 2012", available via www.ehpa.org.
The European Heat Pump Association (EHPA)
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LAMILUX daylight element achieves the best passive house efficiency standard

LAMILUX CI System Glass Element FE energysave: Passive House Institute in Darmstadt awards the first ever passive house certification worldwide for a skylight

Most of the countries in the European Union are issuing national regulations as a means of implementing the EU directive on the energy performance of buildings. This directive demands a near-zero energy building standard for all new buildings by 2020, in order to achieve a practically “climate neutral” building stock in European countries by 2050, with an 80% reduction in primary energy requirements. The energy-efficiency qualities of structural components have therefore become an all-important factor in contemporary construction – and passive house design as the highest standard of energy efficiency is now a hot topic. Once again, as a manufacturer of daylight, SHEV and control systems, LAMILUX is able to help architects and planners by supplying innovative, passive house-certified products: the LAMILUX CI System Glass Element FE energysave has been certified by the renowned Passive House Institute in Darmstadt, Germany, as the world’s first skylight suitable for passive buildings. This highly energy-efficient daylight element for flat roofs has achieved the top efficiency class, the Advanced Component phA category.

The LAMILUX CI System Glass Element FE energysave is the

product of further development of the energy-efficient qualities of the time-tested daylight element (LAMILUX CI System Glass Element FE). During the course of numerous projects, daylight systems manufacturer LAMILUX has integrated both small and large quantities of these elements into the flat roofs of industrial premises, office blocks, school buildings, trade fair and sports halls, prestigious buildings and private houses.

OUTSTANDING HEAT INSULATION WITH A USL VALUE OF 0.84 W/(M²K)

A USL value of 0.84 W/(m²K) was determined by the Passive

House Institute in Darmstadt for the daylight element as a unit, on the basis of EN ISO 10077-1 and 10077-2. A good heat transmittance coefficient is one of the main criteria for successful certification and must be under 1.10 W/(m²K) for horizontal installation in roofs.

Heat losses are calculated for the frame system and the “warm edge” and expressed by the coefficient ψ_{opaque} . The lower this value is, the higher the efficiency class. In the case of the LAMILUX CI System Glass Element energysave, the coefficient is lower than the maximum value of 0.110 W/(mK)

The low heat transmittance coefficient of the entire daylight element is one of the main reasons for its successful certification.



for passive house classification in the phA – Advanced Component class.

SKYLIGHT FOR ENERGY AND COST CONSCIOUS ARCHITECTS AND PLANNERS

“A passive house requires highly energy-efficient components to maintain its high standards,” state testers at the Darmstadt-based Passive House Institute. The independent testing centre carries out tests using standardised criteria to give architects and planners a clear idea of energy efficiency in construction components. “We were able to certify the LAMILUX CI-System Glass Element FE energysave in the highest efficiency class. This skylight thus offers superior energy-efficient quality.”

ABOUT LAMILUX HEINRICH STRUNZ GMBH

Based in the German town of

Rehau, Heinrich Strunz GmbH 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, commercial 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 offers 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. In 2011, LAMILUX, with its 550 employees, achieved a turnover of 143 million euros in its two corporate divisions, LAMILUX Daylight Systems and LAMILUX Fiberglass Reinforced Composites. ●

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Left: This highly energy-efficient LAMILUX daylight element has achieved the top efficiency class: the Advanced Component phA category.

Right: The LAMILUX CI System Glass Element FE energysave provides architects and planners with the first ever passive-house certified skylight element.



DSM paves the way for the smarter energy system

By Hans Nilsson, IDE DSM

The buzzword of today is “smart”. We want smarter energy systems with smarter technologies.

The fast development of innovations in the area of ICT, appliances and distributed generation indicates that the future energy systems will be something quite different from what we are used to.

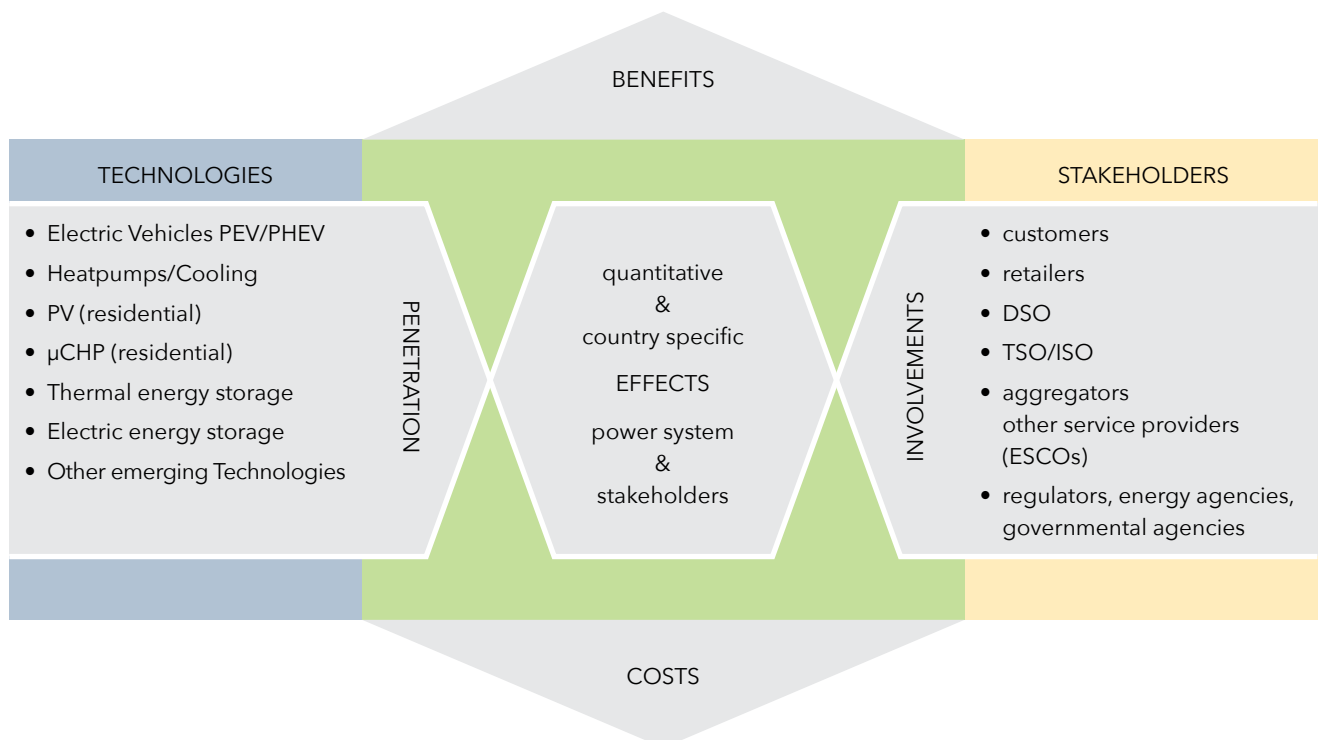
The British researcher Walt Paterson has said that in the future the competition will not be between fuels but between fuel and technology. The smart technology will allow us to be

much more energy efficient than today. We can be smart, comfortable and prosperous with smaller footsteps on the earth. We will simply do more with less.

Technology holds the promises to do so, but the technology must get in place. That is what DSM (Demand Side Management) is about. The IEA DSM-Programme deals with all the important institutional issues that are necessary to make the new technologies accepted by customers, by the industry and by the governments.

A technology that is not liked or understood by customers, enabled by industry and proved useful to regulators runs the risk to remain on the shelf. Such technologies often constitutes a potential and quoted in investigations as opportunities, but not accepted by the market. A huge potential multiplied by zero remains zero.

The simplistic models assume that anything that is more profitable for the user is eventually accepted on the market. Practical experience has proven otherwise. The European Union has recently





*Hans Nilsson,
IDE DSM*

issued an energy efficiency directive aiming at saving 20% of the energy used with profit. The IEA claims equal amounts globally. A recent study from Fraunhofer Institute doubles and triples these numbers.

DSM is about raising the acceptance by among other things working on business-models to distribute and facilitate the uptake on the market, working on behavioural issues to understand what barriers there are to accept new ways to do things and working on integration of renewables into the grid. Some examples:

- **Competitive Energy Services** has been a focus area in which different forms for Energy-Contracting are compared and developed. An Energy Service Company (ESCO) takes over the technical and commercial implementation and operation risks and has to guarantee for its cost and results. Such are well suited to implement innovative energy technologies and also renewable energy systems. The ESCo industry is an expanding business throughout the world contributing to the improvement of energy efficiency, control of energy costs and reduction of greenhouse gas and other emissions.
- **Integration of Demand Side Management Distributed Generation, Renewable Energy Sources and Energy Storages** is a crosscutting activity in which it is in greater detail studied how several new applications may have an impact. There is a complicated interplay between technologies and stakeholders, see figure, to be researched not the least since even if there is an overall gain some important actors may lose from a change and be less prone to work for the new opportunities. In particular use of heat-pumps and electric vehicles have been studied under different scenarios.
- **The Role of Customers in Delivering Effective Smart Grids.** The current pace of change throughout the electricity supply industry is unprecedented. There

are many stakeholders in the energy market with different interactions with consumers and different responsibilities. There is a need to map the interactions of different stakeholders with the consumer as the central focus. The way that customers use and relate to technologies such as Smart Meters, electric vehicles, heat pumps and energy storage has a significant impact on their ability to contribute to an effective Smart Grid.

- **Behaviour change in DSM - from theory to policies and practice.** The best ideas, policies and programmes have been shown to fail again and again in achieving their desired outcomes. The current social norm is still NOT to see energy saving behaviour as a major priority in achieving a transition to a sustainable energy system. The complexities influencing human behaviour are so vast and manifold that simplistic approaches almost invariably fail. It is imperative to uncover the context-specific factors (from infrastructure, capital constraints, values, attitudes, norms, culture, tradition, climate, geography, education, political system legislature, etc) that influence human behaviour in specific sectors. ●

BattMan

Solar Powered Efficiency

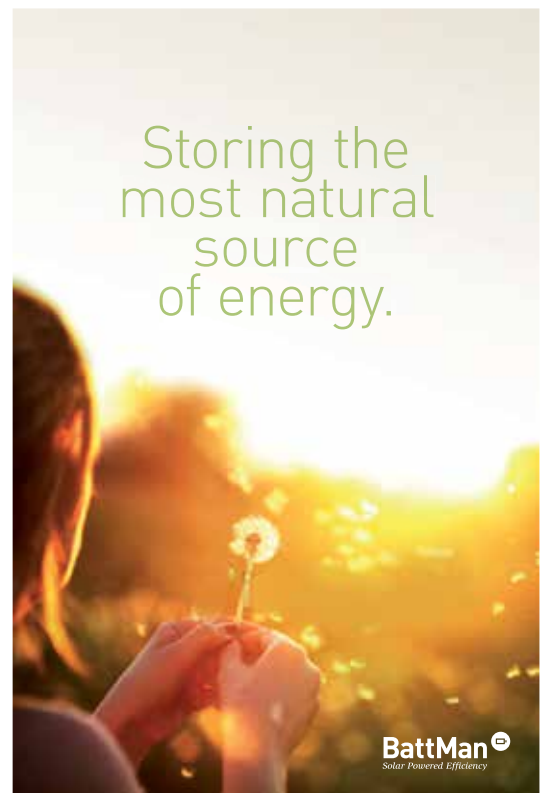
BattMan: Solar powered efficiency

Batteries and battery management systems are essential elements in any standalone, solar-powered application. These systems can be employed in a variety of different markets and applications, yet reliable long-term service of the battery and system remains the common challenge for all. The BattMan project, coordinated by Philips Research, therefore focuses on these essential elements and targets solar-powered, off-grid street lighting poles as a challenging demonstrator. It will be specified, simulated, designed, prototyped, demonstrated and validated in the project.

The knowledge gained within this project, especially for the battery management system (BMS), energy management system (EMS), and generic system designs, will be generated to be used to support a variety of applications. The consortium partners in this small, targeted project bring world-class, state-of-the-art experience to achieve the project objectives, and consist of battery suppliers (European Batteries), battery management IC's and system developers (ams), electronic system developers (NxTech) prototypers (Metatronics), lighting system manufacturers (Philips) and university and research institute partners (Technische Universiteit Eindhoven, SINTEF) active in these fields. The project coordinator Philips Research is responsible for the overall project management

of the entire project. Philips Research is focusing on battery management, and participates primarily in the development of the outdoor off-grid solar-powered street lighting prototype design, development and validation. The Technische Universiteit Eindhoven is responsible for cell level modeling, including ageing, battery pack modeling, thermal behaviour and balancing methods as well as modeling integrated power generating/storage systems for solar off-grid lighting and solar powered electric vehicle applications. Metatronics is responsible for designing, simulating and building of both hardware and embedded software as well as for designing and building of prototypes charged street lighting fixtures. SINTEF will specify the nanoelectronics modules, the electronics and communication systems as well as doing the modeling and the overall simulations. The semiconductor manufacturer ams will provide a new approach for Li-Ion battery management: Cell balancing, simultaneous and accurate battery voltage and battery current sense for SOC, SOH, SOF calculations at further improved accuracy, adapt temperature monitors to application needs, optional scalable high voltage CMOS for cost down, low RDS ON driver devices for active balancing efficiency improvement and potentially embedded memory for post calibration purpose to achieve accuracy targets. ●

The EU funded ENIAC project "BattMan", led by Royal Philips Electronics of the Netherlands, will design and develop lithium-battery-pack systems which manage photovoltaic power feed efficiently and deliver optimized, reliable, low-cost and predictable performance.



This project has received funding from the ENIAC Joint Undertaking under grant agreement 304725 and from the national programs of the Netherlands, Finland and Norway.

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Investment in Renewable Energy Sources (RES): A national priority for Greece

By Nikolas Toleris, Resources Analyst., Deputy Chairman of the Organizing Committee
TRA2012



Nikolas Toleris shaking hands with the Commissioner Maire Geoghegan-Quinn.



The exploitation of natural resources has become a central issue in the Greek Government's development policy in the last years as a driving force to protect the environment and to expand the national growth.

The results of this policy are very encouraging: The use of RES in electricity production has increased from 1% in 2000 to more than 6.5% in 2010, large-scale Hydroelectric Power Plants (HPPs > 15 MW) excluded. At the same time, the total contribution of the RES to the gross final energy consumption has increased by almost 5% the last 5 years, reaching a rate of 11.5% in 2012.

The results have been especially good, in 2011: in this year the wind energy production has increased by 24%, from 1,327 MW to 1,640 MW, while the solar energy production was tripled! Overall, today there exists a capacity of 5,576 MW, large HPPs included, which is a 37% participation of the total installed capacity target of 2020 (15,070 MW). The rest 9,494 MW that have to be installed until 2020, will require more than 16 billion Euros investments with strong cash flows but very attractive expected Return On Investment.

Following the above results Greece decided the increase of its national goal for 2020, from 18% to 20%, regarding the participation of RES in gross final energy consumption. This objective consists of 40%

participation of RES in electricity production, 20% in heating and cooling and 10% in transport.

The country's position in the "Ernst & Young" Investment Attractiveness in RES list, has reached the 12th place globally. This is fully justified, considering that Greece has still a long way to go (8.5%) to achieve its National RES target (20%) and that the electricity demand in Greece is foreseen to increase by at least 10% till 2020.

Moreover, according to the "Measures Maximization RES" and the "Minimum Cost of Environmental Measures" Scenarios, the Energy Road Map of Greece for the period 2020 - 2050 foresees a reduction of greenhouse gas emissions by at least 60%, an 85-100% RES-generated electricity, as well as a 60-70% penetration of renewables in total gross final energy consumption.

THE STRENGTHENING OF THE GREEK RES MARKET CREATES A VERY ATTRACTIVE BUSINESS OPPORTUNITY

The RES Law 3468/2006 has opened the gates for the installation of offshore wind farms in Greece. In general the wind energy potential in Greece is tremendous; hence the wind energy share of electricity consumption is foreseen to increase from 3.7% in 2010 to 24.5% in 2020.

On the other hand, the remarkable solar energy potential of Greece is very attractive for relevant trans-European cooperation. Responding to the diagnosis of existing

opportunities, Greece recently (2012) introduced an ambitious plan ("Helios" project) for the exploitation of the long hours of sunshine, by translating it into an economic benefit for both Greece and the less sunny European regions; this project has been strongly supported by the EC.

In order to further facilitate relevant investments, Greece has simplified the licensing procedures. For example, the approval of the environmental terms procedure has considerably accelerated (Law 4014/2011). Furthermore, an ad hoc Service for the RES development has been created in the Ministry of Environment, Energy and Climate Change, acting as an "one-stop shop" that provides information to all the potential RES-related investors.

At the same time, Greece offers attractive feed-in tariffs with a 20-year Power Purchase Agreement (according to the recently updated -2010- tariff regime), on top of which the investor can claim a pay return from the State for part of the investment, as foreseen in the new Investment Law.

On top of that Greece has an additional undeniable competitive advantage: Due to the relief of the country -great elevation differences within short distances- the use of hybrid systems can be easily and efficiently applied (e.g. an electrical production combination with wind farms and hydroelectric power plants).

The WINDS of investment lead to this SUNNY side of Europe! ●





Pöyry

Energy-efficiency services and new energy-efficiency directive

EU's Energy-efficiency Directive will most likely come into force in December 2012. National enforcement will be 18 months after this. The target to improve energy efficiency is very challenging and requires that substantial measures be taken on all levels of the society. The procedure to adapt the recommendations and requirements of Directive to the national regulations has been started. How Directive's requirements will be materialised throughout EU depends to a great extent on each member country's current level of energy-efficiency and actions taken so far in this respect. Energy-efficiency Directive lays down the guidelines to all players: energy producers and distributors, industrial enterprises, public sector and private consumers.

In addition to Energy-efficiency Directive, new building regulations will be introduced in Finland, which will set very strict requirements on the construction and energy efficiency of the buildings both in new projects and in renovations of old buildings by the year 2020.

Pöyry has been a pioneer in energy-efficiency services in Finland for more than two decades, well before the inception of the first energy conservation scheme. Pöyry's service portfolio covers all the operations of the company, from energy efficiency strategy development to operations improvement of the existing assets in industries, and in energy and real-estate sectors. The focus of energy-efficiency services in Finland is on state-subsidised energy audits,

which contain diverse energy analyses and audits for different industrial sectors and power plants. In deliveries of energy-efficiency surveys to clients in other countries, Pöyry exploits the experience and know-how it has accumulated in its projects dealing with the energy-saving and energy-efficiency programmes that were developed and launched in Finland already in 1990s.

As an outcome of our competences, Pöyry has since the year 2009 been assigned by its client to perform a global energy-efficiency programme, including, for example, extensive database based data collection and analysis services, energy analyses, building up of energy-saving tools and providing training to responsible persons. With the programme the client is committed to fulfil the energy-efficiency and energy-saving targets set both by the company itself. The programme contains the client company's all operations in over 70 countries and 150 locations.

In spite of today's ever-increasing challenges and tightening operational environment, Pöyry is committed to supply these services in order to fulfil its clients' future objectives and obligations for the benefit of whole society. ●

Skaftkärr energy efficient residential area, Porvoo, Finland. Services provided by Pöyry: land use and planning, energy consumption and emission calculations, traffic planning and planning of the energy network.



Pöyry Finland Oy

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Finland: Five Key Facts

Size: 338,145 sq km

Population: 5,387,000

Total primary energy supply (Mtoe): 33.17 ^[1]

Total CO₂ Production: 55.1Mt^[1]

Proportion of electricity from renewables: 47.5%^[2]

[1] IEA data for 2009

[2] CIA World Factbook





Ms Teija Lahti-Nuutila

Photo: Susanna Lehto

Finnish Seam Group Ltd. – an acronym for Sustainable Energy Asset Management – was founded in 2011. Seam promises savings of as much as 50-70% to the electricity bill. How is this possible?

“We combine years of experience in electricity trading and automation technologies in a new business model”, says CEO Jukka-Pekka Häkli.

Companies that consume high levels of electricity typically pay an hourly rate, which is determined by the electricity trading market and varies from hour to hour. Cost reduction is sought by targeting peaks in electricity consumption during cheaper hours.

Seam Group has accomplished an energy saving system for a large meat freezing plant, which stores a total of 8 million kilos of meat products. The plant’s electricity bill has been reduced by as much as 70% through optimization. Some of this was carried out by the plant already before, while

Save up to 70% on your energy bill

Radical reduction in electricity consumption doesn’t always require brand new technology. Sometimes combining mainstream know-how in an innovative way is enough.

Seam Group contributed to approximately 50% of the savings.

TEKES ENABLES AND COORDINATES

Tekes, the Finnish Funding Agency for Technology and Innovation, has an important role in funding and coordinating innovations in Finland. One of the main focus areas of Tekes is to develop new, internationally significant businesses to accelerate the sustainable use of natural resources.

“You cannot rely only on good ideas and technologies. The vision of green growth is possible in a society where the public sector and private companies share the same vision. We need a business environment which favours holistic, eco-efficient solutions and is open to radical new demonstrations. Public procurement must be harnessed to create this new market for entrepreneurs”, states Teija Lahti-Nuutila, Director for Energy and Environment Industries at Tekes.

Green Growth is an ambitious programme run by Tekes, which aims to create a business environment for radical innovations that enhance resource efficiency.

In cooperation with the Ministry of Employment and the Economy,

the programme has sparked a unique process of commitment to sustainable growth. Different public, private and third sector organizations are making concrete promises on ways to advance resource efficiency in the near future, demonstrating a great deal of enthusiasm. However, it remains to be seen how these commitments will actually turn into reality.

NEW BUSINESS FROM SAVINGS

The driving force for the Green Growth programme is to facilitate international businesses with energy and material efficient solutions. There are already good examples in Finland.

Finnish software company Eniram provides advanced decision support systems to large commercial vessels. With Eniram, one vessel can save up to a million euros in fuel consumption per year.

Savings for one company mean business for another. In the five years preceding 2011, Eniram’s net sales grew more than 6.000 %. Green Growth seeks to turn this growth into sustainable long-term business. ●

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Finland Green and going greener

By Mike Edmund

Finland already has some impressive green credentials: the 2011 turnover of its clean technology sector was over 20 billion euros, with an annual growth rate above 10%. Meanwhile, the national statistics site tilastokeskus.fi indicates that almost a third (27.7%) of the country's total energy consumption last year came from renewable sources. And almost half (47.5%) of every kilowatt of Finnish electricity is green, according to the CIA factbook.

Whether or not Europe meets its 20.20.20 targets (and at the moment it looks very much as if it will), Finland, it seems, is thinking further ahead than the next seven or eight years: in July, it updated its energy and climate strategies. The Ministry of Economic Affairs launched a 'clean energy programme', incorporating clean technology business-related goals and tools into the national energy strategy. In an attempt to provide a 'triple boost' to Finland's transition to green growth,

the programme incorporates economic, environmental, and employment-related aspects of the energy system.

On the economic front, the programme aims to reduce the cost of imported energy (currently 7.8 billion euros) by two billion (25-30%; 2011 energy prices) by replacing it with domestically-sourced supply. It is hoped that this will give a further boost to Finland's clean technology sector, which will in turn stimulate exports, improve the balance of payments and create new jobs.

According to the Food and Agriculture Organization (FAO) of the UN, Finland is Europe's most forested country, with 74% covered by trees. Forest industry has traditionally played a major role in the economy: various bioenergy technologies, including pyrolysis oil, biogas, biodiesel, and other bio-oils from wood combined to supply about 30% of Finnish energy consumption in 2010. The environmental aspect of the new programme

focuses upon strengthening the domestic market for innovative energy solutions and new energy business models, including wind energy, distributed solar energy, electrical transport, heat pumps, and - especially - bioenergy.

The Ministry of Economic Affairs expects its new programme to boost employment by creating over 60,000 new clean-technology and bioenergy-related jobs by 2020.

Finland's forests are clearly extremely valuable, but the optimal use of such a large resource has been questioned by energy expert Keijo Mutanen. Speaking on behalf of the Finnish Forest Association, Mutanen suggested that the energy questions of the future cannot be solved in one fell swoop, but by many smaller decisions. Nevertheless, Finland's clean energy programme clearly demonstrates that economic, social, and environmental sustainability can go hand in hand when developing new energy solutions for the future. ●

ForestEnergy2020

Research and innovation programme speeds up the European forest-based bioenergy sector

Finland launched first bioenergy research and technology programmes in early 1990's. Finnish Forest Research Institute (METLA) and Technical Research Centre of Finland (VTT) were actively participating in the forest biomass harvesting and conversion technology development from the very beginning. Now METLA and VTT have joined their forces to push forest based energy production to a new level in the EU.

FORESTS ARE THE LARGEST SOURCE OF RENEWABLE ENERGY IN THE EU

Use of wood and wood waste for energy in EU totals 90 Mtoe annually representing almost 50% of all renewables. Currently, the most remarkable biomass suppliers and end-users are the forest industries using the by products such as sawdust, bark and black liquor in energy production.

District heating and CHP production are also increasing the use on forest biomass as their feedstock. Several studies indicate that EU's forests could

supply about 200 million m³ (35 Mtoe) residual forest biomass and 100 million m³ (17 Mtoe) woody biomass from urban areas, fence wood from farms and wood production on set aside land for energy.

FEEDSTOCK SUPPLY IS THE CORNERSTONE OF COMPETITIVE BIOENERGY

Residual forest biomass (harvesting residues, wood from early thinnings and stumpwood) is already utilized in large scale in Sweden and Finland. About 16 million m³ (2.5 Mtoe) forest biomass for energy production are utilized annually in more than 1,000 heat and power plants in the both countries. The main challenge in EU's forest biomass supply for energy is the mobilization of the existing forest biomass potential in a competitive and sustainable manner. Sustainable and reliable supply of feedstock will be a critical success factor for the long-term competitiveness of biomass-based energy production: Fuel represents typically 60-80% of the total energy production costs of a CHP plant.

NEW TECHNOLOGIES AND SKILLED LABOUR FOR BIOMASS SUPPLY

District heating and CHP production using forest biomass as a feedstock is increasing rapidly and first commercial scale plants producing pyrolysis oil, bio diesel and other biofuels will start in a few years. The mobilization of new forest biomass resources in an efficient and sustainable manner calls for new technological solutions. Biomass supply chains have to be cost-efficient and sustainable also when supply stretches over very long distances. The manpower needed to run the operations is estimated to be over 40 000 machine operators in the EU. By now the entrepreneurs running round wood harvesting for industrial purposes have extended their operation to energy biomass supply. In the availability of skilled labor may become a serious bottleneck of supply.

ECONOMIC SUSTAINABILITY MUST BE IMPROVED

The ecological sustainability of increasing forest biomass

Large terminals for sorting, processing and storage of biomass have been built across Finland. The terminal in Joensuu harbour serves forest, energy and bio-oil industries using truck, rail and waterway transportation.



harvesting has been studied intensively in the Nordic countries. A network of experimental sites was established over Finland and also experimental sites dating back to 1970's and 1980's have been revisited. Results show that the complete removal of the most nutrient rich tree parts (needles and fine branches) can diminish the growth of future tree generations. When the green biomass is left unharvested on sites and the coarse branches and stemwood are recovered, now growth impacts have been detected. In addition, impacts on ground and surface water as well as surface vegetation did not differ from the traditional wood harvesting.

The economic viability of biomass based energy, however, has been found to be the weaker link. Forest based bioenergy is competitive against oil in heat and power markets in many parts of the EU. As a result, thousands of heat and CHP plants using forest biomass as their main fuel have been raised across the EU. Replacing coal with biomass is more difficult in existing plants and requires typically Incentives that already exist in some countries.

METLA's and VTT's new 5-year research and innovation programme 'ForestEnergy2020' aims to open new paths to EU's renewable targets by producing research-based knowledge, technological solutions and service innovations for sustainable forest feedstock supply and conversion. The quantitative targets of the programme are ambitious: The fossil fuel inputs of the feedstock supply chain will be reduced by 30%, the cost of

feedstock will be reduced by 30%, the added value of biomass based energy portfolio will be increased by 30%, and finally, the forest biomass based energy production will increase by 30TWh in Finland and 300 TWh in EU by 2020. The volume of the ForestEnergy2020 -programme is planned to be 50 M€ and 400-500 man years. ●

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Figure 1 Energy use of forest residues has been increasing rapidly in Finland reaching 7.5 million m³ (15 TWh) in 2011. Target for 2020 has been set to 25 TWh.

Value axis: thousands of m³ of solid wood.

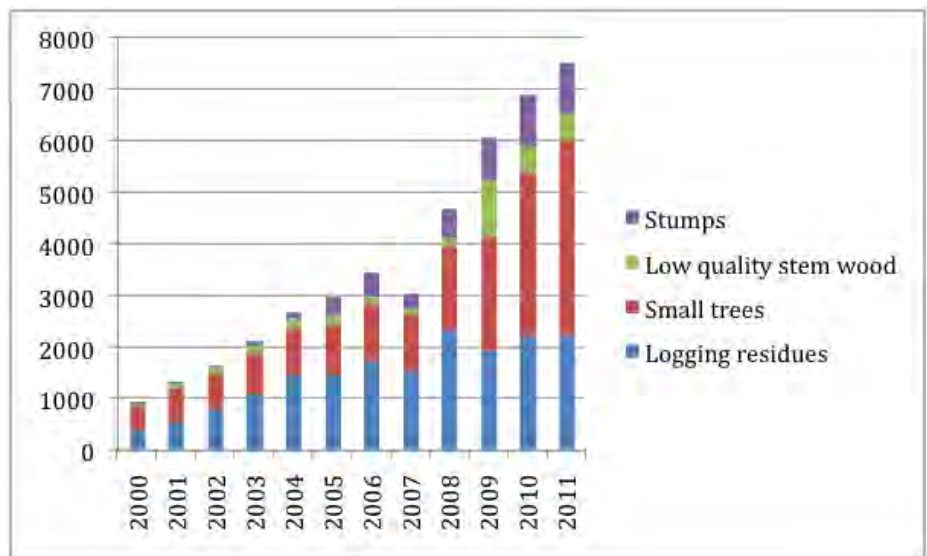


Figure 2 "See how" is an efficient way to share experiences and transfer proven solutions to other regions and countries in the EU.

Finland: Sisu and Computers

In 2010, Finland was voted the most desirable country in the world in which to live. Newsweek Magazine assessed countries according to a variety of criteria that included education, health, quality of life, economic competitiveness and the political environment. No doubt many Finns shared the delight expressed by their Foreign Minister, though it seems likely that few would have wasted time discussing it in public. Two years on, Finnish consumer confidence is down, industrial output and GDP are down; and levels of unemployment, the cost of living and the price of houses are all up. A great deal can happen in twenty-four months, and the prevailing economic climate would seem to have been very harsh for the people of this Nordic country.

There is plenty of domestic evidence of the effects of the global recession: Finnish industrial output, rising steadily since 2005, collapsed in 2009 before recovering in 2010 to stand slightly less than one percentage point higher than it had six years earlier. Though this figure is hardly in the same league as that of China, GDP growth is something of which many countries might feel slightly envious. Meanwhile, according to Suomen Virallinen Tilasto, the Official Statistics, domestic production of electricity amounted to slightly more than 70 TWh in 2011, down by 9 per cent from the previous year. District Heat production fell 13

per cent and the production of industrial heat by 4 per cent in 2011. However, closer examination of these headline facts reveals two interesting carbon-related trends. The first is a decline in the use of fossil fuels and peat in the generation of electricity (down by 21 per cent and 12 per cent, respectively). This is interesting because Finland lacks any significant domestic source of fossil energy and must therefore import petroleum, natural gas, and other energy sources. The second trend is an increase in the use of renewable sources (a rather more modest 3 per cent rise). Nevertheless, in 2011 Finland for the first time generated more "green" electricity than "black". In parallel with this, her CO₂ emissions from the production and use of energy diminished by nearly 20%.

Thanks to latitude and its geography, Finnish winters are long, dark and cold. These factors mean staying warm is a topic that greatly interests the Finnish, and district heating serves somewhere approaching half of the 5.3 million inhabitants. Over 90% of apartment blocks, more than half of all terraced houses, and the bulk of public buildings and business premises are connected to a district heating network. Natural gas is mostly used in the southeast of the country, imported coal close to her ports; and peat in the northern areas, where it is a natural resource. Some 80% of all this heat is produced by combined heat and power [CHP] plants,



and according to EcoHeat4U, the length of the connections in district heating networks is increasing, which suggests that the reach of these the networks is also increasing. One novel application of the approach may be found in Helsinki, where a data centre beneath the Uspenski Cathedral can release its excess heat for the benefit of neighbouring homes. Five hundred of them, that is.

Sisu is a Finnish word that describes a rather interesting concept. Attempts to define abstract ideas are fraught with difficulty; and accurate translation is often impossible. Sisu can however be described: it has much to do with sticking to the task at hand; with quiet

determination and the strength to face adversity head on; with not giving up; and with quietly going about ones business in trying times. And as such, Sisu can be recognised anywhere. Such as when waste heat from computer fans is used to keep people warm when the icy winds of recession are blowing. ●

eko**KUMPPANIT**
ECO₂
 Ekotehokas
 Tampere 2020

Towards an energy-efficient Tampere

Tampere is the third-largest city in Finland and the largest inland city in the Nordic countries. It is a centre of cutting-edge technology, research, education, culture, sports and business. Let us present three projects from Tampere that have as their goal an energy-efficient city.

ISOKUUSI - THE WOODEN CITY LIFE WITHIN A BIG CITY

Finland's largest wooden city district, the yet-to-be-built Isokuusi, will be located a mere seven kilometres from the centre of Tampere. The aim is to build a pleasant, ecological district to accommodate 4,000 residents in the area of Vuores, home to 14,000 people.

In addition to residential properties, spaces intended for businesses, offices, services, work and communal activities will be constructed. Around 1,650 properties are planned for Isokuusi, with 500-700 of these taking the form of residential homes with wooden structures. Around a half of these 500-700 properties will be found in wooden multi-storey buildings.

The heart of Isokuusi will be a lively hub, a square for everyone. In the specific planning of the

housing blocks, attention will be paid to the theme of community as well as to making it possible for the area's residents to meet one another and enjoy hobbies, such as roof-top gardening. Art is also an important part of Isokuusi's appearance.

The placement of buildings will be done in a way that does not impact on their natural surroundings, with the latter's original form preserved as much as possible. In relation to landscape construction, natural waters and the natural absorption and filtration of rainwater and surface runoff - in other words urban runoff - are also being given due consideration.

The aim is to make Isokuusi a carbon-neutral area - the energy consumption of buildings will be minimised. The placement and style of buildings will help in the utilisation of sunlight and solar

energy. Furthermore, renewable and recyclable building materials will be favoured. The carbon footprint of the various building components will be calculated using the model used by the Finnish Environmental Institute.

Isokuusi is a joint scheme involving a partnership between the City of Tampere's Vuores project and ECO2 - which is helping to develop ecological town planning in the city - as well as the company Finnish Wood Research Oy, which implements research, development and innovation projects.

ECO2 - REDUCING BIG CO2 FOOTPRINTS AND FINDING RENEWABLE ALTERNATIVES

The project ECO2 - Eco-efficient Tampere 2020 is working to realise the climate and energy goals of the City of Tampere. One of ECO2's undertakings is to participate in projects promoting low-carbon town planning. One of these is RESCA (Renewable Energy Solutions in City Areas), a project involving a number of large Finnish cities. The purpose of RESCA is to increase renewable energy production and to develop ways for large cities to share information and learn good practice from one another in relation to this goal.

Tampere's share in RESCA comprises four facets. The aim of one of these is to increase the

Photo by: Auli Hannula

Murikka Institute switched from oil heating to wood pellets.





use and visibility of solar energy in Tampere. The potential of solar energy and its economic viability for use in the energy production of individual buildings and different areas of town is being investigated. The purpose of the second of the aforementioned four facets is to replace an existing oil heating system with a 1.5 MW woodchip-burning water heating boiler.

Besides this boiler system, hybrid solutions that utilise heat generated by wastewater and solar thermal collectors are also being looked into. The calculation of carbon footprints is also part of RESCA's remit. By calculating the carbon footprints of two of Tampere's most significant landmarks - the Särkänniemi amusement park and Tampere Hall, the largest congress and concert centre in the Baltic region - data can be obtained on those features that have the biggest carbon footprint, making it possible to determine how best to reduce the latter. Additionally, a 33 MW wood pellet power station, which will be Finland's largest such heat power station once completed, is being built in Tampere and its chain of logistics will be studied.

LOCAL HEATING - MAKING SENSE OF THE LOCAL HEATING JUNGLE

Lähilämpö ("Local heating") is a project coordinated by EcoFellows Ltd (Ekokumppanit) that offers expert advice on making use of local heating solutions. The project is chiefly concerned with heating solutions related to wood pellets, woodchips and solar thermal collectors, but heat pumps and wind power have also been introduced at its events. Buildings heated by oil and electricity are the project's main focus. Participants include municipalities, small households, farms, businesses and other communities. The project is primarily publicly funded, with the European Agricultural Fund for Rural Development and municipalities having been the main financial contributors. Twenty per cent of funding has come from private organisations and companies.

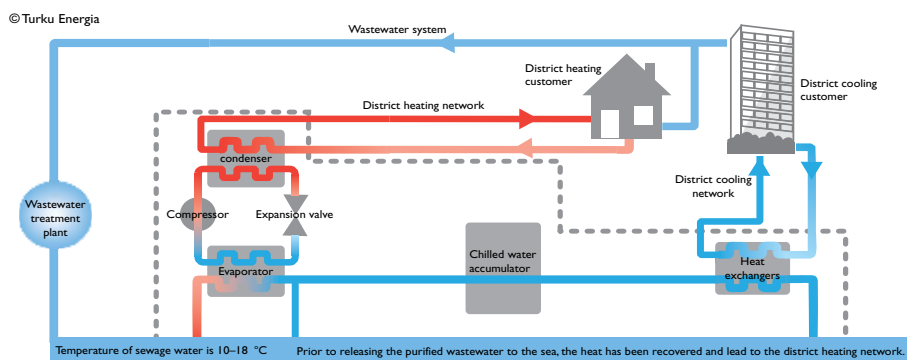
Participants in the project are offered personal advice about how to switch heating systems. In addition, different educational events and lectures have been organised. For instance, people interested in the topic have been taken by bus on a "local heating

*Photo by: Vianova Systems Finland Oy
 The Vuores area showcases ecological town planning in the city.*

safari" to help them acquaint themselves with different forms of renewable heating systems. Experts accompany the group and give more details about the heating systems while the properties' owners talk of their own experiences. Some of the safari destinations can also be followed in real time on the project's website.

The two largest destinations have been the Metal Workers Murikka Institute and the Kämenniemi district of Tampere's regional heating centre, both of which use just under 1 MW of power. The Murikka Institute started using wood pellets instead of oil last autumn while a woodchip-burning power station is currently being planned for Kämenniemi. Experts have assisted these projects from the planning stage all the way through to their realisation. Lähilämpö's most important lesson has been that approaching people and interacting with them - also online - brings the best results. ●

The City of Turku uses wastewater for district heating and cooling



District heating has been the most popular heating system in the Finnish city of Turku for decades. Over 90 percent of Turku's buildings are connected to the district heating network. Since the year 2000, the possibility to connect to a district cooling network has also been available for the central areas of the city.

Part of the energy for the heating and cooling system comes from the municipal wastewater treatment plant. The heat energy of the purified wastewater is captured with a heat pump. In the heat pump the wastewater cools down while releasing thermal energy. The temperature

of the water is usually around 14 degrees Celsius before entering the heat pump and around 4 degrees after the heat recovery. The temperature of the water that goes into the district heating network can be up to 90 degrees.

Over three units of district heating can be produced by one unit of electricity (COP = 3.3). The heating power of the system is 21 MW. The heat from the heat pump covers the need of 12,000 citizens, which is eight percent of Turku's demand. The rest of the district heating is produced in a coal-fired CHP plant and by heating plants operating on woodchips and municipal waste. Over 30 percent of the district heating comes from renewable energy sources. The electricity used by the heat pump also comes primarily from renewables.

The need for cooling has increased during the last decade. District cooling has become very popular in new

and renovated buildings and shopping centres.

After the wastewater has been chilled for the district heating, it is used as a source for district cooling. Between the heat pump and cooling system there's an accumulator for chilled water in order to balance the daily fluctuations of the district cooling network. The cooling power can be momentarily almost tripled. Chilled wastewater runs through heat exchangers before being disposed of in the sea. The cooling power of the system is 14.5 MW and covers 90 percent of the need of the existing district cooling network. So far, over 50 buildings use district cooling, but the network will expand in the near future. District cooling is an easy and environmental friendly technique with low maintenance needs and costs.

The heat pump was commissioned in 2009 when the new wastewater treatment plant began operating. The district heating and cooling network is operated by the city-owned energy company Oy Turku Energia. ●

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Problem solving is in our nature

By Santtu Hulkkonen, Executive Director, Cleantech Finland

Decades of commitment to cleantech innovation, progressive government policies, harsh climate conditions and lack of fossil energy resources have pushed Finland to become a model for the world in solving global environmental problems. Finnish cleantech sector includes about 2,000 enterprises, with a combined turnover of some €20 billion, and is highly diversified. The national objective is to develop the sector into a new cornerstone industry and thus double the annual turnover to € 40 billion and create 40,000 new green jobs by the year 2020.

The Finnish success in providing state-of-the-art solutions for

environmental challenges is based on the fact that Finland has the highest share of public spending on energy and environment R&D per capita in the world. Over 40 % of all public innovation expenditure goes to cleantech. Strongest cleantech R&D segments in Finland are clean energy production, energy efficiency and saving, and efficient industrial processes.

Along with progressive government policies, Finland has recently launched a new strategy, made by the Ministry of the Employment and Economy, for cleantech business development. The strategy areas focus on: 1) Common vision and road map to green growth leadership; 2) Best home market for companies targeting for internationalization; 3) Boosting the internationalization of SMEs.

The environmental problems we are facing globally are not going to disappear but they can be lessened. Finnish cleantech companies have a history of solving environmental challenges, making the country a global leader in, for instance:

Energy efficiency: Due to its energy-intensive main industries, cold climate and long distances, Finland has invested in energy efficiency for decades. Finnish energy technologies excel in various areas including combined heat and power generation, district heating and cooling, efficient industrial processes as well as smart grids and power electronics.

Bioenergy: Finland is a leading user of renewable energy sources in the world. One of the most important renewable sources of energy in Finland is bioenergy, particularly wood and wood-based fuels.

Clean processes and materials: International comparisons of sustainability have ranked Finland among the best in the world. Finland's traditional strengths are in the area of processes and process technologies for the energy, forest, metal and mining industries, and related automation and ICT.

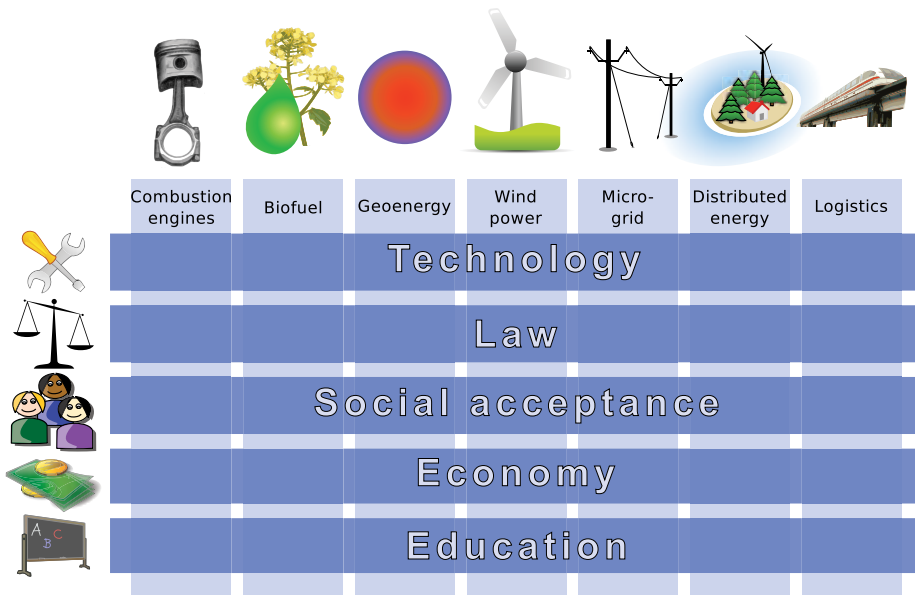
The ability to solve problems is part of the Finnish identity. CLEANTECH FINLAND® is a network of top cleantech experts. It is a national programme aimed at promoting Finland's environmental technology sector and profiling Finnish companies as some of the leading suppliers of the best clean technology available anywhere. Cleantech Finland's new SOLVED digital expert service has been designed to help solve problems and provide solutions for the biggest challenges facing today's world - by leveraging Finnish expertise and international cooperation via an online platform. The aim is to make the service the best in the cleantech field.

Investments in cleaner technologies pay for themselves through efficiency and a better standard of living. This is the know-how that Finland wants to offer to the world. Problem solving is in our nature. ●



Heading to sustainable energy

Vaasa Energy Institute



Vaasa Energy Institute (VEI) is a Finnish expert organisation, which offers a wide variety of research, consulting, and educational services for the energy sector at domestic and international level. VEI's core business idea is to provide expertise and knowledge for the use of companies and the surrounding society.

The region of Vaasa has the largest energy cluster in Scandinavia, comprising some 120 companies and employing more than 10000 people in its value chains. Well known enterprises such as ABB, Wärtsilä, Vacon, The Switch, Mervento, VEO Group, Finn Crimp etc. are key actors in the cluster. VEI is an active R&D partner with a number of these companies and the cluster as a whole.

Despite being highly academic, VEI also has a practical approach towards the energy issues: VEI takes a strong lead in cooperating with other people, companies, municipalities, regions and organisations, therefore benefiting society as a whole.

VEI is a unique combination of multiscientific expertise. The strategy has been formulated to add knowledge in the sustainable energy chain, as illustrated in the diagram below, from renewable energy sources (RES) to energy markets and business.

VEI was formed in autumn 2006 jointly with the University of Vaasa (several units), Vaasa University of Applied Sciences and Novia, the Swedish University of Applied Sciences in Vaasa. However, all the member organisations of VEI are highly experienced in the

energy sector, both academically and practically

Through its member organisations, VEI has comprehensive expertise of energy markets (well established and internationally acknowledged expertise, especially in the field of consumer psychology and behaviour), energy technology (particularly in power systems, including the related applications of ICT and automation technology) as well as sustainable development in the energy sector (especially efficient and competitive energy markets and the wider application of renewable energy sources). The combination of both technical and business expertise also makes VEI a significant player in broader research and education projects. VEI has also built up an extensive national and international network with other experts in the energy sector, which has given rise to significant cooperation.

VEI member organisations have conducted numerous projects funded by various companies (such as Shell, Fortum, Helsinki Energy, ABB, Wärtsilä, energy utilities) and other organisations (such as ERGEG, Finnish Ministry of Trade and Industry, EU, IEE, The Finnish Funding Agency for Technology and Innovation TEKES). ●

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CLEANLY WITH BIOGAS AND NATURAL GAS



Gasum is a Finnish expert in natural energy gases. We import natural gas to Finland, and transmit and supply it for energy production, industry, households and transport via a pipeline network owned by us. Gasum is also an active developer of the Finnish biogas sector. Natural gas and biogas provide the

Finnish energy sector with considerable efficiency and environmental benefits.

Gasum is partnering with the leading Baltic gas companies to explore the opportunity to import LNG and to establish a single Finnish-Baltic gas exchange market.

Gasum
WWW.GASUM.COM

Finland's nuclear drive has come at the cost of renewable energies

By Satu Hassi, Member of the European Parliament

While wind and solar power are growing rapidly in Europe, Finland is struggling with the development of renewables as nuclear projects have been given priority. But the big nuclear plans have run into difficulties.

Last year, 30 000 megawatts of wind and solar power capacity were installed in Europe, which is significantly more than any other electricity capacity in total. The global markets for wind power grew by a fifth and of solar power

by 70%. At the same time, the share of nuclear has declined in Europe and more widely in the world as a consequence of the Fukushima disaster.

New energy technology is a 300-billion-dollar business. The International Labour Organization estimates that the sector will create 20 million jobs in 20 years.

Finland has been slow to adopt the right framework to get its renewables industry off the ground. It was among the last in the EU to introduce a feed-in tariff

while its investment in nuclear in relation to its population is higher than anywhere else in the world. As a result, the neighbouring Sweden has fifteen times the amount of wind power compared to Finland.

Bucking the European trend, Finland is currently building a new nuclear power station, the so-called Olkiluoto 3, 1600 MW, constructed by French Areva for Finnish power company TVO. The project has been an endless story of scandals, deviations from safety and quality norms, not to mention

Satu Hassi



Finland is currently building a new nuclear power station, the so-called Olkiluoto 3, 1600 MW, constructed by French Areva for Finnish power company TVO



labour laws. The cost will be approximately double compared to the purchasing price, and the timetable has been delayed almost by one year each year.

The original plans foresaw that the plant would become operational in 2009. After several delays, this is now set to happen in 2014 or 2015 at the earliest. As a result, TVO recently filed a lawsuit demanding Areva to pay 1.8 bn euros in compensation for the delay. Areva, in return, demands 1.9bn euros from TVO. The disagreement is in international arbitration in the Hague. Areva won the first part in May this year, forcing TVO to pay 125m euros.

Despite all the problems in Olkiluoto, the Finnish Parliament granted principal permits for two more nuclear reactors two years

ago, one for TVO and another to a new company Fennovoima, which plans a nuclear power plant to a new site close to the Northern end of Gulf of Bothnia. Fennovoima's biggest shareholder, the German power company Eon, has this year withdrawn from nuclear projects in the UK. Moreover, the company is facing further headwind as shareholders representing 10% of its shares left the company this year.

The latest setback for the nuclear industry was the warning by the national Radiation and Nuclear Safety Authority that the first final nuclear waste storage facility being built in the Finnish bedrock will not get a go-ahead unless several deficiencies in the construction are rectified.

To make matters worse, the European Commission's report

on the results of its nuclear stress tests concluded that Olkiluoto was one of two plants where reactors are particularly vulnerable to a total loss of electrical power.

To my mind, the best solution for Finland would be to speed up the development of the domestic market for new energy technologies and appliances. The new Government Programme setting out the main goals of the current Finnish government includes a strategic programme for the development of the clean tech sector as well as measures to remove barriers to wind power development. These are good first steps, but more needs to be done to encourage small enterprises and households to invest in renewable energy and to connect small-scale electricity production to the grid. ●





sgem
Smart Grids and Energy Markets



CLEEN
Cluster for Energy and Environment

CLEEN - The smart energy solutions

The cluster for energy and environment, CLEEN Ltd, offers global companies and research institutions an innovative ecosystem and promotes industry's competitiveness by initiating and facilitating wide, deep and shared R&D&I between various industries and academia. By creating global energy and environment knowledge platforms, CLEEN aims to create a central node of world-class expertise.

CLEEN works to make Finland more attractive to companies looking for investment opportunities in Finland and create high value added work opportunities. Open innovation based research and development ecosystems in a stable and trustworthy society attract world's leading industries and institutions to Finland to realize their joint R&D&I operations. The 45 shareholders of CLEEN define the strategic research agenda and the policies of the platform while the consortium's members define the detailed targets and scope of the research programs.

Today, CLEEN manages six research programs: Carbon capture and storage; Distributed energy systems; Future combustion engine power plants; Efficient energy use; Measurement, monitoring and environmental efficiency assessment and Smart grids and energy markets, resulting in a research volume of forty million Euros in 2012. CLEEN also plans to initiate research activities in the areas of bio-energy solutions and recycling and waste management.

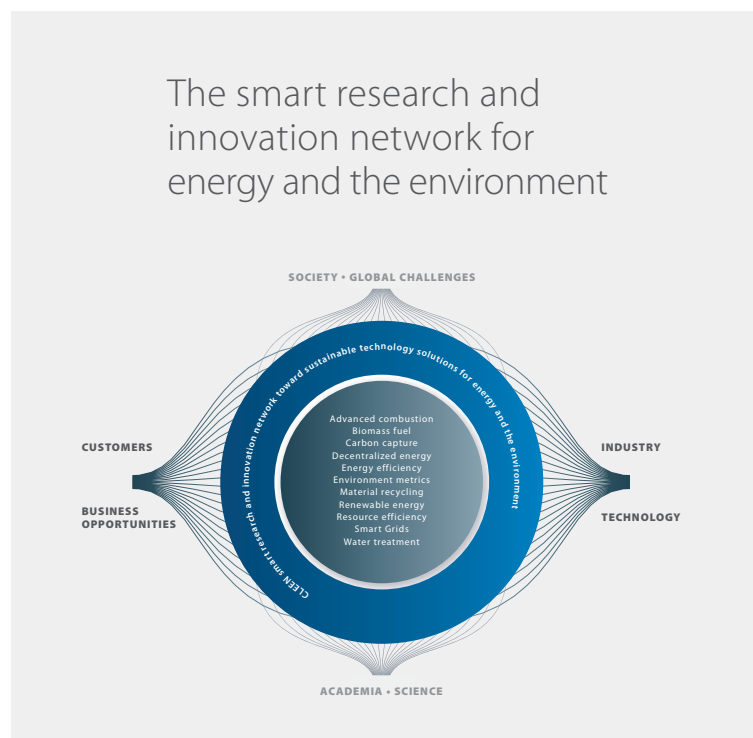
Demonstration Sustainable Urban Living (As Oy Espoon Adjutantti) is a new living concept resulting from the **Smart Grids and Energy Markets (SGEM)** research program. In the program participants research and demonstrate different types of smart grid architectures: new power system technologies,

intelligent management and operating techniques, market integration, and various new business models that will be needed for making the most of tomorrow's smart grids.

At Adjutantti residential building, the eco-efficiency and sustainable living are taken into account comprehensively. The new technology related to smart grids will provide Adjutantti residents with better opportunities to monitor their energy, electricity, water and heating consumption and make it more efficient. The energy the building produces by its solar panels on the roof, is used for example in the lighting for building's stairwells.

Energy use in buildings accounts for about 40% of the energy consumption in the Nordic countries. It is important that the new urban solutions encourage residents to decrease their own carbon footprint. The real-time monitoring of household electricity consumption through smart meters and feeding of electricity generated with the solar panels on the building into the grid are part of the energy-efficient urban living. At the foundation of this vision is the smart grid that connects electricity producers and consumers to each other.

www.cleen.fi



Planning for a carbon-neutral future? Ask the Finns!

By Hannu Takkula, Member of the European Parliament, Finland

Finland has a clear message to deliver to the rest of the EU: as part of our vision for 2050 we are committed to a carbon-neutral future. That vision includes producing electricity and district heating without increasing levels of emissions, despite the fact that electricity consumption is estimated to grow by almost 50% of the current consumption rates. How? We are one of the few countries that have made the decision to invest in advancing nuclear power capacity whilst also developing renewable energy strategies.

To counter the constant threat of climate change, I believe such ambitious goals are necessary. Alongside the difficulties of sustainable development, the competitiveness of the Finnish energy industry is being hampered by soaring energy prices. Like many other countries, Finland is a power-hungry nation yet we have relatively few domestic energy resources of our own. To secure a carbon-neutral future, we require low emitting and inexpensive energy sources. Renewable energy sources in Finland have increased to approximately 25% total share of primary energy supply, but it remains an area where more innovation could take place to meet the growing global demand for energy. Finland collaborates with the International Energy Agency to accelerate the use of environmentally sound and cost effective energy sources, for example in the production

of bioenergy. However, nuclear energy continues to play a major role in Finland, supplying around 25% of the total amount of electricity. We have four active nuclear power plants, one under construction and a further two reactors planned.

The construction and operation of energy infrastructure will of course be largely dependent upon securing finance despite difficult economic times. The European Commission has released estimations of hundreds of billions of Euros required in investments to oversee successful implementation of its long-term energy strategies package for the EU. Roadmap 2050 proposes an overall objective of cutting emissions (predominantly greenhouse gases) by over 80% by the year 2050. The EU is essentially making the economic case for decarbonisation by 2050. It aims to achieve this through a number of initiatives, including zero-carbon infrastructure, doubling annual energy efficiency rates and the creation of European-wide energy markets. Finland and the EU share these "big picture goals," as well as the big economic challenges. When planning for large-scale energy projects, it is worth mentioning that novel public and private financing models are crucial. In Finland for example, the Co-op Model, or the Mankala Principle as we call it, has been widely and successfully used. The concept behind the Co-op Model is to generate a stable financial



base that is independent of price fluctuations. A plant will sell the electricity it produces at a cost price to its shareholders, who then cover the fixed and variable costs of the company. Around half of all renewable energy projects as well as half of our nuclear projects (past and present) have been funded with the Co-op Model.

We can safely say that Finland is moving forward at a rapid pace, integrating research and development ingenuity with practical supply systems. We will no doubt continue to actively participate in international cooperation initiatives alongside the EU while advancing our own investment in a genuinely carbon-neutral future. My advice to anyone in the global energy sector is: if you're planning for a carbon-neutral future, it might be worthwhile asking the Finns. I think Finland has realised the biggest challenge to securing a carbon-neutral future for the younger generation - maintaining innovative but consistent policy. ●

A new global energy landscape is emerging

Rob Kool, Chairman of the IEA DSM-Programme (www.ieadsm.org)

So says the IEA World Energy Outlook 2012 in which they present a new scenario on what would happen if the profitable energy efficiency potential was realised worldwide. They explain further how it would come about: "If new policy initiatives are broadened and implemented in a concerted effort to improve global energy efficiency, this could be a game-changer." How and the economic consequences are elaborated in their chapter 10 where it is said that it would require "... to re-deploy supply-side capital investments into demand-side efficiency improvement investments, which has the effect of changing energy supply businesses or financiers into energy service (supply and demand) businesses and financiers."

This sort of refocusing is part of the IEA DSM-Programme experience that is available and contains examples from all corners of the world. The IEA WEO suggests six steps for a change:

- **Visibility** - The energy performance of each energy end-use and service needs to be made visible to the market. The IEA DSM-Programme has examined the role of municipalities in which several models have been studied.
- **Priority** - The profile and importance of energy

efficiency needs to be raised. The WEO mentions the role of utilities and possible energy efficiency obligation, which has been studied by the DSM-Programme both in with examples of "White Certificates" in Europe and worldwide with Energy Efficiency Obligations presented in a recent publication.

- **Affordability** - Create and support business models, financing vehicles and incentives to ensure investors in energy efficiency reap an appropriate share of the rewards. There is a longstanding and developing work on Competitive Energy Services (Energy Contracting, ESCo Services) in the IEA DSM-Programme.
- **Normal** - Energy efficiency needs to be normalised if it is to endure. Resulting benefits from learning and economies of scale help make the most energy-efficient option the normal solution. Indeed so and that is why we have engaged in improving the technology with co-operative procurement and improving planning for resources and deployment to the market-place.
- **Real** - Monitoring, verification and enforcement activities are needed to verify claimed energy efficiency. The DSM Programme has developed Standardisation of Energy

Savings Calculations and Guide Books for the purpose.

- **Realisable** - Achieving the supply and widespread adoption of energy efficient goods and services depends on an adequate body of skilled practitioners in government and industry. And they also need skills in finding out how human behaviour works to adopt and adapt new methods, which is one of the new areas studied in the IEA DSM-Programme.

According to WEO: The Efficient World Scenario results in a more efficient allocation of resources, boosting cumulative economic output through 2035 by \$18 trillion. Additional investment of \$11.8 trillion in more efficient end-use technologies is needed, but is more than offset by a \$17.5 trillion reduction in fuel expenditures and \$5.9 trillion lower supply-side investment. Those investments pay back well before the end of the lifetime of the energy capital stock and result in huge gains for the economy, energy security and the environment.

We wholeheartedly endorse the IEA WEO 2012 projections and suggestions to make full use of the enormous energy efficiency potentials and in particular to ensure that they are exploited in systematic manner by use of Demand Side Management, DSM. We will be happy to help! ●

Solar fuels from photons, water and CO₂

Leaves and algae split water into oxygen and hydrogen at ambient conditions, exploiting sunlight. This is the first, fundamental step of photosynthesis, a crucial phenomenon active on Earth since 3 billion years ago and chiefly responsible for the presence of oxygen in our atmosphere.

Professor Guido Saracco (Fig. 2), Head of the Applied Science and Technology Department at the Politecnico di Torino, recently funded with the world class scientist James Barber (ENI-Italgas prize in 2005 for his studies on the Photosystem II enzyme which governs the water-splitting process in photosynthesis) a new laboratory, the Biosolar Lab, aimed at exploring this natural process and replicating it in artificial high-efficient photo-electrochemical reactors.

In a first European project (Solhydromics; www.solhydromics.com; 2009-2012), funded in the Future and Emerging Technologies area of the Energy Workprogramme, an artificial device to convert solar energy into hydrogen was successfully developed, achieving an overall 1% conversion of solar energy into H₂ chemical energy. A picture of the Solhydromics prototype in operation is provided in Fig. 1.

The device comprises three main components: an anode to carry the PSII-like chemical (a Co-based water splitting catalyst), a cathode to carry another catalyst to reduce protons into hydrogen, and a membrane enabling the transport

of both protons and electrons (Fig. 3).

Based on these promising results two new projects (namely ArtipHyction, www.artiphycion.org, funded under the Fuel Cells & Hydrogen JTI initiative, and the Eco²CO₂, funded in the Nanotechnologies, Materials and Processes section of the 7th EU Framework Programme), both coordinated by Prof. Saracco, have just started in 2012 (Fig. 3).

The ArtipHyction project aims to offset the Solhydromics limitations by pursuing an efficiency rate of 10% for solar hydrogen generation in a new device characterized by the following features (Fig. 3):

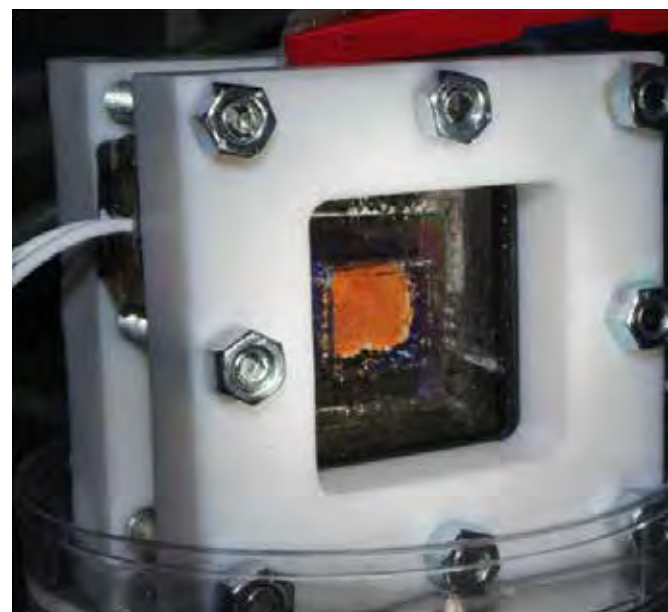
- Water is split at the anode employing a specifically designed electrochemically-tailored catalyst.
- The generated "high energy" electrons are conveyed via a porous electron conducting glass layer (e.g. FTO) to an external wire connection.
- The generated oxygen is removed through the hydrophobic pores of the anode layers; this removal will be facilitated by the waves generated inside an engineered electrode microstructure by pressure fluctuations applied to a water film separating the two

*"Since three billions of years ago photosynthetic microorganisms learned how to split water into oxygen and hydrogen, exploiting this last to reduce CO₂ to form the organic molecules of at ambient temperature. The research team of **Professor Guido Saracco** is at work in a series of EC-funded projects to replicate this even more effectively in artificial devices aimed at the intensive production of 'solar fuels'."*

electrodes;

- The generated protons are transferred to the cathode with minimum resistance via the water phase sandwiched between the electrodes;
- The reduction of protons will be facilitated by a synthetic hydrogenase-mimetic catalyst on a porous cathode (e.g. FTO);
- Light is absorbed by suitable chromophores at both electrodes to boost (tandem cell).

Conversely, the Eco²CO₂ project aims at exploiting a



Left: Fig. 1. The Solhydromics prototype at work. Bubbles of oxygen generated by photochemical water splitting at the anode are visible

photo-electro-chemical (PEC) reactor (Fig. 3) similar to the Solhydromics one to ultimately convert pure CO₂ derived from fermentation processes to produce methanol (with a 6% overall efficiency), as a key intermediate for the production of fine chemicals (fragrances, flavourings, cresol, adhesives,...) integrated with a lignocellulosic biorefinery. A distinct "squared" improvement in the ecological footprint of the envisaged chemical industries will thus be achieved by: i) boosting the potential of lignocellulosic biorefineries by exploiting secondary by-products such as furfurals or lignin; ii) providing a non-negligible contribution to the reduction of CO₂ release into the atmosphere by exploitation of sunlight as an energy source.

Above: Fig. 2. Prof. Guido Saracco

Below: Fig 3. Sketches of the original devices developed in the Solhydromics project and the new devices under development in the ArtipHyction and Eco2CO2 projects

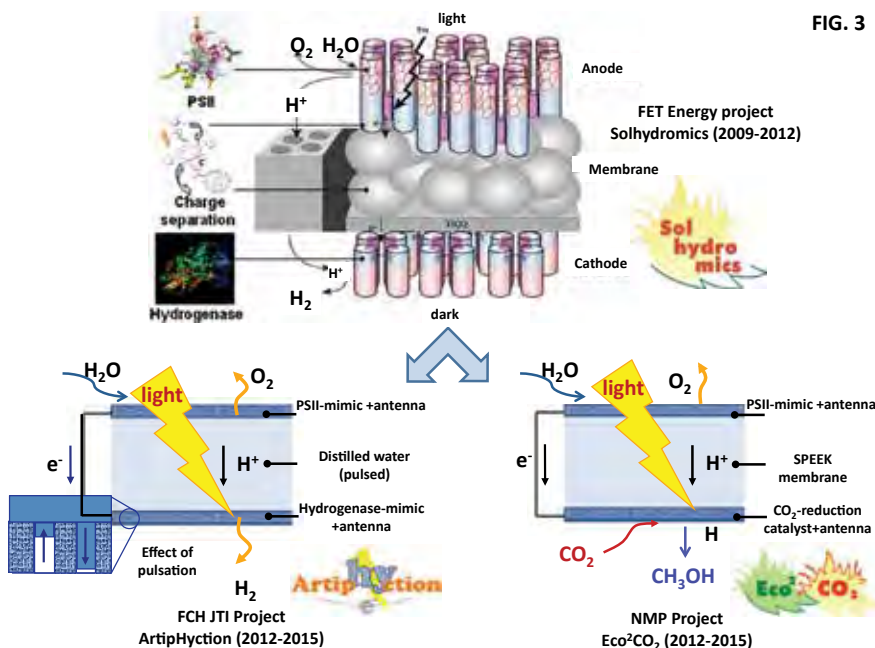


FIG. 3

This commitment to practical issues, with a view to the eventual application of the ArtipHyction and Eco²CO₂ devices, is reflected by strong project partnerships, bridging the academic and business sectors, combining scientific rigor of universities and research centres with the knowledge of the commercial marketplace of SMEs and large companies. Such partnerships are listed in the following.

Professor Saracco says the project are looking to the medium-long-term for commercialization. "The ArtipHyction and Eco²CO₂ technologies and solar fuels will be exploited, but it's not going to happen immediately, possibly within the next 10 years" he acknowledges. ●



The ArtipHyction partnership:

- Politecnico di Torino
- HySyTech srl
- Commissariat à L'Energie Atomique
- Chemical Process Engineering Research Institute
- Solaronix SA
- Lurederra Foundation for Technical and Social Development
- Tecnologia Navarra de Nanoproductos SL
- Pyrogenesis SA

The Eco²CO₂ partnership:

- Politecnico di Torino
- Delft University of Technology
- European Research Institute of Catalysis
- Centro Tecnológico de la Química de Catalunya
- Chemtex Italia SpA
- Avantium Chemicals BV
- Solaronix SA
- Repsol SA
- Catalonia Institute for Energy Research

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The Bioeconomy: a farewell to oil

By Steen Riisgaard, President & CEO, Novozymes

Listen carefully and you'll hear a new buzzword echoing in governmental halls of power: the 'Bioeconomy'. If it's not already on your radar, it's likely that it soon will be. Its promise is richly attractive: a transition from today's petroleum based society to a model that is more sustainable. Recent developments show it is gaining political momentum, and here to stay.

The European Commission launched last February a long term strategy aimed at transforming the continent into a bioeconomy. A couple of months later, the Obama administration published its National Bioeconomy Blueprint. Denmark, Finland, Germany, Ireland and the Netherlands have already adopted action plans. Further afield, Brazil has expressed its intention to develop the world's largest bioeconomy. And, of course, China has included the bioeconomy and biotech sector as a priority within its 12th Five Year Plan.

Yet despite these political developments, most people haven't heard of the bioeconomy, or how it will impact (and indeed is already impacting) their daily lives. The first step in changing this is to get the concept more clearly understood.

So what is the bioeconomy? Put simply, it's about turning naturally abundant and renewable plant based material and waste into

food, feed, fuel and materials.

This is a far reaching vision. One that will eventually see the fundamental building blocks of consumption sourced from renewable, plant based materials, rather than petroleum. In doing so, the transition to a bioeconomy will fundamentally change many industrial supply chains, and the relationship between agriculture and society. Agricultural production becomes central to the economy. Sourcing of fuel and material becomes local again.

If the vision is big, so are the challenges involved in realising it. On the bright side, the science already exists, in large part. Industrial biotech companies like the one I represent, Novozymes, develop the technologies that underpin it. The biotech industry is currently strong in Europe - one of the few sectors where we have the edge over the rest of the world. It can be a trump card for Europe in the global race to create a bioeconomy.

Investment in the necessary infrastructure is clearly the major hurdle to overcome - especially in the grips of a recession. But, with the political rhetoric shifting marginally from austerity to growth, charting a sustainable route to recovery should be a prerequisite for helping Europe out of its economic woes for the short and long term. Pressing energy, climate and food-related challenges have created the "perfect storm" to drive a new

economic model. There are plenty of boxes investment must tick for it to be genuinely sustainable, and not to exacerbate the old problems that contributed to getting us into this situation.

The bioeconomy ticks these boxes, and is in this sense used by governments as a synonym of sustainable, knowledge enabled economic opportunity. Investment in its infrastructure - such as biorefineries - will allow us to





start shifting the emphasis from depleting fossil fuels to plentiful renewables.

At this point you're thinking "Sounds too good to be true", aren't you? The truth is that many bio based products are here today. Bio plastic bottles are used by major drinks brands. Supermarkets offer bio based plastic bags. Some car tyres contain bio based materials. Every tank of petrol in the UK contains some element of biofuels. There are less obvious examples, too. Industrial biotechnology is used to save energy use in laundry washing and textile making, and even to increase the yields and reduce energy in cheese making and wine production.

But there's still so much untapped potential: the creation of a large European agricultural-residue market represents an excellent chance to stimulate economic growth in rural areas and farming communities where employment

opportunities are often scarce. If only 17.5% of the 1bn tonnes of agriculture residues available in Europe were used in biorefineries to produce advanced biofuels, an average farmer could increase its revenues by up to 40% (according to a study by Bloomberg New Energy Finance).

To realise this potential, we need both 'push' and 'pull' mechanisms. The push of government support for developing of public-private partnerships, and funding new development models to create infrastructure and scale up of pilot plants. The pull from farmers, manufacturers, brands and retailers, who all stand to benefit from the bioeconomy - and demand generated by a public aware of the needs for alternative models, and the bioeconomy as a solution.

The bioeconomy is not a panacea. There will be issues to overcome as it develops that we simply cannot see

now. Overcoming a systemic reluctance to change, starting with a deficit of imagination, is no small barrier.

We need to break down some of the traditional boundaries between different interest groups to champion the cause, recognising that nothing significant will be achieved by one group acting unilaterally. Businesses, policymakers, consumers and civil society must work together.

At the heart of the bioeconomy vision lies an alternative to the current global economy's addiction to oil, and a much needed source of economic growth in which Europe is well positioned to take a global lead. Biorefineries can replace our old refineries. Biomass will be able to do everything oil can do. When we look back, I hope that 2012 will be seen as Year 1 of the great transition. The race is on. ●

European gas security through integrated markets

Maria van der Hoeven

In the past decade, a few particularly sharp disruptions in natural gas imports from Russia via Ukraine raised questions about European gas supply security. Some even elevated the issue to the level of strategic conspiracy, with strange Cold War overtones. But the general sense was that reliance on a single supplier and limited infrastructural diversity put security of supply at unnecessary risk for several central and eastern European countries – with knock-on effects for the rest of Europe.

Six years later, the landscape has changed. European gas demand is generally low. Increased gas storage, interconnecting pipelines, and even new LNG capacity instituted in the wake of those previous gas disruptions have mitigated the most acute supply risks. On the regulatory side, European countries have made significant progress in terms of market integration and liberalization – particularly compared with other energy markets. And an unconventional gas revolution in the US has shifted global markets even before North American exports come online. Cheap American coal exports are pricing out European gas, leaving gas-fired power plants at low capacity utilization or even mothballed. In short, gas security in Europe looks good – generators might even say “too good”. But there is no room for complacency.

On the demand side, many of the factors leading to European weakness are undesirable – but also relatively temporary. The possibility of a double-dip recession still looms, with uncertainty shrouding the crisis in the eurozone and prospects for a broader European recovery. In the short term, coal is likely to remain competitive thanks to abundant supply but also to an emerging market slow-down, particularly in China. The European carbon price is too low to significantly impact investment decisions, and with the rise of renewables and weak economic growth, European

countries could still meet 2020 targets even with higher shares of coal.

Yet beyond 2020, there are reasons to think demand will rise. However the eurozone crisis unfolds, a cyclical recovery is still likely within the next decade. And with nuclear energy called into question after Fukushima, gas may have to “plug the gap” if countries struggle to replace their nuclear generation with low-carbon alternatives.

How that demand will be met is still an open question. European upstream production is falling. Declining mature plays in the North Sea will have to be offset by gas imports, which are set to rise by 190 bcm by 2035. Where those supplies come from will depend on the structure and nature of the European market. If market integration can successfully spur additional gas production, and also create favourable conditions for competitive gas imports, then gas will play a major role in European energy supply, providing much-needed flexibility. If not, the search for a new round of supplies will mean the resurgence of pipeline politics and gas supply security concerns, as well as policy steps to constrain the role of gas.

Europe is and will remain the world's largest gas importer, and even the application of a better regulatory framework to encourage unconventional gas development will not turn the tables. Given the burden of high gas prices, there is a strategic interest in creating well-functioning and competitive gas markets. At the European level, gas imports are already sufficiently diversified such that, were the market to be truly integrated, import security would be a non-issue. Europe has come a long way, but the goal of a physical and regulatory infrastructure that provides a platform for a single market is still far off.

And yet the potential pay-off to consumers is impressive. Only recently, a series of

simple regulatory changes in Italy cut the premium over Western European hubs by two-thirds for consumers.

How can the market be further integrated, and what key regulatory reforms are needed? Genuine implementation of competition in end-user markets will be crucial to offering consumers a real choice of suppliers, and contribute to the further development of transparent pricing in European hubs. In most cases the foundations are already in place at the European level, but will depend on rigorous implementation by the European Commission and individual countries.

When it comes to contractual design, many gas exporters claim that long-term contracts are essential for mobilizing investment. They are right. The amount of infrastructure spending needed to bring upstream gas production to markets is around ten times higher than for oil, and this immense capital intensity means that long-term contracts will continue to play a role. But there is nothing to prevent long-term contracts from being compatible with the single market. The compromise between competition and investment security is achievable, and it is also in the interests of exporters themselves.

European gas security is not the same question of isolation and transit cut-offs that coloured the debate several years ago. Events have largely overtaken those concerns, and weak European gas demand is supplying a buffer of its own. The future of European gas insecurity will revolve around the ability of European policy makers to successfully integrate and develop the market so that competitively-developed new gas sources provide power generation in the medium to long term.

If not, Europe will watch the Golden Age of Gas from the sidelines, with deteriorating competitiveness and fewer energy policy options. ●

Security of gas supply and liberalisation: What are the challenges ahead of us?

The European authorities are of the opinion that liberalisation is the best solution to provide consumers with reliable gas supplies at competitive prices. However, a fully liberalised market also presents some risks. Liberalisation induces market players to focus primarily on the short-term benefit. Market players try to avoid commitments for long-term investments ensuring

security of supply unless they are obliged to do so by law. This is the reason why liberalisation should be accompanied by a stable regulatory framework which guarantees security of supply.

Today, Europe is facing new situations which are challenging the existing levels of security of gas supply. The following list tries to enumerate a number of areas

where EU policy makers should act as soon as possible:

THE LACK OF A LONG-TERM VISION FOR NATURAL GAS

Significant investments in gas infrastructure are currently required across Europe. However, in order to attract investors, a long-term vision for gas must be provided. Gas infrastructure requires long-term capital intensive investments. Gas



Photo: RWE



infrastructure built now will last until at least 2050. EU Policy makers should recognise the fundamental role gas is going to play till the year 2050 and beyond. Otherwise, investments for gas infrastructure will not be realised. Furthermore, the development of new low-carbon technologies such as power-to-gas or CCS should be further supported and promoted by the European authorities.

THE INCREASING INTEGRATION BETWEEN GAS AND ELECTRICITY

The electricity market relies more and more on the gas

market. The interactions between both markets are enormous. The potential challenges were made evident during the cold spell last February. Regulatory changes, policy decisions, lack of investments and congestions in the power or gas sectors might impose risks on one or the other market. The EU is yet to fully account for this in its energy policy.

NATURAL GAS AND THE DEVELOPMENT OF RENEWABLE ENERGY SOURCES (RES)

Gas is the cheapest, most competitive and quickest way to

bring immediate reductions in CO₂ emissions when replacing higher-carbon fuels for power generation. However, we are seeing in EU an effort to mainly promote RES development. The fluctuating production of energy from renewable energy sources challenges the power and gas networks in Europe. More flexibility is needed to cope with the variable production of electricity coming from wind and solar. In this sense, gas is also the ideal partner as enabler for RES. The flexibility provided by gas infrastructure is paramount to facilitating the integration of renewable energy sources. New

Photo: PGNIG



market design rules should better recognise the role of natural gas in this new framework.

THE VARIOUS SUPPORTS SCHEMES FOR RENEWABLE ENERGY SOURCES

Currently, Member States are deciding about the schemes to support the development of renewable energy sources at national level. These national support schemes differ between member states and have proven to be unstable. The continuous fluctuations in energy policy is negatively affecting the market, and driving prices for consumers up. In order to avoid distortions, a clear, consistent and affordable framework for supporting investment in renewable energy sources needs to be adopted across the EU.

THE TENDENCY TOWARDS CENTRAL PLANNING

In general, the market will deliver the best signals for efficient investment. Under some specific circumstances, such as security of supply or solidarity, infrastructure investments may not be based directly on market demand. They might even receive EU funds. However, there seems to be currently a trend for Member States to intervene or drive specific types on investment, and return to a central-planning type approach to investment. This approach should only be considered when the industry is not able by itself to realise investments that are needed.

In summary, there is one major risk for the gas market: the regulatory risk. Europe needs to make liberalisation compatible

with a policy framework which ensures competitiveness and security of supply, and which is able to attract gas supplies and promote investments in gas infrastructure. Without adequate gas infrastructure, neither liberalisation, nor a high level of security of supply can be achieved. ●

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A new architecture for the EU's gas supplies?

Jacques de Jong, Senior fellow Clingendael International Energy Programme

A European approach to ensure gas supply security is frequently called for. Regional supply shortfalls have sparked media outcry. Europe is not only facing the inadequacy of its indigenous energy, but rising energy prices and increasing reliance on imports from third countries are reason for unsettling concern. According to many scenarios, by 2030 up to 80% of the EU's natural gas consumption would have to be imported.

Assessing security in the supply/demand balance requires a clear view on the EU's market needs. Security of Demand is a prerequisite for security of supply and vice versa. The EU's developing gas demand is largely based on the role that the market sees for this fuel in the overall energy mix. This role is broadly based on the EU's energy policies.

The EU's major external supply source, Norway, Russia, the MENA-region and the Caspian Basin are the determinant factors on gas security chessboard. Despite the increase of LNG-imports, bringing gas to EU-markets will largely continue via pipelines from the North, the North-East, the East, the South-East and the South. Specific policy attention is focusing on the South Eastern Corridor bringing gas

from the Caspian Basin and from Russia.

For the internal EU gas-infrastructures, ENTSO-G, the European group of TSOs for gas, has the leading role to play, with its coordinated network development planning. Financing and regulation are the key critical factors. This infrastructure will also be key to secure internal solidarity, managing unforeseen supply-interruptions.

THE NEW ARCHITECTURE

It would seem quite clear that securing supplies needs to be balanced with securing demand, and vice versa. Energy demand, including for gas, is basically a long term policy issue. As it is clear that the EU has agreed an energy policy framework for the period up to 2020, for the next period these policies are under consideration. A new Architecture should take these timeframes as a basis, with a distinction between the post 2020 period, and the one up to that year.

The long term vision should cover three chapters, the role of gas in the energy mix and the system, the external energy policy focus, and the internal gas market.

On the role of gas up to 2050 the choice is to make between gas as a "fuel of destination" (the fuel with the best cost-effective



sustainable solution, as a “fuel of transition” (the primary fuel for the road towards a carbon-free economy), or as a “fuel of consequence” (the fall-back option when other options are failing). In all these visions the role of gas in the system and its relation with the power system requires a number of differences to be further articulated. Especially innovative concepts such as “gas-to-power” and “power-to-gas” are to be highlighted.

EU’s external energy relations should be built upon the vision mentioned in the first chapter, with specific strategies for the EU’s main suppliers, Norway, Russia, the Mediterranean region and on the Caspian Basin. For each appropriate and specific mechanisms for discussion, review and institutionalised approaches are to be (re) developed.

The internal market should be further (re)designed to continue its attractiveness for external suppliers.

The short term vision should equally cover three chapters, the Infrastructure Package, the 3rd Energy Market Package, and the Solidarity concept.

New investments in long-haul and cross-border pipelines for gas are critical components of any supply Architecture. The proposed Regulation for the Infrastructure Package, covering specific permitting, financing and regulating projects with a clear European common interests, calls for a timely implementation.

The 3rd package gives a solid basis for organising the EU gas

market, with its TSO-industry set-up, its Network Codes and its supporting guidance, should be completed by 2014/2015.

The new Security of Supply Regulation for gas brings a solid base for organising and managing unforeseen supply interruptions on a short term basis. Past experiences and its concrete alignments would bring a refining and articulation of the procedures under the Regulation. ●



Thales & Clean Sky

As a frontline player in the Clean Sky Joint Technology Initiative (JTI), Thales is proud to be making substantial contributions to the innovative and green solutions that will meet the economic and environmental challenges of the air transport market.

Within Clean Sky, Thales is a driving force on a number of Integrated Technology Demonstrators (ITDs), most notably as joint coordinator of the Systems and Green Operations ITD and of the overall Clean Sky Technology Evaluator, a series of assessment tools that integrate data from the ITDs and translate it into easily understandable, quantifiable benefits for the environment.

Thales is also playing a key role in areas including Green Regional Aircraft, for the development and assessment of green Flight Management System functions on future regional aircraft, and Smart Fixed-Wing Aircraft for green trajectories.

With a view to optimizing aircraft energy, trajectory and mission efficiency, Thales is putting particular emphasis on areas such as aircraft trajectory (both on the ground and in the air), with the adoption of new flight profiles in climb, cruise and approach phases. Global interoperability is a major feature of the targeted functions.

Clean Sky is positioning Thales

www.europeanenergyinnovation.eu

on the cutting edge of green technology, enabling the company to directly address the needs of clients as they seek to keep pace with evolving environmental standards and to use less fuel. As Thales customers integrate the effects of CO2 and noise taxes into their strategies, research carried out within Clean Sky will allow them to optimize their costs.

The work being done by Thales within the Clean Sky JTI is also coherent with the substantial headway being made on programmes such as SESAR (Single European Sky ATM Research), which is making a de-fragmented, interoperable European air traffic control system a reality.

Furthermore, Thales is also naturally involved in the work of industry associations at national, European and worldwide level, bringing its expertise and solutions to bear in the definition of tomorrow's air transport standards and solutions: cleaner, quieter and more efficient

aircraft designed to fly safely and securely in ever-more crowded skies.

Thales looks forward to continuing to deliver during the upcoming phases of the Clean Sky JTI, working in partnership with other European aeronautic industry players towards the common goal of developing breakthrough technologies that will help reduce the environmental impact of aviation. ●

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Reducing crew workload during complex tasks to shorten reaction time
- Environmental impact?**
Managing aircraft energy, approach optimisation, reducing fuel consumption and emissions
- Maximising air traffic?**
Doubling flight density through enhanced air/ground/space connectivity

The civil aerospace world is increasingly complex, with air traffic densities growing, congested zones and air traffic control fast approaching saturation. At Thales we produce equipment, systems and services to enhance the safety and operational efficiency of cockpit and cabin solutions, radar systems, air traffic management and navaid. We combine them into what we call the Critical Decision Chain. It helps flight crews, air traffic controllers and other key decision makers master complexity and make timely decisions for the best outcomes.

To find out more about our Aerospace solutions, scan the QR code or visit thalesgroup.com

THALES
Together • Smarter • Safer

Wind as worthy expedition partner

Belgians Dixie Dansercoer and Sam Deltour push the boundaries during Antarctic ICE, one of the most ambitious expeditions since the discovery of the South Pole. During this 'green' expedition Sam and Dixie made 100% use of the wind to advance.

Dixie and Sam embarked upon the greatest challenge ever in Antarctica since the discovery of the South Pole: Antarctic ICE, the longest autonomous expedition (5013 km!) in one of the last unexplored areas of our planet, East Antarctica. During their journey Sam and Dixie made 100% use of the wind to advance. Their daily average of 68 km was accomplished at a consistent altitude of 3000

meter. "Based on theoretical wind circulation and in cooperation with scientists from the KU Leuven in Belgium we determined a completely new route so that the majority of progress could be accomplished with specifically developed kites. Only by using state of the art kites we could cover the hallucinating amount of distance in complete autonomy," explains Dixie Dansercoer. But the reality of the carefully chosen route appeared very

different than predicted in the crystal ball. More than once it was totally wind still, other times the wind blew from a completely unexpected direction which sent the duo off-course. "The act of testing theoretical models out in the field leaves one vulnerable to the unknown and of course to the extreme conditions, but we were able to see first-hand the dominant weather patterns and the unique factors which influence them," said Dansercoer.



Dansercouer and Deltour didn't just go to Antarctica to set records, but hoped at the same time to assist scientists with data collection for their climate research. During regular intervals the polar explorers completed wind measurements, precipitation and humidity readings, and cloud formation observations. "This unique data collection in an area where no one has really been, is extremely valuable and will help us have more insight into atmospheric and climatological processes in East Antarctica," explains Sam Deltour. The scientific research is taking place in cooperation with universities around the globe.

On Antarctica, the wind is called 'catabatic'. This catabatic wind results from a difference in density between cold air on top of a mountain or a plateau and the warm air in the lower places. Due to gravity, the colder air - and thus air with larger density (heavier) - will move downwards along the slopes of the mountain or plateau. The study of the (catabatic) winds is important because these winds interact with other meteorological phenomena in the Antarctic region.

How important this scientific research may be, there is not much data available from the interior of the Antarctic continent to actually perform the research. Most of our current knowledge of the near-surface wind field over land is from several Automatic Weather Stations present in the interior of the continent, but the vast majority of the continent is not covered by in-situ observations. This gives the first idea of why the

Antarctic ICE expedition is of such large scientific importance. The data that Dixie and Sam will be gathering on the ice will therefore

be unique and extremely useful for scientific research.

www.antarctice.be



Photos: © Polar Circles - Dixie Dansercouer

Renewable energy targets for 2030

Improved grids and a single electricity market would allow the EU wind power sector to reach even greater heights

By Julian Scola, Communication Director, European Wind Energy Association



Just eight years from now one of the European Union's most successful legislative policies in energy - 20% of EU energy coming from renewables - is scheduled to fade away, leaving wind power and other renewable energies rudderless when it comes to charting a new energy

course towards mid-century.

And yet a new 2030 renewable energy target would provide as stable a legislative foundation for wind energy in the future as the existing 2020 target does now.

Wind power investors sector need certainty and a new or extended target would almost certainly become a catalyst for more investments in manufacturing, supply chains, infrastructure and R&D.

Not only that, but a 2030 target, which policy makers are now discussing, would help the EU reach its climate, competitiveness and energy security aims for the next 20 years.

The European Renewable Energy Council has called on the European Commission, Member States and the European Parliament to deliver on the European Union's long-term climate commitment by proposing and endorsing a legally binding target of at least 45% renewable energy by 2030. Among those endorsing this 45% target is the European Wind Energy Association (EWEA).

It is undeniable that Europe's economy is currently going through a period of unwelcome crisis sparked by debts, job losses and a lack of financing.

But at the same time they are trying to find solutions to the economic crisis, policy makers should continue to support sectors that are doing well, one of the brightest of which is European wind power.

Indeed, as a region, Europe is number one when it comes to wind energy. The European Union passed the milestone of 100 gigawatts (GW) of installed wind power capacity in late September, according to EWEA.

By the end of 2011, the EU had almost 94 GW of installed wind power capacity. Asia had just over 82 GW and North America had nearly 53 GW.

In terms of national cumulative installed wind power capacity at the end of 2011, six European countries placed in the top 10.

The 9,616 megawatts (MW) of wind power capacity - 8,750 MW onshore and 866 MW offshore - installed in the EU during 2011 was worth some €12.6 billion, creating both jobs and R&D opportunities.

In addition, the wind capacity installed by the end of 2011 would, in a normal year, produce 204 TWh of electricity, representing 6.3% of electricity consumption - up from 5.3% the



year before.

The growth of renewables in the EU in the past has largely been driven by onshore wind. Now is beginning a massive increase in offshore wind, which has the potential of meeting Europe's power demand seven times over.

EWEA's target for offshore wind is 40 GW by 2020 and 150 GW by 2030. Together, offshore and onshore wind power is expected to reach 230 GW by 2020 and 400 GW a decade later.

The association believes wind power - on and off shore - can provide half of Europe's electricity by mid-century.

It should be obvious by now that the wind power sector is here to stay and that new renewable targets for 2030, coupled with effective national implementation of the existing Renewable Energy Directive, would help the industry achieve even greater success.

So would a commitment to extending and upgrading grid systems so they could efficiently handle increasing amounts of wind energy, especially considering the rapid expansion of the offshore industry.

In addition, the long overdue creation of a single electricity market with large amounts of wind power would bring affordable electricity to consumers, reduce import dependence, cut CO₂

emissions and allow the whole of Europe to access its largest domestic energy source.

Europe should continue to increase public spending on technological R&D which would rapidly bring down the costs of, among other things, offshore wind.

The EU can lead the way to a renewable energy economy, and hasten the end of support for mature renewable technologies like onshore wind, by ending fossil fuel and nuclear subsidies.

Wind power will help Europe in its transition by mid-century to a new green energy economy that is local, affordable, sustainable and dependable. Supportive policy makers can ensure that success. ●

Smart Buildings

A new highlight of the SEE European Eco Forum and Exhibition

The concept of 'Intelligent Buildings' quickly gained popularity in South-East Europe and it associates with energy saving and exceptional comfortable environment.

Smart Buildings is the only specialized b2b initiative in Bulgaria with a focus on the integrated building automation and management systems. It will be held within the SEE Eco Forum, organized by Via Expo. Through the years it has been continuously broadening its scope and as a result the 2013 edition will incorporate several concurrent events covering related topics with direct environmental impact - energy efficiency, renewable energy and waste management.

The smart building industry has a good growth potential in South-East Europe and in this connection, Maya Kristeva, CEO of Via Expo, says: "Our main goal

as an organizer, is to contribute to the creation of the best environment for doing business between foreign and local companies offering innovative technologies which can be implemented successfully in the Region. Markets are very dynamic and the businesses have to be more flexible by exploring new marketplaces."

The event will present the current trends and the opportunities for win-win partnerships in South-East Europe.

Smart Buildings will attract a great number of visitors on a global scale - professionals and entrepreneurs in the construction industry, real estate and architecture.

The Exhibition scope includes: Building Information Modeling, Building Management Systems, Heating / Cooling Intelligent Control, Remote Control Systems, Lighting Management

Systems, Access Control Systems, Automation Software, Communication Systems, Parking Management Systems, Energy Management Systems, etc.

Keynote speakers will participate in the parallel comprehensive program. The main topics will be: Building Automation Systems /BAS/, Building Energy Management Systems / BEMS/, Smart Meters, Building Management Systems /BMS/, Directive on Energy Performance of Buildings Implementation, Passive House & Zero Energy Buildings, Benchmarking of Regulations on Energy Efficiency of Buildings and Energy Storage.

The Bulgarian Council for Sustainable Development will organize a special session devoted to the intelligent buildings and financing of the sustainable business.

For more information:
www.viaexpo.com

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E-MOBILITY

Innovation, technology and research
for the greening of road transportation

European Electric Vehicle Congress

**EU research and innovation intensify
efforts towards electro-mobility**

**Time for the change:
Standards for electric cars**

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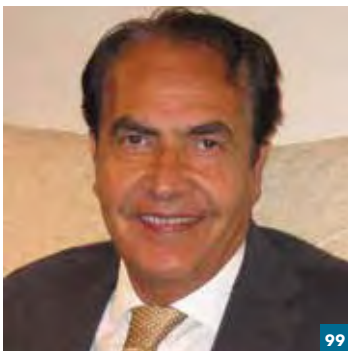
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AVERE

- the European Association for Battery, Hybrid and Fuel Cell Electric Vehicles - founded in 1978 in order to promote the widespread use of electric vehicles in Europe and Africa - is a non-profit making association and European network of predominantly national associations whose members include Users, NGOs, Associations, Interest Groups, Public Bodies, Research & Development Entities, Vehicle & Equipment Manufacturers and Electricity Utilities.

Today, its main objective is to champion the use of Battery, Hybrid and Fuel Cell Electric Vehicles as the principal means of powering personal, fleet and freight transportation.

In this manner, AVERE is leading the way to a green and sustainable mobility.

To achieve this objective, AVERE has several activities such as:

- Developing strategies to speed up market penetration for EVs,
- Dissemination,
- Participation in European and multilateral projects,
- Lobbying,
- Research and development,
- Monitoring,
- Networking,
- Facilitating studies by means of working groups,
- Collaborating with other international bodies with common interests,
- Organising, collaborating and participating in European and International events.

AVERE's mission also includes:

- Supporting collaboration between its members in Scientific and Technological Innovation
- Representing the interests of the Electric Drive Industry and Research & Development institutions to the European Commission with respect to the development of clean vehicles.

AVERE has already participated in several European projects funded by the FP7, and one of which is currently in progress: SAFEDRIVE, dedicated to the conception of a new type of electric drive train for electric vehicles.

AVERE operates not only at a European level but also at regional, national & international levels:

- With AVERE - covering Europe and Africa, EVAAP - Asia Pacific, and EDTA - Americas; the 3 organisations form the World Electric Vehicle Association (WEVA).

Periodically, AVERE, EVAAP and EDTA hold International Electric Vehicle Symposia (EVS).

The 26th edition of EVS was held in Los Angeles, CA in May 2012 and had more than 5,000 participants, 200 exhibitors and delegates from 47 countries.

EVS27 will take place in Barcelona the 17-20 November 2013 and is organised by AVELE, the Spanish Section of AVERE and Fira de Barcelona.

In this edition, the main activities will remain the Congress, the Exhibition and the Ride & Drive, but with a special focus on dissemination of European & International Projects.

The call for papers was open in September 2012 and will close on the 15th February 2013. ●

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EU research and innovation intensify efforts towards electro-mobility

By Frédéric Sgarbi, Directorate-General for Research, Head of Automotive Innovative Systems, European Commission



The European Green Cars Initiative (EGCI) is a research and innovation measure which was included in the European Economy Recovery Plan adopted in November 2008.

Along with two additional research and innovation measures, the EGCI is a so-called Public Private Partnership (PPP) with a total budget amounting to €1 billion to develop new technologies for the greening of road transportation. It includes all kinds of vehicles: two wheelers, passenger cars, bearers, vans and trucks for long distance haulage.

The main target retained for the EGCI has been to contribute to improving the energy efficiency of road transport operation with a double effect on decreasing CO₂ emissions and therefore mitigating global warming on the one hand and securing energy availability through rationalisation and diversification of energy sources.

Although three major research pillars were identified, 1) long distance road haulage representing 50% CO₂ emissions in road transport, 2) electrification of road and surface transport and 3) logistics and co-

modality, electrification represents 50% of research efforts within the PPP.

It is essential Europe to be ready to deliver attractive and affordable e-mobility products that can withstand international competition when massive introduction of electric cars will start probably in 2020 onwards. In the meantime, community research will support European manufacturers to develop electric cars and remain at the leadership of the technology as they do for road transport vehicles based on internal Combustion Engines.

Since the EGCI was launched in year 2008, already more than 70 research projects amounting €350 million are under way in areas such as electric batteries, electric and electronic components, electric engines, safety aspects, new vehicle architecture for electric cars, charging points and vehicle to grid interfaces.

The EGCI has set up a steering committee called the "EGCI ad-hoc Industrial Advisory Group" to define and prioritise technological research topics that are included in the 7th Framework Programme annual



calls. This group is composed of representatives of major European industries (Volkswagen, Renault, Volvo, Siemens, Bosch, Valeo, etc.). Industries have developed several road-maps for research and innovation, in particular a multi-annual road map and a long-term strategy for road and urban transport electrification.

The electrification roadmap foresees mass production of electric cars in 2018-20. For passenger cars two technology paths are considered which can be expected to develop at comparable pace.

On the one hand, the plug-in hybrid car providing 50km pure electric range, having an energy consumption of about 120-100 Wh/km as well as same comfort

and same safety as a conventional car. Studies indicate that customer acceptance can be expected to develop within the next years towards the acceptance of a price of an additional 2000 Euros per unit

On the other hand, the electric car providing 200km pure electric range, seating four passengers, having an energy consumption of 120-100 Wh/km, smart (and on the long run: V2G) charging capabilities, same comfort and same safety. The total cost of ownership will be comparable to the ICE vehicle although the initial cost may still be around €5000 higher, due to the lower cost of maintenance and fuel prices.

Towards 2025 a major innovative step is expected to deliver a profound change in the architecture of the electric vehicle. Hence, the future electric vehicle will move away from the base scenarios defined above and pave the way for an advanced type of electric vehicle based on a novel platform facilitating lower consumption and thus providing a higher range. Modularity may even allow a convergence of full electric vehicle and plug-in hybrid.

At the moment road transport industries together with the Commission Services are reflecting on a successor of the EGCI for Horizon 2020. Industries have developed a concept paper and views from stakeholders were gathered through a stakeholders' consultation that ended in September 2012. There is consensus among stakeholders that the new PPP should be called the "European Green Vehicles



Photos: Maurizio Maggiore

Initiative" in order to broaden its scope to all types of road transport vehicles (passenger cars, trucks, vans, buses, two-wheelers and light urban vehicles). The main objective will still be energy efficiency and use on renewable fuels with a strong emphasis on electro-mobility. ●



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EASYBAT: Switchable batteries for electric vehicles



Electric vehicle inside battery switch station during switching process

The need and demand for alternative drives within the automobile industry is rising due to increasing gasoline prices. Electric vehicles present an interesting possibility for alternative mobility, especially since traction batteries with a high efficiency are being developed and constantly improved. Many cities around the world are testing electric vehicles to utilize them as a method of environmentally friendly urban passenger transportation.

However, an effective charging infrastructure has to be established, before electric vehicles can be used to travel long distances. Modern fast-charge stations and battery exchange stations offer a good

solution to this issue. Better Place developed such battery exchange station. The traction batteries, which can be used for such purposes have to fulfil requirements in regards to safety and switchability. Performance, safety, and connectivity to an electric vehicle are topics, which are being evaluated as part of the EU funded project EASYBAT. This project has been generated under the EU call transport in the field of smart storage integration. Partners are Better Place, Renault, Continental, DNV KEMA, Danish Technological Institute, IKA of University of Aachen, Technical University of Munich, University of Haifa, Fraunhofer Institute, Ernst & Young and TÜV Rheinland.

The consortium works together

to achieve several objectives of this project. These include the development of models for an easy and safe integration of battery packs in electric vehicles. Furthermore, generic interface concepts have to be developed to enable interoperability and interchange ability between the battery and the vehicle on-board systems. In addition, new standards will be suggested to build a consistent framework for the battery pack generic interfaces.

Battery switch stations provide a fast and comfortable exchange of the battery. These stations operate completely automatically. Batteries are being charged, handled and stored under the station. Batteries for such switch stations have to be designed to accommodate the switching process. Important topics are cooling, dimension, fixation and electrical and mechanical interfaces, which allow reliable connection, as well as communication and energy supply between the car and the battery. Goal of EASYBAT is to find economical and safe solutions for these issues. ●

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The fuel cells and hydrogen joint undertaking

advocates further strategic alignment and shared ambitions with (all) European Member States, underlines Bert De Colvenaer

After 4 years of existence, the Fuel Cells and Hydrogen Joint Undertaking, Europe's Industry led Public-Private Partnership, established to support development and deployment of Fuel Cells and Hydrogen technologies, assesses its progress and achievements in preparation for its second operational phase.

Through the developments and preliminary results of some 100 projects managed by the Joint Undertaking, commercial prospects have been well identified in the transport sector (cars, buses, motorbikes), as visitors to the Paris Motor Show 2012 could notice. Moreover, since fuel cells can be used to supply electricity in isolated areas not connected to a grid, particularly if the hydrogen can be produced locally (for ex. using wind turbines), prospects for stationary applications are also evident. For larger scale applications, cogeneration (combined heat and power) with fuel cell powered generators is becoming an increasingly appealing option. Fuel cells powered with hydrogen, offering much longer autonomy than currently available batteries, have also clearly proven their capacity to supply power to portable applications (laptops, cell phones, etc), have been identified as alternate power sources to the electric power grid and have also been used as back-up power generators. Last but not least, with an objective to address

the intermittency of renewables and alleviate European energy dependency from fossil fuels, the energy storage capabilities of hydrogen are quickly gaining momentum.

At the occasion of its 5th annual General Assembly, the Joint Undertaking and its stakeholders convened mid- October in Paris, France, organizing for the first time this event outside of

Brussels. Apart from highlighting that these technologies are nearing widespread commercial reality, the decision to go National is instrumental in stressing the need for reinforced support from local policy makers, both national and European, as well as local private partners.

The European platform, operating on a ring-fenced budget of nearly one € billion for the period (2008-



Antares H2 plane from DLR

2013), which is jointly contributed by the European Commission and private partners, is now preparing for its second step and the strengthening of its ambitions under the Horizon 2020 agenda, the next multi-annual European program for research and innovation (2014-2020).

Next to the transition towards clean and sustainable energy in Europe, it is essential to maintain the competitiveness of European countries, who themselves, possess significant technological capacities in comparison to US and Asian partners such as Japan, Korea and China.

Market forces alone will not sustain the market entry of these Fuel Cell and Hydrogen technologies, ensuring that they can compete successfully with existing technologies. A continuous and determined commitment from public institutions and the private sector together is essential to support the deployment of innovative energy applications in the next decade.

Committed and profound involvement of European Member States is paramount to address Europe's Energy challenges on security of energy supply and energy storage. Coordination with the Fuel Cell and Hydrogen Joint Undertaking should be reinforced to align strategically and technical planning and pool resources for instance hydrogen infrastructure build-up demonstrations, a European wide regulatory framework and appropriate financial mechanisms that are instrumental to long-term private investments and financial leverage. ●



Top picture: Class B Mercedes from Daimler and ix35 FCH from Hyundai
Bottom picture: Intelligent Energy's ENV fuel cell motorbike

Bert De Colvenaer is the Executive Director of the Fuel Cells and Hydrogen Joint Undertaking
For more information: www.fch-ju.eu



Electro-mobility with the EIB

By financing infrastructure and supporting research, development and innovation, the European Investment Bank (EIB) is contributing to turning the goal of electro-mobility into a reality. The aim is to cut pollution and greenhouse gas emissions, while strengthening the competitiveness of the European automotive industry. So whether it is for research, development or deployment of the related infrastructure, services and equipment, we give financial backing, offer consultancy support and help build investment consortiums.

FINANCE AT EVERY LEVEL

Vehicle technology advancement can be supported by a range of innovative funding options for both the private and public sectors. As well, we back the necessary infrastructure development needed for electric vehicles to work.

For example, we can fund projects such as:

- Research, development and innovation by businesses and/or industry consortiums
- Charging-equipment innovation and manufacture
- Electricity management, distribution and supply networks
- Intelligent communication networks including billing systems
- Electric vehicle infrastructure deployment
- Employment of a network of EV fleets publicly accessible or the provision of community services

ADVICE ON ACHIEVING RESULTS

The dream of extensive electro-mobility will struggle to become a reality without the infrastructure to enable electric vehicles to recharge their batteries. Building accessible, safe and user-friendly infrastructure is a complex multi-industry challenge. Our extensive experience enables us to help clients handle major projects.

For example, we have worked with many public-private partnerships and so can advise how best to manage these relationships.

ATTRACTING ADDITIONAL SUPPORT

Our involvement in a project encourages additional investment from private and public sources. For example, we work closely with the European Commission, helping to enhance the effectiveness of their grant funding. We also have strong relationships with national and regional administrations, as well as banks, the private equity industry and other financiers.

A EUROPEAN CENTRE OF EXCELLENCE

As well as achieving desirable environmental goals, our activities foster the competitiveness of the European green-tech industry with long-term benefits for growth and jobs. In short, this helps create a sustainable knowledge-based economy. ●



Photo: Pascal Anziani

Trail blazing electric cars in Paris

The technologies required for electro-mobility are currently being tested live with an innovative car-sharing project in Paris. Since 2011, more than 1,750 electric vehicles have been operating in the French-capital's "Autolib" scheme.

This has been supported by two EIB loans totalling more than EUR 200m to the French Bolloré Group. This has facilitated research, development and innovation of battery technology as well as systems managing subscriptions, billing, recharging and fleet-management.

Intelligent load management for e-mobility value added

The topic of energy management is of major significance with regard to e-mobility. User requirements and behaviour deviate frequently from the capacity of energy networks with the result that intelligent load management is essential.

Cost-efficient concepts are required for the holistic and practical use of e-mobility and the exploitation of its advantages. These concepts must have the optimization and adjustment of maximum charging performance and the corresponding load profile as their objective, and this is precisely the goal of load management.

LOAD MANAGEMENT ADVANTAGES

Load management enables the smoothing of the load curve of the connected vehicle by means of peak shifts, prioritization or distribution. Capacity is thus employed in the best possible manner; costs are subjected to sustained reduction and resource consumption is optimized. The objective of load management is to reduce load peaks and thus to smooth the volume of purchased electricity.

CHARGING POINTS AS COMMUNICATION INTERFACES

Intelligent charging solutions are charging points, which both now and in the future will fulfil more functions than "merely" the supply of power. Against the background of load management, they will serve primarily as a communication interface between vehicles and the load management computer. KEBA's KeContact P20 meets exactly these needs. The smart charging point allows the easy, safe and fast charging - up to ten times faster than with any standard socket. KeContact P20 is certificated for the global market and offers a range of new and convincing features such as RFID, key switches, a PLC modem and Ethernet, and is available in differing variations (Type 1, Type 2, with fixed cable).

INTELLIGENT CONTROL SYSTEM FOR THE EFFICIENT, COST-OPTIMIZED E-VEHICLE CHARGING

However, the simultaneous charging of several e-vehicles may lead to charging capacity that exceeds the volume of power available. In order to avoid such cost-intensive load peaks and thereby maintain charging power, a solution is needed that furnishes protection against overloads and thus facilitates efficient, cost-optimized charging. Within this context, KEBA's KeContact M10 represents the ideal solution. It distributes the available connected power to the vehicles undergoing charging in optimum manner. First and foremost, this prevents high load peaks and the related expenses.

Leading automotive manufacturers such as Daimler, energy supply companies (amongst others Vattenfall) and retailers like Conrad already trust on KEBA whose smart charging solutions already fulfil future requirements today. ●

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Smarter, faster, eCar?

Dr. Angelika Niebler, MdEP

Coming to service stations in order to fill up your car with petrol can oftentimes be more than frustrating these days. During the past years petrol prices have increased tremendously. The situation in many European countries is similar.

Therefore people began to think about alternatives already some time ago. In 2010 the European Commission launched its "European Green Cars initiative" equipped with 5 billion Euros in order to boost the automotive industry during times of economic hardship and to support the development of sustainable forms of mobility. Electrically powered cars are only one kind of sustainable transport, but its importance has been growing constantly.

But can this kind of cars really constitute an alternative for conventionally powered cars? Criticism arises not only regarding the limited range of eCars. But I am convinced that one day, at least in urban areas and for shorter journeys to begin with, electric cars can contribute to achieving the world targets in emissions reductions. Especially the use of eCars for commercial services such as garbage collection might be beneficial, as the reduced noise level of eCars offers new operation opportunities. Within the European Union, 19% of total greenhouse gas emissions are linked to the transport sector and more than 90% of total transport emissions are caused by road transport.

But that is exactly where the problem begins. As long as the electricity being used for powering electric cars comes from coal-fired power plants, electric cars will certainly have a negative life cycle assessment. Green cars will therefore only be green if we will be able to constantly increase the amount of renewable energies. I was more than impressed when I had the chance to visit Masdar City in Abu Dhabi a few months ago. The city within a city completely relies on solar energy - and so do the automated electric cars that serve as public transportation within the city. This is truly sustainable.

But Europe is moving as well. Between 2009 and 2011 the German federal government provided 500 million Euros to fund the development and commercialization of electric mobility. 130 million Euros have been allocated to eight model regions where academia, industry and local authorities cooperate to develop an infrastructure for electric mobility. We need innovative urban infrastructure and mobility concepts. The most attractive parking spaces in the city centres could for example be used as charging stations. France on the other hand is offering sales premiums for customers opting for an electric car.

But there are still problems to be solved. One of the key issues and challenges is certainly the development and implementation of international norms and standards for all interfaces. Without interoperability and connectivity between the

electricity supply point and the charger of electric vehicles the cars are doomed to fail on an internal market with a free movement of goods.

It will still be a long journey before we will find more electric than petrol-driven cars on our roads, but we are on the right way. ●

Angelika Niebler, MEP, test-driving an electric car in Brussels



Engineering future 'Green' mobility

Engineering green and silent vehicles for future mobility is inspired by both ecological and economic principles, turning blue sky technological breakthroughs into feasible industrial solutions obeying the economic limitations of the market. The key challenge for designing green vehicles is to not only optimize, but also balance individual performances such as energy consumption, weight, comfort, safety, reliability and cost. The early assessment and selection of the most suitable vehicle architectures, resolving conflicting design attributes upfront, reduces the testing requirements for ever more complex components and intelligent systems. This requires revisiting the current virtual and physical prototyping approaches, extending them into a model based system engineering (MBSE) paradigm.

To better support our customers facing the aforementioned challenges, we have aligned our research and technology development strategy for virtual and physical prototyping under four main themes: ECO NVH, Lightweight Materials, Mechatronics and Model Based System Engineering (MBSE).

We look to achieve our research goals in co-operation with committed, best in class academic experts and industrial partners, by participating in regional as well as

international research programs and networks. Our current major regional funded projects related to Green Vehicles include IWT projects SRMotif and Hyper2 (SRM electric motor design and vehicle integration), HEV-NVH (HEV noise comfort engineering), ASTRA (acoustics of lightweight structures) and ITEA2 project MODRIO (mechatronic simulation). Our association with leading local competence centers such as Flanders' Drive (automotive), SIM (Strategic Initiative Materials) and FMTC (mechatronics) allows us to foster long term partnerships in our strategic domains. In the same context, LMS recently established a Chair on Vehicle Mechatronics at our university of origin, KU Leuven. These actions are complemented with an extensive portfolio of EU level projects such as eVader (EV exterior warning sound system), ALIVE (lightweight design) and Idealvent (ventilation noise) and Marie Curie training networks such as GRESIMO 'Green and Silent Mobility' and EMVeM 'Energy Efficiency Management for Vehicles and Machines'. Within such projects researchers, engineers and industry partners gain from their

participation in both scientific research and practical application of new testing and simulation methods. All linked to the industry requirements to develop green and silent vehicles. LMS has a proven track record in turning results of such research activities into effective, automotive market ready solutions, thereby helping to ensure the continued evolution of an economically healthy automotive market by developing and promoting research, knowledge and application of efficient virtual and physical prototyping technologies within EU industry. ●

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Time for the change Standards for electric cars

Hans ten Berge, Secretary General, Eurelectric

The successful development of e-mobility is not only confined to the deployment of electric vehicles (EVs), but also very much depends on establishing common standards for charging infrastructure. Indeed, a standardised tie between the electric car and the related infrastructure will play a decisive role in fulfilling customers' expectations and paving the way for mass-market adoption.

Unfortunately however, this process is stuck at the moment: industrial stakeholders and governments cannot seem to agree on a common solution for charging infrastructure. Two types of connectors are currently being rolled out across Europe (Type 2 and Type 3). Given that both are standardised and approved at the international level, the choice between them is left to the market and will depend on the different national regulatory frameworks.

For EURELECTRIC, representing the European electricity industry, it is important that Europe decides on a single connector – whichever it may be. The lack of stakeholder agreement is seriously endangering the spread of e-mobility in Europe. First, European countries are either installing infrastructure that is incompatible with other solutions or they are delaying investments until a European agreement has been reached. Second, how can we expect consumers to be interested in buying an electric vehicle if they need different

chargers or adaptors whenever they cross the border?

In addition, with the development of new electric cars, coupled with an increase in renewables, network operators will face increased pressure on the electricity grid. Imagine a situation when millions of Europeans come home from work in the early evening and plug in their electric cars during what is already a peak time of electricity consumption. Europe's electricity grids are not equipped to cope with such sudden surges in electricity demand.

This situation could be easily prevented by using 'smart charging systems'. Based on automated systems that don't just consume, but also store, produce and re-distribute electricity, smart charging would allow the grid to better coordinate and manage loads. For instance, customers could recharge their car at the cheapest time, as recharging will be scheduled to take place when there is enough electricity available. In addition, the EVs' potential to return power to the grid could also be used as a flexible balancing tool. Rather than becoming a problem for the grid, EVs could in this way help to stabilise the system.

To make all this happen, information and technology communication (ICT) standards will be required between the charging infrastructure, the electric vehicle and the electricity grid. Such communication will enable 'load management' which would better manage charging

during peak consumption and coordination with variable renewables. The customer will be able to receive information about the best time to charge, thereby becoming a more active partner in the system. Thus, ICT standards will be crucial on the way to market penetration of electric vehicles.

If we are serious about getting e-mobility off the ground, it is high time we got our act together to reach agreement on a common solution for a coordinated infrastructure roll-out across Europe. This will make electric vehicles more attractive to the customer and will give interested parties the confidence to invest. ●



Are electric cars good for the environment?

There are in fact two things, science and opinion; the former begets knowledge, the latter ignorance - Hippocrates

By Mike Edmund

We all know that electric vehicles produce no emissions - they do not have an exhaust pipe, after all; and we all know that assessing their environmental impact is not that simple - the electricity has to be generated somehow. What is the state of the science; and what do we know?

ELECTRIC VEHICLES: A GOOD THING?

A team from the Norwegian University of Science and Technology (NTNU) recently published a paper whose first sentence states: "Electric vehicles (EVs) coupled with low-carbon electricity sources offer the potential for reducing greenhouse gas emissions and exposure to tailpipe emissions from personal transportation." If that were all there was to this discussion, then this article would be very short - and it would finish here.

ELECTRIC VEHICLES: A BAD THING?

Of course things are not quite so simple. The science is much more extensive, and the NTNU explored much more than greenhouse emissions. And a team led by Shuguang Ji and Christopher Cherry published a separate study earlier this year, among whose findings was that CO₂ emissions would increase if EVs were to replace gasoline-powered cars in China.

What are we to make of this apparent contradiction? Are there

implications for Europe's 20.20.20 and Transport strategies?

The Norwegian team compared EVs and Internal Combustion Engine Vehicles (ICEVs) throughout their entire lifecycle, from production, through their use to their ultimate disposal. It examined several environmental aspects associated with each phase of the vehicle's life, finding that EVs offer a 10% to 24% decrease in global warming potential (GWP) relative to conventional ICEVs. This should be weighed against the potential for increases in human and freshwater eco-toxicity and metal depletion, this apparently arising from the predicted growth in demand for lithium for rechargeable batteries, although shortages have been discounted elsewhere, on the grounds that Earth's lithium reserves will last a century. One particularly significant observation was that the study results are sensitive to assumptions regarding the electricity source.

The Chinese study, meanwhile, tested the assumption that air quality and health impacts are lower for EVs than for ICEVs. It examined emissions and their health impacts in 34 major cities in China by evaluating five vehicle types (gasoline and diesel cars, diesel buses, e-bikes and e-cars) and by considering how environmental impacts vary according to the emission location. China is particularly interesting because of the spectacular scale of its adoption

of electric vehicles, and for the extent of fossil fuel use in the generation of the electricity. Here, replacing gasoline cars with e-cars will result in increased CO₂ from combustion emissions and mortality risk from particulates. E-bikes, however, offer both environmental and health benefits.

Cherry suggests that Chinese policy makers should not proceed with electric vehicles without



considering the power generation sector. This is remarkably consistent with comments in the Norwegian study, which goes on to observe that EVs will link personal transportation with many other industry sectors. Developments in electricity, electronics, and metals will need to be addressed together, it suggests, in order for EVs to contribute positively. So the two studies do, in fact, agree and we were right all along: if the other

relevant factors are properly considered, electric cars are good for the environment; but they must not be treated in isolation. From this science there emerges a clear message for policymakers in Europe. And beyond.

The Chinese data were reported in one British daily newspaper as offering *proof* that "electric cars DO cause more pollution than normal ones". [The emphasis *in italics* is mine, but the emphasis

IN CAPITALS is not.] The story was treated similarly in several publications here in Europe and around the world, and so there is perhaps another message here for policymakers: one about public perceptions. Or, as the German philosopher Nietzsche once observed: "There are no facts, only interpretations."

Hippocrates might not have agreed, but it seems likely that he would have understood. ●



The e-mobility alliance

The future is electric

Austria ranks high in renewable energy consumption (69%), mainly due to its high share in hydropower, wind derived energy and biomass. It is among the EU countries with the highest share of energy from renewable sources and amongst the Member States committing to the most ambitious national targets for 2020 (34%).

Furthermore, Austria is pursuing an integrated approach, focussing on vehicles, infrastructures and user demands, for implementing electric mobility solutions in both the energy and transportation system.

These facts and the gained experience in technology development and implementation qualifies Austria to be a leading European country to drive electric mobility forward.

THE E-MOBILITY ALLIANCE

Austrian Mobile Power draws on the combined strengths and know-how of 34 leading Austrian companies to drive forward the implementation of electric mobility in Austria and Europe. The platform brings together top representatives from automotive technology companies, system providers, energy suppliers, application technology providers and various interest groups.

This mix of expertise enables Austrian Mobile Power to demonstrate and promote new advanced electric mobility solutions, products and services in all Austrian model regions and lighthouse projects to form a sound basis for a rapid



implementation of e-mobility in Austria and Europe.

Austrian Mobile Power represents the knowledge platform regarding electric mobility in Austria, which discusses and compiles technical requirements as well as framework requirements recommending relevant technologies, quality standards and structured approaches to drive e-mobility forward.

Heimo Aichmaier



THE AUSTRIAN MOBILE POWER MEMBERS

A1 Telekom Austria, ABB, AIT Austrian Institute of Technology, Automobil Cluster Styria, AVL List GmbH, BEKO AG, Clusterland Oberösterreich, Energie Steiermark, EVN AG, FEEI - Association of the Austrian Electrical and Electronics Industries, Fronius International, HAGER GmbH, IV - Federation of Austrian Industries, INFINEON, IMFT, Innovation Service Network, KELAG, KTM AG, Linz AG, MAGNA, New Design University, ÖAMTC, Österreichs Energie, OVE, Raiffeisen Leasing, REWE, Salzburg AG, Schrack, Siemens AG Österreich, The Mobility House, TIWAG, VERBUND AG, VIRTUAL VEHICLE and Wien Energie ●

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Electric vehicles: Thirty years of progress, and counting

European Energy Innovation recently caught up with Mr Angel Aghili, the President of AVERE. He is also the founder and president of AVELE, the Spanish Association for the promotion of Electric and Hybrid Vehicles and is currently involved with organising the next Electric Vehicles Symposium, EVS27, which will be held in Barcelona.

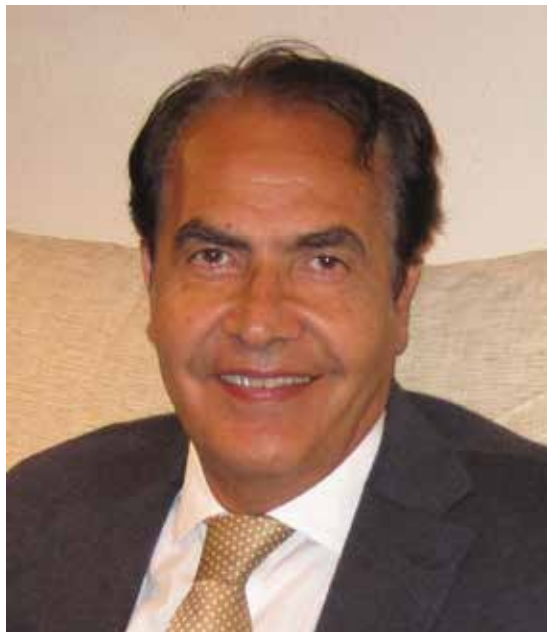
Q Good afternoon, Mr Aghili. For the benefit of those of our readers not familiar with AVERE, please would you tell us little about the organisation?

A AVERE is the European Association for Battery, Hybrid and Fuel Cell Electric Vehicles. It was founded in 1978 to promote greener mobility through these technologies. And even though we were founded over thirty years ago, our membership is still growing - we have recently welcomed new national sections from Finland and the Netherlands. AVERE is a European network of fifteen national associations, to which are affiliated to individual enterprises such as vehicle and equipment manufacturers, electricity utilities, research and development entities, public bodies, interest groups and associations. This structure helps us to share information rapidly and efficiently. Although acting at the European level, AVERE coordinates activities with similar organisations in Asia and the Americas, which together form the World Electric Vehicle Association, WEVA. Our activities are becoming even more relevant as transport emissions form an increasingly important part of EU climate strategy.

Q So what does AVERE actually do?

A On the political level, AVERE presents the concerns of its members to the European Commission. On a practical level, we participate in a variety of European and multilateral projects, particularly involving research and development. For example, we coordinated SAFEDRIVE, a project concerning the development of a new type of drive train for electric vehicles, and which represents pioneering research into low voltage technology. An important part of our activity is the dissemination of relevant information, which is why we are pleased to host EVS 27 in Barcelona next November 2013.

Q Can you tell us a little more about EVS 27?



A EVS27 is the 27th edition of the most prestigious Symposium at an International level about Electric & Hybrid Vehicle and their components, which will be held from 17th to 20th of November 2013 in Barcelona.

EVS27 is organized by FIRA Barcelona and AVELE, hosted by WEVA, AVERE and the City Council of Barcelona. EVS began as an academic forum for discussion and has grown into the premier event for the electric transportation industry. I should explain that EVS27 will comprise four major strands: the Symposium itself; Dissemination of the findings of European and International projects; the Exhibition; and the Ride and Drive. Many major car manufacturers will be exhibiting their battery-powered and hybrid models. So, apart from attracting academic, government and industry leaders from around the world, there is also a great deal to interest the general public. These four elements are key points for the future stable market of hybrid, hybrid plug-in, fuel cell and battery electric vehicles.

In 2013, in Barcelona

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move electric

eVS | 27

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ELECTRIC VEHICLE
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largest international gathering
of the electric drive industry

CONGRESS
+
PROJECTS DISSEMINATION
+
EXHIBITION AREA
+
RIDE & DRIVE

Q Do you think there is a problem with the public image of the electric car?

A There may have been. The exhibition of a wide range of electric vehicles from the mass-market manufacturers should increase public acceptance. Perhaps hybrid technology, which offers driving ranges in the order of more than five hundred kilometres, will persuade consumers that the technology can have a practical role. New technologies such as static and even dynamic inductive charging may also help overcome the issue of the range of the battery.

Q Are you optimistic about the future of electric transport in general, and AVERE in particular?

A What is clear is that we cannot repeat the model of transport and consumption of the twentieth century: the age of cheap oil is long gone. So perhaps it is not so much about optimism, but necessity. Our attitudes towards the car need to undergo a change as significant as the one in our attitudes towards smoking: driving a large 4 by 4 into a city should become socially unacceptable. Our role is to play a part in demonstrating the potential of electric vehicles to fill the gap that will be created as this happens. As much as European countries increase the contribution of electricity produced from renewable energy sources and use it in the transport, as much as Europe will be energy independent in the 21st century. Energy independence is one of the important factors for the economic recovery of Europe.

Mr Aghili, thank you for your time today. ●

The logo features a stylized green leaf with a yellow outline, positioned above a series of yellow and green dots that form a curved path leading to the text. The text "european" is in blue, "energy" is in green, and "innovation" is in blue.

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Electric cars unleashed

By Mike Edmund

At first sight, you might be forgiven for thinking that an electric toothbrush appears to have very little in common with an electric car – beyond the obvious reference to the power source. But in the future, they may share an important technology.

Today, there is a generally-held belief that, given a green source of electricity, electric cars [EVs] offer important environmental benefits. And, though the figures are contested, the cost of mobility appears to be much lower than for an internal combustion-engined vehicle [ICEV]. But there is another generally-held belief

that EVs are too small, too slow and hopelessly impractical for long journeys because they have very limited range and they take a very long time to recharge.

The balance of the economic argument may be changing almost daily, as both ICEV fuel economy improves and the price of electricity rises. Meanwhile, though real enough, the environmental benefits of EVs might only become apparent in large cities, where emissions from large numbers of ICEVs can affect air quality. Elsewhere, proponents of EVs point to advances in battery technology and charging technology that bring a recharge time down to about 90 minutes.

But surely nobody would seriously consider stopping to refill the fuel tank of an ordinary car every hundred miles, or every two hours; and then waiting a further hour and a half while the tank fills. Put another way, nobody who is used to wireless access to the Internet would willingly go back to having to plug in his computer to check his email.

This is where the electric toothbrush comes into the story, but we first have to pay our respects to two scientists, Michael Faraday and Joseph Henry. Both discovered the principle of electromagnetic induction in 1831, but Faraday was the first to publish his results, and



so we know of Faraday's law of induction. It explains how an electric current flowing down a wire will generate a magnetic field around the wire; and by which this effect works in reverse, so that a magnetic field will generate an electric current in a wire that passes through it. The effect is amplified by turning the wire many times into a coil. What it means is wireless transmission of electricity. Electricity may be transferred from one coil of cable to another by nothing more than a magnetic field. Surprisingly, the idea is not particularly new: Tesla proposed it over a century ago, and was even able to

demonstrate it working.

The electric toothbrush uses one wire coil in the base, which is plugged into the mains supply, and another in the toothbrush handle, which is connected to the rechargeable battery. The first coil transfers current to the other, which recharges the battery without being physically connected to the electricity supply. The technique has now been scaled up so that a car may recharge its battery without needing to be physically plugged in: it is simply parked within range of a charging plate, which may be buried beneath the

road surface. This is an attractive enough concept, but charging plates might be located almost anywhere, raising the possibility of frequent battery top ups in slow moving traffic, or even at regular points on long journeys between cities. This is no fantasy, for this type of system is now being tested.

Freed from having to think about nothing but electrical charging points, who knows how attitudes to electric cars may change? Who knows what vehicle designs may be unleashed? ●

Interview with Mr Frédéric Vergels of Electri-City.mobi

EI recently caught up with Frédéric Vergels, who is very busy organising the second European Electric Vehicle Congress [EEVC].

Q Good Afternoon, M. Vergels. Perhaps we could start with your telling us a little about the Congress.

A 308 participants from 31 countries, together with 15 representatives of the European Authorities, participated in the inaugural EEVC last year, in Brussels. The location was chosen for its proximity to the major European Institutions considering the technologies associated with electric transport. The event was a great success, and accordingly, the second EEVC will also take

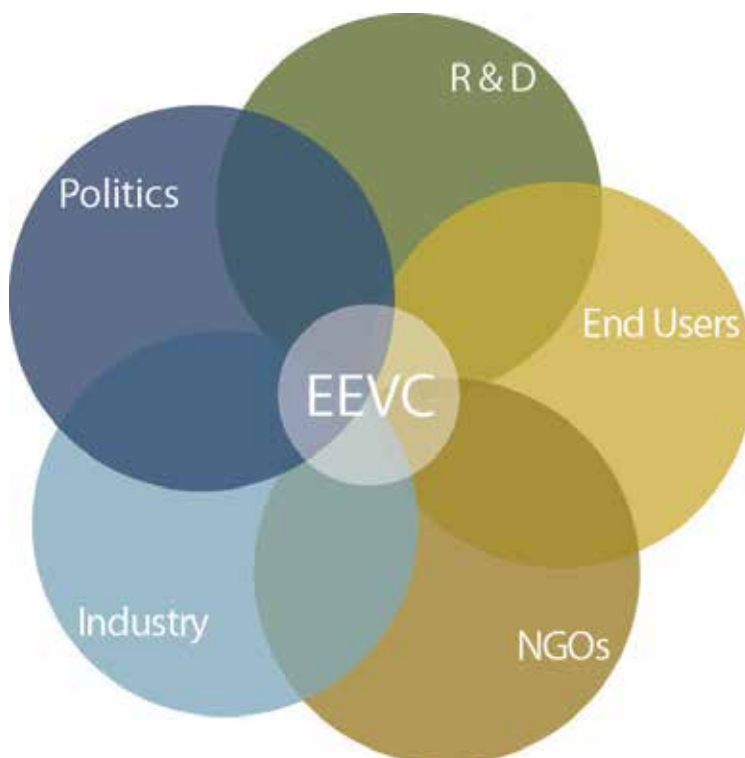
place in Brussels. It will be held from 20th to 22nd November 2012 at the Brussels Sheraton in the heart of the city's business district. EEVC will be of interest to both European and regional policymakers; I think the regional authorities are too often forgotten in these discussions. They are close to the cities, where the electric transport market will really be developed, and large enough to act at national or even supra-national level.

Q What will be happening this year's event?

A One day before the Congress, an EU Project day will be organized to provide an overview of the programmes such as FP7, IEE, EUROSTARS and INTEREG that are supported by the European Authorities; and of various related projects dealing with eMobility. This is to identify possible actions, overlaps, synergies and gaps in activity.

As you will have seen from the Congress Programme, EEVC will examine the lessons already learned, best practices, infrastructure, barriers and market requirements in order to explore how to speed up market introduction of the technology. The Congress will also discuss new mobility concepts, noise and health factors. Too often, large congresses and conferences do not provide much in the way of measurable outputs; one particularly important feature of EEVC, to be presented at the closing session, will be a summary of the event and the discussions, with firm recommendations to help accelerate the introduction of electric vehicles.

There will also be a parade of electric vehicles leaving the congress centre for a 'Ride and Drive', and a party at the museum of the automobile, where the gala dinner will be hosted.





Q How is EEVC different from any other large electric vehicle event?

A Many meetings of this type focus only one aspect of electric transport. Climate change is a global issue, and I believe that it is very important to develop an arena where the needs and constraints of all the players are well understood by each other. This is the best way to make sure that the most appropriate products and technologies for Battery, Hybrid and Fuel Cell Electric Vehicles are selected for market introduction. EEVC aims to provide such an arena by gathering the different stakeholders from industry, research institutes, NGOs and public authorities. Apart from the high quality of the discussion, the

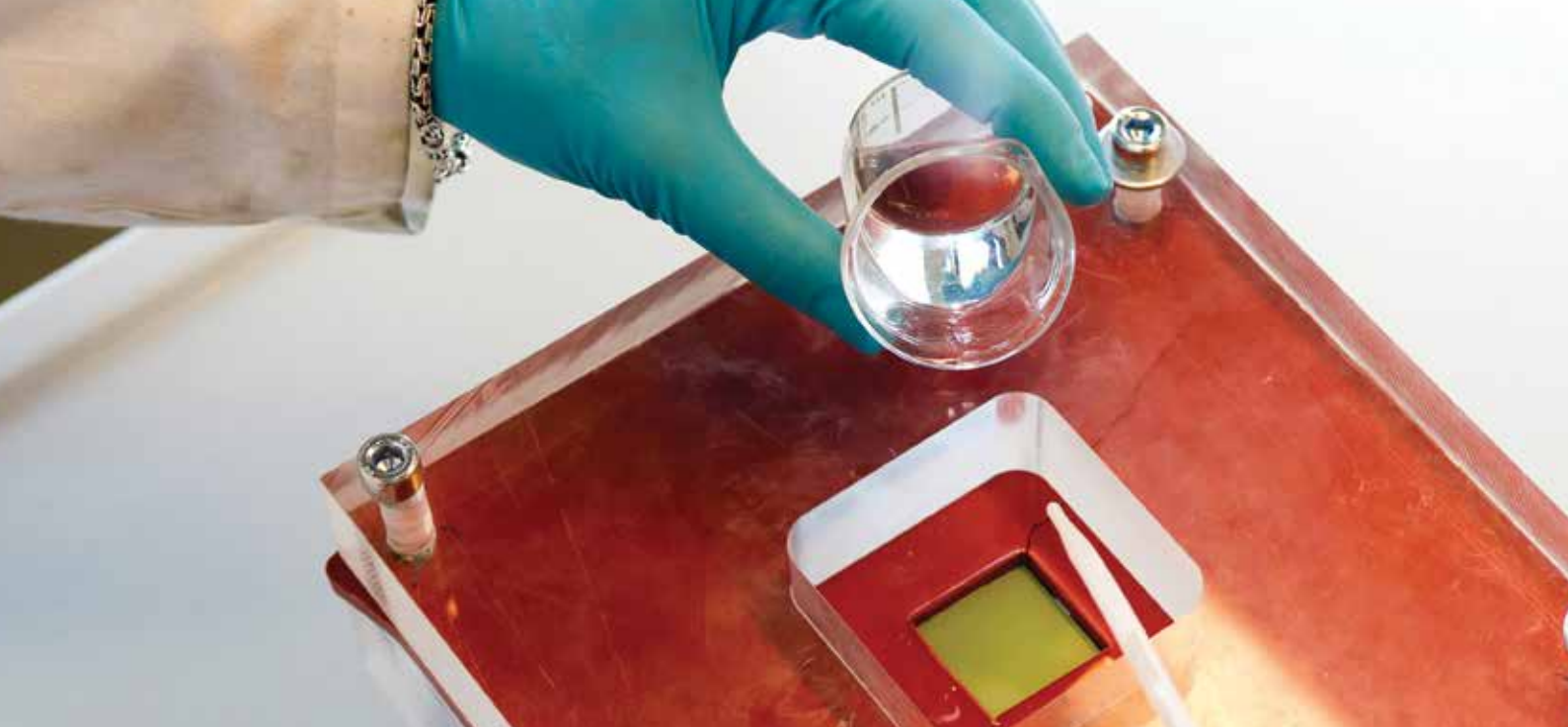
event offers unique networking opportunities and the ultimate goal is to develop a roadmap for sustainable mobility technology.

Q We have learned that there will be over 200 presentations, most in response to your call for papers. How do you explain such interest in EEVC?

A An important aspect is the quality of the material presented. For example, there will be high-level speakers from the Commission at the opening session, and top decision makers from all the major related European Associations will also be there to share their vision. In particular, I would like to mention ACEA, the European Automobile Manufacturers'

Association, EUROBAT, European Storage Battery Manufacturers Association, EURELECTRIC, the Association of the Electricity Industry in Europe and EARPA, the European Automotive Research Partners Association. And with over 200 presentations already confirmed, and growing interest in the Congress itself, we can be confident of attracting between 350 and 400 delegates this year. I believe that it is important to hold an event such as EEVC in Brussels because of the need for policymakers and industry to collaborate over the medium to long term to bring in this new era of electric transportation.

M. Vergels, thank you for your time today. ●



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Key confirmed speakers include:

Dr. Thomas Häringer

Deputy Director,
Representation
Baden-Württemberg
to the Europe

**Prof. Dr. Mogens
Bjerg Mogensen**

Department of
Energy, Conversion
and Storage leader
Denemark

**Dr.-Ing. Karl-
Friedrich Ziegahn**

Program Manager
Renewable Energies
& Efficient Energy
Conversion and Use
KIT

Dr. Shigeki Yasuda

Manager
Panasonic Fuel Cell
Development Europe




More at: <http://fdfc2013.eifer.uni-karlsruhe.de/>



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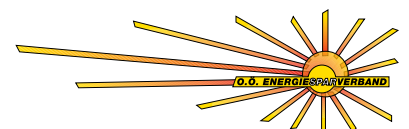
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-  **Nearly Zero Energy Buildings**
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