european energyinnovation

AUTUMN 2018

Connecting Europe's Stakeholders in Energy and Transport

RENEWABLES: SOLAR & WIND

HYDROPOWER

ELECTRIFICATION

SUSTAINABLE PORTS AND SHIPPING

DENMARK ENERGY

Includes editorial contributions from:

Kathleen Van Brempt
Member of the European Parliament

Lars Christian Lilleholt
Danish Minister of Energy, Utilities and Climate

Isabelle Ryckbost
Secretary General, The European Seaports Organisation

International Conference

World Sustainable Energy Days **2019**

27 February - 1 March 2019
WELS, AUSTRIA

CONFERENCES:

- European Energy Efficiency Conference
- European Pellet Conference
- Young Energy Researchers Conference
- Energy Efficiency Policy Conference
- Innovation Workshops Energy and Buildings
- Smart E-Mobility Conference
- Industrial Energy Efficiency Conference
- Energy Efficiency Economy Workshop
- Tradeshow "Energiesparmesse"
- Technical Site Visits
- Poster Presentation

LAND OBERÖSTERREICH

World Sustainable Energy Days 2019

OÖENERGIESPARVERBAND

OÖ Energiesparverband, Linz/Austria
Tel. +43 732-7720-14386, office@esv.or.at, www.wsed.at

Contents

European Commission

European Business Awards for the Environment

Rewarding success in eco-innovation

22 companies, 9 countries, 6 Awards...

who will be Europe's next champions of eco-innovation?

Find out on

14 November 2018!

Live from Vienna, Austria

What is it?

EBAE is a European Commission initiative rewarding European companies that make outstanding contributions to sustainable development.

Who can apply?

Any business from an EU Member State or candidate country.

Follow the Awards Ceremony of the European Business Awards for the Environment live on Twitter under **#EuGreenBiz**

European Business Awards for the Environment

#CircularEconomy
#EUgreenBiz

www.ec.europa.eu/environment/awards

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

European Energy Innovation is published by:
Prologue Media Ltd
1a Shire Lane
Chorleywood
Hertfordshire WD3 5NQ
United Kingdom

Tel: +44 1923 286238
www.europeanenergyinnovation.eu

To obtain additional copies please email info@europeanenergyinnovation.eu

Editor
Michael Edmund
editor@europeanenergyinnovation.eu

Business Development Director
Philip Beausire
philip@europeanenergyinnovation.eu

Head of Brussels office
Sophia Silvert
Mob: +32 4737 30322
sophia@europeanenergyinnovation.eu

Design & Production
RayHeathDesign.com

Website design
pulseart.co.uk

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

Foreword

Recent NASA news stories have demonstrated water and heat movement under Greenland's ice cap and documented the inexorable rises in both atmospheric CO_2 and global temperatures. There is cause for concern.

Elsewhere, this year's EUSEW Sustainable Energy Awards feature a range of innovative decarbonisation strategies. Arguably, the Czech project offers the greatest prospect of future benefit through its encouragement of more energy-efficient architecture. Meanwhile, the opening of the £1Bn Walney Extension makes 659 MW Walney Offshore Wind Farm the world's largest. Fortunately, there is also cause for optimism.

In our feature on Denmark, we are delighted that Lars Christian Lilleholt, Minister of Energy, Utilities and Climate explores the new Danish Energy Agreement. He discusses spending plans for a variety of green projects including wind, biogas, energy savings, lowering energy taxes, district heating, climate research and transport. Power generation has become steadily greener over the last decade, and the Danish Government's long-term goal is net zero emissions by 2050. Jan Hylleberg recounts the early approach to investment in wind and how the Energy Agreement envisages at least 2,400 MW from offshore turbines by 2030. Interestingly, he highlights the potential of the North Sea to generate twice as much electricity as Europe's coal-fired power stations.

Kathleen van Brempt MEP discusses decarbonisation of transport, arguing in favour of intervention in pursuit of climate and air quality objectives, whilst "creating or preserving high quality jobs..." Among the many arguments she presents, perhaps the most compelling is that "European automakers are investing seven times more in electrification in China than in Europe. If we are not creating a home market for these technologies, they will eventually be imported."

"It is time to recognise the role European ports can play as nodes of energy, industry and blue economy", says Isabelle Ryckbost. Foreseeing the upcoming 2021-2027 EU budget discussions, she analyses the likely implications for the transport sector – €24.1 Bn, with an addition €6.1 for dual civilian/military uses.

Professor Ulrich S. Schubert, Jan Post and Pirita Lindholm discuss how two European regions are innovating sustainable energy storage solutions (for which, read 'batteries'). Given the unpredictability in supply and potential toxicity of conventional raw materials such as vanadium and concentrated sulphuric acid, their work with salt-water based polymers offers sustainable alternatives at household scale.

We are once again very grateful to Arnulf Jäger-Waldau for a customarily clear, data-based article. Explaining of the benefits of rooftop PV and self consumption of electricity, he sounds warnings about growing dependence on energy imports over the past 25 years and the need for PV capacity to triple by 2030 if we are to meet Paris targets. He goes on to discuss how the rooftop surfaces of multi-apartment buildings or office buildings might represent a widely untapped resource. There is also a regional economic payoff, as in the Podlaskie region in Poland.

The geological record clearly demonstrates that Earth's climate is not constant. What – ironically – generates heated debate is the extent to which man's activities contribute. Adoption of the Geological term Anthropocene by the scientific community is now gaining traction – although this is not without controversy because of political implications for the climate change debate. As long as there remains cause for concern, let us not become as distracted from our objective as Emperor Nero.

For we know what happened to Rome.

As always, there is more for you to read inside...

Michael Edmund
Editor

The future of fossil free transport is not technology neutral

By Kathleen Van Brempt (pictured), Member of the European Parliament

The European transport sector is responsible for around one quarter of EU's total greenhouse gas emissions and remains the only major European economic sector in which GHG emissions have increased. Congestion costs are rising and the air in many of our cities stays polluted. To cope with all our societal challenges, we need a more electrified, decarbonised, energy efficient, multimodal and clean transport sector and a just transition along the whole automotive value chain.

It is often said that in cleaning up the transport sector, politicians should only agree on the final targets for CO_2 reduction and polluting emissions in a technology neutral way and leave it up to the market to figure out how these targets can be met. But, there are many arguments against a "policy by objectives" approach.

First, under "technology neutral" policies new technologies with enormous long-term potential might never develop. Look for instance at solar panels. Today, they are one of the cheapest ways to produce power. However, at start photovoltaic energy was more expensive than other ways to produce renewable power.

If countries like Germany and Spain had not supported PV so fiercely in a non-technology neutral way, solar technology wouldn't have matured.

The same goes for offshore wind and many other clean technologies. To get such technologies over the "valley of death", some of them need a larger R&D driven technology push and more demand creating market pull. However, once they crossed the valley between the development stage and market commercialisation, move forward on the "learning curve" and enjoy economies of scale, they often outperform existing technologies. Specific support for some highly potential technologies at early stages of development might therefor be justifiable. That, for instance, is the case with zero-emission electric cars that will play an indispensable role in the decarbonisation of the transport sector, at a total cost of ownership that over time will be lower than those of a traditional combustion engine.

Secondly, technological neutrality makes us blind for the macro-economic strategic impacts of our policy choices. Decarbonising transport is not only of utmost importance to deliver on our climate objectives. Each day the EU spends around one billion € on imported fossil fuels coming from geopolitically instable regions. By transitioning to cost effective renewable power and electric cars, Europe will spend more money on clean technology produced at home and sending less money to fossil fuel producers overseas. This will strengthen our competitiveness and create millions of new jobs.

However, these benefits will not emerge to the same extent in all possible policy scenarios. Scenarios that rely more on existing combustion engines on biofuels, cheaper produced outside Europe, can equally deliver greenhouse gas reductions. But they will still leak capital abroad. The same goes for electrification based on large batteries requiring enormous amounts of lithium and cobalt. We may not just exchange the role of foreign fossil fuels suppliers by foreign battery suppliers that keeps us equally dependent on imports.

Thirdly, technology neutrality does not allow us to take proper account of collateral benefits or collateral damages caused by certain technologies. Cars with internal combustion engines that are running on advanced biofuels might lead to the same greenhouse gas savings, but are still emitting polluting nitrogen oxides and particulates and keep on producing engine noise. On the contrary, electric cars have multiple benefits in all these fields and can help us to meet our climate goals and air quality standards at the same time.

Finally, running cars on "advanced biofuels" or electrofuels produced from surpluses of renewable power might lead to the same greenhouse gas reductions. However, since these fuels are depending on limited feedstock, using them for cars makes them no longer available for other

applications. Taking into account the limited availability of some advanced biofuels, we must preserve them to decarbonise these modes of transport that are more difficult to electrify, like aviation, shipping and long distance heavy duty transport.

Therefore, as policy makers we must do more than just setting targets and lean back. We must foster policy scenarios that enable us to meet our climate objectives and air quality standards whilst creating or preserving high quality jobs at the same time. In order to create a European value chain, we need to invest more in research and development of solid state batteries, work on strong battery product requirements and a battery recycling program that keeps battery elements in a closed loop within the EU.

We need industrial and trade policies to enable Europe to set up its own sustainable battery production. A socially acceptable and just transition towards zero-emission mobility by mid-century requires targeted programmes at Union, national and regional levels for re-skilling, up-skilling and redeployment of workers, as well as education and job-seeking initiatives in close dialogue with the social partners, communities and regions.

We'll have to be bold and decisive in imposing these measures. Otherwise, European manufacturers will continue to sell polluting cars in Europe while developing and manufacturing the cars of the future elsewhere.

European automakers are investing seven times more in electrification in China than in Europe. If we are not creating a home market for these technologies, they will eventually be imported. This is the real risk to European jobs and competitiveness. European policy makers and industry may not stand at the wrong side of history. We may not kill industry with kindness.

#EUSEW18
Leading the clean energy transition

Our energy system is in a profound state of transformation. It is clear today that business as usual in which we drive petrol and diesel guzzling cars, rely on more and more fossil fuels such as coal and oil to power our expanding world is not sustainable in the long term.

Behaviours must change and new, advanced technologies developed if we have any hope of maintaining temperatures below 2°Celsius by 2050, while ensuring that we all have access to clean, sustainable and affordable energy.

Only a low-carbon pathway in which energy efficiency is integrated with more renewable resources from solar, wind and hydro will help us reach the goals of the 2015 Paris Climate Agreement and ensure that we are doing what's right for our planet and its inhabitants. Striking the right balance between ambition and cost, while ensuring security of energy supply is a challenge for policy makers not just in Europe but also across the globe.

The good news is that we have already come a long way. Many governments, organisations, companies and individuals are busy working on innovative solutions that will help us reach the ambitious climate goals. And Europe is leading the way.

CUE EUSEW – EUROPE'S BIGGEST EVENT DEDICATED TO SUSTAINABLE ENERGY

What better place to showcase these advancements, exchange best practice and debate the issues than at the EU Sustainable Energy Week – Europe's biggest conference dedicated to sustainable energy policy.

This flagship event, held every year in June, unites policy makers, authorities, industry, NGOs, researchers and academia from across Europe's energy sector as well as individuals interested in a better world. All come together to debate energy policy and showcase the latest technology in the fight against climate change.

"We are stronger if we work together. When it comes to the clean energy transition, we are all in the same boat."

Over 2,500 people gathered in Brussels between the 4 8 June to attend this year's high-level Policy Conference organised by the European Commission's Directorate-General for Energy and the Executive Agency for Small and Medium-sized Enterprises (EASME). The theme of this 13th edition of the EU Sustainable Energy Week called on every one of us to 'Lead the clean energy transition'.

REDUCING EMISSIONS AND BOOSTING THE ECONOMY

#EUSEW18 kicked off on Tuesday, 5 June with opening speeches by European Commissioner for Climate Action and Energy, Miguel Arias Cañete and Director-General for Energy, Dominique Ristori. Speaking at the opening ceremony the Commissioner, said: "We are stronger if we work together. When it comes to the clean energy transition, we are all in the same boat."

"Clean energy production is not just an opportunity to develop renewables," added Mr Ristori "but also the opportunity to have global clean production to reduce greenhouse gas emissions and boost the economy."

Day 1 also featured a motivational Debate with Ambassadors on becoming an advocate for accelerating the clean energy transition. Panellists had some clear ideas on what we should be doing to reduce energy and tackle the climate conunudrum.

"One of the things that can be done to boost energy efficiency is creating awareness and realising that reducing energy use will have multiple benefits, such as lower costs for the energy transition, reduced energy bills for the most vulnerable, a more lenient and competitive EU economy, higher quality of life thanks to cleaner air and environment," said Mechthild Wörsdörfer, Director in charge of renewables, research and innovation, energy efficiency, DG Energy, European Commission.

"Clean energy production is not just an opportunity to develop renewables," added Mr Ristori "but also the opportunity to have global clean production to reduce greenhouse gas emissions and boost the economy."

REWARDING INNOVATION

Innovative examples of technology and projects leading the way in 4 different categories— Businesses, Consumers, Public Sector and Young Energy Leaders—were celebrated at the EU Sustainable Energy Awards Ceremony, hosted by Mr Cañete. Four winners selected from among 12 finalists were awarded a prize made from sustainable materials (scrap wood and recycled light bulbs) and a 5th prize voted for by the public was also awarded. You can see all the finalists and winners on the EU Sustainable Energy Week website.

3 DAYS... 60 SESSIONS, 27 ENERGY TALKS, 40 EXHIBITS

Throughout the 3 days, over 60 thought-provoking sessions took place at the Policy Conference on subjects such as the future of the energy system, energy markets, the latest technologies, clean energy for

Europe's islands – and many more.

This year's Networking Village featured a wealth of presentations and events including: the Energy Fair where 40 organisations hosted stands showing off their latest technological solutions and experts presented their ideas during the 27 Energy Talks. New this year in the networking village was the Energy Lab, where nine people pitched their projects to an expert panel of judges in front of a packed audience. To get the positive energy flowing, participants were even invited to join morning yoga sessions.

And outside Brussels, EUSEW continued in full swing with a record number of over 400 Energy Days organised by companies, NGOs and individuals throughout Europe!

TAKE UP THE GAUNTLET AND LEAD THE TRANSITION

#EUSEW18 may be over for another year but the challenge on making the necessary transition in our energy system remains. We must push forward, and all of us can do our bit.

As Miriam Dalli MEP put it while urging Member States also to act, "be innovative for our climate, our children and our economy. Let's not just depend on our future generations".

This call to action was reiterated by MEP Claude Turmes, whose quote we shall leave you with: "Today we always postpone the difficult things until tomorrow. We are getting close to the tipping point. If we want the planet to be a beautiful place we have to move."

So let's act now! And see you at the European Sustainable Energy Week next year!

Contact information

For more information please visit EUSEW's website (www.eusew.eu) or follow us on our social channels:

@euenergyweek
EU Sustainable Energy Week

Electrification through partnerships are key to reach climate goals

By Magnus Hall (right), Vice President, Eurelectric

The climate challenge is a real issue that needs to be tackled now. We need to continue to develop alternative ways of transport, heating and manufacturing, in order to secure a prosperous future for our children and the generations to come. The energy sector needs to reduce its carbon footprint by finding new ways to produce energy. In electrification lies a great potential to reduce carbon dioxide emissions.

A recent study from Eurelectric shows that in order to meet the climate goals set by the Paris Agreement a major shift to electricity in transport, buildings and industry in the EU is required. The conclusions of the study are completely in line with Vattenfall's strategy and our objective to become fossil free within a generation. The key to success, as we see it, is joint efforts through partnerships.

The Eurelectric study points out that a full EU decarbonisation by 2050 would require an electrification share of 63% in transport and buildings respectively and 50 per cent electrification share in industrial processes. In 2015, direct electrification in the EU ranged between 18–32%, where the group consisting of the Nordics and Baltics had the highest share.

Key economies such as Germany grouped together with Central Europe reached 22%, while the direct electrification rate in the UK and Ireland was 21%.

At Vattenfall, we have shifted our portfolio to move towards a climate neutral energy production. Our purpose is to become fossil free within a generation. But we also recognise that we have the opportunity to contribute to lowering carbon dioxide emissions in other sectors besides energy, like the transport sector and the industry sector.

In 2015 transport stood for approximately 25% of the carbon dioxide emissions in the EU. There lies a substantial potential to reduce emissions with electric transport and we need high ambitions set by the EU to trigger the necessary paradigm shift to clean mobility across Europe.

Eurelectric's members have the necessary experience and expertise to play their part in the development of charging infrastructure. Vattenfall is currently rolling out our electrical vehicle charging network InCharge across North-western Europe. Through a collaboration with municipalities, corporations and housing cooperatives, we provide customised charging solutions in order to pave the way for more electric transport.

Heavy and long-distance transport also contributes for a large extent to CO_2 emissions. Together with fuel producer Preem we are investigating a process to use hydrogen to be able to replace raw oil with residual products from the forest industry like lignin, and hence contributing to the production and use of renewable fuels.

Large parts of the buildings in the EU are heated through fossil energy supply like natural gas. We see that real estate owners are interested to look for more sustainable solutions, both from an environmental and financial point of view. This could, for instance, be an electricity-based heating system like a heat pump in combination with photovoltaics.

Vattenfall provides decentralised and integrated energy solutions to real estate owners with our InHouse concept. We are also working on storage solutions for renewable energy to be used for district heating amongst other things.

Industrial processes are still very much relying on fossil fuels. By replacing coal with hydrogen in the process of manufacturing steel, the carbon dioxide emissions connected to this process can be eliminated.

The steel production alone makes out 10% of the carbon dioxide emissions in Sweden. Through Hybrit, a partnership between the steel manufacturing company SSAB, the mining company LKAB and Vattenfall,

we have started large scale research in a pilot plant to enable such a process.

Another industrial process that emits large amounts of carbon dioxide is the manufacturing of cement, which is produced through the heating of limestone. Using electricity in this process would contribute to a reduction of the Swedish carbon dioxide emissions by 5%. Vattenfall, together with Cementa (Heidelberg Cement Group), strive to realise this process through the joint project CemZero.

These examples show that there is a concrete and great potential for electrification in order to reduce carbon dioxide emissions. The precondition is access to fossil free electricity at a competitive price. This will require efforts from governments, authorities, universities and other research centres.

For Vattenfall, it is about being a partner in this important transition, whether it is for the manufacturing of fossil free steel, sustainable cement or in smart solutions for storage of solar energy and charging of electric vehicles.

I hereby would like to invite other companies and organisations to more partnerships in order to reach our common climate targets for 2050. I am convinced there are many more potential projects out there that can be achieved through joint efforts.

Contact information

Ioana PETCU
Advisor, Press & Media Relations
Eurelectric aisbl,
Boulevard de l'Impératrice, 66,
1000 Brussels, Belgium
Tel: +32 470 45 35 89
Email: ipetcu@eurelectric.org

Solar heat for industrial processes

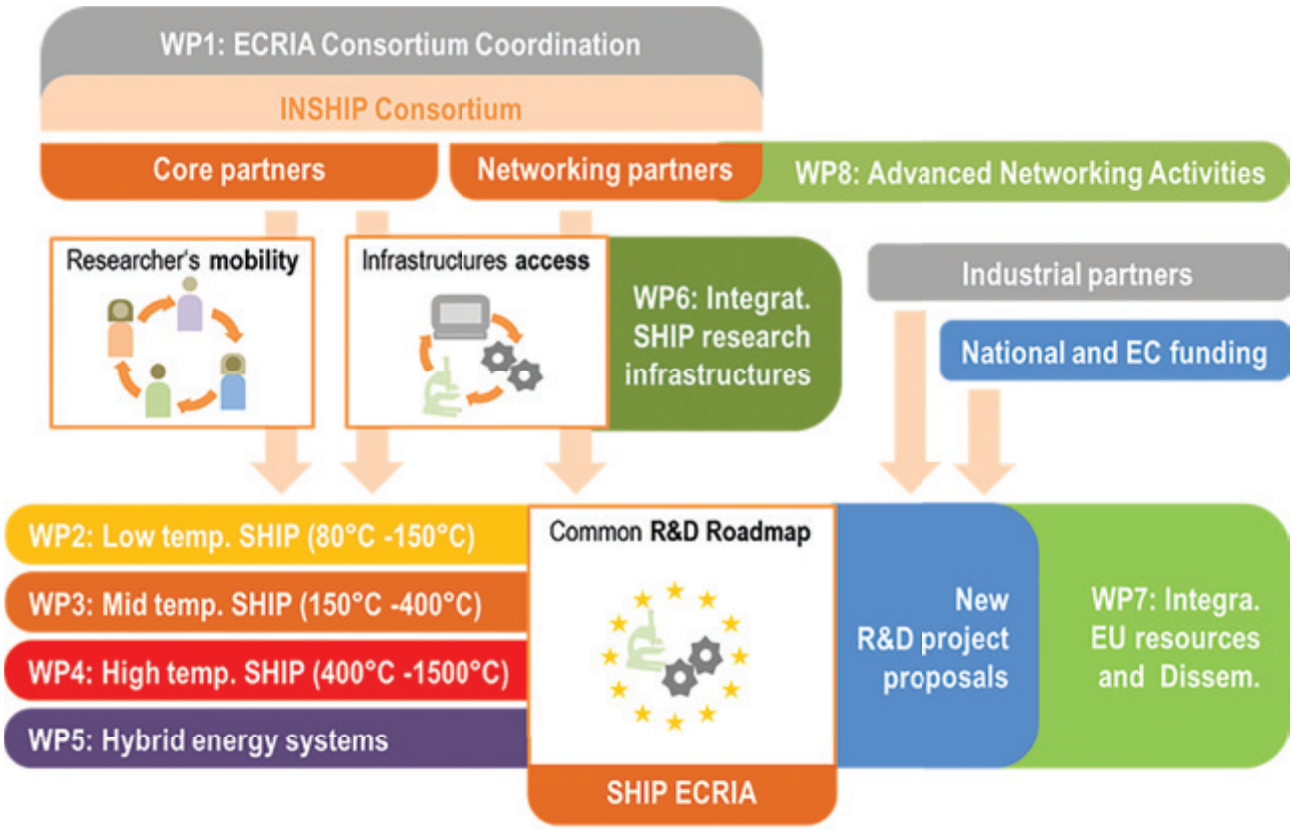
Establishment of a European Common Innovation and Research Agenda

By Josephine Stemmer

Solar thermal technologies face technological and competitiveness challenges hindering a wider contribution of solar resources to the final energy consumption. When considering the use of such technologies in industrial applications, such challenges are even more demanding. Whereas economic and financial questions play a critical role in the penetration of solar thermal technologies into this market, the technical questions specific to the framework of industrial applications already point the topics requiring due attention at R&D level.

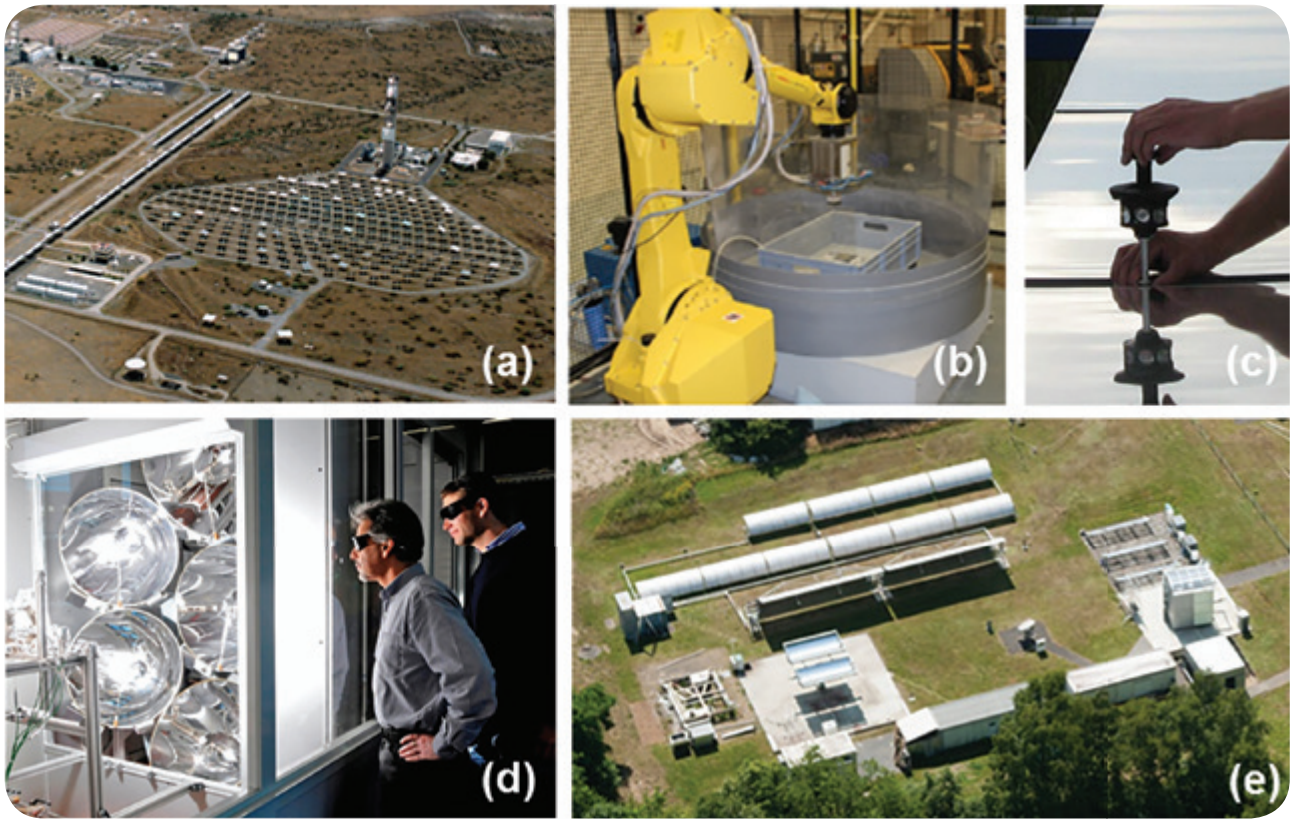
Gathering the participation of 28 European R&D institutions from 12 countries, Project INSHIP (Integrating National Research Agendas on Solar Heat for Industrial Processes) aims at the establishment of a European Common Research and Innovation Agenda (ECRIA). Establishing an integrated structure engaging major European research institutes in the development of coordinated R&D activities (TRLs 2-5), INSHIP's ambition is the progression of Solar Heat to Industrial Processes (SHIP) beyond the state-of-the-art through:

- an easier integration of low and medium temperature technologies suiting the operation, durability and reliability requirements of industrial end users;
- expanding the range of SHIP applications to the Energy Intensive sectors through the development of suitable process embedded solar concentrating technologies, overcoming the present barrier of applications only in the LT and MT temperature ranges;
- increasing the synergies within industrial parks, through centralized heat distribution networks and exploiting the potential synergies of these networks with district heating and with the electricity grid, thus aiming at a full-fledged exploitation of SHIP potential across sectors and temperature levels in both existing and new industrial capacity.



inship

Horizon 2020
European Union funding
for Research & Innovation



Example of INSHIP ECRIA related Research Infrastructures:

(a) Power tower test facilities, parabolic trough collector test facilities with thermal oil and with direct steam generation (CIEMAT)

(b) Design and 3D prototype printing (Univ. Cranfield)

(c) Deflectrometry based optical characterization of solar concentrators (Fraunhofer ISE)

(d) High-Flux Solar Simulator (ETH Zürich)

(e) SOPRAN test facility for pressurized water or direct steam generation (DLR)

INSHIP's R&D activities are framed by coordination and support actions aiming at the alignment of policies, networking activities or dissemination, but including also a Research Infrastructure Access Scheme fostering joint research activities aligned with the ECRIA's specific research topics and open to Consortia involving INSHIP partners and Industry.

Besides the research community and considering the important contribution of different key actors in the pertaining questions addressed in the project, INSHIP ECRIA established a Stakeholders Group (SG). Composed of representatives of industrial associations of technology suppliers or end-users, funding agencies and national policy bodies, the SG will act as a consultative body providing guidance and advice assuring the match between research activities and interest of both end-users and public policies.

The project has a duration of four years and is now in the second year of activities. Information on the project, Consortium and related activities and resources is available at the INSHIP website (www.inship.eu).

INSHIP ECRIA is a Research and Innovation Action supported by the European Commission under Horizon 2020 (LCE-33-2016, GA Nr. 731287).

Contact information

Dr. Pedro Horta
Fraunhofer ISE
contact@inship.eu

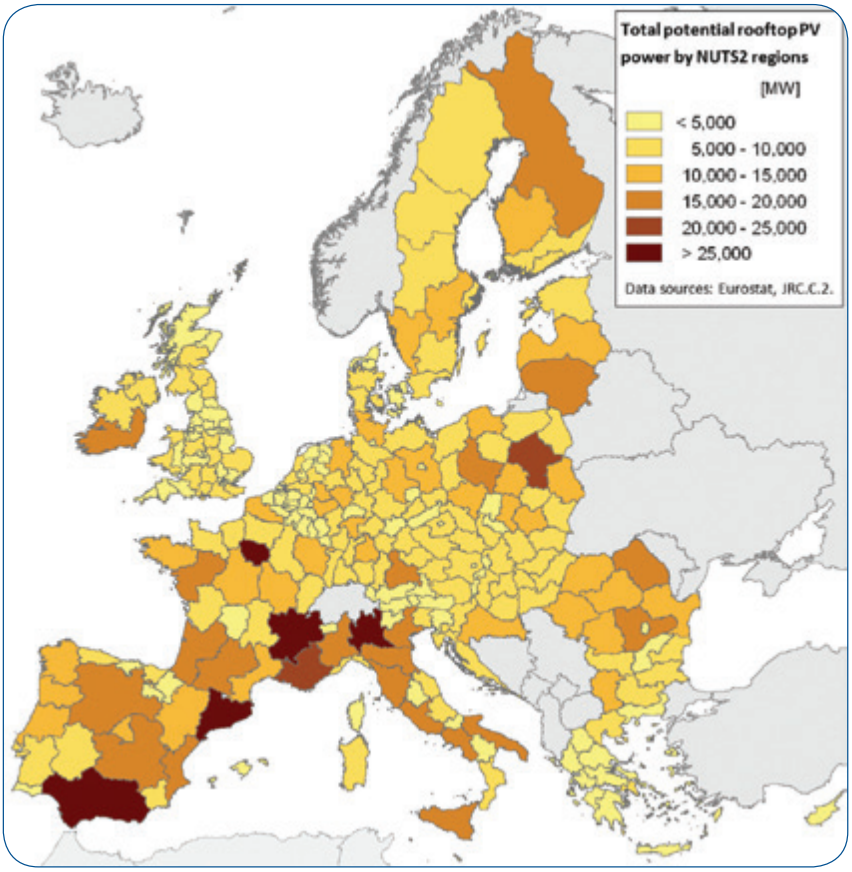
Rooftop PV and self consumption of electricity in Europe
Benefits for the climate and local economies

By Arnulf Jäger-Waldau (below), European Commission, Joint Research Centre, Directorate C: Energy, Transport and Climate, Energy Efficiency and Renewables Unit Via E. Fermi 2749, TP 450, I-21027 Ispra (VA), Italy

The necessity to limit the maximum global average temperature rise as close as possible to 1.5˚C was acknowledged with the Paris Agreement, which went into force on 4th November 2016. However, the current policies in place to limit global greenhouse gas (GHG) emission are still not sufficient to keep the temperature rise below 2˚C[1]. The burning of fossil fuels for energy purposes is still the largest source of the world's greenhouse gas emissions with 68%, making the decarbonisation of our energy supply the single most important component to achieve the targets[2, 3].

World-wide, the power sector was responsible for 38% of the fossil fuel related and 31% of the total CO_2 emissions, even as electricity accounted only for 18.5% of the final energy consumption in 2015. Despite the progress to increase renewable power generation, the total emissions related to the generation of electricity have increased by 45% compared to a 40% total increase of CO_2 emissions between 2000 and 2015[3].

Figure 1: Potential PV capacity per NUTS2 region[11]



To

meet the targets of the Paris Agreement, CO_2 emissions from the power sector have to decrease to 65g CO_2/kWh by 2050 from 506g in 2015[3,4]. This is a huge task and can only be realised under the Sustainable development Scenario of the IEA's World Energy Outlook 2017. For Europe the challenge is even bigger as electricity emissions in Europe should decrease to 45g CO_2/kWh by 2050.

Recent 100% renewable electricity scenarios have highlighted the importance of solar photovoltaics to achieve this goal and decarbonise the power sector in a cost effective manner. To realise a carbon free power supply by 2050 the installed PV generation capacity of about 400GW at the end of 2017 hast to increase to more than 4TW by 2025 and 21.9TW by 2050 to make it happen[5,6].

What options are available to install the required capacity?

a) Large-scale or utility plants, with arrays of free-standing modules, connected to the transmission grid.

b) Dual use of traffic or water infrastructure[7,8], closed landfills [9] and the re-naturalisation of mining sites offer potentials, often in the perimeter of existing electricity infrastructure.

c) PV located on roofs or facades of buildings.

The different options have different economic rationales. Utility PV plants can take advantage of economies of scale to reduce investment and operational costs, and the electricity generated can be traded in wholesale markets.

Dual use systems can have higher capital costs, but this can partially be offset by the additional value, the system provides, like the reduction of water evaporation, noise barriers, lower infrastructure costs or local employment.

Rooftop installations have higher capital costs, but the electricity can be consumed either wholly or in part on site, so the value is related to the relevant industrial or residential retail prices. Rooftop PV also brings a better geographical match between supply and demand, a factor of increasing importance as we progressively electrify the heating and cooling and the transport sectors.

Several studies suggest that roof space is not an issue, even for the most ambitious scenarios. For instance the IEA 2016 Energy Technology Perspectives reports an estimate for PV potential in EU urban areas of over 500GW and 4,350GW worldwide by 2030[10].

Like many other EU-wide studies the IEA relies entirely on population density data as a proxy. In order to use a more direct approach and to map actual buildings right across Europe using earth observation data, the Joint Research Centre

Figure 2: Cumulative installed PV power capacity between 2005 and 2018

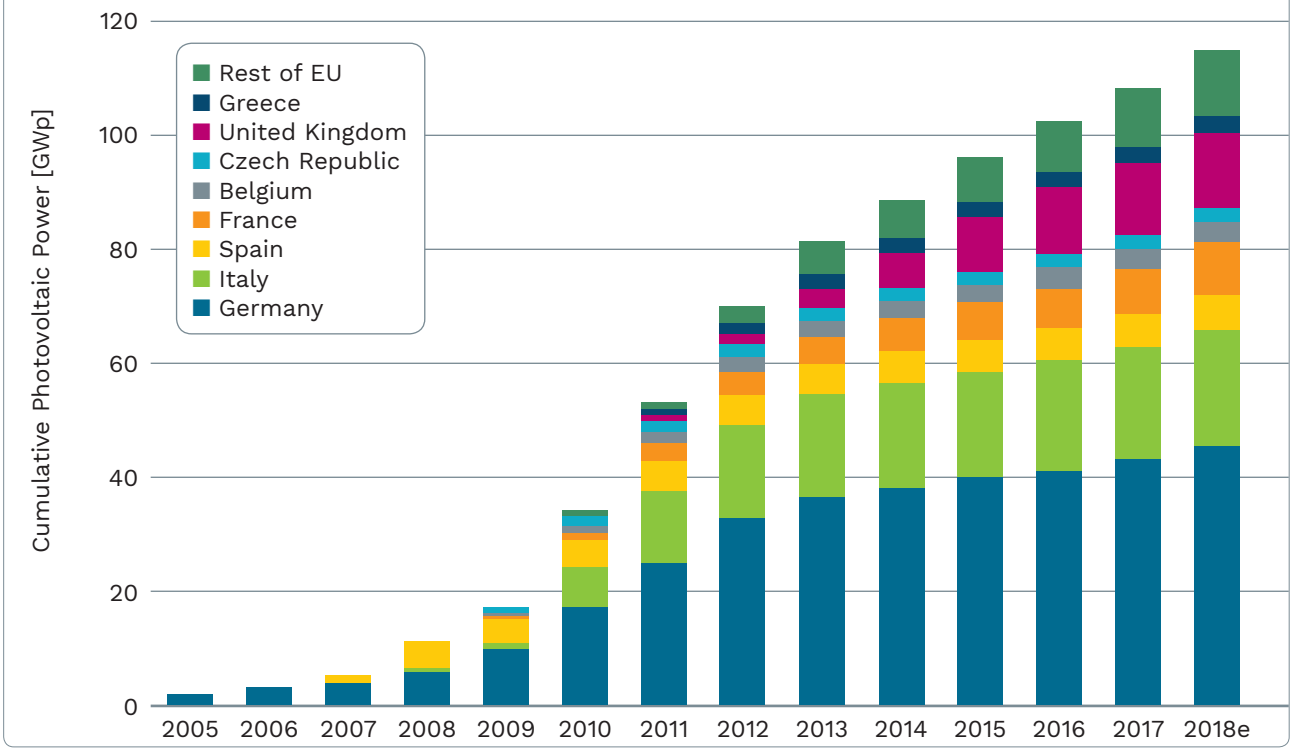
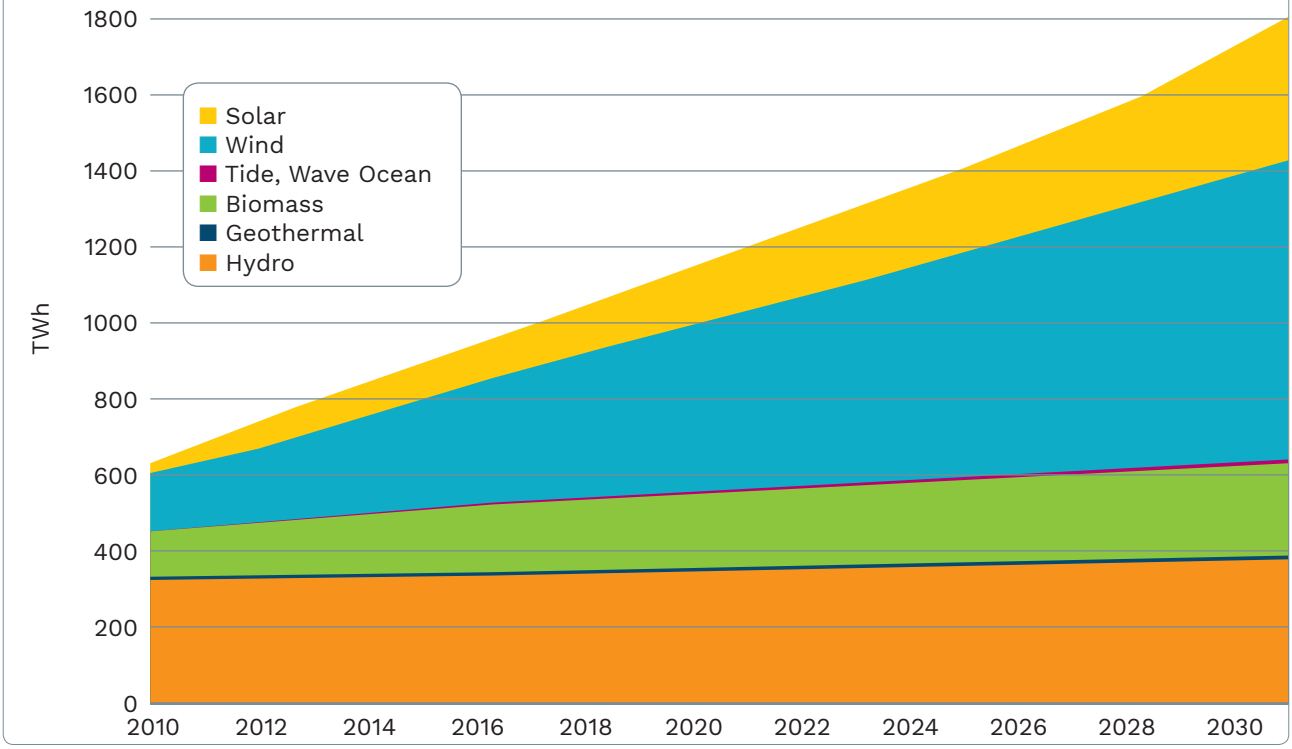


Figure 3: European electricity production until 2030 to meet the 32% RES target (extrapolation based on the impact assessment of the 2016 Market Design Directive proposal[5]).



performed a study exploiting data from the Global Human Settlement Layer (GHSL) initiative. With this it is possible to estimate available rooftop area in blocks of 10 m x 10 m across the entire EU in both urban and rural areas. Calculations on NUTS2 level show that if the suitable rooftop area is used for PV generation this could result in more than 680 and up to 1,500TWh of electricity generation depending on different assumptions of other competing rooftop uses[11,12] (Figure 1). This would require about 600 to 1,200GW of installed PV power compared to the roughly 115GW to be reached at the end of 2018 (Figure 2)[5].

During the recast of the Renewable Energy Directive (2009/28/EC), a political agreement on increasing renewable energy use in Europe was reached between negotiators from the Commission, the European Parliament and the Council on 14 June 2018. The agreement sets a new, binding, renewable energy target for the EU for 2030 of 32%, including a review clause by 2023 for an upward revision of the EU level target[13].

As a consequence, renewable electricity would have to contribute roughly 65% of the final energy demand with around 1,200 to 1,250TWh to be generated from solar and wind power (Figure 3). Of this roughly 400 TWh would come from solar power, about 20TWh Solar Thermal Power Generation and 380 TWh PV, which would require close to 350GW PV capacity to be installed by 2030, about three times the capacity of 2018.

However, with a total installed capacity of about 115GW at the end of 2018 and annual installations between 5.1 and 7.5GW in the last four years (Figure 4), it will be difficult to reach this target[5]. New policies are needed to enable a three times larger annual market over the next 13 years,

“To deliver the Paris Agreement, PV power capacity in the EU has to triple until 2030.”

The dependency of the European Union on energy imports has increased from about 40% of gross energy consumption to 54% between 1990 and 2015.

which is needed to reach the target.

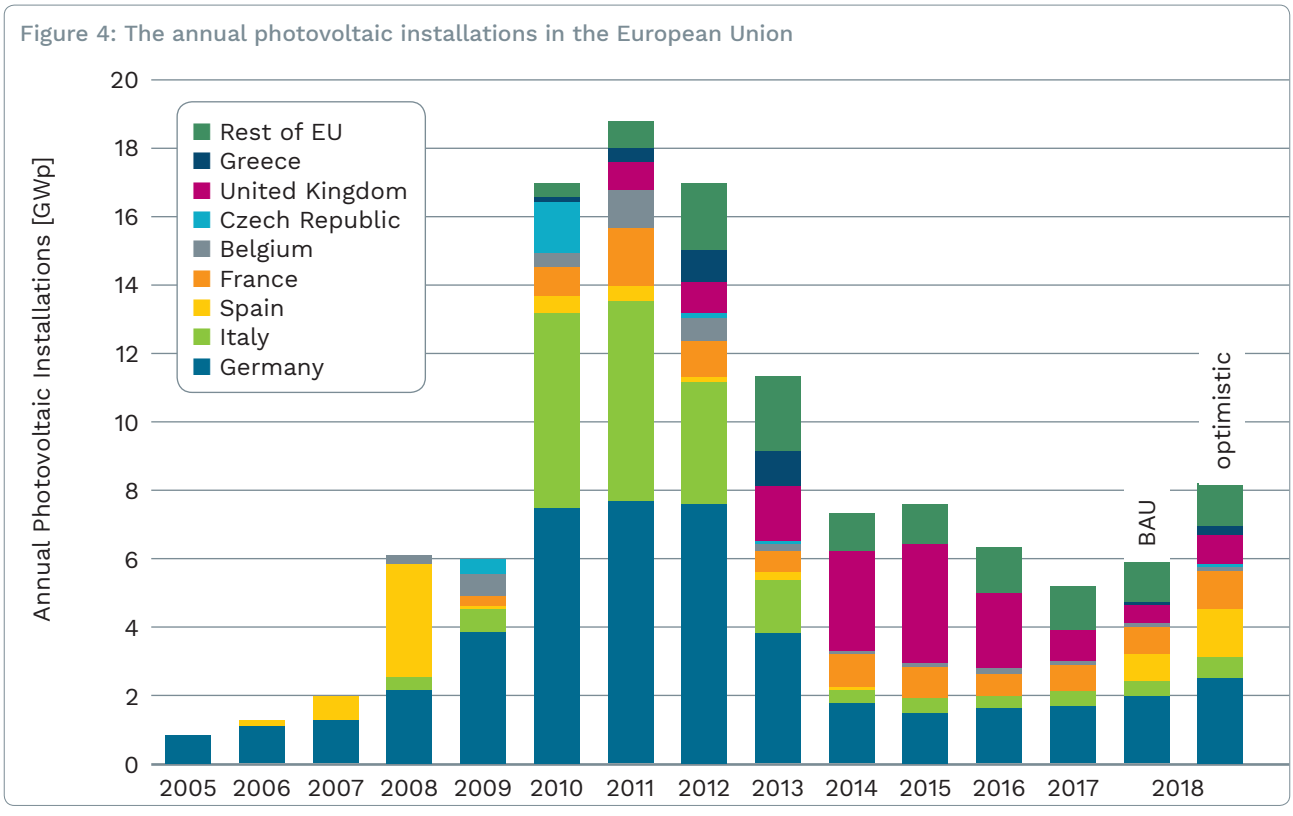
Figure 4: The annual photovoltaic installations in the European Union

The dependency of the European Union on energy imports has increased from about 40% of gross energy consumption to 54% between 1990 and 2015[14]. In 1990 renewable energy contributed about 4.5% and increased to more than 13.2% in 2015. Without this tripling of local generated renewable energy the energy dependency would have exceeded 60%. The annual value of the energy imports amount to more than €400 billion, which values the renewable energy at about €100 billion[15].

In a recently published Opinion, the European Economic and Social Committee highlighted some effects of a decentralised renewable energy supply on jobs and regional economies[15]. Especially regions with no or little own fossil energy resources, which have to spend significant amounts for the import of the needed energy, decentralised local renewable can make a significant impact in local wealth creation. Self-consumption of electricity from PV systems in the Podlaskie region, Poland, is one of the examples highlighted to boost regional purchasing power.

How can the great potential of PV systems on rooftops be utilised and help to deliver the Paris agreement?

One of the problems is that so far, self-consumption in most countries



has been limited to the owners or tenants of single family homes or small PV systems in apartment buildings. However, the rooftops of multi-apartment buildings or office buildings with multiple ownership represent a large share of the total available rooftop. Until now this is widely untapped for self-consumption of commonly generated PV electricity. Despite the fact that new economic concepts of PV system use in such buildings have gained momentum over the last two years, the existing different administrative provisions as well as technical regulations end electricity codes for self-consumption in such buildings make the implementation highly complicated. In a recent study, the current situation of nine different countries in IEA PVPS Task14 was shown[16]. The main obstacle for a wide spread uptake of PV generated electricity with self-consumption are not of technical nature, but regulatory ones.

Increased self-consumption of PV electricity can help to accelerate the transition to a decarbonised electricity system and the utilisation of apartment roofs for PV installations play an important role to reach this goal. To enable the participation of people living in these buildings, appropriate regulatory and legal conditions, which enable a secure and fair financing of the necessary grid infrastructure and providing economic benefits for residential PV system operators and society are necessary. Community initiatives and political de-risking instruments are crucial.

Last but not least, the Energy Performance of Buildings Directive (2018/844/EC) and the increasing requirements for net zero energy buildings is another driver. The JRC estimates that approximately 1.5 million new residential buildings are constructed per year, and 2.5 million undergo substantial renovation. Adding only 10m² PV to each project would potentially add 5.7GW per year. With commercial buildings even more dynamic and the addition of retrofitting existing buildings the potential for PV to contribute significantly to the Paris Goals and the local economies are clearly viable.

Contact information

Dr. Arnulf Jäger-Waldau
E-mail: Arnulf.jaeger-waldau@ec.europa.eu
Web: ec.europa.eu/jrc/en/research-topic/photovoltaics

The scientific output expressed is based on the current information available to the author, and does not imply a policy position of the European Commission.

[1] Watson R, Carraro C, Canziani P, Nakicenovic N, McCarthy JJ, Goldemberg J and Hisas L. The Truth About Climate Change, September 2016, ISBN 978-0-9831909-1-2

[2] International Energy Agency, 2017, Key World Energy Statistics 2017

[3] International Energy Agency, CO2 Emissions from Fuel Combustion, October 2017, ISBN 978-92-64-27819-6 ISSN 2219-9446

[4] International Energy Agency, World Energy Outlook 2017, ISBN: 978-92-64-28230-8

[5] Jäger-Waldau, A., Snapshot of Photovoltaics 2018, EPJ Photovoltaics 9, 6 (2018)

[6] Breyer Ch, Bogdanov D, Aghahosseini A, Gulagi A, Child M, Solomon Oyewo A, Farfan J, Sadovskaia K, Vainikka P, Solar photovoltaics demand for the global energy transition in the power sector, Prog Photovolt Res Appl. 2017; 1–19, DOI: 10.1002/pip.2950r

[7] Kougias I, Bódis K, Jäger-Waldau A, Monforti- Ferrario F, Szabó S,. Exploiting existing dams for solar pv system installations. Progr Photovolt: Res Appl. 2016;24(2):229–39

[8] Kougias I, Bódis K, Jäger-Waldau A, Moner-Girona M, Monforti-Ferrario F, Ossenbrink H, et al., The potential of water infrastructure to accommodate solar pv systems in mediterranean islands. Sol Energy 2016; 136:174–82

[9] Szabo S, Bódis K, Kougias I, Moner-Girona M, Jäger-Waldau A, Barton G, Szabó L, A methodology for maximizing the benefits of solar landfills on closed sites, Renewable and Sustainable Energy Reviews 76 (2017) 1291–1300

[10] International Energy Agency, Energy Technology Perspectives 2016, Annex H: Rooftop Solar PV Potential in Cities, ISBN PRINT 978-92-64-25234-9 / PDF 978-92-64-25233-2

[11] Huld Th, Bodis K, Pinedo Pascua I, Dunlop E, Taylor N, Jäger-Waldau A, "The Rooftop Potential for PV Systems in the European Union to deliver the Paris Agreement", European Energy Innovation, Spring 2018, 12-15 p

[12] Jäger-Waldau A., Huld Th, Bódis K and Szabo S, Photovoltaics in Europe after the Paris Agreement, Proceedings of the 7th World Conference on Photovoltaic Power Conversion, June 2018, Waikaloa, USA

[13] European Commission statement/18/4155, 14 June 2018 (http://europa.eu/rapid/press-release_STATEMENT-18-4155_en.htm)

[14] Eurostat, statistics explained: Energy production and imports, June 2017, http://ec.europa.eu/eurostat/statistics-explained/pdfscache/1216.pdf

[15] European Economic and Social Committee, TEN/660, The effects of a new carbon-free, decentralised and digitalised energy supply structure

[16] Jäger-Waldau A, Bucher Ch, Frederiksen KHB., Guerro-Lemus R, Masson G, Mather B, Mayr Ch, Moneta D, Nikoletatos J and Roberts MB, Self-consumption of electricity produced from PV systems in apartment buildings - Comparison of the situation in Australia, Austria, Denmark, Germany, Greece, Italy, Spain, Switzerland and the USA, Proceedings of the 7th World Conference on Photovoltaic Power Conversion, June 2018, Waikaloa, USA

Perovskite solar cells

Imagine a world where each family residence produces the energy it consumes at lower prices than today's. Imagine a world with free CO_2 residence energy, more sustainable and more integrated into the natural world. GOTSolar has this ambition, make buildings 100 % energy grid free for a more sustainable world!

Perovskite solar cells are a new comer in the field of photovoltaic cells – in 2009 the best device has an energy efficiency of 3.8%; in 2018 GOTSolar's partner Prof. Michael Grätzel (EPFL) announced a top efficiency of 23.25%! No other technology evolved that fast.

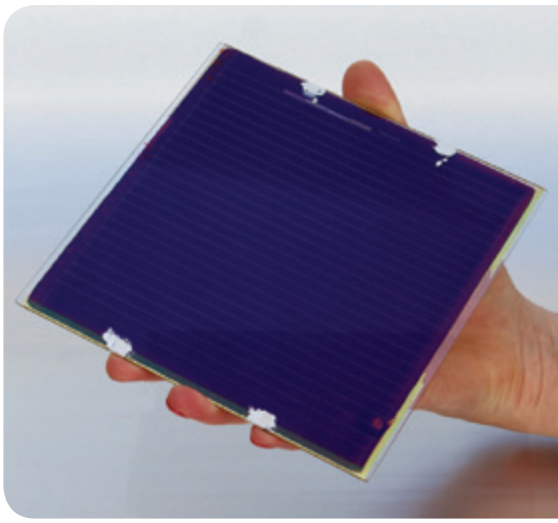
A perovskite solar cell (PSC) is 1µm thick and the light absorber layer, an organic-metal perovskite semiconductor, is just 400nm thick! PSC are made of abundant materials and can be produced easily, incorporating a minimal amount of energy and natural resources; they promise then to revolutionize again the photovoltaic world. Some critics point out the presence of lead in the perovskite composition. However, its concentration is rather small, below 0.1 wt.%, fitting the EU regulations on this matter.

GOTSolar promoted several landmark developments. Among them we would like to emphasize:

- Fundamental properties of the absorbing materials were investigated both theoretically and experimentally. A modelling of halide perovskites with a universal empirical tight-binding Hamiltonian was developed to describe the optoelectronic properties of lead-halide perovskites;
- A new and modified electron selective layers (ESL) were developed depositing a thin layer of amorphous SnO2 (a-SnO2) onto mesoporous-TiO2 using solution based approaches. These modified ESL hold a great potential for their application in the fabrication of highly-efficient PSCs, which are stable under ultraviolet irradiance, a challenge originally posed to the PSCs based on mesoporous-TiO2;
- The development of a dopant-free small molecule-based hole transport material (HTM) with higher thermal stability and similar performance than the standard HTM spiro-MeOTAD, and a series of small band-gap HTMs with absorption beyond the Perovskites threshold;
- Hermetic low temperature laser assisted glass encapsulation of the PSC; the new process uses a low melting point glass paste and a laser pattern for achieving helium hermeticity;
- A new carbon-based honeycomb-shaped counter-electrode is being developed and great potential due to its inherent transparency;
- A selected configuration was chosen to fabricate increasingly larger modules that will be laser frit sealed producing a >100cm^2 fully encapsulated device that will be tested for stability under operating conditions.

The consortium is now working in the second stage of the PSC development, aiming at contributing to quickly bring this technology to our homes and offices.

PROJECT DATASHEET
GOTSolar is a €2,993,403.50 project funded by EU program FET OPEN, which started on January 2016 and will close in December 2018. It was the first EU project funded on the development of perovskite solar cells (PSC). It involves four Universities – UPorto (PT), EPFL (CH), UUlm (DE) and IChF PAN (PL) – a research centers – CNRS (FR) – and two companies – Greatcell Solar (UK) and Efacec (PT). GOTSolar is coordinated by Prof. Adélio Mendes from UPorto.



A perovskite solar cell (PSC)

Contact information

Adélio Mendes
Engineering Faculty at the University of Porto
Rua Roberto Frias
4200-465 Porto
Portugal

E-mail: mendes@fe.up.pt
Tel: +351 220 413 612

Unleashing the power of Solar & Storage

By Raffaele Rossi, Policy Analyst, SolarPower Europe

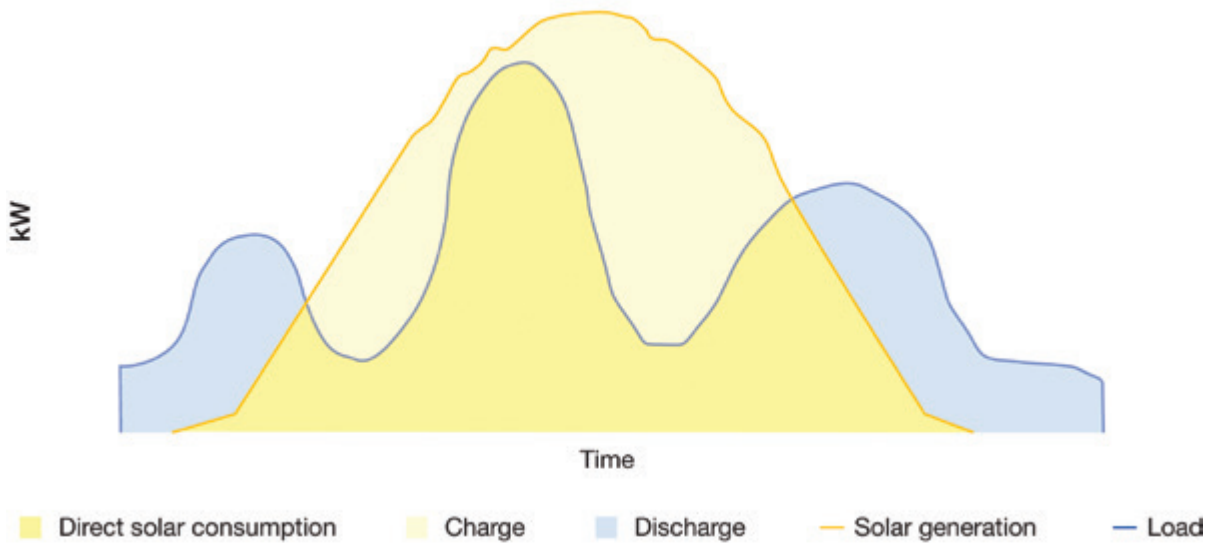
While the uptake of solar power worldwide progresses at an ever-increasing pace, the potential of solar energy still remains largely untapped. The European Union currently sees around 5% of its electricity demand covered by solar, but this amount could easily grow to 15% by 2030.

A key factor linked to the deployment to solar is its co-location with battery storage. Solar and storage are a perfect match: storage represents an important flexibility tool allowing for the provision of more stable, less variable and fully dispatchable solar energy, increasing the system integration of solar PV.

SolarPower Europe, the Brussels-based association representing the sector along the whole solar photovoltaic value chain, supports the deployment of storage technology through its Task Force on Solar & Storage, which includes more than 25 leading companies in this field, including Tesla, Sonnen and Enel. Aim of the Task Force is to ensure that benefits of solar and storage are recognised and effectively communicated to stakeholders and policymakers, in order to capture the full potential of coupling such technologies.

The benefits provided by solar and storage are manifold. From a technical perspective, storage optimises solar supply by absorbing the surplus generation and employing it at a later stage, when the demand is higher (see graph). The presence of

Storage optimises solar supply



a battery system allows a firmer solar output, stabilising energy generation and demand variations. Additionally, solar electricity stored in a battery system is fully dispatchable and can be used during night hours.

Lastly, storage provides a number of ancillary services to the grid, such as correcting fluctuations in frequency with very high accuracy. Under this point of view, storage provides valuable additional benefits to the grid.

Besides the several technical benefits, solar and storage together bring important economic advantages. Storing solar electricity in periods of overproduction when prices are high and using it when they are low helps stabilise the cost of energy, reducing overall price fluctuations. Moreover, the presence of storage ensures higher flexibility and prevents network upgrades and further expansion costs.

Significant social and environmental benefits are also brought by the development of solar and storage: decreased GHG emissions, local job creation, empowerment of consumers and businesses to take a proactive role in the energy transition.

Solar and storage will play a prominent role in the transition to a sustainable, smart and more decentralised energy system. However, for the potential of solar and storage to be fully deployed it is essential that in the current Electricity Market Design negotiations its numerous benefits are entirely recognised.

To ensure that the future electricity system is based on the participation of different flexibility providers operating in an open market, a number of conditions need to be met:

- First, in order to ensure a truly open and competitive market, system operators should not be allowed to own, develop, manage or operate storage facilities. Any influence on the energy market by system operators would result in hampering market development. Exceptions to this principle in cases of clear market failure may be allowed, but only under strict limitations and subject to the supervision of national regulatory agencies.
- Second, the emergence of new business models deriving from the services provided by solar and storage to the grid should be supported. National regulatory authorities should make sure that system operators do not interfere with the development of new markets for grid services, including future markets.
- Third, national authorities should draw up guidelines or procurement clauses on tendering procedures, to ensure that the process is fair and non-discriminatory.
- Finally, active customers and self-consumers should be subject to fair, cost-reflective charges and proportionate obligations, in accordance to their effective impact on the grid. Notably, storage owners should be prevented from double taxation, ensuring that grid fees are only levied once for every kilowatt-hour fed into the grid.

Key European Solar Markets
Trends from the Installers' Perspective

By Saif Islam, Senior Consultant, EuPD Research Sustainable Management GmbH

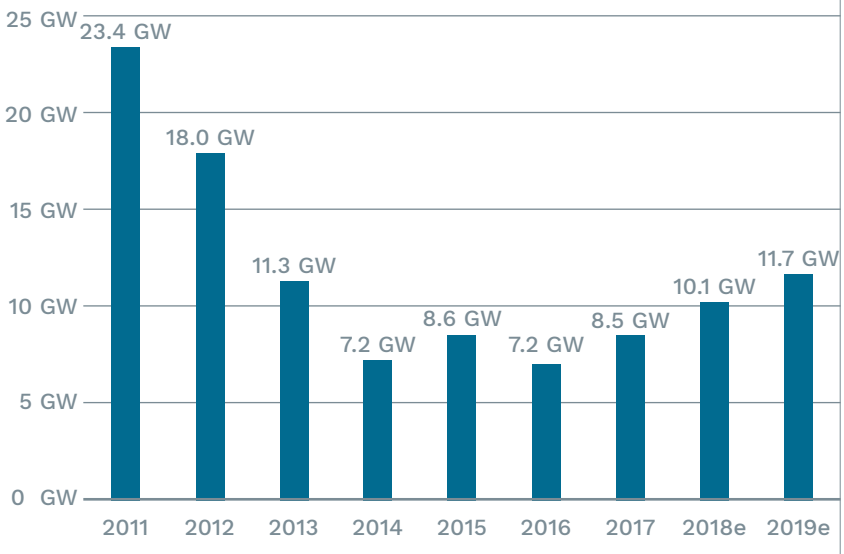
Over the last few years the European PV market has seen some radical developments. In 2011 around 23.4 GW of new PV systems were installed, however, a mere three years later this figure dropped to 7.2 GW. Currently the European market is recovering, as EuPD Research estimates the European PV market will rise (slightly) above 10 GW in 2018. One of the main reasons is the strong industrial and utility segments in countries such as Germany and France. These country markets have highly benefitted from large tender processes. The French market alone grew by nearly 60% in the first half of 2018 (479 MW) due to large-scale solar.

A further key to Europe's newfound success is the emergence of various strong residential markets. Germany has always benefitted from a strong residential segment, but other markets such as the Netherlands are showing an increasing trend. In 2018 the Dutch residential market will be the largest in Europe and will make up nearly 20% of all European system installations below 10 kWp. Furthermore, Belgium will install around 400 MW of residential PV in 2018. Belgium, similar to other markets such as Ireland and Scandinavia, basically only has a residential PV market at the moment.

Energy storage has also become an essential success factor for various residential markets. Germany has the by far largest residential energy storage market in Europe. Over the last few years and including 2018, the German storage market will make up around 70% of the total installed storage capacity in Europe. One of the main reasons is the German installers, who already largely offer energy storage to their customers. Installers are the key factor when it comes to choice of technology and brands. In Germany, 81% of the PV installers already carry storage products in their portfolio. A further 6 % are planning on including storage solutions by the end of 2018. A mere 13% categorically refuse to refuse to supply their customers with this still new technology – the current prices are mentioned as the main reasons why they reject energy storage.

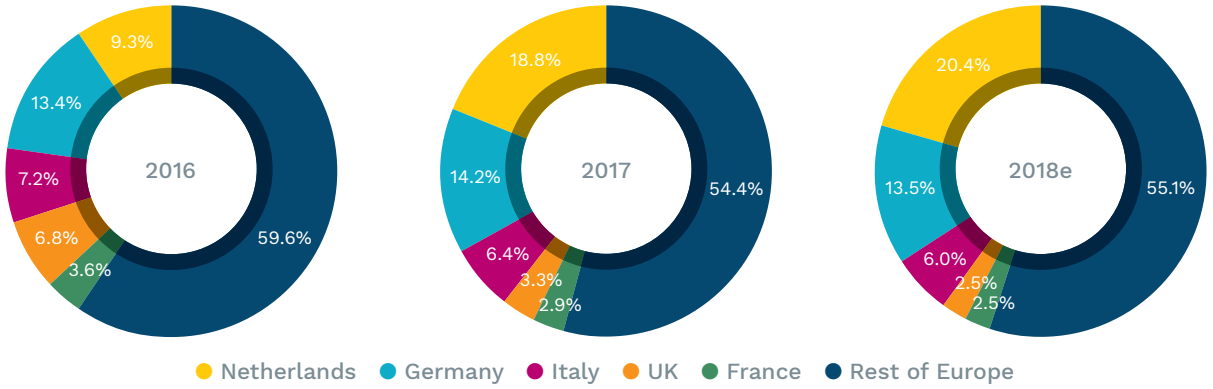
Germany was one of the first countries with a federal subsidy scheme for residential energy storage. However, the support program offered by the "Kreditanstalt für Wiederaufbau"("Reconstruction Credit Institute") has seen some drastic changes. In the first subsidy period from 2013 onwards, 30% of the investment costs for a storage system were funded. Due to the very high system prices at the time, the majority

Capacity of newlty installed PV systems | Europe



Source: EuPD Research 2018

Share of newly installed residential PV systems | Europe



Source: EuPD Research 2018

of storage customers made use of the support scheme. Towards the end of the second subsidy period, the support sum decreased to merely 10% of the investment costs. Maybe it comes as no surprise that merely a quarter of the survey participants for the "Global PV InstallerMonitor 2017/2018" from EuPD Research recommend the program to their customers.

On the other hand, more than half of the survey participants said that they would not recommend the subsidy program. When asked for the reason, most of the installers said that the fact that storage users have to feed in 50% of the generated energy into the grid was not beneficial for the use of a storage system. Furthermore, they describe the application form as too complicated (all in all nine steps are necessary to receive the funding). Amongst the other mentioned reasons, German installers today largely believe that the storage subsidy program is not profitable for their customers. And the fact that customers need to take out a loan from the KfW in order to benefit from the support scheme (even if they have the necessary money) is deemed as a further barrier, as this means that despite having the necessary assets, home-owners would have to pay the repayment instalments over a period of possibly 10 years.

Other countries that could benefit from energy storage face various obstacles. In France, merely a third of the installers already offer energy storage to their customers. Compared to Germany this is a very small share. However, as compared to 2017, where about 60% refused to include storage solutions in their portfolio, this year one third mentioned they were considering energy storage. One does need to take into consideration, though, that the electricity prices in France are comparably low as for instance in Germany. Whereas German home-owners pay around 30 €ct per kWh, the electricity price in France (due to nuclear power) is only around 18 €ct per kWh. However, the French electric utility Électricité de France S.A. (EDF) announced they will invest around eight billion euros between 2018 and 2035 to become a European market leader in electricity storage. This is a clear sign that there is huge potential for energy storage in France.

The Dutch market's potential for energy storage becomes evident when one looks at the strong growth of the residential PV market. In 2017 the Netherlands had around 83,000 PV installations below 10 kWp, whereas only about 2,000 of these PV systems were equipped with a storage solution; however, due to the low electricity prices (16 €ct per kWh) and the net metering scheme, the market currently shows no demand for energy storage. This is supported by the fact that only 20% of the Dutch installers offer energy storage in their portfolio. This could change dramatically, as the Dutch Minister of Economic Affairs and Climate Change Eric Wiebes announced plans to replace the net metering scheme with a new support mechanism for solar and other small-sized renewable energy systems by 2020. As around 600-700MW of residential PV are estimated for 2018, this shows what kind of potential energy storage in the Netherlands has should the net metering scheme be cancelled.

About EuPD Research Sustainable Management GmbH:

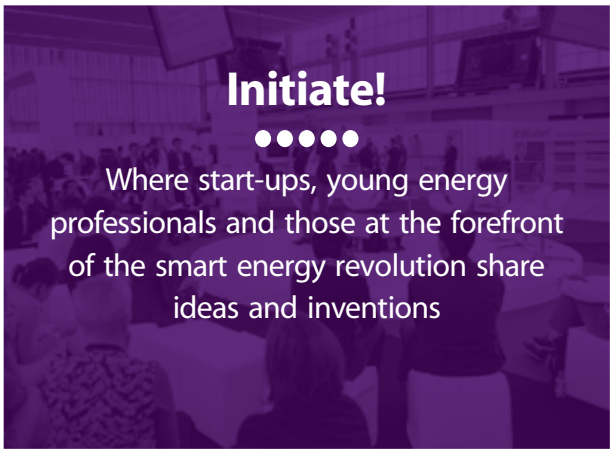
EuPD Research Sustainable Management GmbH is an international service provider focusing on B2B market research with a highly specialized multilingual interview center. We provide our clients in Europe, Asia and the US with the entire range of qualitative and quantitative research services. With the help of in-depth market knowledge combined with methodological professionalism, we provide practical, future-oriented business solutions and ensure that our clients receive a return on their research investment. Our continuous research has enabled us to develop particular skills in the field of renewable energy sources, particularly in the field of solar energy.

European Utility Week

6-8 November 2018 | Vienna, Austria

European Utility Week champions the interests of the smart energy sector and performs a vital role in bringing together more top-level energy professionals than any other event.

The 3-day programme offers content for all key stakeholders and takes on a leading role in facilitating the shift towards clean, efficient and smart energy in Europe.



Join us during the most prestigious energy event in Europe.

www.european-utility-week.com

ORC-PLUS Project

An innovative CSP-TES system for Smart Grids applications

The ORC-PLUS (Organic Rankine Cycle – Prototype Link to Storage Unit) Project is a H2020 European Project (Call: LCE-03-2014 Innovation Action Grant Agreement 657690). The Project Consortium is composed by ENEA (coordinator), F-ISE, CIC, IRESEN, ENERRAY SpA, Soltigua Srl, Euronovia, and includes also the third parties EXERGY SpA and ENERRAY Morocco SAS.

The Project aims to develop an innovative Thermal Energy Storage (TES) system and a set of engineering solutions optimized for a mid-size CSP (Concentrating Solar Power) plant coupled with an Organic Rankine Cycle (ORC) turbine of 1MWe. The targets of the Project are the validation of a form of decentralized power system, based on the CSP technologies specialized for the Morocco territory, and the demonstration of the capability to use a TES system in a plant of this size.

Such experiences could also be beneficial for other arid areas of the Mediterranean region, where the grid power peak load represents a serious problem of management of the local power grid, and where there is not the availability of other back up power systems (e.g. hydraulic power stations) to regulate the fluctuations of the power in such grids. The ORC-PLUS Project will contribute to overcome the present limitation to the expansion of mid-sized CSP plants. In fact actually a limit for this kind of CSP plant is represented by the lack of technical solutions of TES, specialized for this sizes and validated in a relevant industrial environment.

The validation process adopted by the Project includes both a techno-economic analysis of two different kind of TES systems at prototype level, and a validation of the technology at pre-commercial scale demonstrator level. Actually the demonstrator plant is under construction inside IRESEN's Green Energy Park located in Benguerir (Morocco), and its put in exercise is scheduled for the next January 2019. In the final design of the demonstrator plant, have been preferred technical solutions that limit the environmental impact and that allow the activation of possible chains of domestic production of some components, or of the provision services.

The reference size of the thermal energy capacity of the TES system has been fixed at about 20MWht, since this value allows the ORC-PLUS plant a max load of 5MWt, in order to cover a power load peak between 6 pm and 10 pm of a typical Moroccan little town. The TES system will be fed by 3 parallel hydraulic Fresnel solar collectors loops. The heat transfer fluid used is an environmentally friendly mineral oil operating in the temperature range from 180°C to 300°C. The target value of LCOE (Levelized COst of Energy) was fixed at 0,27 €/kWhe.

The ORC-PLUS technology represents a new model of decentralized power production for remote areas and even small industries that need affordable, renewable power and heat. The ORC-PLUS technology was thought to be an opportunity of development for disadvantaged areas.

Green Energy Park (GEP) of IRESEN

Contact information

ORC-PLUS
DISPATCHABLE SMALL-SCALE SOLAR THERMAL ELECTRICITY

Contact information

Email: walter.gaggioli@enea.it
Tel: +39 (0)6 30486212
Web: www.orc-plus.eu.

DENMARK ENERGY

New Danish Energy Agreement boosts renewable energy

A Danish cure for Green Amnesia

Denmark – All in on renewables and electrification

Green business and black numbers

By Steen Schelle Jensen, Head of Product Management, Kamstrup

Digitalisation is the lever for an integrated and efficient energy system with district heating as its natural cornerstone. It will not happen on its own accord but Danish experiences are proving that green business and black numbers are not mutually exclusive and European initiatives are an indicator for much more to come.

Let us – just for a second – put aside the fact that digitalising district heating will enable a greener, more integrated energy system utilising renewable energy sources and surplus heat to decarbonise the heating of buildings. Digitalisation is also simply good business.

The total savings potential from digitalisation in the Danish utility sector is estimated at between 360 million and 1.3 billion euros. These savings will come from using data-based transparency to reduce losses, increase operational efficiency, improve utilisation and maintenance of the distribution network as well as streamline the heavy investments in this area.

There is no shortcut to realising this potential – and it will not happen automatically. For district heating utilities, reaping the financial benefits from digitalisation is a process that begins with them investing both their time and money in digital tools that enable them to change the way they do things today.

COLLABORATION IS KEY

Few will argue that optimising production and distribution based on real-time data is not more efficient than using theoretic models. But for most utilities it is less obvious exactly where, how and how much savings can be made – and that is a prerequisite for any investment. Closer collaboration between utility experts and technology providers is key to solving this challenge.

In an ongoing project with one of the world's biggest district heating utilities, AffaldVarme Aarhus (AVA), operations staff from the utility therefore work together with data specialists from Kamstrup to prove detailed business cases for areas where digitalisation is expected to hold financial value.

One of these many areas is leak detection based on smart meter data analytics rather than aerial drone thermography. The project will provide fact-based proof to validate AVA's potential investment in this area as well as give important insight with regard to renovation of their distribution network.

DIGITAL TRANSFORMATION UNDERWAY

With its strong history in district heating, Denmark is amongst those leading the way for digitalising this sector. However, the potential is just as relevant in other district heating countries – and the digital movement is making headway fast.

Initiatives such as Euroheat and Power's recently released Digital Roadmap for District Heating & Cooling are generating all new awareness and insight into the possibilities, challenges and potential in digitalisation. Combined with real-life showcases like the AVA project that produce quantified results, this is what will pave the way for digital utilities with bottom lines that are as green as they are black.

kamstrup.com

New Danish Energy Agreement boosts renewable energy

By Lars Christian Lilleholt (pictured), Danish Minister of Energy, Utilities and Climate

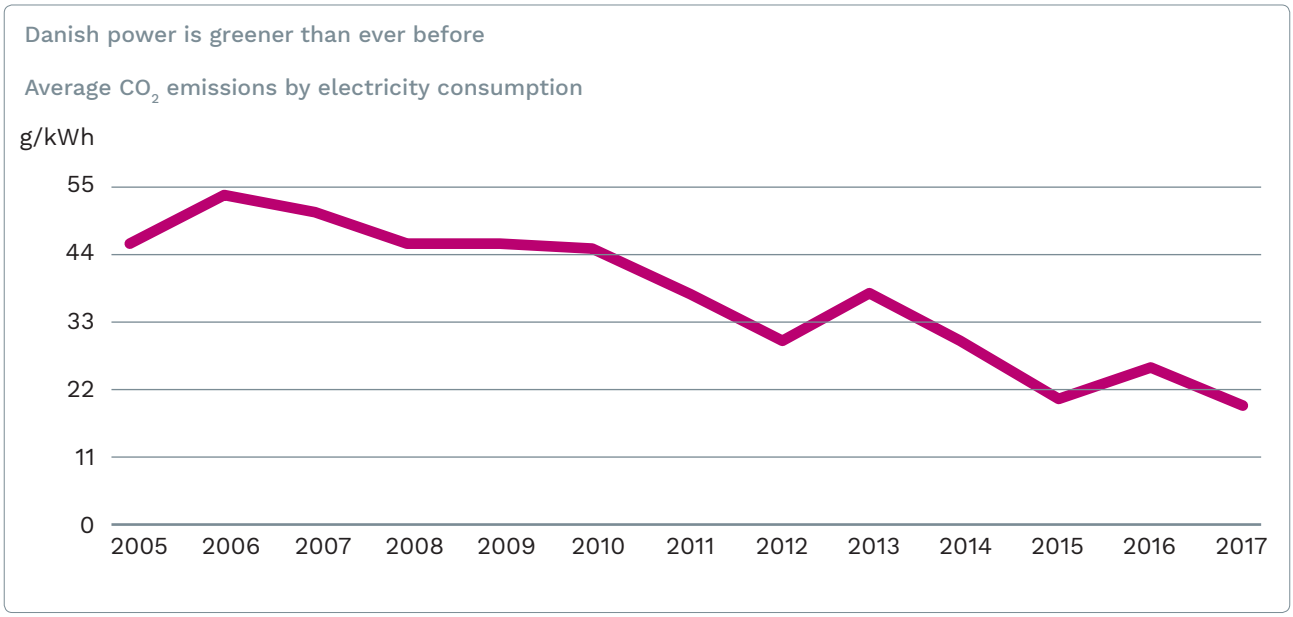
Denmark has set itself on a path towards 55% renewable energy in 2030 and net zero emissions by 2050 at the latest in a new Energy Agreement adopted with support of all parties in the Danish Parliament.

The new Danish energy agreement contains a wide range of ambitious green initiatives and lowering of electricity taxes. It will help Danish consumers replace fossil energy with green electricity. Companies and consumers will receive greener heating through a modernisation of the heating sector.

The new energy agreement sets a clear direction for turning Denmark into a net zero emissions society by 2050 at the latest – meaning that there will be a balance between the amount of greenhouse gas emitted and removed from the atmosphere. The first step will be to supply up to 55% of the Danish energy consumption with renewable energy by 2030. To achieve this while keeping electricity bills down, Denmark will introduce more competition to the renewable energy sector and build large offshore wind farms which are to set a blueprint for offshore wind energy without public subsidies. Denmark will overhaul taxes on energy that will deliver a green transition of the energy sector at a lower cost.

The majority of these initiatives are to be realised from 2020 to 2024. From 2025 onwards, substantial additional funding will be allocated to a reserve for further deployment of renewable energy. Given the uncertain nature of technology and price developments between now and 2030, Denmark will assess its efforts on a regular basis to ensure that the renewable energy goal for 2030 is reached at the lowest possible cost.

With this energy agreement, three new offshore wind farms will be established by 2030. The first wind farm will consist of 800 MW. Once completed, it will be the largest of its kind in Denmark. It will be constructed in the period 2024-2027. Efforts to realise energy savings will be largely focused on gaining greater value for money and thereby addressing criticism of the existing



system. Energy and climate research gets a cash injection with the goal of allocating DKK1 billion a year in 2024. At the same time, there will be substantial lowering and restructuring of energy taxes as well as a smarter use of waste heat.

THE AGREEMENT UNDERPINS DENMARK'S POSITION AS ENERGY AND CLIMATE LEADER

Danish Minister of Energy, Utilities and Climate, Lars Christian Lilleholt is very pleased with the final agreement.

"The government's long-term goal is for Denmark to become a net zero emissions society by 2050 at the latest. This means that the amount of greenhouse gas emitted will equal the amount removed from the atmosphere. I am therefore pleased and proud that all the parties in the Danish parliament have united behind this agreement which underpins Denmark's position as an energy and climate pioneer. It creates confidence and secures consistency that this is the direction we are heading towards," says Lars Christian Lilleholt.

The new Danish energy agreement includes the following initiatives:

- A commitment to work towards a target of net zero emissions by latest 2050 for both Denmark and the EU.
- By 2030, three offshore wind farms will be established, without public subsidies except for the transmission, with a total of at least 2400 MW. It is expected that the wind farms due to technology developments will be significantly cheaper to construct than wind farms of the past.
- DKK4.2 billion (€564 million) is allocated to a tender process, where different technologies such as onshore wind and solar can compete on delivering green electricity at the lowest price.
- More than DKK4 billion (€537 million) is allocated to expand the production of biogas and other green gasses. A share is allocated for organic biogas.
- From 2021 to 2024, DKK500 million (€67 million) annually will be allocated to a market-based grant pool focused on energy savings – primarily in business – DKK300 million (€40 million) for industries and DKK200 million (€27 million) for energy savings in buildings.
- A reserve of DKK400 million in 2025 (€54 million) and then DKK500 million (€67 million) annually will be allocated to further enhancing the use of renewable energy after 2026.
- Immediate lowering of electricity and electric heating taxes amounting to approximately DKK2 billion (€268 million) in 2025 (excl. VAT).
- A modernisation of the heating sector where both the district heating sector and consumers have a free choice to decide future investments, resulting in greener heating for both companies and consumers.
- Phasing out coal in the Danish electricity production by 2030
- Energy and climate research will receive a cash injection with a target of DKK1 billion (€134 million) by 2024.
- DKK500 million (€67 million) is allocated to green transportation in 2020-2024 to enhance green mobility and transportation.
- Working towards ambitious CO_2 standards for cars, vans and heavy duty vehicles.

UNIQUE FACILITIES

- 1200 t LIFTING CAPACITY

Denmark's largest industrial cluster with 100+ companies representing production, supply chain and testing. **Synergy** that creates competitive advantage.

FOR OFFSHORE WIND

- 2000+ t ROLLING CAPACITY

LINDØ
PORT OF
ODENSE
LPO.DK

A Danish cure for Green Amnesia

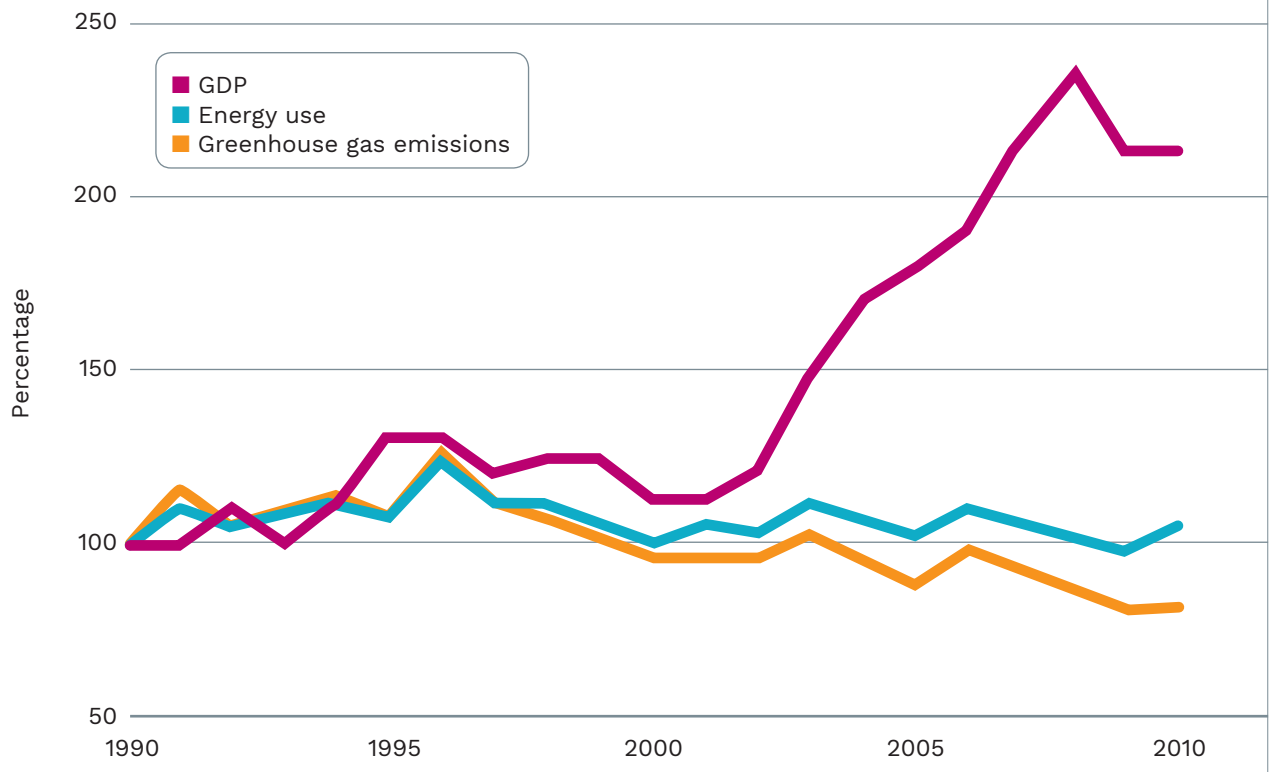
By Morten Helveg Petersen MEP: Vice Chair, ITRE committee

A spectre is haunting Europe. However this time it is not the spectre of Communism, but rather the spectre of a frightening decease: Green Amnesia. It has already infected governments across the continent. The symptoms are severe and may include:

- Signing the Paris Agreement and committing to reduce CO_2-emissions, but then forgetting to support legislation that would do so.
- Claiming to support renewable energy, but refusing to support EU laws that increase the share of renewable energy even as wind and solar costs have halved during the past three years.
- Giving speeches praising a market-based approach, but then allowing for protectionism and blocking of transmission of electricity across borders in the EU.
- Alleging to put "energy efficiency first", but then watering down ambitions, even as Europe needs to reduce its energy consumption and reliance on Putin's Russia more than ever.
- Acknowledging that the transport sector is key in terms of reducing CO_2-emissions, but then hesitating on reforms in favour of e-mobility and higher fuel efficiency standards.

These patterns of behaviour go directly against the governments'

Danish GDP, energy use and emissions



©Nordic Energy Research 2012. Source: EEA/World Bank 2010

promises made in Paris less than three years ago. The apparent inconsistency between words and actions should be a cause for concern. Especially when those actions constitute a threat to our citizens and our planet, as CO_2-emissions and global temperature levels continue to rise.

DANISH CURE

Fortunately there is a cure. In Northern Europe, experts have found that a combination of renewable energy and energy efficiency have helped reduce CO_2-emissions, while growing the economy. In fact already in the early stages of the treatment, Denmark was able to double the size of its GDP, while reducing greenhouse gas emissions.

Today Denmark is on track to 100% renewable electricity in 2030 with new offshore wind parks contributing to an ever-more sustainable energy supply.

If the infected European governments try this cure, they will find that Green Amnesia is significantly reduced in scope. Furthermore patients will notice side effects such as decreased pollution, healthier citizens and better environment. With treatment becoming more effective and cheaper every year, benefits now also include substantial economic gains, as energy bills for consumers, companies and public authorities continue to fall.

A PANDEMIC

The challenge of Green Amnesia is global. The decease constitutes a bigger problem than ever in Washington, D.C., where especially one patient is in a stage of denial. Beijing is recovering, though from a very critical level, while Delhi could go both ways.

Again the Danish cure can be prescribed. Already wind is powering over 2 million Californian homes (despite the President's fascination with coal) and in China, a quarter of the total power generation comes from renewables.

But there is a long way to go, considering global trends in energy consumption. We are far from reaching an ideal and sustainable solution, as oil still accounts for about 35% of energy consumption, coal close to 30% and natural gas almost 25% globally.

In addition, we know that climate change also accelerates other global problems including migration. As countries in Africa and elsewhere experience more draughts and floods, harvests are hollowed out leading to poverty and hunger in fragile communities. This in turn increases the scope of migration, which threatens stability both in the country of origin, as well as the transit and recipient regions. In a world of almost 10 billion people by the middle of this century, solving climate change thus has important effects on other key challenges.

The threat of Green Amnesia is severe. Though solutions are well known and fully cost-effective, we still lack political leadership to take action. I therefore urge citizens, political colleagues and NGOs to continue their work, informing governments in Europe and elsewhere of the decease and its effects. If we succeed, we can provide cleaner and healthier communities for our people, while improving the competitiveness of our businesses. If we fail, we will increase the harm of climate change, including more extreme weather conditions that will accelerate problems such as migration.

Morten Helveg Petersen has served as a member of the European Parliament since 2014 as a Vice-President of ITRE, acting as rapporteur of the ACER Regulation and shadow rapporteur on the Energy Performance of Buildings Directive, as well as the Electricity Market Design files and the Gas Di-rective. Before that, he served as a member of the Danish parliament from 1998 to 2009 and thereafter worked for the European Commission and the Confederation of Danish Industries.

Denmark
All in on renewables and electrification

By Jan Hylleberg (right), CEO, Danish Wind Industry Association

Denmark was one of the first countries in the world to go all in on wind energy and set ambitious goals for the development of wind technology. Because Denmark did not fold, but instead kept betting on wind energy, the pioneering role has rendered it possible for Denmark to win a wind energy jackpot.

Subsequently, Denmark today in many ways is still leading on matters regarding wind energy production, a substantial industry presence, and a state-of-the-art phase-in of renewables in the power grid. The combination of this, ensured an average of 43.6% electricity from wind, last year.

The Danish energy system and market is designed to handle periods where wind energy supersedes 100% of the electricity consumption as well as times, where wind energy does not supply power to the grid, and other technologies and imports must carry the load.

However, this catch 22 with wind energy is getting more and more evident as wind energy is built out and provides ever more renewable electricity. In other words: Denmark was the first country to bet on wind energy, and now Denmark will also be the first country to develop and implement measures that facilitate a broader, more intelligent, use of electricity.

NEW PLAN TO PAVE THE WAY

Back in June, a unanimous Danish Parliament agreed on a new energy agreement, which aims towards 2030 and lays out concrete measures until the middle of the decade. At that time 55% of the total energy consumption is set to come from renewables, with wind energy and biomass contributing lion's share. Because of this target, 100% of the electricity consumption will also come from renewables no later than 2030.

As part of the agreement, three offshore wind farms are to be established between 2025-2030. With a total minimum of 2,400 MW, the coming turbines will give a significant boost to the renewables scene in Denmark. Onshore, the agreement follows a different political strategy, as the cumulative production of wind energy is expected to rise, while the number of onshore wind turbines is set to a maximum of 1,850 in 2030, where the agreement calls for taller and more efficient turbines onshore.

Overall the new Danish energy agreement sets strong initiatives for wind and other renewables and plays in the global trend of technology neutral auctions, as all technologies, except large scale offshore wind, will compete for subsidies, thus lowering the total cost of the green transition in Denmark.

Since Denmark produces vast

amounts of renewable electricity, a main driver in the new energy agreement is to secure the use of electricity across sectors. Politically, there are many good and strong intensions in the agreement, among them a decreased tax on use of electricity in private heating and a budget earmarked for improving green transportation. This Autumn a climate agreement will also be formed, hopefully setting targets for a larger expansion in the use of electric vehicles. On this matter, Denmark still has an unresolved potential.

Overall, the most recent energy agreement is an expression of the Danish awareness of the country's pioneering position, and the climate agreement will hopefully play into this.

IMPORTANCE OF MULTILATERAL COOPERATION INCREASES

Because of the pioneering role in both on- and offshore wind, Denmark has played a leading role in forming the North Sea declaration. A declaration which, together with nine other countries bordering the North Sea, brings about a regulatory and a more strategic take on the expansion of offshore wind in the region.

With a number of working groups and changing presidencies across the participating countries, the goal is to take a regionally more aligned approach towards renewable built-out e.g. by unifying standards for lighting, colours and other technical aspects, that vary across markets today. With uniform requirements production can be simplified and thereby reduce the cost of the individual offshore wind farm.

On a strategic level, the North Sea declaration also seeks to coordinate timelines for coming offshore wind farms, and thereby aims to mitigate the risk of bottlenecks, where multiple wind farms are to be installed at the same time. A more widespread pipeline will have a positive impact on the use of installation vessels, logistics and overall production in the wind industry value chain, leading to lower peak costs.

The North Sea declaration has strong support from the wind industry, and the industry also takes part in the ongoing work and recommendations.

The importance of the cooperation across the North Sea is immense. It is my hope that the future will bring about more multilateral cooperation regarding barriers for development of renewable energy and electrification. Increased cooperation on a regional level will play an important role along side the political frameworks and goals set on an EU-level for 2030 and beyond to further boost the deployment of renewables in a more cost-efficient way and thus making the appetite for RES sources even larger.

The cooperation can take on many forms, including share of good sites for wind energy. The North Sea has the potential to generate twice as much electricity as the current production from Europe's coal fired powerplants. This also means that countries in e.g. Central or Eastern Europe could install offshore wind in the North or Baltic Sea to meet the EU conditions related to the 32% renewable goal set recently by the EU.

Railway system energy management

By Daniel Krištofík (pictured), Director, Service Department, sféra, a. s.

Sféra, a.s. was founded in 1992, and since then the company has become established in sustainable development on the IT market, with a long-term focus on the sectors of power engineering, transport and industry.

Since its establishment, the company has been focusing on the research, development, supply and implementation of technically-oriented graphic information systems and on the digital processing of cartographic and map works. Its solutions cover the processes of asset management and maintenance management as well as the processes of the life cycle of large technological units owned by big industrial and energy companies. It also covers the processes of investment, construction, and the design of energy networks. Later, this activity was supplemented with the design, supply and support of business information systems for the energy sector and as well as consulting, advice and analyses.

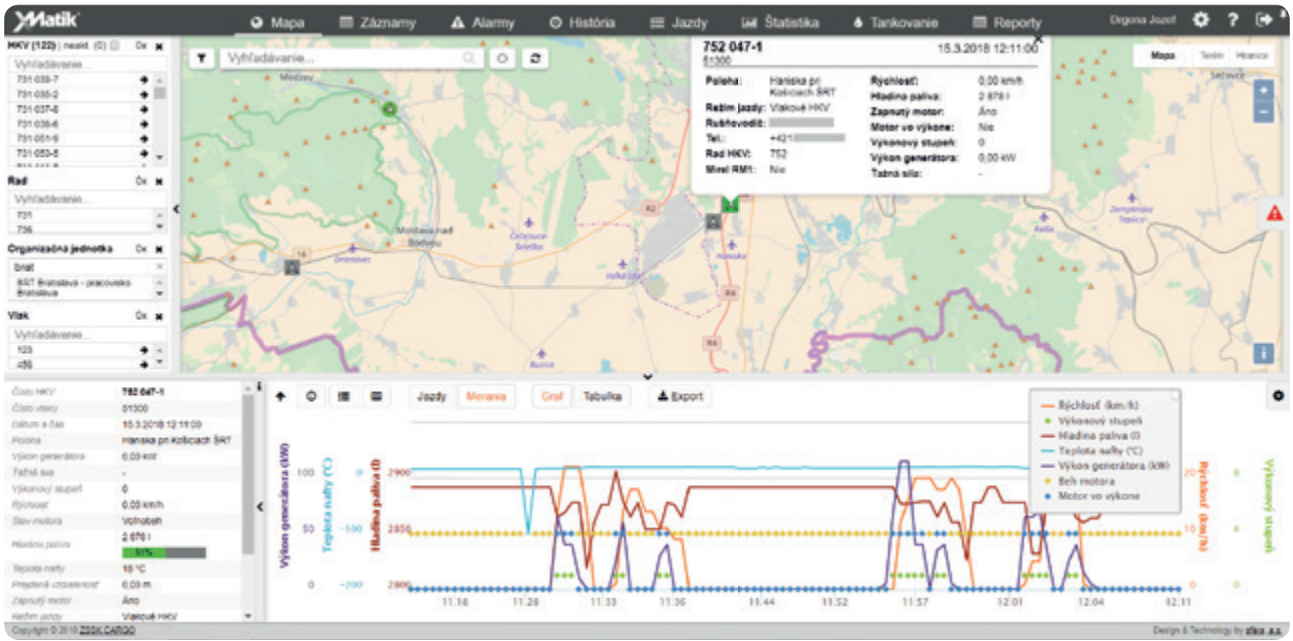
The company aims its research and development at perspective fields of data analysis, smart grids, artificial intelligence (AI) primarily for the sectors of energy, transport and maintenance.

ENERGY EFFICIENCY ON RAILWAYS? LET`S GET DOWN TO IT!

At present, the monitoring and optimisation of consumption of traction electricity and diesel have been an issue which almost every carrier wants to find. Carriers' costs of traction electricity and diesel range from hundreds of thousands to millions of euros a year, depending on the carrier's size. Even a small percentage saving means a significant reduction of the carrier`s costs. sféra, a.s. has been dealing with cost optimisation since 2009. A team of experts has succeeded in developing unique products focused on the solution of cost optimisation and the preparation of data that is necessary to adopt strategic decisions.

Our knowledge comes from practice. At present, an energy control room system has been used by a SR infrastructure manager and the two biggest carriers in the Slovak Republic, Železničná spoločnosť Slovensko, a. s. and Železničná spoločnosť Cargo Slovakia, a. s..

The companies have profited from the system mainly in the following fields:



- Optimum use of a tractive rolling stock (TRS) within a selected traffic route.
- Indication and warning of negative conditions related to the TRS operation.
- Minimising the thefts of traction diesel.
- Detecting anomalies in consumption at the time a new or repaired TRS is put into operation.
- Providing a train driver with instructions for a better TRS operation.
- Providing information in order to compare a planned and an actual consumption diagram for electricity supplier.
- Preparing a diesel consumption plan.

An energy control room does not only deal with the monitoring of consumption, but also with factors that directly affect it, such as the position of a tractive rolling stock (TRS), a train driver`s driving style or extraordinary stops. Thanks to advanced instruments, it is possible to evaluate specific journeys and the whole sets of rounds. For example, we can use the evaluation of train drivers` driving style, where a 20% difference in consumption has -been achieved depending on the driving style.

All the above factors affect total costs and they also can be used for a more effective management of carriers` business activities. Thanks to the instruments that make it possible to evaluate train positioning data by means of GPS, a space for the predictions of TRS or whole trains journeys has been created, resulting in a more efficient transport system.

In standard mode, the system offers the possibility of automatic reporting for groups of workers according to their profession, either for control room staff or for energy, maintenance, and company management staff. In order to inform employees in real time, the system includes an implemented system of alarms and an automatic control mechanism. The system makes it possible to define critical events and persons can be notified by means of e-mail, SMS or warnings within the system.

Forecast of energy commodities consumption as well as optimisation of energy efficiency are trends which European companies seek and sféra is able to support them.

sféra
Grafické informačné systémy

Contact information:

www.sfera.sk
email: dagmar.jarasova@sfera.sk
Innovation Department
obchod@sfera.sk

A new framework for renewable energy in Europe for the coming decade

Sufficient enough to reach the goals of the EU and the Paris Agreement?

By Dirk Hendricks, Senior Policy Advisor, European Renewable Energies Federation (EREF) (pictured)

In the early hours of June 14th 2018, the lead negotiators of the European Commission, the European Parliament and the Council finally managed to conclude a deal on the development framework for renewable energies for the period 2020-2030.

The deal includes many important points which can be beneficial for the further roll-out of renewable in the EU. One key issue was the EU-wide legally binding renewable energy target for 2030 which is now set at 32% of renewable energy in the energy mix by 2030, with an upward review clause by 2023 at the latest.

The renewable energy sector had requested a 45% target to provide a strong political signal for the industry and investors as well as to fulfil the EU's international commitments towards the Paris Agreement of 2015 and live up to the promise of the European Commission "to make the EU the world number one in renewable energies".

This claim was supported by several members of the European Parliament and rapporteur José Blanco-Lopez (S&D) managed finally to include a 35% target in the position of Parliament. In contrast, the Commission's proposal released of late 2016 was astoundingly unambitious due to negative guidance from the Council in 2014.

If the sum of the national contributions of renewables is found to be lower than the overall EU target, gap filler measures are foreseen with the monitoring of the Commission, a mechanism now ensured in the other piece of importance legislation, the Governance regulation.

Next to the establishment of so-called one-stop-shops and streamlined administrative and permit granting procedures for new renewable energy installations, the major innovation of the new Renewable Energy Directive is certainly the clear right and role of European citizens, local authorities, small businesses and cooperatives to produce, consume, store and sell their own renewable energy, without being subject to punitive taxes or excessive red tape. It bans discriminatory measures that some countries introduced to prevent their citizens from participating in the energy transition, such as the Spanish 'sun tax', which dis-incentivised small-scale renewable energy production with high fees and administrative barriers.

The EU has recognized that citizens are active and central players on the energy markets of the future. Increased transparency and better regulation give more opportunities for

> *"It shows that over 264 million European Union citizens, half of the EU population, could be producing their own electricity by 2050."*

civil society to become more involved in the energy system and respond to price signals.

A recent report[1] estimates the number of energy citizens that exist today, as well as how many could exist by 2030 and by 2050, in individual EU Member States and in the EU as a whole. This is the estimation of the potential number of energy citizens, providing the right legislation is in place.

It shows that over 264 million European Union citizens, half of the EU population, could be producing their own electricity by 2050. These energy citizens could be producing 611 TWh of electricity by 2030 and 1,557 TWh by 2050. Therefore, by 2030, energy citizens could be delivering 19% of the EU's electricity demand, and 45% by 2050. This is a significant contribution to achieving the EU's 2030 renewable energy target and moving towards a 100% renewable energy system.

Citizens provide additional investment and activities for the implementation of renewable energy projects. These activities contribute to local jobs and local wealth creation as money for energy stays within the community (instead of paying for energy imports). Their projects contribute to the reduction of energy poverty and to the increase of energy security as neither import nor transport is required. The democratisation of the energy system leads to an increased social acceptance for renewables and to an increased energy consciousness resulting in decreased energy consumption.

Another important part of the Directive relates to support schemes and the organisation of tenders for renewable energy installations. In this recast, Member States keep the right to apply technology specific tenders and provide for alternative competitive bidding procedures or exemptions. In addition, retroactive changes to existing support schemes will be prohibited from 2021 on. This is paramount to secure investor's confidence in renewable energy projects.

The renewable heating and cooling has an indicative target of 1.3 pp of annual increase; the target for renewables in the transport sector has been set for 14% by 2030. It gives encouragement for consumers to stay out of the mineral oil equation. In addition, a sub-target for advanced biofuels of 3.5% by 2030 is also part of the Directive. The new Directive foresees a phase out of palm oil from biofuels by 2030, starting with a freeze on existing quantities of imported palm by 2020. It also includes a freeze on so-called first generation biofuels such as ethanol with an identical deadline.

For the transport sector, a target of 14% of renewable energy by 2030 was set. It gives only moderate encouragement for consumers to stay out of the mineral oil equation. In addition, a sub-target for advanced biofuels of 3.5% by 2030 is also part of the directive. The new Directive foresees a phase out of palm oil from biofuels by 2030, starting with a freeze on existing quantities of imported palm by 2020. It also includes a freeze on so-called first generation biofuels such as ethanol with an identical deadline.

The new Governance Regulation complements the Renewable Energy Directive providing a framework and roadmap for the development of renewables throughout the EU and the EU contribution to the Paris Agreement's objectives. Notably, it requires Member States to provide national action plans which lay out their individual paths to meet

their collective obligations under the Renewable Energy Directive. In addition, the Governance Regulation enshrines the concept of "carbon budget" in European law together with the need to achieve at EU level a net-zero carbon economy in the next couple of decades. It encourages Member States to joint renewable energy development and strategic planning.

Negotiations on the so-called Winter Package might be finalised by the end of 2018 ending with legislation development for a new EU electricity market design. The main challenge within this current Trilogue negotiation will be to be coherent with or even enhance the provisions of the new Renewable Energy Directive and Governance Regulation. Yet, the EU needs to become still more ambitious to fulfil its commitments under the Paris Agreement.

1 CE Delft, 2016. The Potential for Energy Citizens in the European Union, available at bit.ly/energycitizenstudy

European regions innovating on sustainable battery solutions

By Professor Ulrich S. Schubert (CEEC Jena), Jan Post (AquaBattery) and Pirita Lindholm (ERRIN)

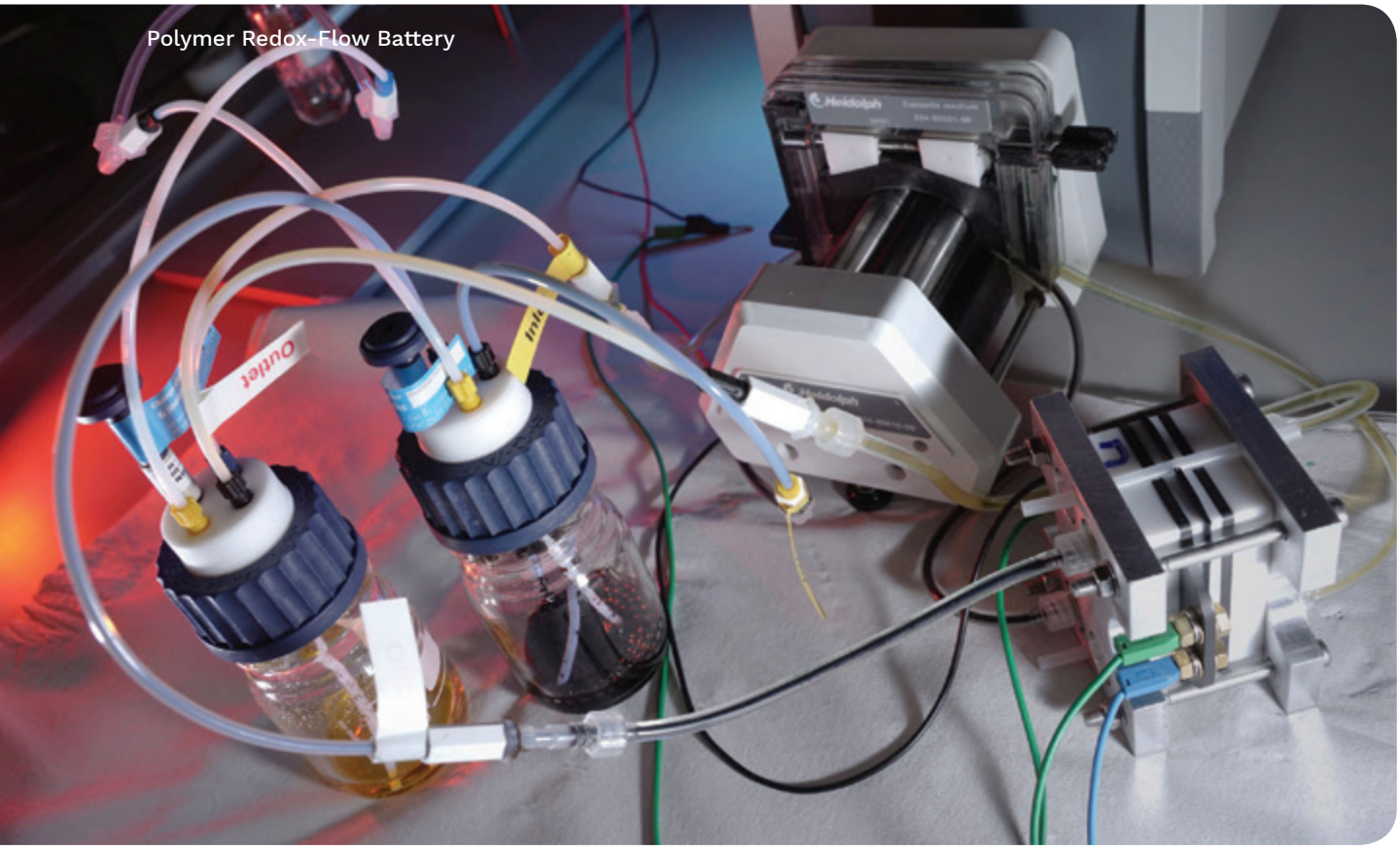
EUROPEAN REGIONS CAN CREATE "OUT OF THE BOX" INNOVATIONS IN ENERGY STORAGE

Clean energy transition, with increasing use of renewable energy and electrification of the energy system, has placed energy storage as a key challenge for the coming years. Traditional storage and battery technologies are developing fast. However, there are many environmental, social, and economic reasons for adopting new and alternative technologies to the current energy storage approaches and products such as resource dependency, pollution, and social challenges.

European regions have a significant role to play in developing innovative solutions, creating new value chains, and opening up markets for sustainable energy storage solutions. This article introduces two innovative, sustainable, and stationary energy storage technologies from two European regions, Thuringia (DE) and Friesland (NL). Their battery solutions are not based on conventional lithium-ion technology, nor use scarce raw materials. What these examples also show is that Europe can take a leading role in sustainable energy storage innovations – if we move fast – and tap into the great economic growth potential of the sector.

POLYMER REDOX-FLOW BATTERIES BY CENTER FOR ENERGY AND ENVIRONMENTAL CHEMISTRY (CEEC) JENA

Current battery technologies are often based on inorganic active materials. The metals used are critical raw materials and access to these resources is anything but guaranteed.

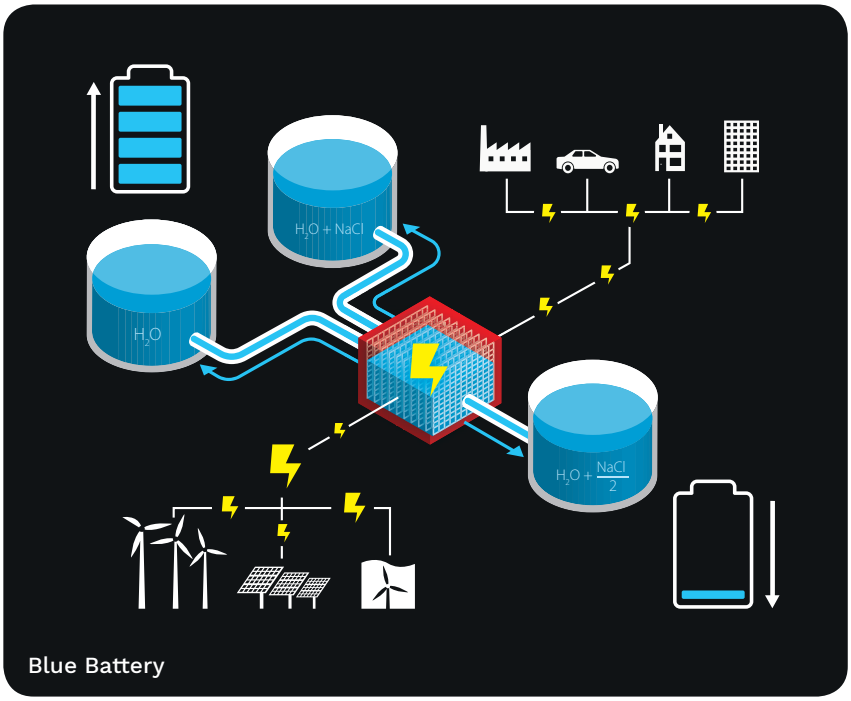

Polymer Redox-Flow Battery

In addition, these compounds can be toxic and are not environmentally benign. Consequently, there has been a steady increase in research on organic active materials for batteries over the last couple of years.

At present, the only available commercial Redox-Flow Batteries (RFBs) technology is the vanadium RFB, which uses vanadium salts as active materials that are then dissolved in concentrated sulfuric acid. These solutions, the so-called electrolytes (anolyte and catholyte) are stored in two separate tanks. For charge and discharge of the RFB, the electrolytes are pumped into an electrochemical cell consisting of two electrodes separated by a membrane (cell stack) where the redox reactions are taking place. The great advantage of RFBs is that the power (i.e. the size of the membrane/cell stack) and the energy (i.e. the size of the storage tank) can be scaled independently. However, the main drawbacks of the existing commercial V-RFBs are the high cost of the active material vanadium which is a critical raw material.

To address this, CEEC Jena has developed a salt water-based polymer to replace vanadium in RFBs. As membranes are then cheaper, the polymer RFBs cost significantly less while also being more sustainable and easy to handle. The polymers (macromolecules) can be charged / discharged (oxidized and reduced). The macromolecules are larger in size compared to the sodium and chloride ions opening up the possibility to utilize size-exclusion membranes (i.e. dialysis membrane).

The possible application areas for polymer RFBs are similar to other flow battery technologies providing many opportunities for applications of different sizes. As an example, CEEC Jena are currently working together on the project brine4power with EWE, a large German electricity producer and provider, where this new and pioneering metal free RFB will be used to operate salt caverns for energy storage, essentially creating the world's largest battery to store green electricity.



Blue Battery

THE BLUE BATTERY

Within AquaBattery – a Netherlands-based spin-off company from Wetsus, European Centre of Excellence for Sustainable Water Technology – a team of eight young engineers and entrepreneurs are collaborating on the development of a novel stationary electrical energy storage system: the Blue Battery. This Blue Battery stores electricity in water and table salt. Electrical energy is used to separate fresh water from salt water during the charging phase, and with the same technology electrical energy is regenerated when fresh water and salt water are mixed during the discharging phase.

The unique selling points of the Blue Battery compared to other stationary energy storage systems are its sustainability, availability, safety, and scalability. Unlike most other grid scale electrical energy storage systems, the Blue Battery does not contain any toxic or scarce materials. It is safe as it has no fire or explosion hazard, and it can be built on every scale (kWh-MWh-GWh) as well as without geographical constraints. The Blue Battery has a very distinct advantage in that the energy storage capacity is very cheap (basically salt water and a reservoir). This means that by adding additional reservoir volume, the energy storage capacity is increased. This characteristic allows to charge and discharge the battery for longer periods of time. Therefore, discharge times of multiple hours to weeks are possible with the Blue Battery which really sets this technology apart from other storage systems.

AquaBattery and its partners are testing the first household-scale (1kW-10kWh) Blue Battery at The Green Village in Delft. Different components, such as membrane stacks, water tanks, and pumps are upscaled and integrated for the first time and they are operated autonomously on a smart battery management system. The aim is to showcase the potential of the Blue Battery in a controllable but realistic environment, and to obtain valuable insights of how it functions within an electricity grid and


The AquaBattery team

in the interaction with the residents. AquaBattery also participates in the BAoBaB project funded by the EU's Horizon 2020 research and innovation programme. The project aims to increase the energy and power density of the Blue Battery further by splitting salt water into acid and base during the charge phase and recombining these back to salt water during the discharging phase.

PLACING SUSTAINABLE ENERGY STORAGE AT THE HEART OF POLICY AND FUNDING PROGRAMMES

New battery technologies need – quickly – further support to move into large scale demonstration. Taking that step requires both setting sustainable energy storage as a key policy priority, as well as dedicating adequate funding to support the necessary innovations. For example, EU initiatives such as the Strategic Energy Technology Plan and the European Battery Alliance (EBA) should support development of stationary and sustainable battery solutions. From the funding perspective, it is crucial to use different funding programmes and instruments in an intelligent way to achieve maximum impact of combining regional, national, EU as well as private sector financing.

Sustainability should be an important driver for Europe when it comes to supporting innovation and new technologies in energy storage. This should also be reflected in the design of the priorities in Horizon Europe through for example a dedicated mission on sustainable energy storage. Achieving the EBA's objective of creating new jobs and re-skilling the European workforce requires further efforts on creating value chains in Europe. European regions are a key partner for achieving this goal. They have innovative solutions to offer that should be further supported and better integrated into on-going and future initiatives.

Further information

https://www.errin.eu/events/energy-storage-vision-2025-can-europe-beat-elon-musk

ERRIN, the European Regions Research and Innovation Network, is a Brussels-based platform that gathers together more than 130 regional organisations from 24 European countries. The network aims to strengthen the regional and local dimension in the EU Research and Innovation policy and programmes. It promotes knowledge exchange between its members, focusing on joint actions and strategic partnerships to enhance regional research and innovation capacities and thereby foster sustainable and inclusive growth all regions.

[1] *Nature* 2015, 527, 78.

Exhibitions & Conferences for South-East Europe

16-18 April 2019, Sofia, Bulgaria

EE & RE

ENERGY EFFICIENCY & RENEWABLES

SMART CITIES

BUILDINGS, MOBILITY & ENVIRONMENT

Save *the PLANET*

WASTE MANAGEMENT & RECYCLING

Early Bird till 1 November

ViaExpo Organizer: www.viaexpo.com

A joined-up approach for ocean energy in the next financial framework

By Andreea Strachinescu, Head of Unit, Directorate-General for Maritime Affairs and Fisheries, European Commission (pictured)

New technologies are now allowing mankind to realise the potential of the 71% of the planet's surface covered by oceans for the clean energy we will need if we are to avoid a climate catastrophe.

It has been estimated that wave energy can provide 29,500 TWh/year for the planet as a whole, 4,100 TWh/yr of which is in Europe. Tidal energy, either from the difference in level of high and low tide (tidal range) or the horizontal flow (tidal stream) can generate 106 locations with a strong tidal stream potential in Europe, which have been identified, together offering 48 TWh/yr. Approximately 15% of the total solar energy falling incident on the oceans is retained as thermal energy and stored as heat in its upper layers. Thermal energy conversion (OTEC) can take advantage of the temperature difference between this upper layer and cooler waters beneath. Estimates of the total potential global OTEC energy resource that could be extracted without having a major impact on the thermal characteristics of the world's oceans range between 30,000 and 90,000 TWh/year.

The research and development necessary to harness these resources is now taking off within a European blue research community that is providing insights and technologies to move forward across a whole spectrum of challenges. The EU has played a major role in supporting this research, with approximately €350 million a year from successive Framework Programmes. All of this is supporting a world-leading European industry. Europe already leads in cruise shipping and dredging vessels. Many leading companies in underwater technology have developed round the petroleum fields of the North Sea. Much propulsion or navigation equipment in Asian shipyards comes from Europe. Now Europe is at the forefront of offshore renewable energy – floating wind farms, tidal energy.

But, we cannot stand still. We need to build on this. Business innovation in the areas of offshore energy, aquaculture, biotechnology, data services, seabed activities builds on insights gained in research. We need to join everything up. The challenges are similar and lessons learned in one

"The research and development necessary to harness these resources is now taking off within a European blue research community that is providing insights and technologies to move forward across a whole spectrum of challenges."

domain can be applied in another. Underwater robotics, lightweight materials and anti-biofouling coatings are reducing the cost and increasing the reliability of offshore installations for both renewable energy and marine transport. Understanding how DNA affects species characteristics is already revolutionising pharmaceuticals and fish farming. It promises to deliver biofuel from algae without diminishing precious land or freshwater resources. This was recognised in the Commission's 2014 Communication on Blue Innovation.

In the next Multi-Annual Financial Framework setting out the Commissions' proposal for spending in the years 2021-2028, presented in early May this year, the Commission has indicated that research and innovation will be boosted compared to the present Horizon2020 programme, both in absolute terms and as a proportion of the total. Within this programme, the Commission is looking how to stimulate and increase cross-sectoral cooperation between the different strands of the marine and maritime domain.

And it is looking at improving coordination between EU programmes and national programmes. For example dialogue and collaboration for Europe's energy transition is structured through the Strategic Energy Technology (SET) Plan. According to the SET Plan, clean energy investments on research and innovation from the private sector are estimated at 77% of the total, while investments from national budgets are at 18% and the EU level support at 5%. This shows the importance of creating synergies and of triggering the private investments that will contribute to reach our energy and climate objectives and promote EU competitiveness.

All this is leading to increased pressure for sea space. Unlike on land, different economic activities, mussel farming and wind farms for instance, can share the same waters; The EU now obliges authorities to draw up plans defining what can and what cannot take place in each area. These outline permissions then reduce the time taken for licensing and thus reduce risk.

Then deciding where to deploy these new structures requires knowledge of parameters such as seafloor topography, sediments, waves and salinity. Ensuring that the environmental impact is with acceptable limits requires knowledge of the distribution and diversity of marine life. The EU's European Marine Observation and Data Network (EMODnet) has brought together marine data held by hundreds of organisations into seamless digital seabed maps that reduce the time and effort needed to deliver these plans and assessments. This

Better communication and joint planning are not only needed across the different research themes but also between industry, education and research. Knowledge and Innovation Communities (KICs) have been very successful in bringing these sectors together in the energy domain. The European Institute of Technology has proposed a new one in the marine and maritime area. This would deliver the cross-fertilisation, expertise, knowledge and ideas that industry needs to stay ahead of the game by providing educational courses in entrepreneurship, acceleration of promising ideas and joint projects between industry and academia.

The last piece of the jigsaw is money. Financial institutions and fund managers are now looking at the opportunities. Many see that in a planet with increasing population and diminishing terrestrial resources, investing in the blue economy will, in the long term, be a good financial

bet. The European Investment Bank and the European Fund for Strategic Investment have already helped the offshore wind energy industry reach a point that it is competitive with dirtier fossil fuel technologies. They are now looking at some of the smaller companies that provide services all across the blue economy and that will drive the innovation needed to realise the promise of the ocean.

Ports as spiders in building the sustainable transport and energy web

By Isabelle Ryckbost (pictured), Secretary General, European Sea Ports Organsiation

In the next weeks and months, European policy makers will be intensively discussing at different levels and in different fora the budget for the next financial period 2021-2027. The Commission tabled its general budget proposal, the so-called Multi-Annual Financial Framework, on 2nd May, and clarified which envelope it is willing to reserve for Transport. Beginning of June, the Commission issued its "Connecting Europe Facility II", the proposal outlining the priorities for financing transport, energy and telecom projects for the next years.

Considering the budget constraints that result from the Brexit and the many different policy challenges with which transport has to compete, I think we should embrace the €24.1 billion that have so far been reserved for transport. It remains to be seen however how the new additional envelope of €6.5 billion that has been foreseen for making Europe's transport infrastructure better prepared for the movement of military transport and assets will be spent. Given the "dual use" criterion, whereby only investments that serve both military and civil purposes will get support, we must see to what extent this budget can really be considered as an additional 20% for transport investments.

As concerns priorities, the Commission proposes to dedicate 40% of the transport budget to horizontal priorities of which, investments in alternative fuel infrastructure and projects enhancing the resilience of transport infrastructure to climate change are a substantial part. Moreover consistency with the Union and national energy and climate plans is the common thread through the new Connecting Europe facility proposal. Like all other lines of the European budget, 25% of the CEF expenditures must support climate objectives.

European ports are facing huge investments: The study "*The infrastructure investments and financing challenge of European ports*"[1] commissioned by ESPO, reveals that ports' investment needs amount to €48 billion for the coming ten years. Even if investing in basic infrastructure remains a first priority, sustainability is becoming an increasingly important driver of port investments: the decarbonisation agenda, building resilience to climate change, the overall greening of vessels, mitigation of air emissions, increasing pressure from the city obliging the port to move further out and greening of hinterland connections are all high on the

investment lists of European ports.

In view of the limited budgets and the huge investment needs across all modes, the Commission is putting a lot of effort in directing ports towards innovative financing instruments.

As ESPO we are convinced that these new financial instruments can play a role but we are equally convinced that many of the environmental investments in ports are having a high societal value, while only a limited and slow return on investment. For these investments, grants remain vital. The investments in On Shore Power Supply are a good example. Investing in OPS, means for many ports, not only investing in the needed equipment on the quay side but also investing in a sometimes costly connection to the grid. All together a good investment and a good way to lower shipping emissions at berth and to make maritime and port operations more acceptable for the people around the port. But it takes two to tango: the ships must use the installations. Using OPS costs more than burning fuel on board: land-based energy is taxed whereas ship-generated energy is exempted. And even without taxes, there seems to be a price difference in favour of the fuel used on board of ships.

We therefore hope that ports can benefit to a larger extent from support from the Connecting Europe Facility in view of lowering their environmental footprint and accommodating the greening of shipping.

But there is more. We believe that it is time to recognise the role European ports are and can play as nodes of energy, industry and blue economy, which can make of European ports the ideal stage director for developing port areas into nodes of sustainable growth. So far Europe's Transport Infrastructure policy is very much geared to prioritising cross-border projects. Ports risk to miss this boat since, situated in one Member State, they are not perceived as cross-border. Ports however do not only have a huge cross-border impact but also an important cross-sector impact linking transport, energy, industry and bleu economy. In view of Europe's decarbonisation agenda, it is time to see how ports can be a spider in the web for guiding Europe through the energy transition.

“It is time to recognise the role European ports are and can play as nodes of energy, industry and blue economy, which can make of European ports the ideal stage director for developing port areas into nodes of sustainable growth.”

[1] https://www.espo.be/media/Port%20Investment%20Study%202018_FINAL_1.pdf

Shipping's green transition

The European Union bank is investing millions to clean up the maritime industry and switch to alternative fuels

By Chris Knight (below), Senior Editor, European Investment Bank

Maritime shipping can be dirty, dangerous and competitive. Many vessels burn a heavy, high-sulphur fuel that creates a lot of pollution. The water stored in tanks to balance ships can cause trouble when dumped back into the sea. The shipping sector is inherently risky, involving highly leveraged, mobile assets, so obtaining financing is difficult. When the economy starts to tank, so does the shipping industry.

Transport is one of the most important ways Europe can increase economic growth and competitiveness. The shipping sector of transport often struggles to find financing that will help it expand, remain competitive and transition to green technology. European shippers need better financing options, because good roads, trains, airways and waterways enable the free movement of people and goods and ensure better lives for everyone. Better mobility achieves social cohesion, economic growth and employment.

The European Investment Bank is injecting hundreds of millions of euros into the maritime sector to build better ships, make vessels friendlier to the climate and improve the industry's reputation. The Bank is trying to help many areas of maritime shipping, including inland waterways and short-sea shipping. It also is actively seeking ways to encourage alternative fuels.

CLEANING UP THE SEAS

For the past two years, the EIB has been making key investments to help the maritime sector switch to more sustainable operations. One way the Bank is helping: a new €750 million Green Shipping Guarantee Programme that encourages environmentally friendly projects to improve air quality (reducing greenhouse gasses and other harmful exhausts) and to make the seas and ports cleaner.

The programme is an umbrella project of the bank's European Fund for Strategic Investments, which was set up to fill financing gaps across Europe. This new shipping programme is also supported by the Connecting Europe Facility, an EU funding instrument that has been promoting growth, jobs and competitiveness for many years.

As the shipping industry faces significant regulatory pressure to clean up its emissions, ship owners have shown a lot of willingness to improve their environmental performance. But they face many challenges. First, investing in green technology is expensive and often hurts profits and competitivity. Second, many banks stopped lending to the sector after the 2008 financial

crisis and are still very reluctant to finance shipping companies today.

"The investments in shipping are important for the climate, but on the financing side, new environmental regulations are causing significant increases in capital investment for shipping companies," says Michael Finucane, a loan officer at the EU bank. "So it is important that the EIB is there for the sector."

A FINANCING GAP

The EIB is doing its best to fill this financing gap. The Green Shipping Programme, for example, is supporting the construction of new ships and the retrofitting of older vessels with sustainable technologies, such as cleaner alternative fuels, better ballast water handling and more energy efficient equipment.

"I think it's no secret that the shipping sector is a major contributor to CO2 emissions," says the EIB's president, Werner Hoyer. "Climate action is one of the EIB's top priorities, and this type of green shipping financing is an incentive for ship owners to consider doing things differently."

Recent examples of the EIB's commitment to the maritime sector include:

- a €50 million loan to help Finnlines upgrade its hulls and propellers and to add scrubbers that eliminate toxic fumes.
- €75 million loan guarantee to help the Irish Ferries company build an environmentally friendly ferry to carry freight and as many as 1,885 passengers and crew. The ship will have a more efficient motor and a cleaner exhaust, making sure it will meet new EU emission standards.
- two €150 million loan guarantees with ABN AMRO in the Netherlands to encourage lending that helps shippers reduce emissions and become more fuel efficient.
- a €150 million green shipping guarantee with Société Générale in France.
- a €300 million green shipping deal with ING in the Netherlands.

THE VALUE OF GREEN SHIPPING

The shipping industry appreciates the EIB's help because ship financing is not easy, but to make matters worse, it is tough for shipping companies to invest in green renovations because their clients are often unwilling to pay the higher costs that come with transporting goods on more environmental friendly ships.

"Many companies that transport goods on ships do not yet recognize the value of green shipping, and their unwillingness to pay for the extra costs is not conducive to green investments," says François Gaudet, a senior loan officer at the EIB.

The Bank is constantly open to new shipping investments and always trying to engage with maritime organisations, ship owners, shipyards, governments and commercial banks to improve the investment climate. It's important that we reach out and encourage discussions in many corners of the shipping industry to ensure both economic growth and environmental sustainability as the sector makes the green transition.

Contact information

Chris Knight
Tel: +352 4379 22000
Email: :c.knight@eib.org

European Investment Bank

Recharging Hydropower in Europe

By Hege Brende, Executive Director HydroCen, NTNU, Ole Gunnar Dahlhaug, Professor, NTNU and Arne Nysveen, Professor, NTNU

Renewable energy is a hot topic in Europe. EU has ambitious targets to reduce its greenhouse gas emissions by 80-95% by 2050. Billions are being invested, and expectations are sky high. In this scenario, what is the role of hydropower?

In recent years, we have seen massive deployment of wind and solar, paving way for a renewable energy system in Europe. Still, at present, large parts of Europe depend on coal, gas and nuclear power to deliver necessary electricity. Further, the implementation of wind and solar presents new challenges to the energy system; these technologies only produce electricity when the sun shines and the wind blows, but meteorological conditions does not necessarily coincide with the needs of grid system operators, industrial consumers or households.

As a renewable energy source, hydropower has a unique ability to store energy, and produce electricity, on demand.

A VALUABLE TECHNOLOGY

Good regulation is a requirement for stability and supply in all energy systems, and there is an increasing challenge to manage and provide necessary flexibility in a renewable energy system. Organisations such as IEA, NREL and EURELECTRIC

have investigated future needs for flexibility to maintain a secure, renewable energy system. A general conclusion is that hydropower, due to its quick response time and good ramping capabilities, represents a very important asset for the system operator.

Hydropower has been a reliable energy source for over a century and often regarded as a 'conventional' technology. Yet, hydropower is 100% renewable and utilises over 90% of the potential energy of water, where solar cells and wind turbines (and coal) have an efficiency of 15-40 percent. Hydropower plants have significantly longer lifetime with 60 years and upwards. Hydropower can be regulated and stored in reservoirs, and is able to deliver very quick response on production and power for balancing and ancillary services. In this respect, hydropower is a key player for development of more renewables in Europe, uniting high flexibility with new technologies.

NEW NEEDS – NEW RESEARCH AND INNOVATION

At the Norwegian Research Centre for Hydropower Technology – HydroCen , the main objective is to ensure future value creation from one of the most efficient renewable energy sources. For more than a century, Norway has developed its hydropower system to deliver our entire domestic electricity demand; industrial, commercial and households. Thus, Norway has led the way for hydropower innovations, excellent engineering competence, and in recent years, environmental design.

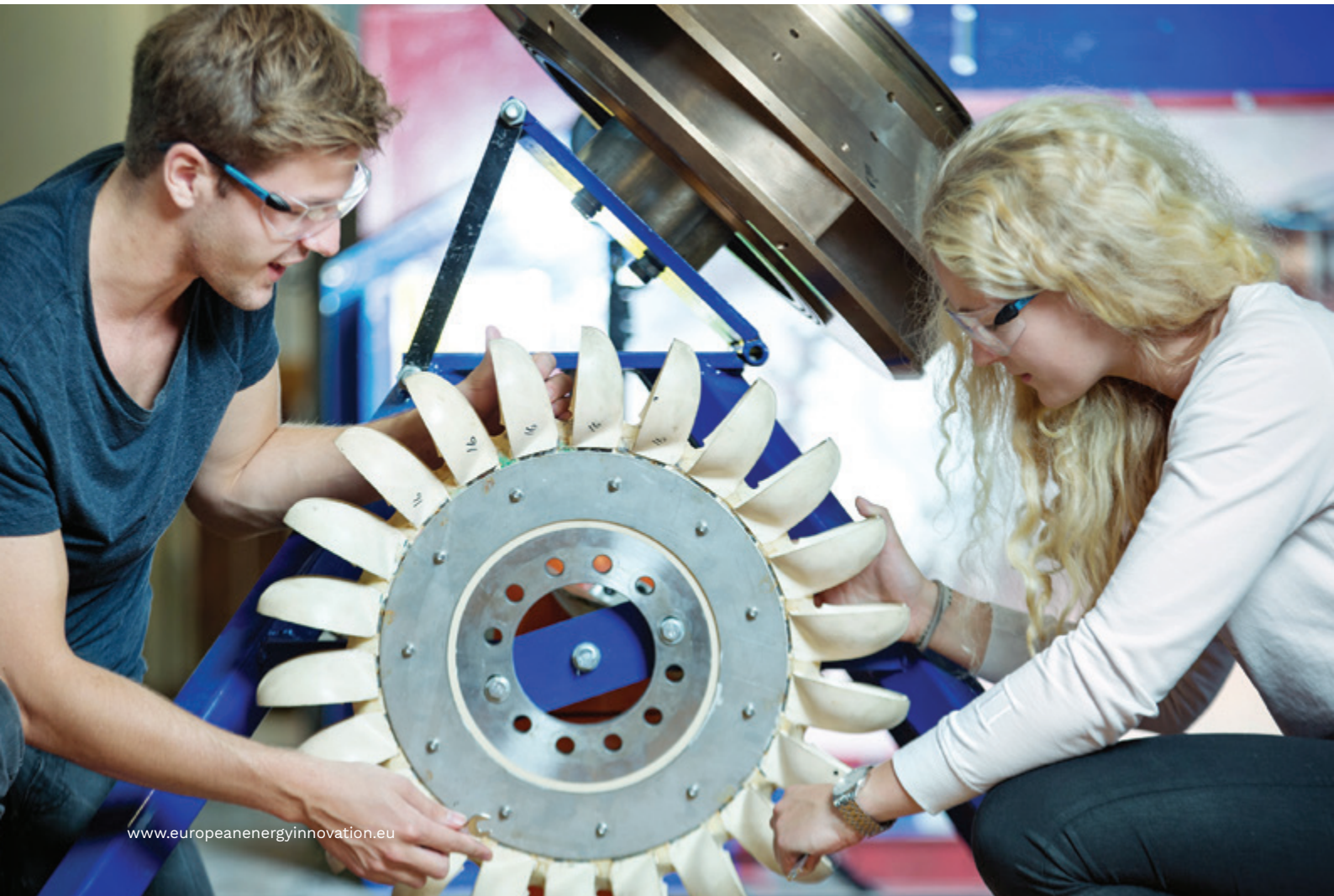
Still, the future energy system presents new challenges. Historically, hydropower plants were typically designed to operate with stable loading over longer periods (seasons). However, load requirements become increasingly fluctuating. This stresses the components; it reduces lifetime and increases maintenance costs.

Through new research, we are able to develop the technology necessary for hydropower plants to operate in tune with future market needs, grid requirements, environmental constraints and water management regulations. In order to achieve this, we address the system across disciplines: dams, intakes, tunnels; turbine and generators; market and services; environmental design.

THE INNOVATION POTENTIAL

Innovation requires connection between theory and application. In HydroCen we have gathered a partner consortium that covers the whole value chain, from basic research to tech developers and consultancies.

One pressing topic is variable speed operation of turbines. The



aim is to enable wider operating ranges, faster ramping rates and longer lifetime. By effective use of variable-speed operation, single-regulated Francis turbines can become double-regulated machines, with wider efficiency curves and increased operating range. Variable-speed turbines also have significant potential for improvement in quick response for power output variations, thus utilising the flywheel effect from the rotating masses.

In combination with modern power electronic converter technology, hydropower plants can provide a set of ancillary services, such as frequency control, reactive power compensation, oscillation damping and increased transient stability to other units in the power system.

Converting existing hydropower plants to pump-storage power plants enable optimal adaptation to markets variations and demands.

Just replacing a Francis turbine with a pump-turbine gives cavitation problems in pumping mode. This can be resolved by using a booster pump. The design of such a pump in combination with the pump-turbine is now being explored; it significantly reduces investment costs and optimises use of existing facilities compared to a full refurbishment.

Furthermore, more flexibility demands more intermittent operation of the plants, without increase in operational costs. Hence, condition modelling and lifetime assessment becomes important issues for research: detailed fatigue modelling of turbine runners, optimal operation of a fleet of aggregates, monitoring of in intakes and tunnels.

Effects of climate change is a pressing issue, and the possibility for water management in regulated rivers has given hydropower a new role related to flood dampening and drought control. Still, hydropower production affects local environment, and increased flexible production in the future could change the conditions in the watercourses. Our concept 'Environmental Design' encompasses a project portfolio that develop specific tools and methods to mitigate impacts and secure good environmental standards in regulated rivers, e.g. solutions for two-way fish migration, fish-friendly intakes, improvement of spawning habitats, solutions for DNA-mapping and biodiversity monitoring.

HYDROPOWER AT THE CORE OF THE EUROPEAN ENERGY TRANSITION: THE ENABLER FOR A RELIABLE RENEWABLE ENERGY SYSTEM

Reduction of GHG-emissions is not optional: we do not have choice in order to meet the growing demand for electricity in Europe and in the world. A full renewable energy system is a huge part of the answer to this.

In order to achieve this mission, one single technology is not sufficient. The way forward is a basket of renewable technologies, with different capabilities and applications.

In this context hydropower is an existing system of very high value, both for industries and society: the maturity of the technology, the invested assets and the comprehensive knowledge base is a true vantage point, where value creation from innovation are highly realistic and potentially very profitable with the right incentives and boundary conditions. Hydropower is at the core of the European energy transition: its capabilities enables our future renewable energy system.

Facts about HydroCen

HydroCen
NORWEGIAN RESEARCH CENTRE FOR HYDROPOWER TECHNOLOGY

Norwegian Research Centre for Hydropower Technology - HydroCen

The main objective is to enable the hydropower sector to meet complex challenges and exploit new opportunities through innovative technological solutions. HydroCen is a Centre for Environment-friendly Energy Research (CEER). The centre is funded and established by the Research Council of Norway. In addition, HydroCen has about 35 national and international financing partners from industry. The Norwegian University of |Science and Technology (NTNU) is the host institution with SINTEF Energy and the Norwegian Institute for Nature Research (NINA) as main R&D partners.

www.hydrocen.no

Paving the way to sustainable port management

For centuries, ports have been the gateways to the world. As bridges for wealth and growth, ports can be meaningful for a region. Efficient logistical processes require the constant and long-term expansion of port infrastructure. To act and think sustainably is of central importance to our company.

Our responsible handling of scarce resources, the reduction of CO2 emissions ashore and at sea, as well as the creation of good and safe working conditions for our employees and the development of our ports in line with market requirements is geared toward the future. A sustainable development will create additional benefits for all – our ports, our stakeholders and the environment – and thus has to be managed strategically.

Figure1: Locations of Niedersachsen Ports

INTEGRATING SUSTAINABLE VALUES WITHIN THE PORT GROUP

Niedersachsen Ports (NPorts) is one of Germany's largest operators of public seaport infrastructure and an important link in the maritime value chain. NPorts provides the port infrastructure (such as locks, road and rail grids, quay facilities, and lighting systems) for the maritime shipping and logistics industries in 15 ports in Niedersachsen.

Since the port group is a part of the maritime logistics chain, we need to take responsibility for our actions and keep the social and environmental effects in mind that arise from the operation, the development, and the marketing of our port infrastructure.

To think and act sustainably is engrained in our business activities and an integral part of our corporate culture. This awareness is at the heart of our corporate mission statement:

- Taking over responsibility for the region
- Creating sustainable values
- Creating a encouraging working environment

THE NEED OF A STRATEGIC APPROACH TOWARDS SUSTAINABILITY

The success of our previous

> *The success of our previous projects and measures, motivates us to approach sustainability in an even more strategical manner.*

Figure 2: The sustainability strategy of Niedersachsen Ports

Sustainability Strategy of NPorts 2018–2025

Action field goals	Operational goals until 2025	Selected measures
CLIMATE & AIR "We make a proactive contribution towards climate protection and towards cleaner air."	• Compared to 2017, the direct greenhouse emissions are reduced by 30%	• Improve energy efficiency for our facilities, buildings and the port lighting • Intelligent energy controlling & management systems for own facilities • Raising the amount of renewable energies for own facilities and buildings • Development of joint solutions in cooperation with maritime and port related industries for the deployment of alternative energies and innovative technologies within the port
EMPLOYEES & SAFETY "We promote the development of our employees and provide an attractive and safe work environment."	• Compared to 2018, the average number of hours for advanced training and continuing education is up by 10% • The accident rate remained below the average number for comparable industries	• Implementation of a staff development concept • Further development of measures for the work-life-balance of employees • Continuation and expansion of the corporate health and safety management • Further development of gender equality measures
NATURE & RESOURCES "We are managing our ports responsibly and we are using our resources in a smart and sparing way."	• Four environmental projects have been put into practice • Compared to 2017, the waste separation ratio for our wastes has improved by 10%	• Consideration of environmental criteria during planning, construction, and maintenance of facilities and buildings to keep environmental intrusions to a minimum • Development and implementation of sustainability criteria for the purchasing process and for the realization of projects • Execution of a proactive natural habitat management on our surface areas and raising awareness for the protection of the environment • Optimization of the waste management systems • Creation of the right conditions for an ideal disposal of ships' wastes
CUSTOMERS & THE REGION "We are expanding our ports in a customer-oriented manner and we raise the awareness for the added values that our ports create within the region."	• Compared to 2018, the customer satisfaction has increased • Compared to 2017, the total handling tonnage has increased by 10%	• Optimization of customer management • Introduction of a quality management system • Further development of risk management • Promotion of cooperation with regional stakeholders

projects and measures, motivates us to approach sustainability in an even more strategical manner. A sustainable orientation is not only associated with resource and cost savings; it offers the opportunity to position our port locations as future-oriented logistics hubs in Europe and to identify and implement innovation potential. The investment in more eco-friendly and more efficient technologies, or the initiation of measures to motivate our employees will result in tangible benefits. We can gain benefits from acting sustainably and it is our answer to global future challenges, such as the enduring climate change, the increased

In cooperation with our employees, customers, politicians and other stakeholders, we have developed four major action fields and sustainability goals.

scarcity of natural resources, environmental pollution and changes in demographics.

SETTING CONCRETE GOALS FOR A SUSTAINABLE PORT DEVELOPMENT

In cooperation with our employees, customers, politicians and other stakeholders, we have developed four major action fields and sustainability goals. With our action fields we focus on areas, where our contribution towards a sustainable development can be especially effective.

The action fields are important corner stones of the sustainability strategy of Niedersachsen Ports and address economic, social and ecological goals. The concrete goals help us to monitor and manage the development, and at the same time they provide orientation to our internal and external stakeholders regarding the future development of our port group.

In order to reach our sustainability goals for each action field, specific action plans were developed that consist of different measures.

SUCCESS FACTORS OF A SUSTAINABLE PORT DEVELOPMENT

There are a number of success factors that support us during the initiation and implementation phases of our measures and help us reach our stated goals. They all cause an effect on a number of action fields and must therefore be handled proactively:

• COOPERATION

We believe that partnerships and cooperation (with other ports, ship owners, port related companies and companies in the hinterland) are key to finding the best approach to effective solutions. Cooperations not only enable us to exchange know-how and experience, but also to benefit from new and valuable perspectives. In addition, risks and costs can be shared among several partners. A good example is the INTERREG project DUAL Ports where ports work together to find measures and strategies for tackling climate change.

• MANAGEMENT SYSTEMS

We are developing a corporate-wide sustainability management system to meet our sustainability goals. A systematic approach supports us in planning the right measures, implementing them in our ports, and verifying their success.

In addition, we are planning on using various management systems, such as the port-specific environmental management PERS (Port Environmental Review System), the Quality Management System, and our Risk and Energy Management System.

• INNOVATION

We proactively strive to find progressive solutions today for issues that may arise in the future. We actively promote innovation and sustainable solutions – by participating in research projects, by testing new technologies, or by setting up pilot projects – thus co-creating the future of the maritime economy.

Sustainable development does not happen overnight. It requires a long-term coordinated process and the active participation of employees. Sustainability must be reflected in the daily thought processes, actions, and within the decision processes of employees. If we pay attention to these factors, we can reach our ambitious goals and secure providing future-oriented, responsible and by that attractive port locations for our customers.

Contact information

Niedersachsen Ports

Dr. Matthäus Wuczkowski

Sustainability Management

Niedersachsen Ports
GmbH & Co. KG
HQ, Hindenburgstraße
26–30 26122 Oldenburg

Tel: +49 441 35020 613
Fax: +49 441 35020 999
E-Mail: mwuczkowski@nports.de
Web: www.nports.de

ENERGY STORAGE Global Conference

POLICY TECHNOLOGY MARKET

Energy Storage Global Conference

24 - 26 October 2018
Hotel Le Plaza, Brussels

THIS IS YOUR CHANCE TO ATTEND THE THIRD ENERGY STORAGE GLOBAL CONFERENCE!

The ESGC 2018 offers a unique opportunity to industry, researchers and policymakers to exchange views on key issues for the storage sector.

Day 1
WHAT WILL BE THE NEXT BREAKTHROUGH TECHNOLOGY?

Day 2
DISCOVER MORE ABOUT THE FUTURE LEGAL FRAMEWORK

Day 3
LEARN FROM SUCCESSFUL BUSINESS CASES

www.esgc.org

Follow @ESGlobConf on Twitter!
For more information please send an email to events@ease-storage.eu

Sponsored by

EDF

IBERDROLA

35th EU PVSEC 2018

35th European Photovoltaic Solar Energy Conference and Exhibition

The Innovation Platform for the global PV Solar Sector

24 - 28 September 2018

SQUARE - Brussels Meeting Centre
Brussels, Belgium

www.photovoltaic-conference.com • www.photovoltaic-exhibition.com