

REVOLVE



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RENEWING ENERGY





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Energy



SUSTAINABLE
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13-17 June 2016

Revolve Magazine:



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Q&A

Maxime Bureau, 3M, Director, Government Affairs, Europe



Engaging consumers in the energy transition

On the eve of EU Sustainable Energy Week, REVOLVE met with Maxime Bureau, who heads the Government and Public Affairs team of technology giant 3M. How does 3M see the EU's energy transition? And what role is 3M playing to move towards a sustainable and low-carbon future?

How can we address climate change and make the energy transition a reality?

To fight climate change we need what I like to call the 3 M's of COP21: Mandate, Mechanics and Market.

First, we need a clear and global political mandate in the form of a strong agreement on the joint fight against climate change. The Paris Agreement is a crucial step in this regard.

Second, we need to get the mechanics right. Governments around the globe must develop legislative and regulatory rules that incentivize the reduction of greenhouse gas emissions. This is where the EU's Energy Union comes in and on which we need to make progress.

Third, the mandate and the mechanics must allow the market to produce the technologies, services and products which are needed to tackle climate change. This is where 3M technology helps to power a more energy efficient, low carbon and interconnected Europe.

Can you give an example of what 3M is already doing?

Energy efficiency and heating and cooling are high on the EU agenda. Our 3M window films help Europeans to save energy for cooling their homes. This provides more

We have cut our greenhouse gas emissions by 64% since 2002.

comfort and saves up to 30% of their cooling costs.

A second example is our solution to help manage the growth in renewable energy in Europe. With the increase in renewables, the energy grid is experiencing a shift from predictable generation to variable generation. 3M Sensored Cable Accessories help avoiding grid congestion by allowing a cost-effective, simple and fast upgrade of existing network stations. They provide utilities with highly accurate data and offer them real possibilities to control and improve the management of their electricity distribution..

A third example is related to interconnection. 3M has developed a solution to maximize the capacity of existing power lines to make sure Europeans have the electricity they need, when they need it. The major benefit is that 3M overhead transmission conductors help to double the capacity of an existing power line without building new towers.

What else is 3M doing when it comes to sustainability?

At 3M we have a rich history of setting ambitious goals and delivering them. We made our first formal environmental commitment 40 years ago with the launch of the Pollution Prevention Pays Initiative. We have continued to create challenging goals – and to achieve successful outcomes –

ever since.

We have already taken dramatic steps to reduce our own greenhouse gas footprint. We have cut our greenhouse gas emissions by 64% since 2002. These reductions prevented more than 140 million tons of greenhouse gases from entering the atmosphere.

We do not plan to stop there. 3M wants to go further with a new set of commitments to be achieved by 2025:

- Improve energy efficiency by 30%.
- Increase the use of renewable energy to 25% of our total electricity.
- Cut greenhouse gas emissions to at least 50% below our 2002 baseline, while growing our business.
- Help our customers reduce their greenhouse gas emissions by 250 million tons of CO2 equivalent emissions through use of 3M products.

In addressing climate change and the energy transition, our approach at 3M is that Science is just Science until you make it change the world. 



More than 8.1 million people worldwide are now employed by the renewable energy industry – a 5% increase from last year – according to the International Renewable Energy Agency (IRENA).



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Cover image: Floating solar panels, Rotterdam.
Source: Branko de Lang



A new deal for Europe's energy transition

Writer: Dominique Ristori

Energy is affecting all of our economies and 100% of our populations day and night. It plays a key role for our security, our competitiveness, but also our environment and comfort of life.

In the light of the on-going Russia-Ukraine tensions, European energy security cannot be taken for granted and at the same time, with the liberalisation of the energy market, ambitious climate and energy targets, and new technologies we are moving towards a more decentralised, sustainable, and smarter power system.

In this rapidly evolving landscape, our main goal is clear: We need to provide Europe's citizens and businesses with the secure, sustainable, and affordable energy they need.

Adaptations, notably of the internal market, are necessary but a fundamental change in the role consumer play in the market is also indispensable, supported by the regulatory framework but also facilitated by new technologies. These are also the main tasks of the Energy Union.

Last year in February, the Commission adopted its Energy Union Framework Strategy built around five dimensions: Energy security, solidarity and trust; the internal energy market; energy efficiency as a contribution to the moderation of energy demand; decarbonisation of the economy; and research, innovation and competitiveness.

But in 2015, we have not only defined a long term vision, we have also started implementing it: In July, the Commission came forward with the first deliverables, in particular a legislative proposal for ETS reform, a proposal for a framework legislation on Energy Labelling, as well as a consultative Communication on energy market design and a Communication on a "new deal" for energy consumers.

The overall aim of the "new deal" for energy consumers is to give consumers the tools they need to be active participants and enable them to control their consumption, lower their bills and benefit from new smart energy technologies.

This highlights the need to better connect the retail and wholesale energy markets in order to give consumers access to flexible tariffs. But it also means allowing them to benefit from new technologies to control their energy consumption. Consumers should be able to react to energy prices, and decide where and when to consume energy. Using smart grids and home energy management systems to intelligently manage the energy consumption and costs will not only benefit energy consumers, but will help modernise our energy systems while creating growth and jobs.

Furthermore, rapidly falling technology costs mean that more and more consumers could reduce their energy bills by using technologies such as rooftop solar panels or heat pumps. In this perspective, we need to put the necessary enabling legal framework in place.

Later on, in November, the Commission came forward with the first annual State of the Energy Union, assessing the first results of delivering on the Energy Union. It included one very important message: If we

want the on-going energy transition to be successful, it has to be consumer-centred but, very important, also socially fair.

The fact that in 2014, one in every ten EU citizens felt being unable to keep their homes warm shows that action is needed.

In that context, the European Parliament voted successfully for the report, 'A New Deal for Energy Consumers' (Griffin report) on May, 25 2016. It calls for the end of termination fees when switching to cheaper suppliers, simplified energy bills, guidelines to ensure suppliers notify customers when cheaper tariffs exist and for affordable energy to be a basic social right.

The Commission agrees with the Griffin report that energy efficiency measures are key for addressing energy poverty.

The Commission is already working to create the appropriate framework for decentralised generation and self-consumption of renewable energy in the Market Design Initiative and in the revision of the Renewable Energy Directive foreseen for the end of the year, taking of course into account the cost-benefit.

Moreover, the Commission will present later this year an Energy Efficiency package including the revision of the Energy Efficiency Directive (EED), the Energy Performance of Buildings Directive (EPBD) and a Smart Financing for Smart Buildings

initiative. Buildings are the largest energy consumer and crucial also for boosting the construction sector, economic growth and jobs.

2016 is a key year of delivery for the Energy Union. At the end of the year, the Commis-

sion will have proposed a set of key initiatives that will define the energy landscape for the next years. The place of consumer will be more than ever at the heart of its policies. 

Dominique RISTORI, Director General Energy

Dominique Ristori has been working in the European Commission since 1978 where he has held several positions. Prior to his current position, he was Director- General of the Joint Research Centre (JRC) (2010-2013).

Between 2006 and 2010 Dominique Ristori was Deputy Director General of the Directorate General for Energy.

Whilst Director in charge of General Affairs and Resources at Directorate-General for Energy and Transport, he was responsible for interinstitutional relations; enlargement and international relations; coordination of energy and transport research; internal market, state aids, infringements and public service obligations; passengers' and users' rights; central management of human and budgetary resources (2000 - 2006). Between 1996 and 1999, he was Director in charge of European Energy Policy at Directorate-General for Energy.

Dominique Ristori played an important role in the preparation and adoption process of the 2 first Directives on the Internal Market for gas and electricity. He launched also successfully the Firenze and Madrid Forum for electricity and gas at the origin of the Regulation process in the Energy Sector.

In the period of 1990 – 1996 Dominique Ristori was in charge of transnational cooperation between SMEs at the Directorate-General for Enterprise policy.

Dominique Ristori graduated from the Institute of Political Studies of Paris (1975).



REVOLVE ENERGY DEBATE

Join the thought leaders of the energy transition!
Brussels, June 13, 2016 at Thon EU Hotel

To kick-off the EU
Sustainable Energy Week



An initiative of the  European Commission

Supporting Green Entrepreneurs in the MENA region

Writer: Giorgio Mosangini



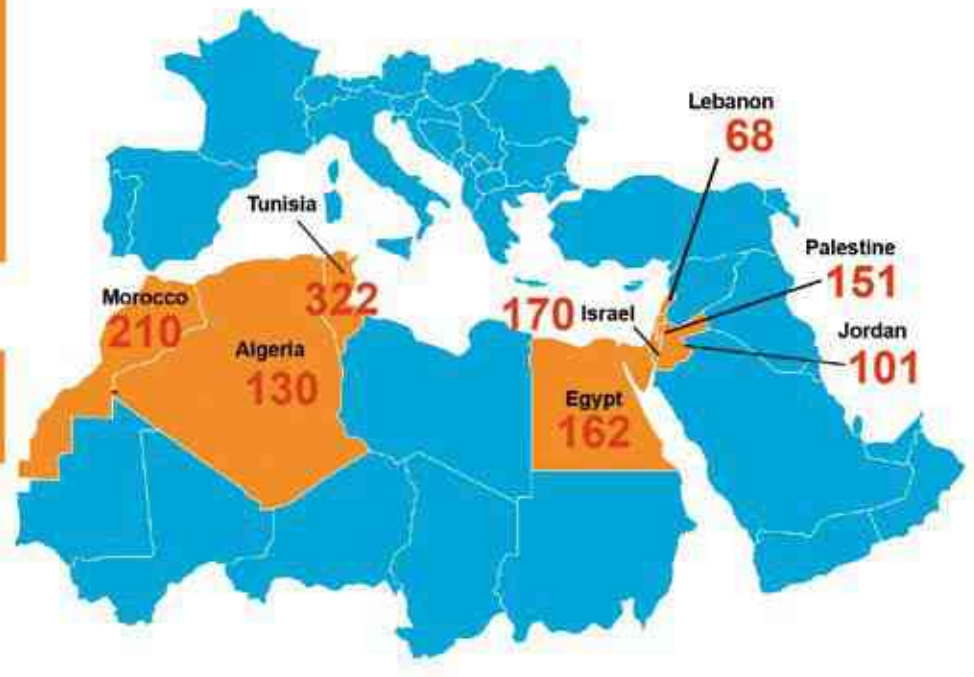
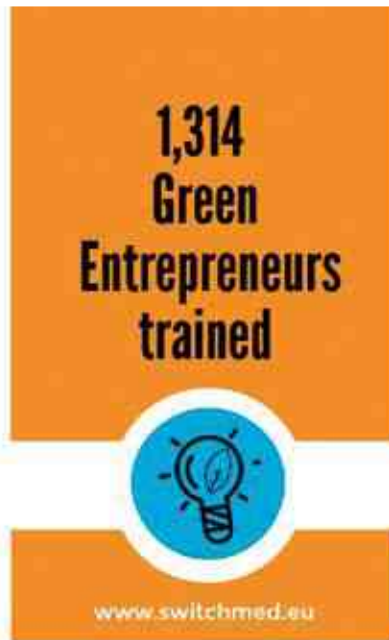
Image: Training of trainers on green entrepreneurship, Morocco
Source: SCP/RAC

The Middle East and North Africa (MENA) region faces major economic challenges, such as the highest unemployment rate and the lowest women's labor force in the world. The MENA region is also confronting major environmental challenges, including climate

change, water scarcity, land degradation, pollution and waste management.

At the Regional Activity Centre for Sustainable Consumption and Production (SCP/RAC), we are convinced that Green

Entrepreneurs are one of the main drivers of job creation and to move towards more sustainable lifestyles. Indeed, Green Start-Ups create economic value and also environmental and social value, successfully addressing employment needs and



environmental challenges. Thus, through the SwitchMed initiative, we are developing a training and supporting program promoting Green Entrepreneurship in eight MENA countries: Morocco, Algeria, Tunisia, Egypt, Jordan, Israel, Palestine and Lebanon.

To date, more than 1,300 Green Entrepreneurs have been selected (out of 3,500 applicants) in the eight countries and already started or completed the training program. During a period of three months, they are supported for the development and the testing of their Green Business Models.

The best Green Business Models are then selected to take part in an incubation program. In the next two years, we expect to train up to a total of 2,400 Green Entrepreneurs and support the creation of 45 Green Start-Ups in the eight countries.

Stories from Green Entrepreneurs that have developed ecological and social innovative solutions that are making an impact on the circular economy and sustainable living in the Mediterranean are promoted through The Switchers platform.

See more examples:
www.theswitchers.eu



SwitchMed (www.switchmed.eu) is an initiative funded by the European Union that supports and connects stakeholders to scale up ecological/economic social innovations around the Mediterranean. It is collaboratively coordinated by the EU, the United Nations Industrial Development Organisation (UNIDO), the United Nations Environment Programme Mediterranean Action Plan (UNEP/MAP), its Regional Activity Centre for Sustainable Consumption and Production (SCP/RAC), and the UNEP-DTIE (Division of Technology, Industry and Economics).



Renewable Energy & Energy Efficiency in the Western Balkans

Western Balkan countries are struggling to attract investments in renewable energy and energy efficiency projects despite the handful of improvements in policy and regulatory frameworks. In this challenging context, what are the critical elements to mobilize finance in the region?

Writer: Elisa Asmelash



Germany

Poland

Czech Republic

Ukraine

Slovakia

Austria

Hungary

Romania

Slovenia

Croatia

Bosnia and
Herzegovina

Serbia

Bulgaria

Montenegro

Italy

Macedonia
(FYROM)

Albania

Greece

Over the past two decades, countries in the Western Balkan Region¹ have made significant policy and legislative progress in their renewable energy and energy efficiency sectors. Driven by prospects of integration into the European Union, together with pressures from membership in the Energy Community to set national renewable energy targets, countries in the region are on the road to rebuilding their entire energy systems.

On the basis of a shared commitment to market reforms and the operation of an integrated regional market, they have advanced in developing targets and policies to promote the diverse renewable energy sources

that are abundant across the region. This policy progress offers the best opportunity to build sustainable and efficient energy sectors that can exploit and develop the enormous potentials in renewable energy and energy efficiency sectors.

Viewed from a global perspective, investment needs in terms of sustainable energy infrastructure in the region remain significant and there are very few signs of concrete investment in renewable energy and energy efficiency projects going forward. This is the key message of the UNECE Renewable Energy Status Report, which is the result of a joint effort of the United Nations Economic Commission for Europe

(UNECE) and the Renewable energy Policy Network for the 21st century (REN21), in collaboration with the International Energy Agency (IEA). The report covers 17 selected UNECE member states², including countries in the Western Balkan region, all facing common challenges as they develop renewable energy solutions and improve energy efficiency. While Western Balkan states are doing better than the other countries covered by the report, the enabling environment needs to be improved in order to attract more investments in renewable energy and energy efficiency to match up with its potentials.

Renewable Energy Potential

Energy markets in the Balkan Region are characterized by two main features:

1. They all are net energy importers: all countries in the region depend heavily on imported fossil fuels, with energy imports accounting for 44% of total energy use and costing over EUR 3 billion³.

2. Energy subsidies are rooted in all countries' energy systems, characterizing the overall political strategy in the region, as governments tend to invest large amounts of money in energy subsidies because the sector is seen as a crucial engine of growth. According to a 2015 study of the International Monetary Fund (IMF)⁴, two of

the six Balkan countries, Serbia and Bosnia Herzegovina, are in the world's top ten of countries with the highest percentage of energy subsidies in the Gross Domestic Product (GDP).

In addition to these two components, energy demand is projected to increase by 70%

Images: Fierza Hydroelectric Power Station in Albania.
Source: Tobias Klenze



over the coming two decades⁵, and without a sufficient and reliable energy supply to maintain economic growth the threat of a regional energy crisis is around the corner. All this creates the need in the region to diversify energy supplies and technologies towards deploying more renewables.

Hydropower and traditional biomass represent the backbone of the electricity systems in the region (Figure 1). In Albania, the power system is run almost exclusively on hydropower and in Montenegro hydro represents more than half of electricity produced in the country, while Serbia was third among the 17 UNECE countries in hydropower production (11,109 GWh). All countries in the region are largely endowed with biomass resources, mostly used in the form of fuelwood in the heating and cooking sectors. However, this persistent use of traditional biomass has harmful and damaging environmental and health effects and calls for a replacement by modern biomass and renewable energy solutions for both district and local heating purposes.

In 2014, other renewable power technologies, such as solar PV, onshore wind and modern biogas, have been experiencing increases in installed capacity. Similarly, the development of all renewable power tech-

nologies is underway: wind energy projects are in the planning stages in Serbia, Bosnia and Herzegovina and Montenegro, where small hydro capacity is also being tendered.

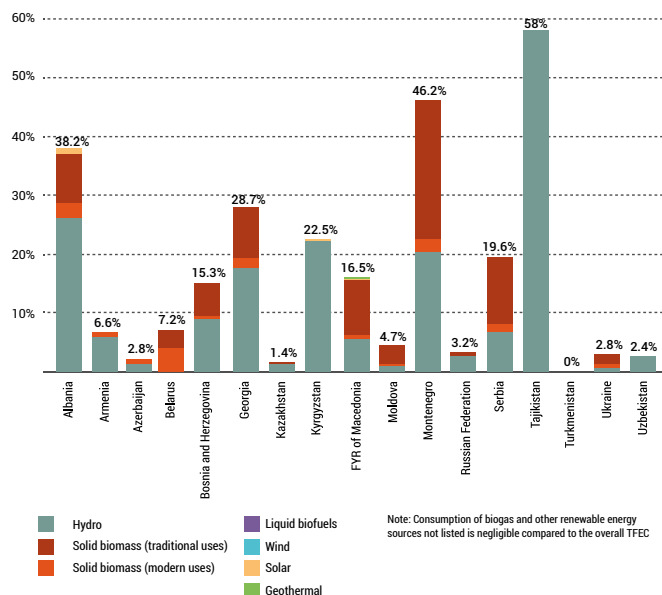


Figure 1: Share of renewable energy in total final energy consumption, 2012.
Source: UNECE Renewable Energy Status Report, 2015, REN21

Main Challenges

Despite improvements in policy and regulatory frameworks, the region is still facing major barriers in attracting investments and blocking the full transition to renewable energy and energy efficiency. These barriers can be grouped into three main categories.

Institutional, Regulatory and Financial Constraints

Attracting investors and mobilizing capital in order to fund renewable energy projects has proved to be very challenging, as national energy markets do not provide for stable and transparent regulatory frameworks for such investments. Policy reforms need to be integrated into robust and long-term energy strategies, and especially to ensure a sustained commitment to their concrete implementation. This first policy-related element can be broken down into three sub-components:

a. Policy credibility, transparency and stability. While support regimes, in the form of regulatory policies and framework are in place in almost all Balkan countries, the main challenge is the actual implementation of policies, taking them to the 'operational' stage. Weak governance, widespread corruption, inefficient government bureaucracy and frequently changing policies are just one side of the picture. To this, one should add two other key elements: (i) The complexity of government structures, which is a tedious and heavily bureaucratic machine in all Balkan countries. The lack of coordination and communication in the provision of information between different levels of administration including agencies and institutions is a major problem in all Western Balkan countries. In Bosnia and Herzegovina, there is no legislative framework for renewable energy at the national level. Regulatory policies have been addressed by two entities, the Federation of Bosnia and Herzegovina and

Republika Srpska, both with their own targets and laws regulating renewable energy. (ii) the lack of serious political commitment, which is due partly to the lack of awareness on the importance of renewable energy and energy efficiency and partly to other pressing regional issues that are currently featuring higher in the countries' political agenda, such as the migrant crisis.

b. Long procedures to obtain authorizations and permits for projects. Besides issues of land property rights definition in Albania, for example, the multiplicity of authorities, such as state water companies as well as local and national authorities, create complex layers of permits, authorizations and licences. The long and bureaucratic permitting process for starting an energy project deters all investment, but especially foreign investment, for whom the procedure is time consuming. The REN21 report highlights how the lack of a sound secondary regulation, results into a mod-

est installed renewable energy capacity for power generation, which reaches less than 60 MW of installed capacity. For instance, in Serbia, the lack of a bankable power purchase agreement (PPA) for power plants above 50 MW has resulted in the deployment of small-size renewable energy projects (typically up to 1 MW for biogas, solar PV and small hydro, and up to 10 MW for wind power).

c. Lack of skilled and experienced human capacity. This is particularly evident at administrative and regulatory levels, as well as at project planning/developing levels. The capability of administrators needs to be reinforced to ensure that they have the capacity and means to develop strategies and implement policies encompassing better market regulations and especially renewable energy and energy efficiency developments. The potential of renewable energy is not politically recognized despite its significant importance in the region. As a result, countries are far from being able to offer adequate training to develop the required skills and knowledge in the renewable energy sectors at national and regional levels; and the sectors do not offer employment conditions that are adequate enough to attract and retain staff. Expertise is often missing at project planning levels among renewable energy developers with a local and regional presence and especially in structuring comprehensive bankable solutions in order to attract project financing from international financial institutions (IFIs).

Fragmented Markets

All six Western Balkan countries have made progress in aligning their regulations and operations with the EU standards, but energy systems in the region are fragmented, and cooperation between them is lacking. Available resources are widespread across all six countries and despite their strategic geographic position at the cross-roads between energy-rich areas (Russia and Central Asia) and energy consuming areas (Central and Western Europe), they have not been successful in capitalizing on this key location. Most markets suffer from power shortages, electricity imbalances,

which suggests that they can largely gain from a regional integration and cooperation of markets, which could allow to have a diversified energy mix and thus optimize production capacities. Besides, the reduced size of most national markets in the region coupled with their low energy density allows for little and almost no opportunities for economies of scale in production.

a project) have little if no possibilities to borrow money despite the different finance facilities available. Similarly, foreign investors lack confidence in the region. This is a combination of two main factors:

a. Internal political and regulatory risks, such as potential regulatory changes, together with uncertainties around the length of the processes and the timeframe of the return on investment inhibit private sector financing.



Limited Funding and Small-size Projects

The high capital-intensity of renewable energy projects demands for large volumes of investments and funds to be available well in advance of operations. However, most countries in the region are characterized by a lack of financial solidity and obstructed access to finance. In the countries' unstable regulatory context, local project developers (who most of the times lack capital to start

b. Political instabilities in neighbouring countries (especially of EU members) create a perceived risk of possible spill-over effects in Western Balkans countries which adds to their shaky national policy situation.

Besides these regulatory risks, all Balkan countries are characterized by small markets with small projects that are less attractive than bigger projects for international investors, including banks like the European Bank for Reconstruction and Development

(EBRD) and the European Investment Bank (EIB) and create significant problems in obtaining private financing for national/local investors. Small-scale projects struggle to attract funding from larger financiers. To put this in perspective, because the initial investment involved is relatively small – compared to medium-large projects – limited project financing is simply not feasible. As suggested by a 2013 World Bank report⁶, economies of scale in due diligence are significant, and many larger financial

institutions will gingerly if not unwillingly consider small projects. International commercial banks are generally not interested in projects below \$10 million, while projects up to \$20 million find it difficult to stimulate large investors' attention as well. And it remains difficult to raise funds for small renewable projects from local commercial

banks too. Given their limited resources to make large-scale loans, domestic and regional banks operating in smaller economies have lower limits for projects' costs, and overall they have little experience in developing bankable renewable energy and energy efficiency projects.

How to Mobilize Finance in the Region



Images: 34.2 MW wind park near Dubrovnik, Croatia.
Source: WP Rudine

Renewable investors and developers need to be wary of several factors when locating their projects. This is particularly evident in Western Balkan countries where investment needs for renewable energy and energy efficiency are substantial (see Figure 2). In this challenging context, there are three critical elements to mobilize finance in the region:

1. Policies and strategy formulation must be transparent, involving broad public consultations and seeking input from academia, energy and environmental associations, as well as consumer organizations. Investments in the production of research and studies on the economic potential and benefits of renewable energy technologies and energy efficiency solutions in the region is key to raising awareness amongst the wider public, including government institu-

tions. Having a comprehensive view of the status and potential of the regional renewable energy industries, including reliable statistical data, could act as a solid base and starting point for any policy/regulatory intervention, thus better aligning reality and policy-making. Leaving the reform process unfinished will perpetuate current vulnerabilities and leave markets at the mercy of under-regulation and speculation. Solid and transparent market-based reforms have the potential to reassure investors and consequently to attract and trigger new investments, which are highly needed to establish more sustainable energy systems. Serbia offers a good model by updating its national guidelines in 2013 for investors interested in renewable energy projects, such as wind, solar, hydro and biomass, and has issued the first national investor guide for solar thermal.

Notes:

1. The region of the Western Balkans, a term coined by the European Union in the late 1990s, includes Albania, Bosnia and Herzegovina, Croatia, Kosovo, the former Yugoslav Republic of Macedonia, Montenegro and Serbia. Heating, Ventilation, Air Conditioning
2. 7 UNECE Member States located in the South East and Eastern Europe, the Caucasus and Central Asia, and namely: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Montenegro, Russian Federation, Serbia, Tajikistan, The former Yugoslav Republic of Macedonia, Turkmenistan, Ukraine and Uzbekistan.
3. "Western Balkans: Scaling Up Energy Efficiency in Buildings" World Bank Group, June 2014
4. Coady D., Parry I., Sears L., Shang B., 2015 "How Large Are Global Energy Subsidies?", International Monetary Fund (IMF) Working Paper WP/15/105.
5. "Final Report- Western Balkans: Scaling Up Energy Efficiency in Buildings" World Bank Group, June 2014
6. Hussain, Mustafa Zakir. 2013. Financing renewable energy options for developing financing instruments using public funds. Washington DC : World Bank.

2. Simplify solutions for obtaining concessions and authorizations for constructing renewable energy facilities, including permits for network access and licences for power generation and sale. Long and cumbersome permission granting procedures deter investors from considering, let alone investing, in any type of renewable energy project. Renewable energy is a bankable investment, but it is risky and calls for long-term commitments as well as clear and simplified procedures. According to the REN1 report, Macedonia has adopted a number of legislative amendments reducing the number of documents that need to be submitted as well as the number of procedures that renewable energy investors must follow. Similarly, Serbia updated PPAs for renewable energy in 2014 and Montenegro concluded 21 concession contracts for the construction of 41 small hydro plants (6 of which are already in operation) and issued construction permits for two wind farms (Krnovo and Možura).



Figure 2: Renewable Energy Investment in 2004-2014. (billion USD)
Source: UNECE Renewable Energy Status Report, 2015, REN21

3. Undergo a two-fold reform of the market structure by targeting the creation of a regional market, thus appealing to be more attractive for private investors than the current small individual markets. An integrated regional market with physical and regulatory cross-border connections can generate liquidity. Cooperation could also include a financial/normative perspec-

tive, based on the exchange of best practices which could increase policy learning across the region. And there should be an increase in cooperation with EU countries towards the harmonization of technical plans and standards, with the aim of leveling the playing field between EU and non-EU countries. The physical transfer from Western Balkan countries could be used by

EU members which are still struggling to achieve their internal 2020 targets, to add it to their capacities; and the possibility of physically transferring capacity, could create economic incentives for Western Balkan countries to develop further and beyond the targets set by the Energy Community and/or by internal policies.

Private involvement in the energy sector is becoming increasingly important as public funding diminishes. International financial institutions and facilities, such as the EBRD and EIB, play a pivotal role in providing technical assistance programs to project developers in designing bankable projects, in lending facilities for renewable energy and energy efficiency financing and espe-

cially in encouraging joint facilities, pooling grants from different donors and sources, in which the international bank plays a role of guarantor. In addition, the Energy Community Secretariat is making strides in fostering inter-regional cooperation in terms of policy-making, energy market design, awareness raising and capacity building to improve the overall regulatory environment to attract for-

eign direct investment. The road to increasing investment flows in renewable energy projects in the Western Balkans is full of obstacles, but current trends suggest that these challenges will be overcome and integrate more with Europe.



Revelle Group is a development consultancy working in developing countries and emerging economies in three key sectors: energy, environment and climate change and sustainable economic & social development. Revelle works with governments and international organisations to help create visions, develop roadmaps and implement strategies that tackle today's main global challenges for a more sustainable world.

Key Criteria for Deploying Renewable Energies in the West Balkans

Writer: Qendresa Rugova



The following are some bankability considerations for national governments to stimulate the development and financing of renewable energy projects in the West Balkan region:

National strategies: Action plans and implementation roadmaps for each renewable energy sector to ensure national targets are translated into deliverable and measurable action items.

Regulatory framework: Support schemes should ensure a stable, efficient and balanced support for renewables (given the decreasing cost of RES technologies) with limited demands on public spending. Avoid sudden material policy changes that are detrimental to industry developments. To mitigate such risks investors may seek an explicit guarantee ensuring that future changes in law with regards to support schemes will not be imposed on plants already in operation and those in development. Priority access and mandatory power

offtake is also of significant importance as it manages volume risk. Mandatory offtake should be guaranteed for the entire project lifetime or alternatively projects should be allowed to access wholesale power markets or to enter bilateral agreements with third parties.

Local RES developers: Develop local capabilities to bring quality projects to the market. This is important as foreign investors often seek joint venture partners to mitigate local risks. Technical assistance programs from IFIs¹ are instrumental in providing funding as well as knowledge transfer in key technical and financial areas.

Permitting: Develop a streamlined and transparent permitting process. Permitting-related risks are especially important to equity investors who require clarity to be able to commit to developing renewable energy projects. Usually such regulatory obstacles discourage investors from investing in a given region and, conversely, to favor others in the global competition to attract capital. In addition, permitting and all other development costs are becoming increasingly more important to investors as the ever-declining technology costs means that soft costs, such as non-hardware costs, represent a bigger share of total project costs and therefore have a higher impact on project profitability.

Grid access: Lack of transparency when it comes to accessing national grids is often a main challenge for investors. National governments need to provide clear information

on grid availability, technical specifications, connection points as well as the permitting steps to be granted access to national grids.

Project agreements: Project finance structures require robust project agreements to allow for risks to be transferred to parties that are best able to manage them. In the West Balkans, it is often challenging to conclude bankable agreements with strong, creditworthy counterparts able to undertake and deliver on those agreements. Such limitations occur in all key areas (power offtake, EPC² companies, O&M³ providers and fuel suppliers for biomass and biogas plants). Limitations on the availability of counterparts make it difficult to anticipate and guarantee long-term stability in terms of price and quality. The long-term aspect is particularly important as investors and lenders need to rely on the fact that such parties will be in the market for the life of the project.

EPC and O&M related risks in renewables are typically easier to manage as they can be passed onto third credible reputable parties via long term agreements. However, the most important agreement remains the PPA which if not properly structured could expose investors to market and incumbent utility credit risk. To accommodate this, strong and bankable PPAs in line with international standards should be developed.

Qendresa Rugova is a corporate and project finance adviser focused in the energy industry. She specializes in renewable energy, emerging trends in clean technologies and financing models. 

Notes:

1. International Financial Institutions
2. Engineering, Procurement & Construction
3. Operations & Maintenance

Buildings: Essential for Smart Energy Systems

The transition of the energy market is causing current energy demand-supply imbalances, presenting opportunities for buildings to take on an important role in balancing the grid through demand management with new technologies.

Writers: Cosmina Marian and Maarten De Groote

Images: The Kuggen building makes use of green building technology on four different levels: adaptive ventilation, adaptive lighting, interactive heating and cooling systems, and effective daylighting.
Source: Wikimedia





The Changing Role of Buildings

The EU energy market is undergoing a transformation. As it is not constricted by traditional borders and national systems anymore, it is becoming less centralized, more interconnected, and more variable. These developments are challenging the balance of the energy system due to the increasing amount of mostly volatile and decentralized renewable energy production and because of the electrification of heating and transport. The Paris COP21 agreement to limit global warming to 1.5 degrees Celsius raises the stakes further applying greater pressure to meet this new goal.

Flexible technology solutions exist to overcome the energy demand-supply imbalance. In this new era, the ability of end-use consumers to modify their energy “pattern” during system imbalances or in response to market prices will be crucial to unlock the potential of a low carbon energy system.

The buildings sector has a wealth of solutions to offer. There is an essential energy saving potential and the next step is to

transform buildings into micro-energy hubs providing multiple benefits. Buildings interact more and more with the energy system and can have a stabilizing role by providing renewable energy production, energy storage and demand response. These three roles are complementary and reinforce each other.

The significant growth of renewable energy sources (RES) connecting to the grid is essential to achieve a sustainable and decarbonized energy market. At the same time, the variability of RES puts additional stress on the grid given their intermittent generation and the fact that the grid infrastructure is not always ready to integrate a

large amount of decentralized production facilities.

This is where innovation and market uptake in storage capabilities are needed: in a few years, the combination of photovoltaic energy systems and power storage in buildings is expected to reach its tipping point and demand response could soon become more accessible to residential customers. The emergence of Energy Management Systems (EMS) and new technologies such as smart meters, smart thermostats and other load-control technologies with smart end-use devices, is likely to make managing energy use as easy as installing an app on a smartphone.

In this new era, the ability of end-use consumers to modify their energy “pattern” during system imbalances or in response to market prices will be crucial to unlock the potential of a low carbon energy system.

Image: Concept design for stationary battery system.
Storage electric power generated from solar and wind power
Source: Chesky, Shutterstock



An Organic Evolution?

In a complex energy environment, flexible technologies are going to be valued. Therefore, technologies that can rapidly adapt to operating loads, absorb or release energy when needed, or convert from electricity to heating are increasingly important in the new energy market. A number of technologies offer this flexibility, including:

- combined PV and battery storage
- co-generation technologies bridging electricity and thermal systems
- industrial sites transferring surplus heating or cooling to local district heating and cooling (DHC) networks or absorbing excess heat from the thermal grid to convert it into electricity
- thermal and hydro storage

Technologies exist and pilot projects prove that buildings can already take up their role of micro-energy hubs, but what is the hold-up?

“The old idea of fixing a capacity problem with extra cables is not sufficient anymore. We would need more cables than technically possible to solve the problem [...] IT solutions have become so widespread and cheap that this is a much better solution than adding another cable in the ground.”

- Eandis (Belgian DSO¹)

How to Go Beyond Initiatives

Innovative entrepreneurs, such as the Tesla's Elon Musk, have understood the signs and decided to enter the building market by launching new products, like affordable battery solutions for residential use. The market uptake of products like home batteries can pave the way to decentralized power trading at the individual building level and contribute to shifting the market from the innovative to the growth phase.

It's still too early to pick a market winner. Battery-based projects, though likely to account for a large part of future building-related storage investments, are not the only option. Hot water storage is a frequently found technology, however, the storage of heat or cold in the building mass (walls and ceilings) is a less common technology with a practically

untapped potential, despite very low costs and short returns on investment. Another more innovative technique is to apply construction materials with integrated 'phase change materials' that can store heat or cold 'latently' by using a process that occurs at a defined temperature level.

Companies like Johnson Controls, Siemens, Honeywell and Schneider Electric, together with new entrants, offer services related to demand response for the residential market. New market actors, which originated from ICT, such as Google and Apple, the transport sector and the utility (E.ON and British Gas for example) value chains, are now entering the market, capturing value across this sector. There is an opportunity for manufacturers of HVAC², monitoring systems and white goods to

adapt their products to work in this new technological environment. Market actors lagging behind in this transition will lose their competitive edge.

Being trailblazers in this new context doesn't only imply creating innovation, it also entails the capacity to break into the market place. Third-party-driven business models (aggregators, agents or ESCOs³) are also among new actors challenging the status quo and are much needed. They are pulling together energy consumers and offer them services such as control and management services, providing technologies through specific financing models, such as leasing, and optimizing the building performance and its flexibility capacity helping residential customers save energy, money and increasing life quality and comfort.

Notes:

1. Distribution System Operator
2. Heating, Ventilation, Air Conditioning
3. Energy Service Companies

REVOLVE

Sustainable Mobility

Reinventing Urban Mobility

A Revolve public information campaign/exhibition during the European Mobility Week (September 16-22) about the projects, technologies and policies that are making mobility more sustainable.

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Image: "Powerwall increases the capacity for a household's solar consumption, while also offering backup functionality during grid outages."
Source: Tesla

Who Will Lead?

As buildings and their smart devices interact more and more with the energy market, new actors are emerging but there is a missing piece. Who is harmonizing and shaping all these components? While the market can undergo organic evolution and integrate new technologies related to demand response, it may need a ring-leader.

The EU has a comparative advantage since most of the developments needed are linked to high-tech innovations and

Europe has an abundance of research and development institutes that can support innovation and encourage large-scale market uptake. Whether the EU, national governments or other actors assume this role remains to be seen. Until now, technological breakthroughs on the market were mainly driven by entrepreneurs – often based outside the EU.

Various measures need to be adopted across the board to unlock the transition:

- Politically: a comprehensive vision for the electrification of heat (and transport) and more specifically on the integration of demand response, renewable energy production and storage in buildings
- Legally: an enabling regulatory framework, encouraging buildings' interaction with the energy system
- Aggregators supporting not only industrial, but also commercial and residential consumer groups
- Pricing; availability of dynamic price signals for industrial, commercial and residential consumers
- Technologically: smart and user-adapted metering and control systems with a universal communication protocol
- Strategic planning of the grid, both at transmission and distribution levels

Sustainable Buildings of the Future

We should all grasp the untapped potential of buildings.

The Rocky Mountain Institute reports that in the United States, in the residential sector alone, widespread implementation of demand response can save up to 10-15% of potential grid costs, and customers can cut their energy bills by 10-40% compared to existing rates and technologies. In Europe, according to the Imperial College London, flexible energy demand has an energy saving potential of 500 billion euros.

The energy and cost saving potential is there. Technologies are available or right around the corner. A reasonable amount of consumers is interested. We now need the structural framework for this transformation to happen. The upcoming political agenda of 2016 should therefore be considered as the main opportunity to transform our buildings into energy hubs balancing the EU energy market and making it more sustainable and decarbonized.



Image: Internet of Things, allowing to control energy use from afar.
Source: Danfoss

We should all grasp the untapped potential of buildings.

BPIE will hold a policy conference on June 15 during the EU Sustainable Energy Week entitled “Smart consumers and smart buildings: the active role of buildings in a transforming energy system”.

For more info visit:
bpie.eu



BPIE is a non-profit policy research institute located in Brussels, dedicated to improving the energy performance of buildings across Europe. We focus on knowledge creation and dissemination for evidence-based policy making and implementation at national level.

Committed to Increasing Energy Performance of Buildings Across Europe

The EU is committed to reduce its greenhouse gas emissions and to become a low carbon society. This is expressed through a range of strategy documents and a political commitment by all Member States to the 2030 climate and energy package, including a 40% reduction of greenhouse gases, a renewable energy share of 27%, and an energy efficiency increase by at least 27%. These targets will not be achieved without significant action in the building sector.

The EU's intention to develop an Energy Union which increases energy security highlights the importance of the building sector to reduce energy consumption and foster the growth of renewable energy. Europe's budget from 2014 to 2020 increased research and innovation spending to 38 billion€ for low carbon activities.

The achievement of these targets and strategies will have to be supported by relevant policies, either through the revision of existing ones such as the Energy

Performance of Buildings Directive and the Energy Efficiency Directive or by developing new initiatives.

BPIE is supporting all these processes through a variety of projects, both at EU and Member State levels, enabling policy-makers and stakeholders to agree on effective programmes. These projects include analysing progress on nearly-Zero Energy Buildings, monitoring the building stock, developing energy saving strategies for shopping malls and innovative retrofitting approaches, and more. 

EU buildings - Key figures



Designing the Wind Turbine of the Future

Quiet. Durable. Efficient.

Technology innovations that enhance turbines and reduce costs are needed to propel the wind sector and maintain Europe's technological leadership. A group of key industrial players and research centers have joined forces to demonstrate their innovative designs on a turbine in Spain.

Writers: Guillaume Corradino and James Ling

Images: A routine inspection at La Cámara wind farm in Spain.
Source: Gamesa





Winds of Change

The wind industry has changed beyond recognition in the last 30 years. Onshore, 20-meter turbines with a capacity of 50 kilowatt (kW) have given way to 2 megawatt (MW) models stretching over 100 meters into the sky. Offshore generation only began in 1991. Since then, more than 3,000 turbines have been installed in Europe's waters, together providing more than 11,000 MW of installed power.

The industry will continue to evolve in the future. Offshore wind is expanding and developers will explore new sites in deeper waters further out at sea with stronger winds. On land, due to the gradually diminishing availability of sites in Europe farms will be located in lower wind areas and possibly closer to urban centers.

These changes create new challenges for the sector. The difficulty with repairing and maintaining deep-water offshore turbines makes reliability a growing priority for manufacturers. Onshore turbines will

need to strive for the highest levels of efficiency and performance to maximize the energy extraction from lower winds. They must also be quieter to minimize noise pollution.

The latest trends in the wind sector - moving offshore, and into lower wind areas - make reliability a growing priority for manufacturers.

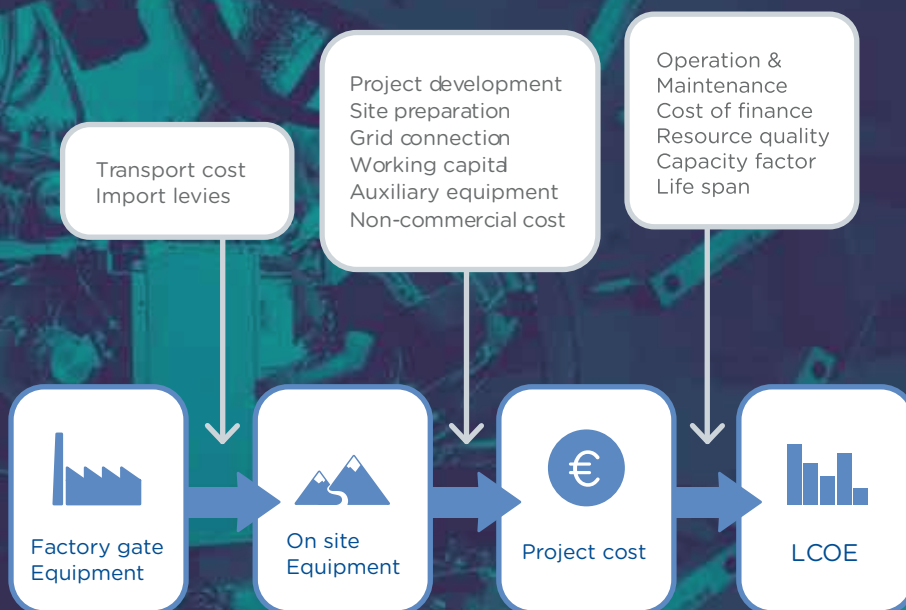
Images: A wind farm off the coast of Belgium.

Source: LM Wind Power - Jan de Nul ©mennomulderphotography



Calculating the Cost

The Levelized Cost of Electricity (LCOE) is a measure of an energy source that compares different methods of electricity generation. It is an economic assessment of the average total cost to build and operate a power-generating asset over its lifetime divided by the total energy output of the asset over that lifetime. LCOE is an important guide for investors as it can be regarded as the minimum cost at which electricity must be sold in order to break-even over the lifetime of the project.



Reducing the Cost of Wind Energy

Improved reliability and efficiency will contribute to lowering the cost of wind power. As with all energy sources, reducing the cost of the generation process is the key to greater competitiveness. The cost of electricity from wind power has already experienced a stunning drop, falling by about 2/3 between 1988 and 2014. As a result, the price of electricity from farms in high resource areas can now compete with more traditional energy sources. However, to achieve widespread grid parity, and boost Europe's global competitiveness, further cost reductions are needed.

Reliability and durability have a profound impact on a project's operation and maintenance (O&M) costs. Reducing the need to replace parts and extending the periods between scheduled maintenance reduces running costs. Improved turbine efficiency also boosts overall performance, optimizing the balance between energy production and machine life. O&M costs represent the second largest cost after upfront capital

costs (turbine manufacturing, construction, planning and grid connection), accounting for around 20-25% of the total Levelized Cost Of Electricity (LCOE) from a given project. There is therefore significant scope for cost reductions in this area.

Technology innovations will lead to cost savings. During the last three years, prominent industrial players and research centers in Europe have been working in col-

laboration on this very issue. The Windtrust consortium has combined forces to devise an enhanced, next generation turbine. By optimizing the design, operation and maintenance phases, the partners have extended the limits of reliability and availability, as well as reducing overall costs. The consortium focused on enhancing three key components with high improvement potential: the blades, power electronics and the controller.

Future cost reductions in wind energy will largely hinge on driving down O&M costs, which currently account for between 20-25% of the LCOE of an onshore wind project.



Improved Rotor Blades

Rotor blades are put under a lot of strain. Completing up to 20 rotations a minute, the blade tips can reach speeds of 180 miles per hour generating a huge amount of force. Factor in rain, hail and other particle impacts and it is hardly surprising that the blade surface can be susceptible to erosion. The problem is particularly acute for offshore turbines, which are typically larger – increasing tip speed – and exposed to salt water. Naturally, erosion shortens the lifetime of the blade and results in increased O&M costs, leading to a significant loss in annual energy production, caused by the extra downtime and reduced general performance. The LCOE increases as a consequence.

Manufacturers are constantly looking to optimize blade designs in order to extend their lifespan. The blades, which

are produced in huge specially-designed moulds, must be strong and light, but also cost effective. They are made from composite materials such as fiberglass, reinforced polyester or wood-epoxy. Within the framework of Windtrust, Spanish manufacturer Gamesa has continued to explore the use of carbon fiber in rotor blades. Carbon fiber is renowned for its stiffness and extreme lightness, and the increased durability and reduced weight will extend the overall life of the turbine to potentially 30 years.

Alternative solutions to protect the blade surface against erosion have been developed in the past. The standard methods have been tape or coating applications on the blade

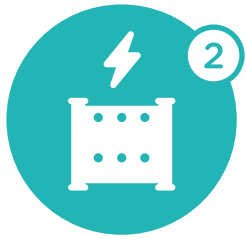
leading edge but the previous solutions lack durability and involve frequent maintenance or replacement.

In quest of a better solution, a new leading edge protector called ProBlade has been developed by LM Wind Power in Denmark. The unique system comprises an innovative polyurethane brush-on coating that is applied to the blade, which has proved to be much more durable. The ProBlade has been tested in extreme environments, undergoing state of the art accelerated rain erosion testing, proving huge improvements compared to previous systems. The ProBlade solution performs five times better than tape and more than 50 times better than the gel coat. These positive results represent the first step towards widespread adoption.

The use of carbon fiber to increase durability and reduce weight will contribute to extending the overall life of the turbine to 20-30 years.

Images: Dynamic blade testing facilities in Denmark.
Source: LM Wind Power





Optimized Power Electronics

The voltage and frequency of electricity generated by turbines must be adapted before it can be transferred and used. This vital task is carried out by the power electronics, which convert the non-regulated power from the generator into an alternate current (AC) output voltage of 690 volts, changing the basic characteristic of the wind turbine from being an energy source to an active power source. The converter has a generator and a line inverter to feed a voltage waveform into the electricity grid. Due to its crucial role in the generation process, increasing the reliability of the power electronics is critical to the turbine's annual energy production.

In order to achieve the highest possible level of reliability, German firm Semikron has been looking to optimize the design of its power electronics component by focusing on three aspects: humidity protection, scalability, and reducing the number of parts.

Usually located in the nacelle, the power electronics are often exposed to vibration, humidity and dust. Any condensation that occurs can result in water flows with catastrophic consequences. Semikron has improved the sealing and heating systems, particularly to reduce humidity levels.

As turbines increase in size, power electronics modules have to be combined in order to convert power of 6 MW or more. Semikron makes the component more compact, with its new intelligent power module having a 30% higher power density than previous models. Having successfully reduced both volume and weight, this will help limit the overall weight of the nacelle.

Statistics show that more parts equals more failures. By revising their entire assembly technology, Semikron's new power module is made of 50% less parts compared to other examples on the market. This more compact component has the added benefit of helping to reduce system costs – smaller components mean that racks, connectors and cables are all reduced. This newly optimized design has gone through rigorous testing which has shown a significant improvement in both reliability and durability, making traditional modules redundant in this rapidly changing market.



Q&A: Jesper Madsen

As wind energy expands, future wind turbines will be built closer to urban areas, making noise levels increasingly important. Jesper Madsen is chief engineer at LM Wind Power that has been developing innovative noise-reduction solutions.

What factors influence turbine noise?

What most affects the noise level is actually the speed of the blade tips and the rotor diameter. Blade lengths have been growing considerably during the past years, as wind farms have been installed in lower wind speed sites, thus increasing the swept area to increase energy generation.

How can turbine noise be reduced?

One of the ways to deal with noise issues is to stop the wind turbine in certain wind directions, or run the turbine in low-noise mode. However, both actions have a negative impact on the energy generation.

What solutions has the Windtrust project advanced?

Some of the latest developments in this field are serrations: serrated plastic panels mounted on the trailing edge of the blade. These serrations act as flow control devices, which focus on lowering the noise emission from the blades. Their lightweight design and simple mounting process make them an attractive choice for new turbines and for those already installed. By bringing the noise under the authorized limit more machines can be installed. And crucially, at wind farms in noise-restricted areas, turbines equipped with this technology will be able to run at an optimal setting and therefore have a higher annual energy generation.



Smarter Turbine Controller

Though a large amount of research is undertaken to identify the best locations for wind farms, wind speed and direction remain hard to predict. To combat this, certain control methods are used to manoeuvre the turbine in order to maximize the energy generation at any given time. The most common control variables are adjusting the 'pitch' and the 'yaw'. Pitch control is specific to the blades and their 'angle of attack' with respect to the incoming wind, while yaw refers to the horizontal rotation of the entire wind turbine.

Apart from the inherent difficulty in identifying the most optimal turbine position, inaccuracies in turbine design and installation are also a challenge for the controller. The enormous size of the turbines makes millimetre-precise installation virtually impossible. The resulting discrepancies between the paper plans and the installed turbine mean that monitoring

is extremely complicated. Finding ways to overcome these positioning errors, Gamesa has been developing control algorithms to enhance the pitch and yaw controller. The two control methods are used to optimize or limit power output. At low wind speeds, the controller seeks to optimize, to run the turbine at maximum efficiency and extract all available power. When winds are stronger than ideal, the controller looks to limit the generated power.

The enhancement of the smart controller will significantly increase the performance and energy production of a turbine – misalignments of just 5 degrees can cause thousands of euros of energy loss per year. The algorithms will also help reduce extreme and fatigue loads which threaten the structural health of the turbine. This will reduce maintenance costs by preventing breakdowns, and extend the overall lifetime of the turbine.

A Better Deal

Greece's Center for Renewable Energy Sources and Saving (CRES) were one of the organizations responsible for testing the enhanced components, with Levelized Cost of Electricity being a key indicator.

Andreas Makis, research engineer at CRES is excited about the results, with a significant reduction in LCOE projected at the studied scale, such as 2MW wind turbines and a 60MW wind farm. The innovations would likely have an even greater impact on wind turbines of larger capacity, and on onshore developments.

Cheaper electricity production guarantees a better deal for consumers and a higher likely return for investors, improving the

business case for wind power projects. The technology innovations developed by Windtrust will help the wind power sector to keep growing, as it aims to serve a quarter of the EU's electricity needs by 2030. 

The total reduction
in costs could range
between 14 and 22%



Q&A:
Fernando
García
Ayerra

Chief Engineer
Technology

Development at

Gamesa and Technical

coordinator of Windtrust discusses
the impact of the project, and the
future of wind energy in Europe.

How have you validated the results of Windtrust?

The innovative components have been fitted to an onshore 2 MW prototype turbine located at the experimental Alaiz Windfarm in Pamplona, Spain. This will enable us to compare the performance with those of existing, well-known turbines. Although this project is primarily aimed at onshore, most of the results are also applicable to offshore, where much greater benefits should be obtained.

What is the expected impact of these improvements?

Although the cost of the enhanced parts will probably be higher, the reduced cost of repairs and less downtime will render an increase in the amount of energy produced. This increase is expected to exceed any additional costs, thereby leading to an overall reduction of the cost of energy. It is important to understand that all the money invested in R&D is focused towards the reduction of the cost of wind energy, which will hopefully reach the final consumer.

What does the future hold for wind energy generation across Europe?

In Europe we want to achieve a clean and reliable energy supply at the lowest possible cost. The creation of a truly European energy market and system, including pricing, transport and management, will allow the maximum deployment of sustainable energy generation sources.



Images: The view inside the tower of a wind turbine.
Source: Gamesa



The Windtrust project has demonstrated the technical and economic feasibility of innovative and more reliable solutions for multi MW wind turbines in order to improve the competitiveness of wind energy technologies. Coordinated by Gamesa, nine partners from six EU countries, including key industrial players and research centres, collaborated over a period of three years. Having successfully validated their innovative designs on a 2 MW wind turbine, the project will draw to a close in August 2016.

Learn More:
www.windtrust.eu



This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under the grant agreement No 322449



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VIEWS

VISUALIZING ENERGY

A photo essay by Branko de Lang



Bringing to light new renewable energy projects is a way of documenting the energy transition in action. I would not have been able to cover the construction of the Luchterduinen offshore wind farm without the assistance of Eneco, the power company that partly owns it. They arranged for me to sail to exclusive zones in the North Sea and took me to the Vestas site in Denmark where the turbines are shipped on oddly-shaped vessels. My

ambition is to discover and cover projects leading the energy transition around the world.

My passion for the energy transition derives from my worries about climate change and environmental pollution. Therefore it fills me with great pleasure to see projects like the one led by Greenpeace in Switzerland, where students are involved in building solar

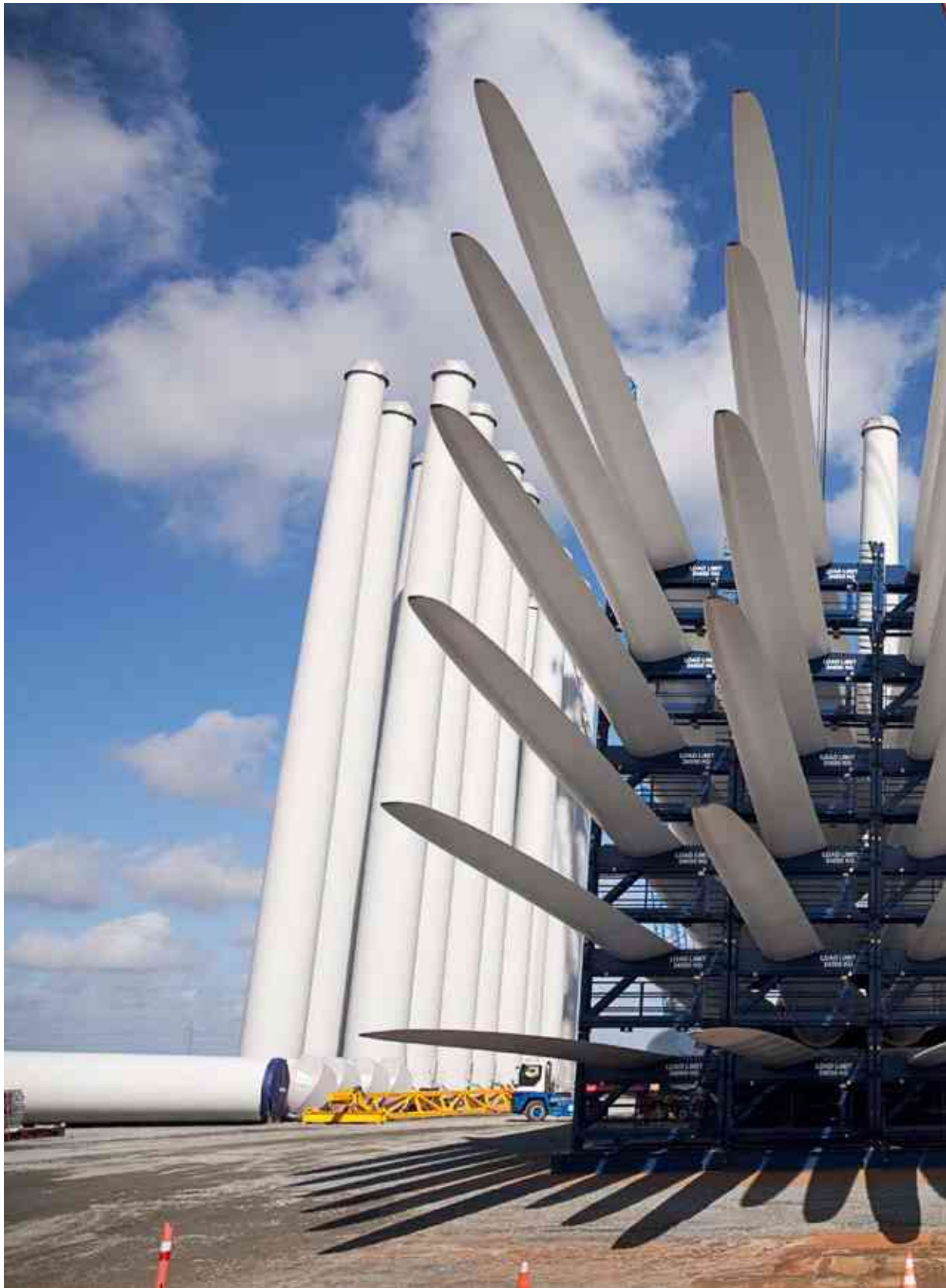


roofs. This is about creating awareness, fostering team work for a higher purpose while transferring knowledge efficiently with a long-term positive effect in people's lives.

The creativity and inventiveness in the field of renewables are astonishing, such as the beautifully-designed solar trees along highways, solar cells in bicycle lanes and floating solar panels at a sewage sludge reservoir.

It's a pleasure to capture these innovations as well as the bigger projects. With flooding rains hitting western Europe at the time of publishing this VIEWS, my motivation to continue this series is growing with every thunderstorm.

Branko de Lang

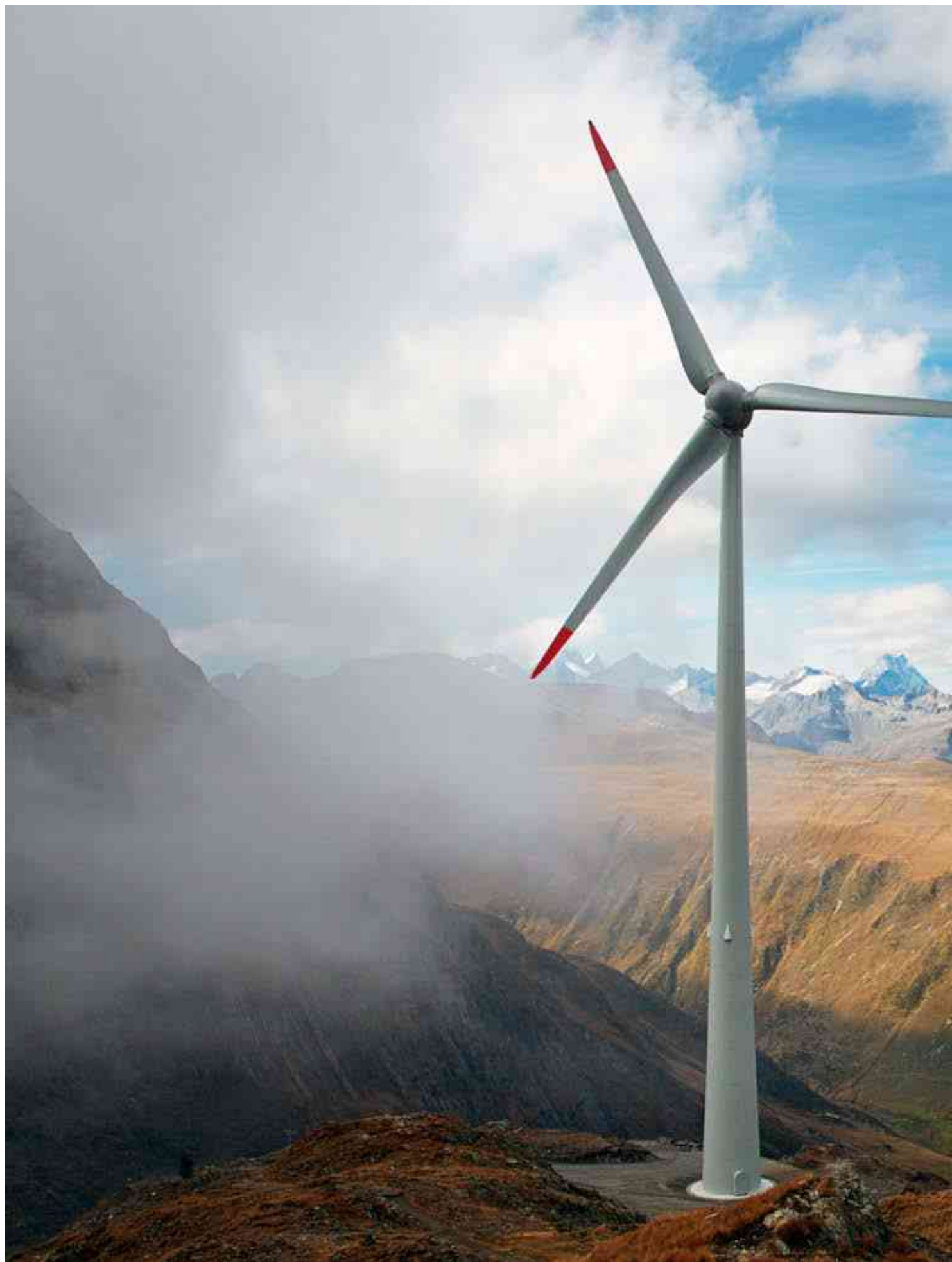


Previous page: Building the foundation of a massive onshore wind turbine with a height of 200 meters in Meer, Belgium, for Storm Windpower.

Top: Shipping of wind blades for ENECO's offshore wind farm Luchterduinen at MHI Vestas in Esbjerg, Denmark. The blades are loaded on a specially-designed vessel for transporting and constructing offshore wind parks. The wind mills are largely assembled onshore. MHI Vestas Offshore Wind is a joint venture between Vestas Wind Systems and Mitsubishi Heavy Industries.



Next page: Wind mill at Nufenen-pass in Wallis, Switzerland, located at 2,400 meters above sea level, making it the highest wind mill in Europe with a view on the Alps of Bernes Oberland.









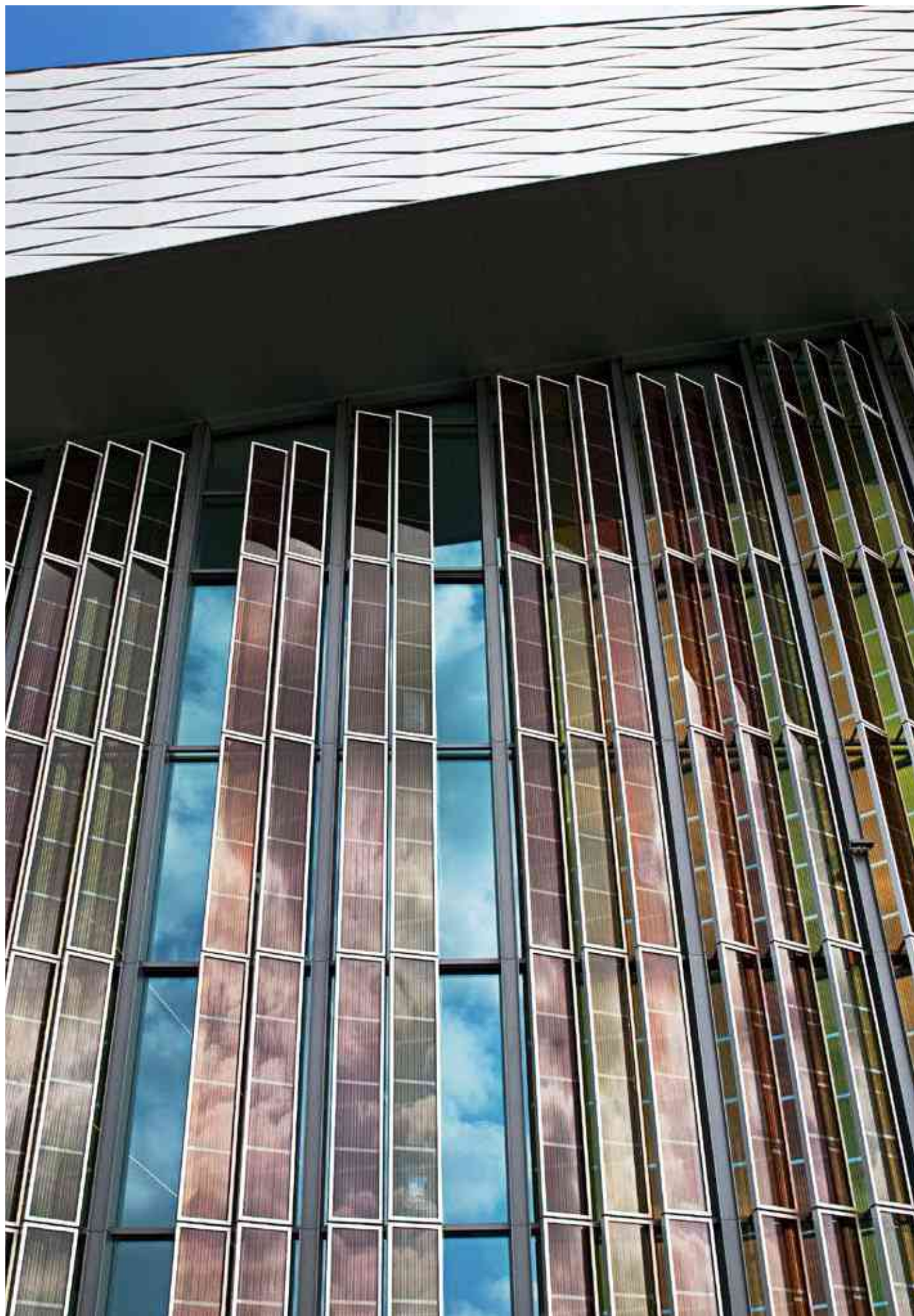


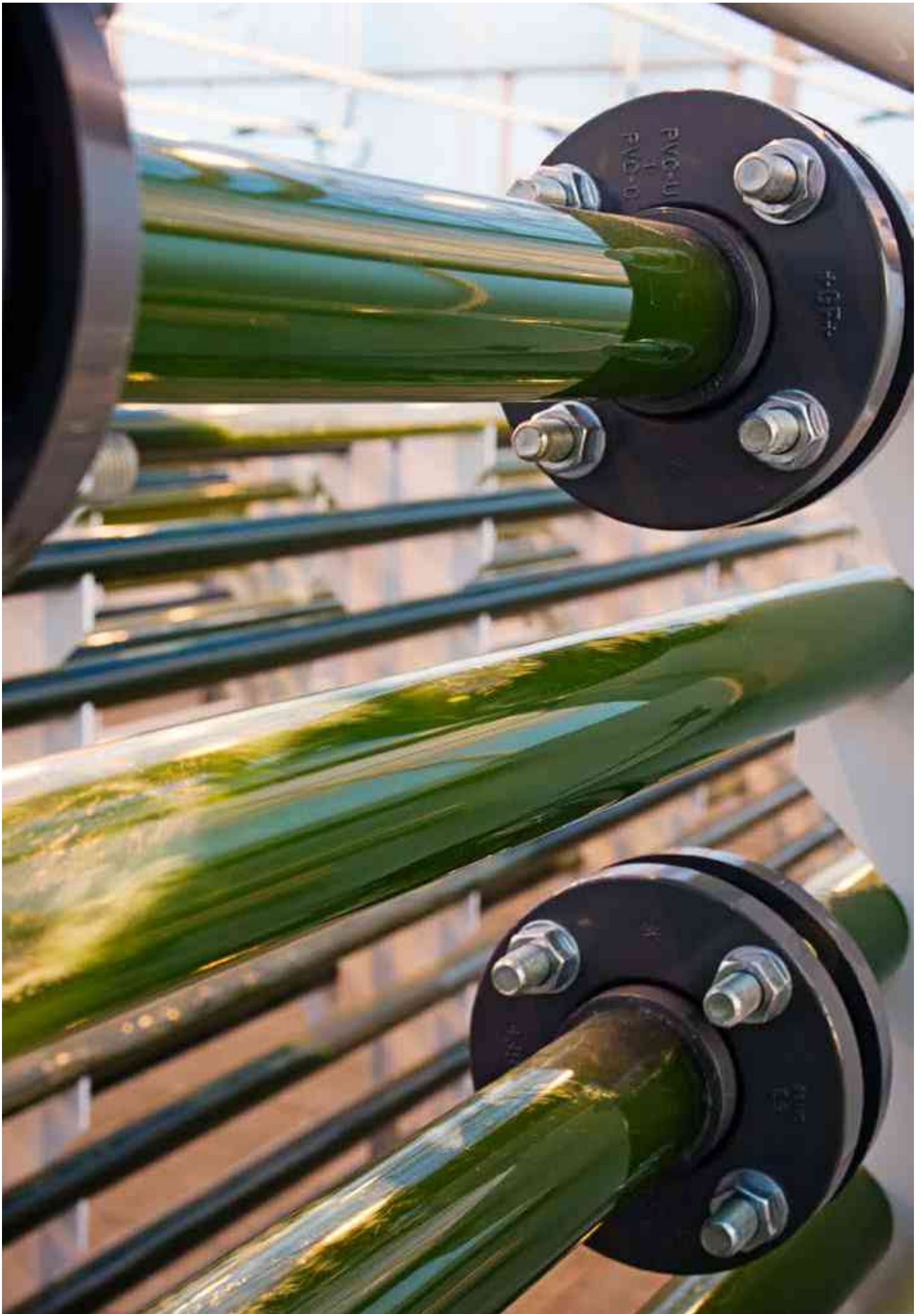
Previous page: Production of 43 wind mill pylon pieces by SIF in Roermond, the Netherlands, for the ENECO Luchterduinen Wind Farm installed 23 kilometers off the coast between Noordwijk and Zandvoort. What makes these foundation pieces special is the fact that the wind turbines will be mounted directly on top of them, representing an innovative new technique which has only previously been applied in a small number of cases.



Top: A steel tree structure integrating solar panels along “the road of the future” in Oss, the Netherlands. Instead of leaves, solar panels are mounted on the branches. Hermans Energy is the supplier of these customized solar panels.

Next page, left: The new Swisstech Convention Center in Lausanne has the first major architectural application of dye solar cells. A dye-sensitized solar cell (DSSC, DSC or DYSC) is a low-cost solar cell belonging to the group of thin film solar cells. It is based on a semi-conductor including a photo-sensitized anode and an electrolyte, a photo-electrochemical system.







Top: Installation of the Swiss Solar Tank in an apartment building in Oberburg, Switzerland. The tank, made by Jenni Energietechnik, is used to store energy collected from solar power.

Previous page, right: Research lab for intensive algae production at Wageningen University, the Netherlands. In six different test tubes, the production of algae is being compared. Algae can be used as ingredients for cosmetics, food, and as a source of 'green' energy.

Next page: Construction of an onshore wind park in Hoeven, Holland, where Vestas V90-turbines of 2 MW are installed for the Dutch energy company Eneco.



Branko de Lang is a Dutch photographer based in Breda. He works for press agencies in both the Netherlands (ANP) and Switzerland (Key-stone). His main focus is on environmental issues, the energy transition, and climate change. Other topics include daily life, politics, agriculture, infrastructure and travel. One of his next assignments is to cover water and energy issues in Morocco for Revolve.





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To the Moon and Back

Transforming Europe's Power Sector

Europe is on a complex mission to transform its existing power infrastructure for a decentralized energy future. This major transformation requires a €600 billion investment to facilitate the integration of renewable energy sources in the most reliable, efficient and cost-effective manner. This involves almost 300,000 km of transmission lines, over 10 million km of power lines - 13 times to the moon and back - and 260 million connected customers.

Writer: Karolina Krzastek

Image: The West of Duddon Sands Offshore Windfarm.
Source: Iberdrola





The Energy Transition Challenge

Within 15 years, renewable energy will overtake coal and gas to become the world's top source of electricity.¹ As the share of electricity produced from variable renewable resources grows, so does the need to integrate these resources into the power grid in the most efficient, reliable and cost-effective manner.

The growing share of renewable generation will require a **€600 billion investment in a large-scale transformation of the transmission infrastructure** to accommodate the new intermittent and geographically diverse sources of power.²

Demand for carbon-free electricity is growing. However, carbon emissions

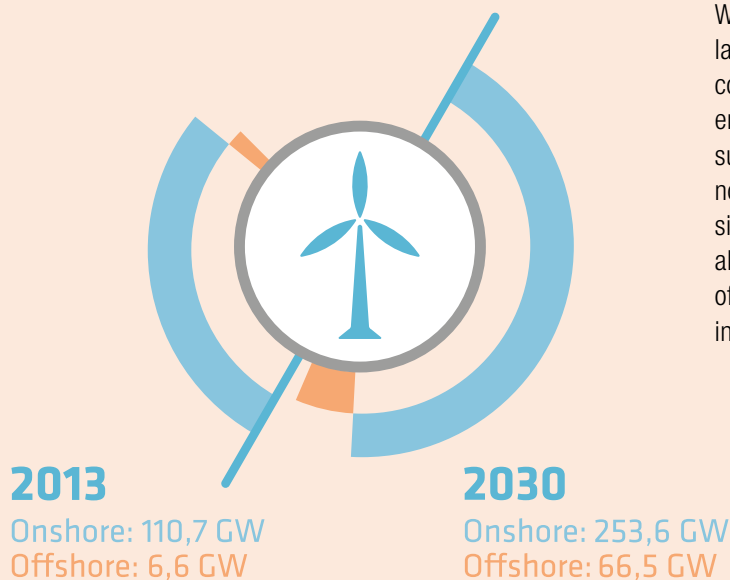
from energy use account still for 70% of total greenhouse gas (GHG) emissions while those related to electricity approach about 50%.³ Consequently, the European Commission has enacted policies to curb GHG emissions from the power sector, including regulations requiring the majority of Europe's electricity to come from renewables by 2050.

The transition to a low carbon society by 2050, based on renewables and energy efficiency, implies a transformation in the way that electricity is generated and transmitted. It requires industry to develop and adopt, on a large-scale, new power engineering technologies that will improve the system's security and flex-

ibility to avoid power outages and inefficiencies, and accommodate wind power cost-efficiently.

The grid faces two main technological challenges in accommodating renewables: location and variability. Wind energy is often produced far away from where it is needed. To transport vast quantities of electricity produced on off-shore sites in the North and Baltic Seas over long distances to the consumption areas on the continent, power grid infrastructures need to be upgraded. In addition, wind production is both variable and uncertain, and grid system operators have to make sure they have enough reserves to balance them.

CUMULATIVE WIND POWER INSTALLATIONS IN THE EU (GW)



With a projected 392 GW installed, wind energy will be the single largest source of power generation in the EU by 2050 ahead of coal and gas.⁴ Although small penetrations of renewable generation on the grid can be smoothly integrated, accommodating such significant amounts is not without its engineering and economic challenges. The European grid already faces transmission challenges with the alternating current (AC) infrastructure almost reaching its transport capacity. Large-scale transmission of electricity requires new approaches to extending and operating the grid.

Large-scale transmission of electricity requires new approaches to extending and operating the grid.

1. International Energy Agency, World Energy Outlook Report, 2015, p.47
2. Euroelectric, Power Distribution in Europe Facts & Figures, 2013, p.6
3. International Energy Agency, World Energy Outlook Report, 2015, p.25
4. Wind Europe, Wind Energy Scenarios 2030, August 2015, p.7

How to Realize the Potential

The objectives of the Best Paths project are the development and deployment of new technologies facilitating the widespread integration of more offshore and onshore wind power into the European electricity system by 2020 and beyond. Coordinated by Spanish Transmission System Operator – Red Eléctrica de España (REE), this is the biggest European energy demonstration project to prepare the grid for bulk renewable energy transmission, benefitting from an EU contribution of over €35 million for a total cost valued at €63 million. The project unites expert partners around five large-scale demonstrations to deliver replicable industrial solutions improving the interconnections, capacity and flexibility of the entire power grid.

Delivering renewable energy over long distances

The focus is to upgrade and repower existing overhead transmission lines to increase their capacity. Given growing difficulties in obtaining permission for new power lines, using innovative materials and geometries for pylons, conductors and insulators will help to keep within the space already used, while allowing for a higher electrical capacity.

260 million European households and businesses are linked to transmission systems by around 10,700 transformation stations and more than 4 million distribution transformers.

Source: EURELECTRIC

The project will also develop and test 3GW-class superconductive cables, enabling the transmission of significantly more energy to congested cities than existing conventional systems. In addition, the Best Paths team is working on the Voltage Source Converter: a technology that offers an improved maintenance and security in the system.

Ensuring interoperability

Ultimately, the objective is to ensure interoperability among different solutions and grid components produced by different manufactures. The potential lack of compatibility could create monopolies for

the manufacturers of equipment and prevents network operators from competitive tendering. The experimental results of Best Paths will address this challenge, showing the scalability of the developed solutions, and benefiting replication across the pan-European transmission network and electricity market.

The initiative also sets out to increase the integration of offshore wind energy in Europe using high voltage technology. The enhanced interaction between wind turbine generators and high voltage networks (connecting offshore wind farms to the onshore grid, used to deliver power to households) is of great importance as it represents the technology of choice for bulk transmission over long distances.

Source: 50Hertz



New European Power Engineering Technologies

With over 10 million km of power lines, almost 300,000 km of transmission lines, 2,400 electricity distribution companies, and 260 million connected customers, the existing infrastructure for electricity transmission and distribution is an increasingly complex and sensitive system. As such, successful modernization of the grid requires integrated solutions

that reconcile renewable energy development and market integration while ensuring security of supply, fully in line with customer demands for competitiveness.

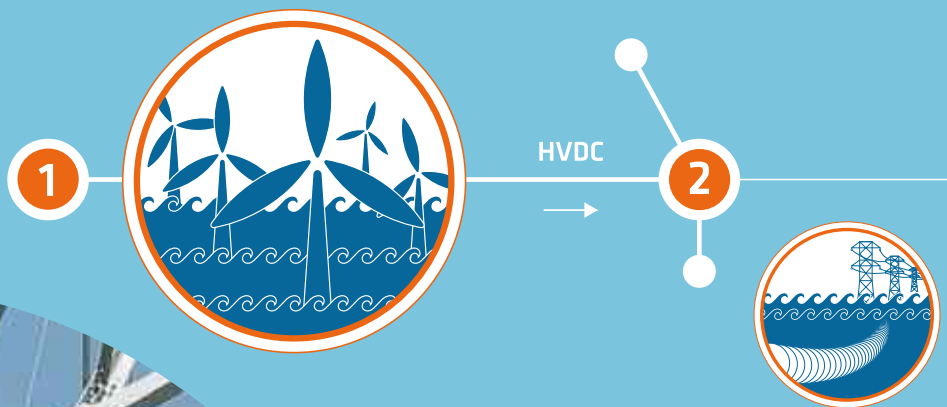
Best Paths addresses this challenge by evaluating the technical feasibility, costs, impacts and benefits of new grid technologies in a variety of real operational envi-

ronments in Belgium, France, Germany, Hungary, Italy and Norway. Developing and testing the performance of each of the five demo-sites provides an essential opportunity to understand the technology, manage operational and financial risk, and experience hands-on multi-partner delivery.

Integrating offshore wind farms

The first demonstration aims to understand better the complex interactions and the related risks occurring where large offshore wind farms are grid integrated with high voltage links. The Best Paths team examines the interactions of the wind turbine converters with the high voltage converters in a laboratory environment.

1



2

Maximizing interoperability

The main focus of the demonstration is to maximize the interoperability of industrial equipment such as Voltage Source Converters stemming from various grid component manufacturers, transmission systems operators and grid users. The interoperability is explored and assessed in a variety of situations comprising fault conditions, special sequences and normal operations.



Upgrading interconnectors

The objective of the demonstration is to design, develop and test new technological solutions, including: submarine and land cables with improved insulation; multi-modular converters and high performance conductors for overhead lines; and, pre-coated glass insulators that enable the upgrade of interconnectors. The existing link taken as business case is the SACOI (Sardinia-Corsica-Italy) line.

3

Repowering transmission lines

Best Paths aims to demonstrate how existing overhead transmission lines can work at higher temperature to increase the capacity of transmission corridors. The teams are assessing High Temperature Low Sag conductors and insulated cross arms offering the ageing potential and reliability required for the repowering of corridors. Moreover, the project develops advanced overhead line designs and innovative working processes to minimize the duration of outages as well as a prototype dynamic line rating system for higher temperature operations of the current line technology.

4



HVDC

AC

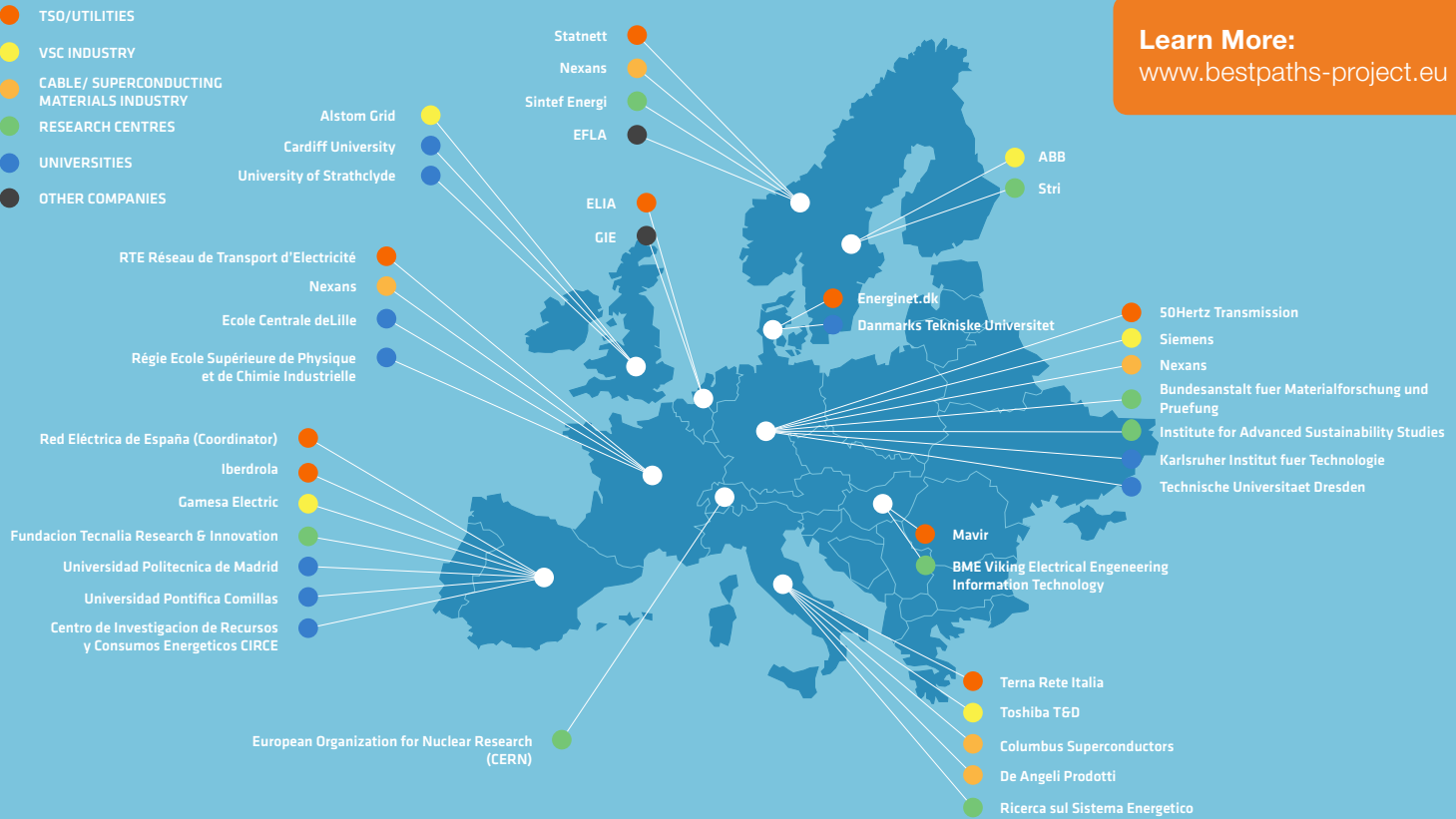
5

Transmitting more energy

Super-conducting cables are well-suited to serve the need of massive power injections in European urban areas and propose an excellent alternative to pass through large urban cities with limited voltage. The project will develop a new direct current cable technology relying on Superconductors that enables transmission of significantly more energy than in any existing conventional system. The work will lead to the first high voltage cable system demonstrator with a transmission capacity of up to 3.2 GW.

About Best Paths

Thirty-nine partners have joined together to deliver a substantial change to the power grid's capacity and flexibility. The partners represent the entire chain of innovation in Europe, from Universities and research centers generating new knowledge, the power industry developing new products, to Transmission Systems Operators (TSOs) and energy producers, specifying their need for new industrial solutions.



Learn More:
www.bestpaths-project.eu



Q&A

Vicente González López

Integrating Renewables for Cleaner Electricity Networks

Vicente González López, Coordinator of Best Paths and Head of R&D at the Spanish Transmission System Operator – Red Eléctrica de España (REE) talks about the major challenges in developing network technologies to increase the pan-European capacity for transporting electricity from renewable sources.



Image: Vicente González López.
Source: ENTSTO-E

Can we integrate large-scale renewable energies for a low carbon economy?

The difficulty is that we are not able to manage the generation capacity of the systems as we have done until now with conventional power plants. The main characteristic of the electrical system is that we have to maintain a balance between generated and consumed electricity. The answer is YES but only if all the relevant actors take up the challenge.

Does the integration of renewables make European energy supply more secure?

For sure, renewable energies can and must contribute more to the security and quality of supply, in accordance with their primordial role within the complete chain of supply. The present levels of security of supply in Europe are better than in any other region all around the world. However, this substitution of conventional power plants by renewables requires new grid services to maintain present levels of

supply. We are studying new functionalities in our research project.

How will this approach going to benefit the consumer?

Our research will help to maximize sustainability at the best possible costs for the industry, investors, suppliers and – ultimately – for consumers. The goal is to develop integrated solutions that will allow for a smooth penetration of renewable energy sources while ensuring an affordable market for electricity consumers. 



This project is co-funded by the European Commission under the Seventh Framework Programme for Research, Technological Development and Demonstration under grant agreement no 612748.

Recover Energy, Don't Waste it!

What do a Norwegian fjord, a Belgian brewery, a Danish dairy plant, a Finnish data center, a German office building, and a French sports center all have in common? They use heat pumps – and nobody knows.

Writer: Thomas Nowak





Heat pump technology is well known for providing heating, cooling and hot water to residential buildings in an efficient and reliable manner. Less known are the larger cousins of residential heat pumps – industrial and commercial units. While they also provide the same primary services, they add an important factor to energy systems in cities, large buildings or industrial processes: large heat pumps close energy loops.

Wherever humans are active, they require energy. Energy always “flows” from a higher to a lower temperature level. The result is a surplus of energy at a level usually deemed not useful. In a typical residential building, the users need heating and cooling, lighting, entertainment, and while the inhabitants enjoy these services, energy is eventually lost. The same holds true for commercial buildings, hospitals, and schools.

Heat pumps can provide energy, but they can also help reduce the absolute energy demand by being integrated into heat

recovery systems. In larger buildings, a smart, heat pump-based energy management can distribute energy between parts of the building requiring heating and those in need for cooling. This could also be done between different buildings.

The effect is even bigger in industry. Apart from the need to heat and cool buildings and to provide hot water for the kitchen and showers, many industrial processes today run at temperatures below 100°C. This makes them suitable for the use of heat pumps. Prototypes can even provide temperatures up to 170°C. An evaluation of the technical potential of heat pumps in industrial applications revealed an energy savings potential of 174TWh or about 10% of industry heating energy demand. The savings amount is even larger, when considering the integration of cooling and refrigeration processes into the system.

Heat pumps can use **renewable energy** from air water and ground or **recover** waste energy. Independent of the energy source, energy demand and CO2 emissions are greatly reduced.

Note: In the European Union energy from air (aerothermal), water (hydrothermal) and ground (geothermal) - to be used by heat pumps - is recognized as renewable energy.

Connecting the dots is a key challenge to exploit energy fully

Energy flows in industry are often complex. They require and provide energy at different times, locations and temperature levels as well as in different quantities.

Every energy input results in waste energy at a lower level, every cooling/refrigeration processes produces waste heat and even if a heat pump is used for heating, it results in waste cooling. This energy can either be discarded to the environment or recovered to improve overall energy efficiency.

People need to understand this process to decide favourably for its implementation. Experts responsible for designing and operating industrial processes also may not know about the opportunities. A typical comment of a plant manager was: “a by-product of our main process is energy at 50°C but it is useless to us. Even worse,

it becomes a cost factor, as we have to invest in installations to get rid of it.”

The challenge is to connect application areas and to find a use for waste heat from a cooling process or for waste cold from a heating process. Sometimes it may just need some creative thinking, sometimes it

can only be achieved by re-designing the whole production process. If successful, efficiency improvements are tremendous. To an extent that the beneficiaries of these improvements do not want others to know, preferring to reap the cost advantage for as long as possible.

Heat pumps can provide heating, cooling and hot water for residential, commercial and industrial applications as well as for district heating and cooling grids.



Heat pumps are becoming state-of-the art in commercial applications

Office buildings, hotels, restaurants, hospitals, and sports facilities all need heating and cooling – quite often they require more cooling than heating. Most of them also need hot water for different purposes. Installing a heat pump as a stand-alone solution or in a hybrid configuration is more and more common. Using only one machine to provide heating and cooling is economically even more efficient.

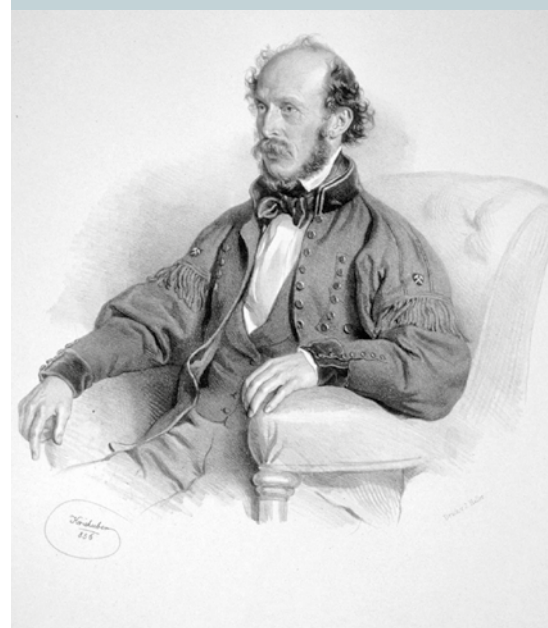
Industrial Processes

Heat pumps can be applied in many industrial production processes.

Application areas include:

- heating / cooling of buildings
- cleaning
- drying – usually energy loops are closed by connecting the waste energy side to the source energy side and bridging the difference in temperature via the heat pumps. If necessary, an additional energy source fossil burner is added as a back-up energy source or to cover peak demand.
- food production and processing (flakes, brewing, malting, fruit and vegetables, yeast noodles, potato as well as meat, milk and cheese).
- general production (such as textiles, timber industries, rubber and plastics, paper, brewing, malting brick production, and metal coating).

The history of heat pump applications has started in the 19th century in Austria where Peter von Rittinger developed a technology to reduce energy demand in salt extraction. Its application became the de-facto standard for salt mines in Austria. Since then, the technology has significantly improved.



Images: Peter von Rittinger
Litho by J. Kriehuber 1856



Connecting energy loops by using the waste energy from one process, shifting it to a useful level and providing it to another process is the holy grail of efficient process design.

The following examples give insights into realized advantages of large heat pump installations in diverse application areas for office buildings, district heating, paper mill, hotels, and dairy production. They can only be an incentive to consider heat pump applications further. To fully unleash this potential, it will not only require the industry to develop the technology even further, but also political clout. Policy makers need to create frameworks and markets that favor heat pump based systems as most sustainable solutions.

They should favor energy demand reduction by using recovered energy in a similar manner as they favor the use of renewable energy today.

Last but not least, fixing the current market mechanism is the elephant in the room. Payback times of heat pumps that are acceptable to industry as well as availability of financing options depends largely on the comparison with cost of fossil fuel alternatives. If policy makers want to use the market mechanism for the energy transition, they need to set a corrective price signal.

Heads of states and governments have signed the COP21 agreements on limiting global warming to significantly below 2°C last december in Paris.

Making full use of the potential of large heat pumps in residential and commercial buildings, industrial processes and cities will make achieving this target much easier. But even more than that: a decarbonisation of the energy system is impossible without a decarbonisation of the heating sector; a decarbonisation of the heating and cooling sector is impossible without heat pumps.

Using the waste energy from cooling processes to create heating and hot water where needed is most efficient.

1,2 MW hybrid heat pump to produce dry milk/base milk at Arla Foods in Denmark.

The heat pump continuously provides 85°C water which is used as an energy source in the drying process. The energy source for the hot water production is energy derived from cooling down another part of the process. The unit is meeting the expectations of the factory owner. The investment paid back in 2,5 years and significant reduction in energy demand and CO2 emissions.



Waste heat from server operation heats architectural landmark

The IT server room is the heat source for a renovated office building in Hamburg, Germany. The building, originally built by Danish architect Arne Jacobsen, is an architectural landmark. Its dimensions lead to cooling demand in the sun-orientated areas, while shaded areas need to be heated. A new heat pump energy management system allows for the provision of heating and cooling in parallel. Two heat pumps provide 720kW capacity with a combined heating and cooling capacity of 8 (1kWh of electricity results in 8 kWh units of heating and cooling).



A city symbiosis: drying paper and heating houses

The paper mill in Skjern, Denmark, is using 4 large heat (total capacity 5,2 MW). They recover the waste heat from the paper drying process at around 30°C, lift it to 70°C and transfer that energy to the local district heating grid. Closing the loop is saving 8,200 tons of CO₂ annually.

Each body of water means “energy at your fingertips”

The machine room hosting 14 MW heat pump capacity overlooks a Norwegian fjord, which is its energy source. 8°C water is efficiently used (COP of 3) to provide 90°C hot water to the Drammen district heating system. The company is happily saving € 2 million annually while scrapping 1,5 million tons of carbon emissions.



Exercise, relax and enjoy

A landmark hotel in St. Moritz, Switzerland, uses a 150 kW heat pump to provide hot water on the coldest winter days. Instead of discharging the energy stored in the waste water from the Spa area, it is turned into the energy source for the heat pump, again providing hot water for the hotel. Heating is provided from a heat pump-fed district heating system using lake water as energy source.

Fully decarbonizing Europe's heating
and cooling sector is impossible
without heat pumps.

Background: Heat pump technology

Heat pumps convert air, ground heat and water into energy – it's that simple! The general principle of the technology is identical and independent of application. A heat pump can provide heating, cooling and sanitary hot water for residential, commercial and industrial applications.

Heat pumps transform energy from renewable energy sources (air | aero-thermal, ground | geothermal and water | hydrothermal) into useful heat. They can also use recovered energy from industrial processes, infrastructure installations (sewers, subway, underground parking) or

exhaust air from buildings. The transformation is done via the refrigeration cycle. It consists of a heat source, the heat pump unit and a distribution system to heat/cool the building, usually either air ducts or water pipes.

While a number of technical variations for heat pump technology exist, the electric compression cycle is most commonly used. In an electric compression heat pump, a transfer fluid (refrigerant) transports the heat from a low-energy source to a higher energy sink. Auxiliary energy – usually electricity or gas – is needed to

run the compressor and the pumps.

In the European Union, more than 8,3 million heat pumps are operating. Each year, they use 93,2 TWh renewable energy, reduce primary energy demand by 55,9TWh and reduce CO2 emissions by 24 Mt. If all markets showed the same heat pump penetration as Sweden, annual renewables integration would be 754 TWh, primary energy demand would fall by 952 TWh and CO2 emissions by 197Mt. Currently, the market grows by roughly 850 000 units / year.

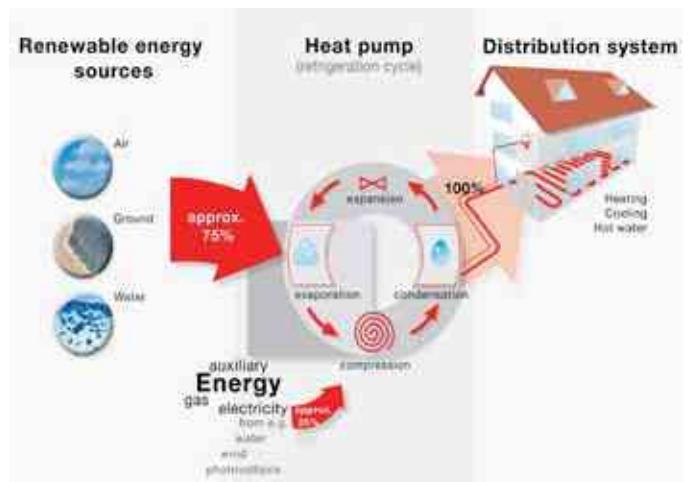
The refrigerant cycle provides heating and cooling, continuously

Heat pump systems are optimized for heating or cooling. In heating mode, ambient energy is the heat source and the building/process is the heat sink. In cooling mode, the building/process is cooled down using the outside as the heat sink. Obviously, a system's efficiency increases greatly in application areas with a parallel demand for heating and cooling giving such systems an additional economic advantage.

Positive side effects of deploying the heat pump technology include increasing local employment, reducing import dependency, making energy costs more stable and predictable, and bridging the electric and thermal sectors by providing demand response potential while stabilizing the electric grid.

Heat pumps are cross-cutting the modern, future-oriented energy system. The required decarbonization of the energy system cannot be achieved without decar-

bonizing the heating sector. The heating sector cannot be decarbonized without heat pumps! 🌍



For more info:
www.ehpa.org



The European Heat Pump Association (EHPA) represents the majority of the European heat pump industry. Its members comprise of heat pump and component manufacturers, research institutes, universities, testing labs and energy agencies. Its key goal is to promote awareness and proper deployment of heat pump technology in the European market for residential, commercial and industrial applications. EHPA aims to provide technical and economic input to European, national and local authorities in legislative, regulatory and energy efficiency matters. All activities are aimed at overcoming market barriers and dissemination of information in order to speed up market development of heat pumps for heating, cooling and hot water production.



Olot: Clever District Heating & Cooling

The Catalan hillside city of Olot is demonstrating the possibility for energy innovation to be implemented in historic centers.

Writer: Sander Laudy

If district heating and cooling networks are only being built because of their efficiency of scale, then from a technological point of view they can be just as boring as the modern housing developments where they are usually carried out. But if they respond to shifting paradigms in energy-management – like the decentralization and diversification of sources, supplying energy to a variety of functions, in the middle of a century old and dense urban fabric... and all this with exclusively renewable energy – then they can rightly be called ‘innovative’. And such is the case in the northern Spanish city of Olot. It’s no surprise they won jointly last year’s European Heat Pump Award.

In Catalan they call it the ‘Xarxa Espabilada’ (‘Clever Network’) and Franc Comino, CEO

of Wattia Innova, talks with contagious enthusiasm about his latest project, and biggest until now: “We are doing something really complex over here”, he says smiling. When the city government opened the tender in 2014, Franc was in the middle of his ‘Espai Zero’ project, running the offices of his engineering company Wattia with zero external energy consumption the whole year around (summer temperatures in Olot can rise easily to above 35 degrees Celsius and in winter they tend to go below at -5 degrees Celsius), thanks to a combination of solar photovoltaic (PV), geothermal and aerothermic energy.

To participate in the tender for this large scale project, Wattia Innova joined forces with the Barcelonese office of Aiguasol (specialists in district heating and cooling networks), with the national energy utility Gas Natural and with architecture firm B01 arquitectes, who had to take care of the integration in an existing building and of the relation with the public space. The team won the tender with a concession on the exploitation during 15 years and at this moment, with some part of the geothermal network already functioning, the works on the whole of the central are proceeding and completion is planned for September 2016.

Image: Aerial view of the Renewable Energy Central in the former hospital, downside of the picture, and the buildings that will be connected in a first (yellow) and in a second phase of the project.
Source: B01 arquitectes

Visibility is a main feature of the project since the central of the network will occupy the ground floor of an emblematic former hospital and because the machinery will be visible from the main artery that runs through the city center of Olot.

There are five buildings being connected to the network: the municipal market, two residences for the elderly, a museum and a civic center. Their vicinity and different energy demands (cold-heat / time schedules / amounts) made it an interesting combination, which could draw their energy from a series of sources that were evenly diversified.

When the foundations of the newly built market were being executed, holes were made for the geothermal circuit. Two biomass pellet stoves (that together add up to 600 KW) have been installed, next to a 90 square meter pellet deposit. "In winter, this deposit will need to be refilled about every two weeks", explains Oriol Gavalda from Aiguasol. He shows drawings of the worm-drive tubes that will transport the wooden pellets through the basement floor towards the stoves and says that Olot and the Garrotxa region are famous for their dense and unspoiled woods. The choice to



apply biomass as a renewable source for heating energy was obvious in this context and one of the suppliers of the pellets will be the renowned La Fageda Cooperation that manages many surrounding agricultural terrains.

As a last renewable source, the central will manage the PV installation to be installed on the roof of the market. This energy will mainly be used to pump the hot and cold water from the central to the different buildings to create the desired temperatures – applying electric energy for this would be highly inefficient compared to

the geothermal and biomass systems. The installation of this part of the renewable energy installations still has yet to be started and the fact is that a recently approved law on the Spanish national level, the so called 'tax-on-the-sun' makes this part of the network now unfeasible. General opinion in Spain predicts the derogation of this law anyhow, since all political parties but the one that redacted it are against it.

the construction of the central has taken longer than foreseen but the team is aware that the effort is pioneering. Inserting such a complex system into the center of a historical and dense city is not easy and

there are many unforeseen problems to be solved. An energy central in the basement of an existing building was simply unseen and building regulations did not contemplate it as an option.

If it is possible to make this piece of urban environment carbon neutral, then it has to be possible in other places as well. Olot's 'Clever Network' will serve as an example for many more cities that want to join the renewable energy transition. ☀️

Image: Seldom has an energy central been implemented in an existing building. The works in the interior of the installation rooms are proceeding and the central will be finished in September 2016.
Source: B01 arquitectes



The winner of the 2016 Heat Pump City of the Year is Hylke, Denmark. The Danish city convinced the jury of experts with its deep community involvement and the high replication potential of the project. The award was handed over from last year's winners: the city of Olot, Spain, and Mäntsälä, Finland. Both projects showed innovative ways of using heat pump and district heating & cooling to deliver affordable and renewable heating and cooling to their citizens. The Heat Pump City of the Year is an EHPA project which started 6 years ago and aims to award the most efficient, smart and sustainable heat pump projects at local levels.

Regions in the Energy Transition

Regions have been at the forefront of developing sustainable policies in Europe for many years with two major factors favoring this trend: (1) promoting renewables and energy efficiency is not only environmentally sound, it is also economically beneficial, and (2) regions are the right political level to make such change happen.

Writer: Céline Dawans





The favorable economics of energy efficiency have never been as clear and compelling as now. Strategies aimed at implementing pervasive improvements in efficiency are an obvious and effective way to save energy, to improve competitive-

ness, and reduce greenhouse gas (GHG) emissions. Moreover, in an overall European context seeking to improve energy security, the diversification of energy sources through renewables represents a trump card. Renewable energies can also

boost research, and consequently innovation, and act as an engine for job creation thus fostering economic growth. Finally, renewable energy sources are available locally on a decentralized basis.

Long Regional Track-Record

This is precisely why regions are relevant partners and have a key role to play in energy strategies, in spite of varying levels of devolved competences. It is not surprising that energy has been high on the AER agenda for quite some time with work led by the Working Group on Energy and Climate Change.

In 2006, and together with the European Federation of Regional Energy and Environment Agencies (FEDARENE), AER established a declaration committing regions to deploy energy efficient practices and alternative energy sources. Two years later and together with 11 partner regions, AER kicked off the MORE4NRG

project to help regions improve their sustainable energy strategies and to create a specific tool that measures their progress towards achieving energy targets.

In 2007, when the EU triple 20 targets were established, regions were sharing good practices, developing projects, carrying out peer reviews, lobbying the institutions and generally developing policies in their territories in favor of better use of energy. In 2010, AER published a white paper on Energy and Climate Change as well as a survey on Sustainable Energy Policies in European Regions. Each year, AER is involved in the World Sustainable Energy Days in Wels (Austria) and in 2015

AER was proud to represent regions at the historic COP21 in Paris.

AER is a proud promoter of the Compact of States and Regions, encouraging regions to report, showcase and analyze their climate efforts. The Compact of States and Regions is the first dedicated global reporting mechanism for states, provinces and regions to showcase and analyze their climate efforts. Through an annual assessment, it provides a transparent and global picture of actions to tackle climate change – allowing state and regional governments to measure their emissions and set ambitious reduction goals.

COMPACT OF STATES AND REGIONS

As a critical part of the post-Paris agenda of action by Non-State Actors, AER invites all European regions to report to the Compact of States and Regions between April 4 and 15 July 2016.

Contact person:

Jean-Charles Seghers,
Compact of States and
Regions Manager

jseghers@theclimategroup.org

Governments reporting to the Compact of States and Regions in 2015



Image: Currently the Compact has the support of 44 states and regions together representing 325 million people which is one eighth of the global economy.

Source: The Climate Group

AER has also worked closely with other organizations, networks and even private partners involved in the field of energy including UNDP, General Electrics, R20, FEDARENE, NRG4SD, to name but a few.

Peer Reviews in MORE4NRG

MORE4NRG is an INTERREG IVC project to strengthen the delivery of regional strategies for renewable energy sources and energy efficiency by exchanging best practices on sustainable energy policies and jointly developing an integrated monitoring tool for measuring the effect of regional sustainable energy strategies.

To improve energy efficiency within its territory, the region must assess the consumption of energy in different public and private utilities such as factories, services and public buildings. The energy audit should serve as a starting point for any new reliable and effective regional energy strategy. Once the energy audit is done, appropriate energy

efficiency measures should be quickly implemented where important energy profits can be released at relatively low price.

5 peer reviews were carried out in the framework of the project: Maramures (RO), Western Greece (GR), Gabrovo (BG) and Prahova (RO) in 2009, as well as Abruzzo (IT).

“The outcomes of these audits are more than satisfactory”, says Anne Bliet, Chair of the MORE4NRG Monitoring Board and Deputy Queen’s Commissioner of the province of Flevoland (NL), adding that “AER’s Peer Reviews undoubtedly played a key role in the project’s success. They allowed us

to share our knowledge and to learn from each other. The regions that hosted peer reviews were offered the unique opportunity to identify their strengths and weaknesses when it comes to developing innovative energy policies. Our project has triggered a major change in their energy policy making, and I am happy to see how fast their energy landscapes are being transformed.”

The project also highlighted the regional diversity and creativity in tackling a huge variety of environmental challenges. MORE4NRG led to the identification of 33 good practices, with 10 of them already in the transfer process. Some examples:

The “Soap-on-tap” initiative, implemented by the Italian region of Lazio, encourages reductions in the use of packaging, and subsequently optimizes energy consumption linked to the production of paper, thanks to reusable washing detergent containers installed in the large-scale retail trade. The project has been implemented in the province of Flevoland.



The Centre for Renewable Energy Sources and Energy Efficiency in Western Greece created the Park of Energy Awareness. The aim is to offer citizens a chance to discover various forms of alternative energy sources and learn more about technologies used to produce clean energy. A similar park should be created in Prahova, Maramures and Gabrovo to fill a gap in the ecological education system by providing concrete demonstrates that make it more practical.



Gabrovo has integrated a special chapter on energy efficiency into its regional development strategy while Prahova is prepared its regional energy action plan.



Maramures explored the possibility of using satellite technologies in the field of biomass-based energy.

Regional Stories

Hampshire County (UK) Integrated Waste Management System

Hampshire County Council sends a smaller proportion of waste to landfill than any other county in the UK. Much of this success can be attributed to the county's

investment in three state-of-the-art Energy Recovery Facilities (ERFs). These facilities, capable of taking 420,000 tons of waste per annum, convert non-recyclable waste that would otherwise be landfilled into up to 38MW of electricity for the National Grid – the equivalent to that which would power over 53,000 homes. The three ERFs, which have all been acclaimed for their stunning architecture and their minimal impact on the environment, have given Hampshire an

energy recovery rate of 47%. The kerbside collection schemes of 'dry' materials like paper, card plastic and cans have been set up by local authorities and now cover 96% of Hampshire's households. The materials collected from the kerbside are delivered to the Materials Recovery Facilities, where they are separated by a combination of automatic and manual sorting. (Source: Hampshire County Council and Veolia Environment)

Oppland County (NO) Waste Management in Lillehammer

96% of the total energy production in the county comes from hydropower. The remaining 4% is bio-energy. The County of Oppland consumes approximately half of its energy production. The rest is transferred to the other areas within Norway or exported. Despite the surplus in energy production, the potential for generating energy from hydro and biomass resources is still not fully harnessed, as the county is covered with large forest areas and a high number of mountain rivers. An

increase in the production of bio-energy is one of the county's main goals. The waste management plant Mjøsanlegget AS in Lillehammer (Oppland-NO) is the result of a growing desire for environmentally friendly treatment of waste in the beginning of the 1990s, and especially in the planning of the Olympics at Lillehammer in 1994. The plant is producing biogas, fertilizer and compost from food waste from 246,000 inhabitants in the region. In addition, they are processing food waste

from businesses as large households, grocery stores, restaurant and hotels. The plant was put into operation in 2000, and expanded and upgraded in 2015. The plant currently has the capacity to process 30,000 tonnes of food waste. After upgrading the plant have more closed buildings and processes, which will give less problems with smell and less access to the waste for birds and other animals. (Source: Oppland County Council)



Västernorrland (SE) Storing snow for cooling in Sundsvall

Västernorrland County is in northern Sweden, a part of the world generally associated with snow and cold, but the summers are warm and buildings and equipment need to be cooled. The County Council

has consistently worked to reduce the use of energy since 1995, steadily replacing conventional chillers with other solutions. Snow cooling is the most acknowledged energy-efficient project to date and the technology is used to cool the hospital in Sundsvall. The plant is the first of its kind in the world (operating since 2000) and the method is very simple: snow is stored in the winter and melts in the summer. The meltwater is used to cool the hospital over the summer. The method is old and proven and can be used wherever snow is available. The storage has a volume of 30,000 m³ and covers a football field of around 6,000 m². The snow is stocked on a waterproof, heat-insulated plate. The layer of wood chips that covers the storage prevents snow from melting rapidly. Water

from melted snow flows into a pump and directly into the hospital. Thanks to this system, the consumption of electricity at the hospital has been reduced from 450 MWh to 40 MWh and the amount of cooling medium is reduced from 500 kg to 0 kg. (Source: "Renewable energy in Västernorrland", Västernorrland Energikontor)

After visiting the snow cooling plant in Sundsvall, Japan has set up 160 similar facilities since the Fukushima disaster.

Baden-Württemberg (DE) Exploiting Hydro-electricity

The German region is home to the adjustable hydroelectric plant, by Hydro-Energie Roth GmbH. By using innovative technology, the plant can produce up to 40% more power annually compared to traditional hydroelectric plants. It is low maintenance and can reduce noise pollution by using quiet generators on a common shaft, and the plant's generator technol-

ogy can achieve a higher energy output of between three and five per cent, which can be increased by up to 40% when operating with large quantities of water.

“As for the future, your task is not to foresee it, but to enable it.”

- Antoine de Saint-Exupéry

Vojvodina (RS) Expanding the Use of Biomass



The Autonomous Province (AP) of Vojvodina is an energy-deficient province in Serbia relying on imported energy for 55-60% of its consumption. The primary goal is to increase energy efficiency and replace fossil fuels with renewable energy sources (RES) from domestic sources. Biomass represents approximately 59% of the total potential of the RES in the country and offers many advantages: high availability, increase of fossil fuel prices, local employment and job creation, and the reduction of greenhouse gas emissions. In its Energy Development Strategy for 2030, the Republic of Serbia explored two scenarios for the future, one as “business as usual” and the second with energy efficient measures applied. The latter will

result in 9% saving in the final production in 2018 compared to the reference scenario. The sectors that are largely impacted are households, commercial and public utility sectors, industry and transport. In AP Vojvodina, based on the current energy sector situation, the emphasis is placed on a greater use of biomass and geothermal resources in the production of heating energy. Furthermore, the application of solar energy for domestic hot water production and the production of electrical energy remains on the list of priorities of future activities. It can be expected, in a not too distant future, that this form of clean energy occupy a prominent place on the map of power plants in the territory of Vojvodina. 🌞

Connecting regions, inspiring Europe since 1985



The Assembly of European Regions (AER) is the largest network of regions in wider Europe, gathering regions from 35 countries, working for a peaceful and prosperous Europe. We promote a multi-ethnic, multi-cultural and multi-lingual Europe through the diversity of our members which we believe are at the core of European values.

The strength of the organization lies in its reputation in the European circles gained from 30 years of constant dialogue with the highest European authorities, the active involvement of its politicians and the number of successful programs and projects which nurture the exchange of good (and bad!) practices among its regions.

With its decentralized, flexible and bottom-up structure, AER is the independent voice of regions in Europe. The network promotes true ownership by its members encouraging any region willing to do so to lead on the topics, initiatives and actions of their choice.

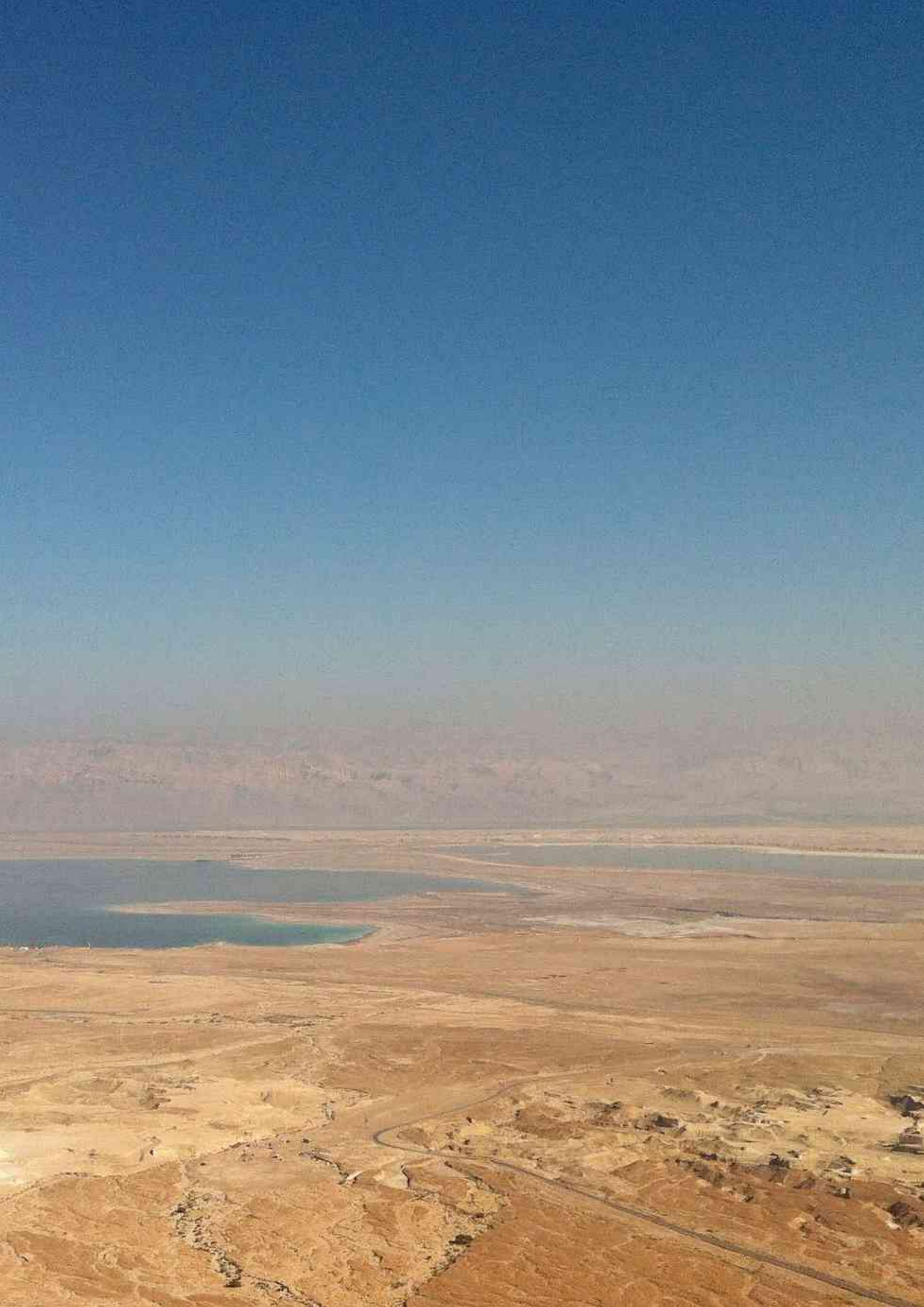
Addressing Water Scarcity in Jordan

Climate change, human activities and demographic pressure are exacerbating water scarcity in Jordan. Rainwater harvesting, water reuse and permaculture are solutions to tackle this issue that can be replicated as adaptation measures to climate change for the water sector.

Writer: Valeria Mazzagatti and Guido Sabatini

Image: Dead Sea, Jordan.
Source: Pixabay





The Consequences of Water Scarcity

Jordan is among the world's four most water-scarce countries and it is located in one of the most arid areas of the Middle East. Drought, overexploitation and depletion of underground water reserves and climate change are making the serious shortage of water even worse.

On top of the climatic and geographic aspects, demographic pressures also play an important role. Over the next two decades, the population in Jordan is expected to double. The increase is caused by inflows of migrant workers and by several waves of refugees fleeing the conflicts in the region, most recently from Syria. This puts a significant strain on water resources and the environment.

The inefficient and aging infrastructure for water supply is also among the causes for

rapid depletion of water resources in Jordan: around 50% of water is lost in distribution systems. This impacts significantly the water demands from a growing population and a growing economy in the country. This is reflected in the decreasing trend in water resources availability that has long been registered in Jordan. Annual per capita water availability has declined from 3,600 cubic meters in 1946 to 145 today.

To face such an issue and increase fresh-water supply, the Jordanian government has recently taken action with the development of two projects: the Disi Aquifer water conveyance and the Red Sea-Dead Sea pipeline. The Disi water conveyance became operational in 2013 and transports water to Amman and other Jordanian cities from the Disi Aquifer (located in the country's southeast). The Red Sea-Dead

Sea project got the green light at the end of 2015 and aims at increasing water supply through seawater desalination.

However, even with government strategies and future plans to solve the problem of water shortages, experts still expect a significant increase in the water deficit for all uses. Emergency water rations to one day a week have been implemented by the Jordanian government since the early 1980s and still recur frequently. This causes limited access and intermittent supply of clean water especially for the remote poor communities in the Jordan Valley and the Highlands Plateau. The severe weather conditions that characterize this region are reflected by great variation in rainfall distribution within the region. Around 90% of Jordan's 90,000 square kilometre-wide area receives an average annual rainfall of less than 100 mm while only 3% of the land receives an average annual precipitation of 300 mm or more. Rainfall often occurs at high intensity when crop water requirements are minimal. The total amount of rainfall received by this area largely exceeds

Image: Drought-induced soil cracks.
Source: Pixabay



all other utilized sources of water in Jordan.

Changes in many extreme weather and climate events, including reduced precipitation, maximum temperature increase, increase of drought/dry days and evaporation have been observed since circa 1950. In the long term, this impact will cause serious soil degradation that could lead to desertification, exacerbating future condi-

tions and worsening the situation of the agriculture sector due to the lack of sufficient water which will affect the income of agricultural workers.

In its contribution to the last UN climate change summit in Paris (COP 21), Jordan underlined that low incomes could ultimately reduce the ability to adapt to climate change. Families would be unable to

respond to the pressing needs for replacing traditional water supplies with new methods that require more spending, such as purchasing drinking water from tanks. Water problems will also put key North African and Middle Eastern countries at greater risk of instability and state failure, according to the U.S. National Intelligence Council.

What are some Sustainable Solutions?

There is a clear increase in climate consciousness within the Jordanian government and among the population. Since 1998, the Jordanian authorities have carried out important first measures to reform both the water and agricultural sectors, while actively promoting resource protection. The Jordanian authorities are also committed to promoting regional cooperation in the fields of water and climate protection as well as raising climate and environment consciousness amongst the population. An example of this commitment is the request for program funding submitted in 2015 by the Jordan Ministries of Planning and International Cooperation and Enhanced Social & Economic Productivity Program to the Adaptation Fund. This organization was established under the Kyoto Protocol and finances projects and programs in developing countries for adaptation to climate change. The Jordanian proposal aims to increase the resilience of poor and vulnerable communities to climate change impacts in Jordan through the implementation of innovative measures in water and agriculture. Rainwater harvesting, wastewater reuse and permaculture are mentioned among the adaptation measures suggested for the water sector in Jordan – as sustainable solutions at local level that can have a direct impact on the population:

Rainwater harvesting

The outstanding role of ancient Middle Eastern cultures in the development of water-harvesting techniques is widely

acknowledged. Historical evidence of rainwater collection systems in Jordan to provide water for various domestic uses dates back to 4,000 BC. Several sites in Jordan provide examples of these creations: these include the cut-stone reservoirs of the city of Petra, as well as the underground cisterns and traditional village houses. Even agriculture systems using rainwater harvesting techniques such as the Roman pools near Ajloun, Madaba and Mwagger are still operational.

The wide range of practices that involve the collection of water from the surfaces where rain falls, and its subsequent accumulation and storage, still plays a fundamental role in ensuring water sustainability in Jordan for its multiple uses, from municipal consumption to agriculture, industry and tourism. Rainwater harvesting can be adapted to local needs and applied to irrigation programs, and implemented to clean, store, and render water available to address domestic demand. Systems for harvesting rainwater could be used to recharge

groundwater through the creation of wells. It is estimated that the amount of flood water that is largely lost by evaporation exceeds all the utilized sources of water in the country. This shows how harvesting part of this water should be a priority. Through the use of geographical information systems, the National Centre for Agricultural Research and Extension identified around 223 localities in the Jordan desert that have huge potential for rainwater harvesting. These sites are mostly located in the north of the country.

The type of interventions oriented towards the implementation of rainwater harvesting practices ranges from traditional solutions to innovative ones. Among the latter, the “Vallerani system” has proven to hold great potential for optimizing the storage and use of rainwater. This system has been tested since 1997 in Syria and Jordan as well as many North African countries and consists of a mechanical creation of micro basins in which the rain is collected and directed deep underground, significantly increasing

Around 223 localities in the Jordan desert have huge potential for rainwater harvesting.

water efficiency of agriculture systems. The potential impact of this solution in remote rural areas is extremely significant in ensuring long lasting food security and economic revenues for the local population.

The great variety of ancient water harvesting techniques that have been documented in the region still constitute good examples of how to improve water sustainability. Rooftop harvesting, floodwater diversion systems, rock and earth dams are all suitable solutions for an integrated and efficient use of water resources that in regions characterized by humid climate conditions would be considered non-conventional, while in Jordan they are essential in addressing water scarcity.

The costs for rainwater harvesting vary widely depending on the innovation degree and the complexity of the system adopted. Different solutions can be tailor-made on the basis of locally available materials and the needs of the beneficiaries. They can also be replicated in other parts of Jordan and the Middle East. The costs of these solutions – especially for small villages and communities – are still much lower than large-scale projects and relatively easy for governments to subsidize.

Water in agriculture

Agriculture only makes up 3.8% of the Jordanian Gross Domestic Product (GDP). Yet agriculture in Jordan consumes 53% of the available water resources, as in many other arid to semi-arid regions. Finding a sustainable and long-term solution for the use of water in this sector is therefore absolutely key. In its National Water Strategy 2008-2022 the Jordanian Government recognizes the need to regulate irrigated agriculture in the highlands and that groundwater extraction for agricultural purposes is beyond acceptable limits.

Wastewater reuse

The Jordanian government has identified wastewater reuse as one of its main actions to reduce the use of fresh water in agriculture. This method shows great potential for

agriculture, industry and urban landscapes. Wastewater reuse means treating wastewater to 'clean' it and then reuse it for a beneficial purpose. This allows supplies of fresh water to be significantly expanded in communities facing water shortages. Wastewater reuse is becoming more popular throughout the world as a climate change adaptation measure, particularly in arid and semi-arid regions. Reusing treated wastewater to irrigate crops is generally considered an efficient method to free up fresh water for domestic consumption. Reusing water instead of discharging it every day directly aug-

ments the total water supply of a country.

The Jordanian Ministry of Water and Irrigation (MWI) aims to increase the volume of recycled wastewater more than fourfold by 2022. This will provide a substantial percentage of the irrigation water in future years. Only about 34% of the total domestic water consumption is treated in wastewater treatment plants, according to 2010 fig-

Agriculture in Jordan consumes more than 53% of the available water resources.





Image: CGIAR Research Program on Dryland Systems, 2014.
Source: www.flickr.com/photos/crp_drylands/14462873863

provides safe reused water for irrigation in the Jordan Valley and also eliminated the odours that were being released from the previous plant.

However, the cost of upgrading waste stabilization ponds to treatment plants is very high. The new As-Samra treatment plant was expected to cost around \$150 million. The cost of operating and maintaining these plants is also higher than for waste stabilization ponds. The quality of the new wastewater treatment plants increases the possibilities for new applications of water reuse in Jordan, not only for agriculture but also for industrial and even municipal use, thus decreasing health risks, potential damage to crops and to industrial processes linked to wastewater. The potential of these new techniques therefore needs to be seriously considered, as they can safely expand the supply of water.

Permaculture projects in Jordan

Another interesting way to counter water scarcity and adapt to climate change is permaculture. Permaculture is a branch of ecological engineering, environmental design, construction and Integrated Water Resource Management that develops sustainable architecture, regenerative and self-maintained habitats and agricultural systems that are modelled on natural ecosystems. Permaculture is more than just organic gardening and farming practices. It integrates growing food, providing energy and building houses to create communities whose lifestyle has less impact on the environment.

The benefits of permaculture were seen in 2008 - two years after the start of a first pilot project in the Jordan Valley. The project turned unproductive land into a farm that successfully cultivates a large amount of vegetables and fruit trees with more efficient water consumption compared to traditional agriculture. Water salinity in the soil was reduced. Looking at the broader picture, after 2 years the farm had attracted a wide and diverse range of native animals and local species of plants that were not

ures. Administrative and technical losses are the main reasons behind the low figure of treated wastewater. Technical losses due to the leakage in water supply networks are estimated around 25-40% of the pumped amount. Additionally, about 40% of residential buildings are not connected to the sewer network.

For the past three decades the plants operating in Jordan to treat water have used less efficient and less costly methods, namely waste stabilization ponds. The result was that many of these plants in Jordan have been overloaded and are not able to meet the quality standards set by the government. This poses a clear risk associated with using treated wastewater to irrigate

crops, especially for crops that are eaten raw. However, thanks to the use of more modern and effective techniques (such as activated sludge and extended aeration) the quality of water in some of the newly operated plants is very high.

This is the case of the new As-Samra wastewater treatment plant, which replaced the old waste stabilization ponds plant in 2008. It is the largest wastewater treatment facility in Jordan. Most of the treated wastewater of the heavily populated cities of Amman and Zarqa is discharged in the Zarqa River and is stored in the King Talal Dam reservoir. The upgrade of the As-Samra wastewater treatment plant improved the quality of the water from the King Talal Dam. It now



Image: Semi-arid landscape, Jordan.
Source: Pixabay

present at the beginning of the project. Local communities were both involved and interested in the project.

The project submitted in 2015 by the Jordanian government to the Adaptation Fund (see above) included permaculture amongst the proposed actions. The primary goal is to demonstrate the potential for improving the livelihood and living conditions of people in the Jordan Valley using low-cost and low-

tech approaches. In many successfully implemented projects the results show that the application of permaculture methods and introducing permaculture techniques like swales, natural mulching, legume cultivation, can have a positive impact in improving soil properties and reducing soil salinity.

Permaculture can reduce the pressure on the use of water in agriculture also because

with the same amount of water for irrigation the production of crops and fruit in the Jordanian permaculture projects was increased. The revegetation of degraded landscapes is fundamental to solving water scarcity. The establishment of more trees and bushes on the surface can help infiltrate water into the underground reserves and increase plants transpiration, which has a significant impact on atmospheric moisture that falls as precipitation.

Conclusion

Jordan is facing dramatic water scarcity. The growing population and the refugee crisis will continue to affect the availability of water. The effects of climate change are expected to worsen water scarcity. Within this fragile context, with high social and environmental stakes, it is fundamental to

promote effective policies to reduce risks stemming from water scarcity. A strategy that includes measures such as rainwater harvesting, water reuse and permaculture could help reduce the pressure on Jordanians. Jordan is one of the few countries with a stable political situation in the Middle East

and can therefore introduce an effective strategy to counter water scarcity. The Jordanian government supports several programs that move in this direction, and their successful implementation could serve as the leading example for other countries in the region. 

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