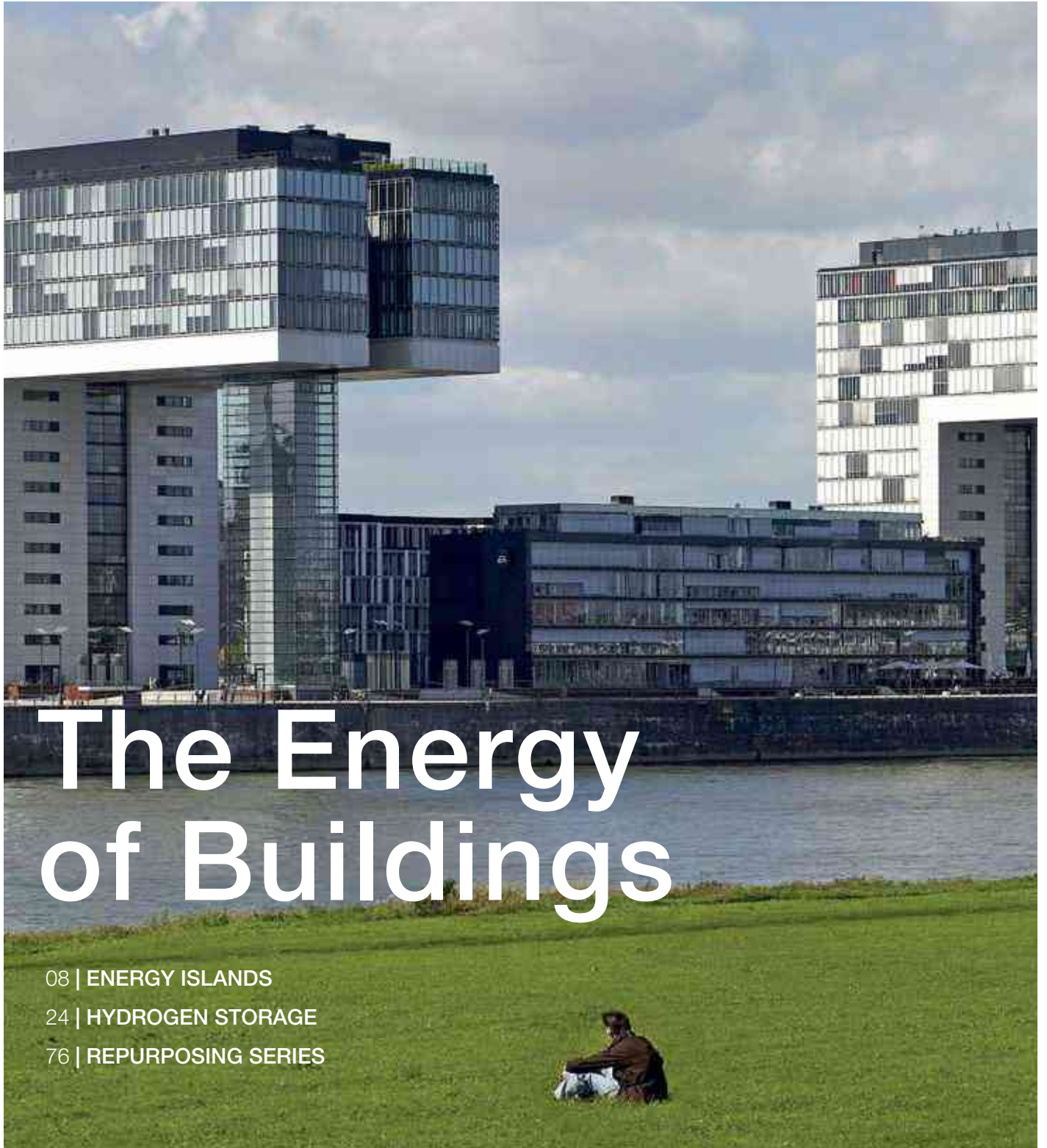


REVOLVE



N°24 | SUMMER 2017



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Construction of the largest windfarm to date in the Netherlands: a 48 wind turbine Westermeerwind Wind Farm in the artificial lake of IJsselmeer generating energy for 160,000 households.

Source: Westermeerwind



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We Need a Carbon Floor Price

Why are dirty, coal-fired power stations continuing to operate in Europe, in the face of an apparent political consensus that they should be shut down? The answer is rather simple: the decarbonization flagship instrument – the Emissions Trading System (EU ETS) – does not deliver. In light of this failed attempt to set a meaningful price to carbon, EU policy-makers should adopt without delay additional measures such as a carbon floor price.

Coal-fired power plants benefit from preferential treatment in the sense that they are exempt from the “polluter pays” principle enshrined in EU treaties. A collapsing EU ETS makes it artificially cheap to emit CO₂ at around 5 euros/ton. Unfortunately, the reforms of the ETS put forward by the European Commission for 2020-2030 are not enough to restore the fortunes of a system that has been progressively weakened to become little more than a lifeboat. Since every attempt at reform gets caught in the crossfire of German industry and Polish electricity firms, there is little hope of seeing this market emerge from the legislative process any stronger than it was before. As a consequence, the EU should introduce additional measures.

The first of these measures would be to establish a maximum authorized level of

greenhouse gas emissions: An Emission Performance Standard (EPS). The EPS level should be set in such a way as to immediately rule out the construction of any further coal-fired capacity. For existing power stations above a certain threshold, power plants would not be allowed to operate and should either withdraw from the market or carry out the investment required to be compliant with the law. The Commission’s proposal included in the ‘Clean Energy for All Europeans’ directive is a good yet insufficient starting point.

Firstly, the threshold chosen is too generous at 550g CO₂/kWh and needs to be set no higher than 350g CO₂/kWh to ensure a chance to meet our climate objectives.

Secondly, the threshold is rigid and uniform when it should be variable and

gradually decreased to leave time for stakeholders to adapt. This level would not necessarily have to be the same for the whole of the EU, but could initially be determined on the basis of the energy mix of each Member State, and then progressively converge.

Thirdly, the threshold should apply to all power plants – not only to the ones benefitting from public support through capacity mechanisms.

In addition to EPS, a carbon floor price must be introduced. The UK is a pioneer in this respect. French authorities also originally committed to such a scheme. Environment Minister Ségolène Royal instructed a triumvirate consisting of Gérard Mestrallet, Pascal Canfin, and Alain Grandjean to come up with a set of proposals for leaving coal behind. They handed over their final report in July 2016: *We are in favor of the proposal to establish a price corridor for the European carbon market, with a floor price of €20-€30 in 2020, an annual increase of 10%, and a ceiling price of €50.*

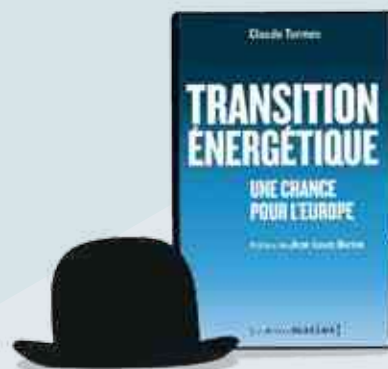
Despite this report, nothing happened. Why? Because French authorities made a questionable strategic move: they linked the floor price discussion to the ETS reform. This obviously did not work, as it encountered the strong opposition of two categories of Member States: those who oppose a fast decarbonization of the electricity mix (chiefly V4 countries), and those who are pro-climate but believe that the ETS is a Holy Grail whose purity should not be effected by the establishment of any corrective measure (as in the case of the Netherlands and Scandinavian countries).

no carbon floor price will emerge from the ETS reform

The result is known in advance: no carbon floor price will emerge from the ETS reform. As I don't see it happening at the supra-national EU level, this could be the result of voluntary regional cooperation. The French electricity market does not exist anymore. Nor does the German electricity market. The whole Central-West European zone is coupled into a single electricity market. Hence this regional cooperation, originally known under the name of 'pentalateral' as it also includes Benelux countries, is the best forum to establish a joint regional carbon floor price. The election of Emmanuel Macron and the appointment of Nicolas Hulot as Energy Minister is good news. After the German elections in September, I hope that both countries will stick together to jointly propose a carbon floor price. We need a strong Franco-German impetus.

This price should be set a relatively low level at first, and progressively increase over years until it reaches a meaningful level. A carbon floor price would also penalize electricity imports from neighboring countries using coal and lignite resources. The Western Balkans' pro-coal policy has a sky-high health cost in terms of premature deaths, pulmonary and respiratory diseases, and heart failure, evaluated at €8.5 billion in financial

terms, and the region is already home to seven of Europe's ten most polluting power stations. The EU should contribute to push Ukraine and the Western Balkans away from coal. The planet is not waiting, our carbon budget is shrinking, and we simply cannot afford to burn any more fossil fuels. Let's act now! 



Claude Turmes is a Member of the European Parliament from Luxembourg in the Greens/European Free Alliance (EFA) Group. He is the author of "Transition énergétique, une chance pour l'Europe" (2017), forthcoming this summer in English: "Energy Transformation, an Opportunity for Europe". Order copies at: www.claudeturmes.lu

The Caribbean's Renewable Energy Future

With solar, wind, geothermal, and marine energy potential, Caribbean islands have a tremendous availability of domestic renewable energy resources. Yet the region stands at an energy crossroads, facing heavy dependence on imported fossil fuels, exposure to volatile oil prices, and undiversified energy supply.

Writer: Elisa Asmelash

The Caribbean region is a paradise for renewable energy.

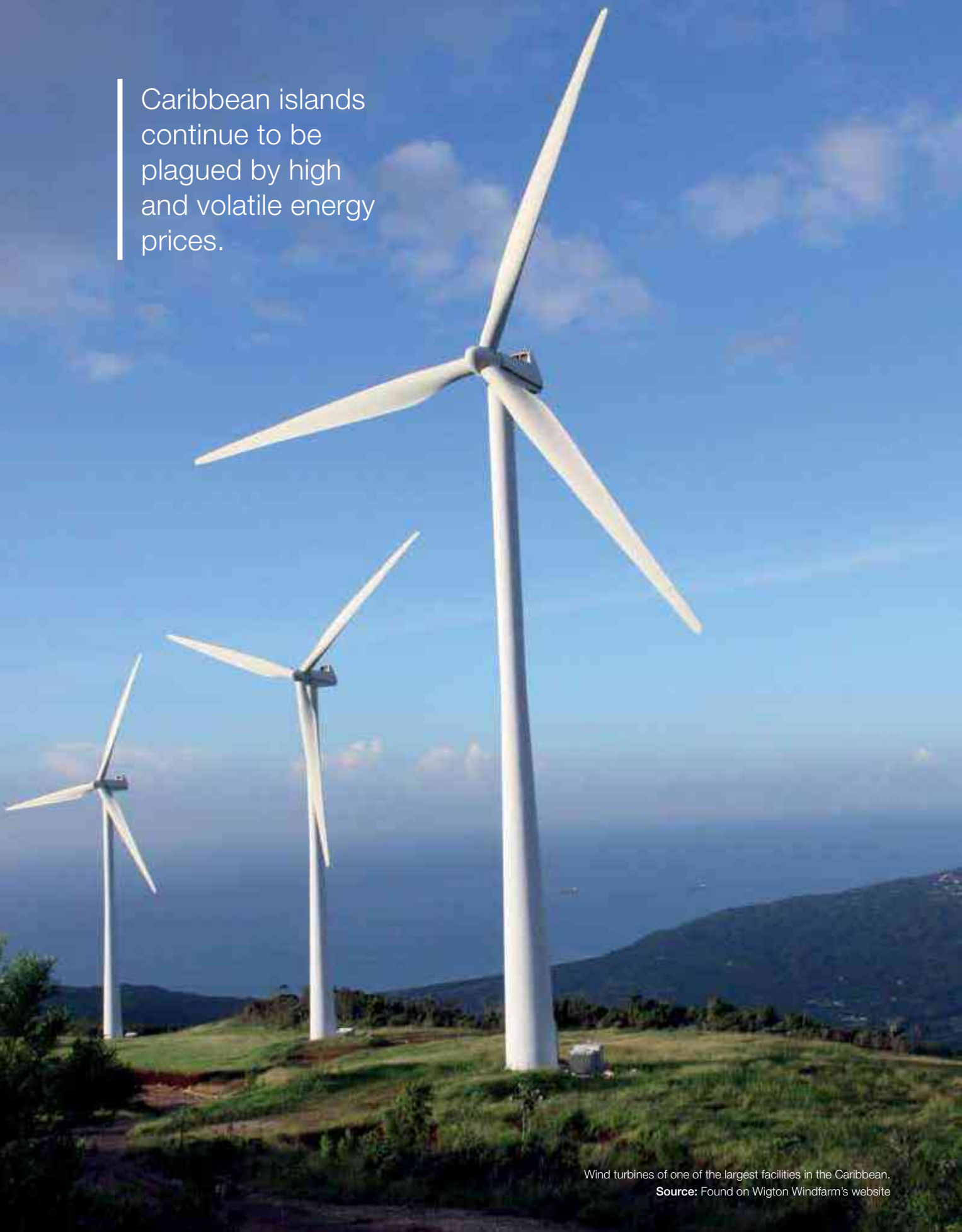
Consistent winds, sunshine all year, and hot lava inside volcanic islands make the region the ideal location for the development of renewable energy. Small-scale hydropower resources are already widely used in the region's small island states, providing electricity access to remote populations. Geothermal resources, which are currently available but unexploited, have the potential

to make several of the islands renewable energy exporters.

However, Caribbean islands continue to be plagued by high and volatile energy prices with no opportunities for economies-of-scale or diversity in electricity supply. Similarly, climate change impacts such as warmer temperatures, sea level rise, and the increased frequency and intensity of storms all pose major threats to the region's small island economies.

Individually, almost all Caribbean countries have seen success with renewable energy development. However, these individual efforts cannot be effective without a coordinated approach through harmonized regional policies, legislation, and interconnectivity solutions. All these approaches could offer wonderful opportunities to maximize each island's individual resources while working together toward common and coherent renewable energy development goals.

Caribbean islands
continue to be
plagued by high
and volatile energy
prices.



Wind turbines of one of the largest facilities in the Caribbean.
Source: Found on Wigton Windfarm's website

Exploiting the Potential

Recognizing the need to forge a coordinated and sound approach to addressing regional energy challenges, The Caribbean Community (CARICOM) began developing a regional energy strategy in 2002. CARICOM's first energy policy was approved in 2013 and set a region-wide target of installing 47% renewable energy generation capacity, a 33% improvement in energy efficiency, and a 46% cut in greenhouse gas emissions by 2027. To complement this regional approach, all 15 CARICOM Member States have also shown their individual commitment towards the development of renewable energy and have set national targets to achieve those goals (Table 1 and Table 2).

Today, the increased use of renewable energy and improvements in energy efficiency have become the core focus of CARICOM's energy activities. The combination of region-wide goals and national targets under CARICOM provide a powerful long-term vision which makes renewable energy a key pillar in the energy sectors of respective member states and across the region.

In addition to formal regional targets, a regional center was inaugurated in 2015 to further enhance collaboration on renewable energy and energy

efficiency. The Caribbean Center for Renewable Energy and Energy Efficiency (CCREEE) is located in Bridgetown, Barbados, and aims to address all gaps in the areas of capacity development, knowledge and data management, awareness raising, investment, and business promotion in the region's renewable energy sector.

The Caribbean region is a paradise for renewable energy.



Caribbean solar power. Source: Eniday.com by Andrew Burger

Table 1:
Renewable Energy and Electricity Targets in CARICOM Member States (2015)

COUNTRY	RENEWABLE ENERGY	RENEWABLE ELECTRICITY
Antigua and Barbuda	15% by 2030	20% by 2020
The Bahamas	30% by 2030	15% by 2020; 30% by 2030; 10% residential self-generation by 2014
Barbados	10% by 2012 20% by 2026	29% by 2090
Belize	50% reduction in fossil fuel dependence by 2020	89% by 2033
Dominica	100% by 2020	25% by 2010 100% through addition of geothermal by 2020
Grenada	20% by 2020	10% by 2013 and 20% by 2017 (Grenada) 40% by 2011 (Carriacou and Petite Martinique) 100% by 2030
Guyana	None	90% through hydro development; 15,000 solar home systems installed (no date given)
Haiti	None	20% by 2017 28% by 2022 46% by 2027
Jamaica	20% by 2030	12.5% by 2015 20% by 2030
Montserrat	None	100% (geothermal and solar) by 2020
Saint Lucia	35% by 2020	5% by 2013 15% by 2015 35% by 2020
St. Kitts and Nevis	None	20% by 2015 100% by 2010 (Nevis)
St. Vincent and the Grenadines	None	30% by 2015 60% by 2020
Suriname	None	None
Trinidad and Tobago	None	5% of peak demand (or 60 MW) by 2020

Table 2:
Energy Efficiency Targets in CARICOM Member States (2015)

COUNTRY	ENERGY EFFICIENCY
Antigua and Barbuda	20% improvement by 2020
The Bahamas	None
Barbados	22% reduction in electricity consumption compared to business as usual by 2029
Belize	At least 30% Improvement in energy efficiency and conservation by 2033 (suggested)
Dominica	20% reduction in public sector electricity consumption by 2020; line losses below 10% by 2020
Grenada	None
Guyana	Removal of duties and taxes on energy-efficient CFLs and LED lights
Haiti	36% of households using improved cooking stoves by 2015 (kerosene/LPG instead of charcoal)
Jamaica	Energy intensity reduced to 6.3 million joules per USD of GDP by 2030 (from 22 million today)
Montserrat	None
Saint Lucia	20% reduction in public sector electricity consumption by 2020
St. Kitts and Nevis	20% reduction in projected electricity demand by 2015 (resulting in peak demand of 45.7 MW)
St. Vincent and the Grenadines	5% reduction in projected increase in peak demand by 2015, 10% by 2020 7% reduction in power losses by 2015, 5% by 2020 15% reduction in electricity generation by 2020
Suriname	None
Trinidad and Tobago	Currently no target, but is finalizing the administrative framework for a 150% tax allowance to be granted to commercial and industrial enterprises that achieve a target share (to be determined) of energy efficiency improvements.

Tables' Source: 'Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS) –Baseline Report and Assessment', Worldwatch Institute, Washington DC, 2015 (re-adapted)

A Dirty and Expensive Reality

CARICOM's approach and bold targets provide an ambitious vision to boost renewable energy across the region. If carried out successfully, these goals will establish CARICOM as a global leader in sustainable energy development. However, despite having all the ingredients to dive into renewable energy, Caribbean countries still face a dirty and expensive reality:

Caribbean solar power. **Source:** Eniday.com by Andrew Burger



1. High energy costs dampen the region's competitiveness and potential growth

According to the Rocky Mountain Institute, 90-100% of electricity in most countries in the region comes from imported diesel and fuel oil. Caribbean electricity users pay between \$0.20 and \$0.50 per kWh, in contrast with the average retail price in the United States of \$0.098 per kWh. The International Monetary Fund (IMF) has estimated that in 2012 the national electricity bill in Caribbean countries represented as much as 9% of an individual country's GDP – a burden for both households and industry. Ultimately, these resources are transferred directly to oil companies instead of going towards tapping into plentiful domestic renewable energy sources.

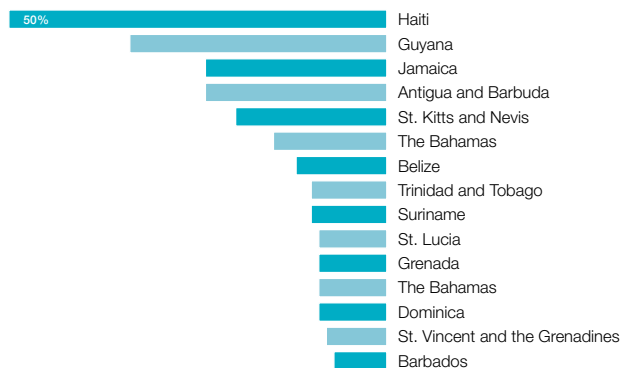
2. The power market structure is under-regulated and supply is undiversified

The electricity markets in the Caribbean islands are served by a single utility companies on each island, which hold exclusive licenses for the generation, transmission, distribution, and sale of electricity. However, the financial status of most of these utilities is weak due to the high cost of diesel generation and technical and commercial efficiency losses. Consequently, most of these monopolies are not in the position to providing adequate financing instruments for investing in improvements in the generation capacity of renewable sources. This leaves consumers without access to reliable and affordable energy.

Fig.1

Power Utilities' Commercial and Technical Losses
(in percent of net generation)

Source: CARICOM Energy Strategy





Solar panels in Antigua and Barbuda. **Source:** Found on Meeco.net by The Meeco Group

3. Power systems suffer from inefficiency and high system losses

Electricity generation in the region depends on power plants, while transmission and distribution lines are inefficient, unreliable, and not well maintained. This causes major technical and commercial transmission losses for the grid (Figure 1) as well as frequent power cuts and load shedding, which have led to the installation of private diesel generators on many islands.

4. Small-size projects and limited financial resources hinder investments in renewable energy

Caribbean countries are characterized by small markets with small-scale projects, which are less attractive for international investors. This also creates significant problems in obtaining private financing for national and local investors as many large financial institutions like international commercial banks are cautious if not unwilling to consider small projects. Projects below \$10 million are often not considered at all, and even when projects approach \$20 million it is difficult to create interest among large investors. Similarly, raising funds for small renewable projects from local commercial banks is challenging due to their limited resources. Local banks tend to operate in small economy systems, and so have lower limits for project costs. More importantly, they have little or no experience in developing bankable renewable energy projects.

90-100% of electricity in most countries in the region comes from imported fossil fuels.

5. Weak regional institutional support

In many of the islands, the implementation of national policy commitments for renewable energy is still at an embryonic stage. Transforming these policies into investment opportunities and creating a vibrant market with an industrial renewable energy sector is a lengthy process. The existing regional institutional framework is not yet fully prepared to support CARICOM members to effectively carry out capacity development, knowledge and data management, awareness, as well as support investment and business promotion in the sustainable energy sector. The local private sector and industry are unable to take advantage of the growing sustainable energy markets and job opportunities.

Sailing Towards a Clean Energy Future

In this challenging context, there are three critical elements that could help the Caribbean region to exploit more fully its renewable energy potential:

1. A cohesive and coordinated regional approach

Every island has different needs and potentials, and so regional cooperation can be a useful tool to facilitate the creation of sustainable energy investments, markets, and industries. CARICOM's policies, activities, and programs demonstrate the region's understanding that having a cohesive and coordinated regional approach will make it easier to tackle the many challenges of a fundamental energy transition. Although individual members can contribute greatly to advancing the use of renewable energy, regional collaboration offers opportunities to share best practices and experience, driving development more effectively.

Regional cooperation can leverage the combined economic resources of individual states and the complementary renewable energy resources across the region. This is particularly evident in the development of bankable projects. In fact, the islands' economies are too small to independently develop renewable energy projects on a scale large enough to attract investment. A regional approach can aggregate projects and reduce transaction costs which will contribute to the development of regional supply chains. This will ease the financing of energy initiatives within the Caribbean, improve knowledge-sharing and capacity-building, and lead to broader economic and social benefits throughout the region, including faster job creation.

2. Cross-border interconnection between islands

The small size of each island's energy market and corresponding high energy costs provide the key barrier to increasing renewable energy solutions. Here, increased interconnectivity between islands presents a highly economical option. As the region is composed of a large quantity of isolated and widely dispersed small island states with low energy demand, interconnectivity could potentially pose some physical challenges for designing and installing an electricity structure. However, cross-border interconnection solutions could allow for the development of utility-scale renewable projects and thus pave the way for greater security of supply, flexibility within the power systems, and larger use of renewables.

3. Public sector and energy sector reform

Many of the barriers hindering development of renewable energy in the private sector come from the public sector. For renewable energy projects to thrive in the Caribbean, it is vital for local governments to facilitate a more favorable investment environment that offers strong encouragement to renewable energy investments and technology developments. This could be fostered through a proper legislative and regulatory framework, which would be more inviting to private investments in financing and developing scale renewable energy projects.

Similarly, the urgent need for the Caribbean to reform its energy sector is clearly highlighted by the issue of high energy costs and their impact on the competitiveness of the region. The decline in oil prices should be viewed as a temporary phenomenon, one which should be used as an opportunity for making the necessary decisions to reduce dependency on expensive imported fossil fuels. This is critical because it contributes to the high cost of business and affects the growth potential of the economies in the region.

Though their relative isolation has provided a barrier to the energy transition for nations in the Caribbean, the possibility of increased interconnectedness provides a possible solution through which members of CARICOM can work towards renewable energy. With the abundant natural resources already in place, current low oil prices, and energy goals already in place, there is a bright future ahead for sustainable and self-reliant energy in the Caribbean. 



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

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Harnessing Marine Resources for Clean and Secure Islands

Despite the deployment of renewables around the world, many islands remain highly dependent on imported fossil fuels. In the Caribbean, only a small percentage of energy comes from renewable sources, even though there is easy access to a largely untapped energy resource – the ocean. Dive into the challenges and opportunities of marine energy for the future of Caribbean energy grids.

Writers: Julián Eduardo González and Vanessa Vivian Wabitsch

Due to its equatorial location, the Caribbean region is blessed with an abundance of natural resources for harvesting energy, most notably abundant solar and wind resources. Nevertheless, penetration of renewable energy in the region has been

slow or even absent, with renewables supplying less than 6% of the total electrical energy. With more than 40 million inhabitants and millions of visitors each year, growing demand for energy in this region requires more sustainable solutions.

The world's largest deep seawater intake pipeline in Hawaii - a key technology for OTEC and SWAC. **Source:** Makai

A full-page background image with a blue tint. It shows a diver in the water next to a large, curved pipe or tunnel. The diver is holding a light and looking towards the camera. The water is slightly murky, and the overall scene is underwater.

Marine energy
could supply more
than the world's
entire electricity
demand.

The Caribbean Energy Market

Despite ambitious renewable energy goals for the upcoming decades, most Caribbean countries are heavily dependent on fossil fuel imports. According to the World Bank, 97.6% percent of all energy generated in the islands came from fossil fuels in 2015. Spot and market energy prices in Caribbean islands are extremely susceptible to volatility associated with international market pricing and the availability of import fuels such as diesel, coal, natural gas, and fuel oil. As a result,

Caribbean countries have one of the highest electricity prices in the world. Moreover, this reliance on fossil fuels is contradictory with their overall commitment to protect land and marine environments – their most valuable assets – and one that is severely threatened by climate change. The drop in fossil fuel prices has reduced the burden of imported carbohydrates on public deficits, meaning that shifting towards renewable energy deficits is now seen as less urgent.

What we are left with is a region with a booming tourism industry, an abundance of renewable energy resources waiting to be harvested, energy matrices that are almost exclusively dependent on fossil fuel imports, an overall lack of governmental support, and limited policies to enhance renewable energy. To overcome these challenges, it is time for Caribbean islands to turn to the underdeveloped but most abundant and promising source of energy: The Ocean.

Riding the Wave

Marine energy could supply more than the world's entire electricity demand. The global estimated potential for all marine energies – tidal, marine currents, waves, salinity, and thermal forms of energy extraction – is over 24,500 TWh/year. In theory, this means that 50% of the global energy demand could be met with wave energy alone.

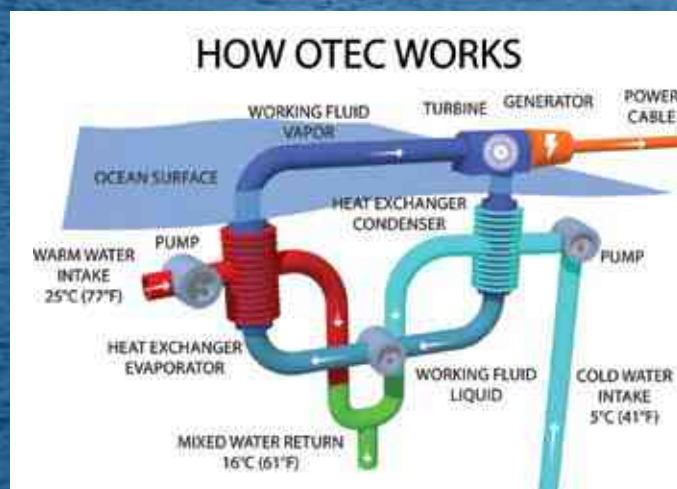
Whereas kinetic forms of marine energy, such as wave and tidal power, have enormous potential in open seas at higher latitudes, ocean thermal energy finds most of its untapped potential closer to the equator. The excellent bathymetric conditions (submarine topography) and high thermal differentials exceeding 20°C provide excellent conditions for technically

and economically viable ocean thermal energy projects. The Caribbean is one of the most promising regions for ocean thermal technology deployment – along with by south-east Asia – where several Ocean Thermal Energy Conversion (OTEC) and Sea Water Air Conditioning (SWAC) projects are currently at various development stages.

The OTEC Process

A closed-cycle OTEC process is similar to standard refrigeration cycles. Warm seawater passes through an evaporator, which vaporizes the working fluid. The vapor then enters a turbine that turns a generator, producing electricity. The low pressure working fluid enters a condenser where it is then cooled with deep sea water. The working fluid is then reused to repeat the cycle.

The economics of OTEC are unclear as OTEC systems have not been widely deployed yet. However, a study in 2015 by Ocean Energy Systems – an International Energy Agency Initiative – estimated that the first commercial scale OTEC projects could have a cost of energy (LCOE) ranging between \$150-280 per MWh. A study by the Worldwatch Institute estimated the LCOE for tidal power at between \$210-280, and \$40-160 for onshore wind as of 2013. OTEC energy can be competitive with marine and other renewable energies but OTEC technology would need to benefit from a tax and subsidy support scheme similar to competing energy sources. While OTEC may still need to undergo extensive R&D to achieve its promise, SWAC is already a commercially-viable technology that also exploits the marine thermal gradient, albeit with a different purpose.



A basic closed-cycled OTEC plant. Source: Makai.

OTEC harnesses the temperature differential between cold, deep ocean water and warm, tropical surface waters to produce electricity. According to the World Energy Council, the resource potential for OTEC is much larger than that of other ocean energy solutions. Around 100 countries could tap into this potential. While OTEC technology is still under development, several pre-feasibility studies for the applicability of

OTEC in the Caribbean show promising results. OTEC is a stable and secure power that can be operated around the clock and would be easier to integrate into current electricity networks than intermittent renewables such as wind or solar, especially as island networks were not designed to cope with large quantities of

intermittent renewables. OTEC is therefore a comparatively more advantageous renewable energy option for islands, as limited transmission and distribution grid investments are required.

50% of the global energy demand could be met with wave energy alone.



The SWAC System

In a SWAC system, the marine thermal gradient is used to produce low-cost sustainable air conditioning for buildings or urban areas close to shore. Akin to an OTEC system, a pump brings cold water via a pipe system to an onshore heat exchange station where it absorbs heat from a water loop that the buildings use to power their AC. The seawater then removes heat from the building before being poured back into the ocean.

A study released by CAF (the Development Bank of Latin America) found that SWAC could be an economically-viable option to provide air conditioning to a series of hotel resorts and large public buildings in locations such as Montego Bay in Jamaica or Puerto Plata in the Dominican Republic. In both cases, it is estimated that costs would fall between 34-48% less than conventional air conditioning. Similar results may be expected in other Caribbean sites with sizable cooling loads and favorable bathymetric sites. Currently, HINICIO, Makai Ocean Engineering, and DCNS are analyzing further potential sites for SWAC installations in locations in Panama, the Dominican Republic, and Colombia.

Most Attractive sites for OTEC and SWAC in the Caribbean. Source: Hiniçio

Image: Offshore OTEC project in Martinique. Source: DCNS



Jose Andres, President and CEO of Makai

How can SWAC and OTEC technologies become more integrated in the Caribbean?

SWAC systems are a fundamentally different technology than OTEC. SWAC is a proven and commercially-robust technology, while OTEC still requires development and large-scale validation before being proven as commercially-viable. Since SWAC is more mature than OTEC and its application to the Caribbean is more likely in the short-term, I will focus on SWAC for this interview.

SWAC involves a district cooling system with a network of underground pipes supplying chilled water to buildings in a coastal area. The technology is simple yet relatively

unknown, so educating stakeholders on the benefits of SWAC is key. Successful project execution requires buy-in from all stakeholders, including governments, regulating authorities, customers, the community at-large, and investors. This means that the single most important factor in project success is having a strong local champion capable of financing and developing large energy projects (\$25 million to \$250 million). Each Caribbean island community has a unique constellation of government and private sector actors, and understanding how to build a project in that specific environment is paramount. Thus, the primary challenges for SWAC are associated with project development rather than technology risks.

Are SWAC and OTEC key technologies in the energy transition for Caribbean islands?

Yes – especially SWAC. OTEC is promising over the next decade, but SWAC can make a real difference today. Areas with high population

density and air conditioning loads that are near the shoreline – especially tourist areas with multiple hotels – are good candidates. SWAC can reduce energy consumed for cooling by up to 90%, which can result in huge cost savings of millions of dollars annually while decreasing the strain to the local electrical grid. SWAC also reduces environmental footprints by eliminating the evaporative water and sewer usage required for conventional AC.

What can be done to enable a future powered by ocean thermal energy?

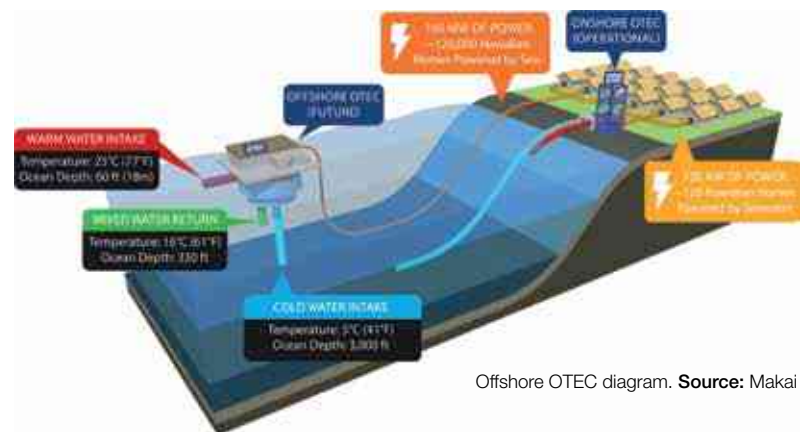
The industry needs a successful project in the Caribbean to serve as a model for the rest of the region. However, the early-stage money to study feasibility and cost for a project are at-risk dollars. The studies funded by CAF (Development Bank of Latin America) and others go a long way towards reducing that early-stage risk. Once a single successful project is built in the region, I am certain you will see many more projects following suit.



Makai Ocean Engineering, Inc. was established in 1973, focused on providing engineering for ocean renewable energy (OTEC and SWAC), large underwater pipelines, submarine cables and arrays, autonomous underwater vehicles, and general ocean R&D. Makai has been at the forefront of OTEC and SWAC development since 1978, when Makai was involved in the design of the world's first net-power OTEC plant. Since then, Makai has designed multiple SWAC systems including the world's first commercial deep seawater air conditioning system, and is the designer, owner, and operator of the world's largest currently operational OTEC power plant. More info: www.makai.com



SWAC in the Caribbean. **Source:** Makai



Offshore OTEC diagram. **Source:** Makai

Promising Prospects in the Caribbean

Since the 1970s, SWAC and OTEC technologies have been under development with several existing demonstration and pre-commercial projects. Project developers across the marine energy value chain have chosen mostly Caribbean locations to develop the first demonstration OTEC and SWAC projects. Aside from the tremendous energy challenges

that the Caribbean islands face in their struggle to wean off fossil fuels, these sites' bathymetric conditions are highly favorable for both OTEC and SWAC. The "smooth" slopes of the ocean floor and relatively short distances to a significant thermal difference between the upper and lower layers of the ocean provide the ideal circumstances. Most importantly,

there is a large concentration of hotel resorts on the Caribbean coastline with significant continual energy and cooling demands. Most resorts are located within 5km from the sea, offering optimal conditions for SWAC and OTEC.

Notable locations with ongoing OTEC projects include the Bahamas, Japan,

Martinique, Hawaii, Bora Bora, Reunion island, Grand Cayman, and Curacao. SWAC projects have been implemented in Toronto, Halifax, Hawaii, Stockholm, New York, Bora Bora, Bahamas, and Curacao. A study by HINICIO highlighted the top 10 locations for both OTEC and SWAC in the Caribbean region and South America. Jamaica was judged the best location for SWAC operations, and Santa Lucia for OTEC. This study covered 67 cities in Latin America. Their estimated cooling load, bathymetric conditions, attendant ocean temperatures, and the resulting estimated CAPEX, OPEX, and levelized cooling costs were compared. Pre-feasibility studies by Makai Ocean Engineering in Puerto Plata, Montego Bay, and Santa Marta have shown interesting returns on investment for SWAC. Several pilot projects for hotels and resorts in the Caribbean show that the technology is on the rise.

In the years 2010-2015, most Caribbean islands have set renewable energy goals and roadmaps for the next decades

but most countries lag far behind their stated objectives. Nevertheless, countries like Jamaica, Barbados, Aruba, and the French islands of Guadeloupe and Martinique have all made remarkable prog-

OTEC energy can
be competitive
with marine and
other renewable
energies

ress. The Bahamas, Jamaica, Grenada, Barbados, and the Cayman Islands are all aiming for a renewable energy penetration above 30% in the next decade. Today all of these islands are virtually 100% dependent on fuel imports, but also have several interesting locations for SWAC and OTEC deployment. This demonstrates that the Caribbean is a promising market for developers who should start

working on financing sustainable marine energy projects.

Many challenges remain: energy monopolies, the lack of policy support and leadership, weak public finances and access to commercial financing, lack of technical expertise and assessments of marine energy potential, as well as political pressures exerted by oil exporters pertaining to existing agreements (such as Petrocaribe) which maintain the status quo. However, the excellent conditions for marine energy, promising OTEC and SWAC projects, and a new generation of emerging political leaders aware of climate change and sustainability are promising prospects for the development of marine energies in the Caribbean. At the end of the day, the ocean will do what it does best: The rising tide will come in and wash away all stakeholder doubts about the potential of marine energy in the Caribbean. Harnessing energy from the seas will bring Caribbean islands one step closer to being self-sufficient as they overcome one of the greatest challenges today: achieving energy independence. 🌊



HINICIO is an international strategy consultancy specialized in sustainable energy and mobility, with offices in Brussels (HQ), Paris and Bogota. In Latin America and the Caribbean region, we advise multilateral donors, public authorities, and private companies in the implementation of marine energies, especially SWAC, OTEC technologies and district cooling. **HINICIO** brings together a team of high level experts with multi-disciplinary backgrounds including engineers, PhDs, MBAs, former indus-

try executives, economists and energy policy experts to advise large corporations, energy utilities, public authorities, as well as startup companies and corporate investors on new opportunities arising in the sustainable energy and mobility projects and strategies.

For further information about SWAC, OTEC and District Cooling please contact:

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Water Innovation Europe 2017

The value of water: the case for innovation
and investment in water

14-15 June, Brussels

Using Clean Cars as Power Plants

The combined engine capacity of the new cars we build in just one year is more than the entire electricity generation capacity in the world. If we power our cars with fuel cells, we can use them as clean power plants for 96% of the time we are not driving in them, generating all the electricity we need, at competitive costs, with zero emissions. This is how it can be done today in the United Arab Emirates (UAE).

Writers: Frank Wouters and Ad van Wijk

We are not using our cars very much in the UAE, nor elsewhere by the way. A quick scan on Dubizzle (the leading internet platform for used cars in the UAE) shows that we drive some 20,000 km per year. At an average speed of 60 km/h, this means that we use our car less than 1 hour per day. The remaining 23 hours, or 96% of the time, our cars sit

idle. In another context we would call that stranded assets.

Let's assume that an average vehicle has an engine capacity of 100 kW. More than 80 million cars are sold each year, which represents a capacity of 8,000 GW. The combined capacity of all power plants in the world producing electricity amounts

to 5,000 GW, so each year we are adding more capacity in our car engines than we have installed to produce electricity. And we only use those cars 4% of the time, while power plants are used thousands of hours per year. Of course a car engine, as we have them now, does not produce electricity, it only moves the car; but let's look at fuel cell cars.



With an annual addition of 8,000GW of car engine capacity, it would take less than a year to replace the entire existing stock of power plants in the world

Hydrogen Power

A fuel cell is a device that produces electricity from hydrogen, with pure water coming out of the exhaust. If we put a fuel cell in a car, the electricity is used to power electric motors that move the car, just like other electric vehicles. The difference is that pure electric vehicles (EVs) require batteries, which add weight to the car and require a long time to charge. A fuel cell car can drive 100 km on one kg of hydrogen and tanks that take 7 kg of hydrogen can be refilled in 3 minutes. Several manufacturers are now offering hydrogen fuel cell vehicles, or HFCVs,

among which are Toyota, Hyundai, Honda, Ford and General Motors.

At Delft University of Technology in the Netherlands, the team of Dr. Ad van Wijk, Professor of Future Energy Systems, has developed a concept around fuel cell vehicles, that are not only used as cars, but could ultimately replace our power plants. The idea is to use the fuel cell in the car to produce electricity also when it is not driving, which is 96% of the time. To make that possible, the car would need to be hooked up to a supply of hydrogen when it is parked and it

needs to be connected to the electricity grid, either at home, at work or in a parking garage. The exhaust water can also be used as drinking water and in colder climates the waste heat could be used for heating.

With an annual addition of 8,000GW of car engine capacity, it would take less than a year to replace the entire existing stock of power plants in the world. It is possible to turn our stranded assets into the energy supply of the future, especially if we can find a cost-effective and clean way to produce the hydrogen.

Solar energy plant on Emirates beach. **Source:** EUGCC



Hydrogen Economy

The term hydrogen economy – first coined by John Bockris at General Motors in 1970 – describes an energy system that uses hydrogen as the primary energy carrier. Hydrogen can be produced from water, using clean energy, and when hydrogen is converted into useful energy such as electricity or motion, it only produces water as a by-product.

Due to the lack of carbon or nitrogen, no other harmful exhaust gases are produced, hence burning hydrogen does not contrib-

ute to climate change. It should be noted that it is also possible to produce hydrogen from natural gas, or use electricity from fossil fuels to produce hydrogen, so hydrogen is not always “clean”. In fact, 95% of hydrogen is produced from methane today.

We modeled such a clean hydrogen system on the UAE, which is a major

exporter of oil and gas, but has a strong forward-looking vision on energy. The system described here is completely clean, feasible and cost effective and opens an avenue for the UAE or other GCC countries to remain global energy players in the new low-carbon energy paradigm. The main reason being the availability of low-cost solar energy in the region.



Hydrogen fuel-cell vehicles. **Source:** EUGCC

Since solar PV is the cheapest form of electricity but not dispatchable, it makes sense to work towards a combination of solar PV and electricity from the fuel cells.

Cost

This is feasible with present day technology and sounds promising, but what about the cost? Although hydrogen fuel cell cars are still more expensive than standard cars, there is no reason why they should be more expensive in the future, if we manufacture them at similar scale. So the main difference lies in the cost for the fuel. It requires 50 kWh to produce 1 kg of hydrogen and since solar energy costs 2ct/kWh in the UAE, the energy cost to produce hydrogen is 1\$/kg.

An electrolyser costs approximately \$600 per kW nowadays. If we implement large scale projects such as proposed here, it is safe to assume an electrolyser of 1MW will cost \$400,000 in a few years from now. The UAE has more than 2000 annual sun-hours, hence such an electrolyser coupled to a solar PV system would produce 40,000kg of H₂. Assuming a ten-year life and linear depreciation, this would add 1\$ to the cost of the hydrogen. The overall cost of hydrogen in such a scheme in the UAE would hence amount to 2\$/kg.

Given the spectacular decline in the cost of solar PV electricity in just a few years, and given that fuel cells, electrolyzers and related equipment are not deployed on a mass scale yet, it is safe to assume that this cost estimation is conservative and that the cost will be (much) lower over time. One should always bear in mind that the cost dynamics of hydrogen made like this, since it is made from plentiful sunshine and water, is only related to the cost of the technology, which has a fundamentally different dynamic than e.g. fossil fuels.

A fuel cell car can drive 100km on 1 kg of hydrogen. At 2\$/kg for the hydrogen, the fuel costs are 2ct/km. The present cost for unsubsidized petrol in the UAE is 1.81 AED or 50ct per liter. A modern and fuel efficient car that drives 17km per liter therefore has fuel cost of 3ct/km, so a fuel cell car that drives on hydrogen made by solar energy in the UAE is 50% cheaper per km than a conventional car.



xxx. Source: xxx

Cars in the UAE

The UAE has among the highest car ownership rates in the world. In Dubai there are more than 540 cars per 1000 inhabitants, so there are an estimated 5 million cars in the country. With each car driving 20,000 km per year, this adds up to 100 billion km in total. If all cars were fuel cell cars, and knowing that a fuel cell car can drive 100 km on 1 kg of hydrogen, we need 1 billion kg of hydrogen per year.

We want to produce the hydrogen using locally available solar energy, which is the cheapest in the world and which is cheaper than conventional energy. Hydrogen can be made from water using electricity in an electrolyser; present day electrolyzers require 50 kWh/kg H₂, including

the electricity required to demineralize sea water and compress the hydrogen. So we need 50,000 GWh of electricity to produce 1 billion kg of hydrogen. With the high number of sunshine hours in the UAE, we would need 23.5GW of solar PV to produce enough H₂ for all cars.

With an average capacity of 100 kW per car, we would have 500 GW of fuel cell capacity available to drive, but also to generate electricity for the grid. Remember that most of the time our cars are not used. Given that we have a little more than 27 GW of grid connected capacity in the country, this would be more than enough to replace conventional power plants.

The UAE has among the highest car ownership rates in the world. In Dubai there are more than 540 cars per 1000 inhabitants, so there are an estimated 5 million cars in the country

Goodbye Stranded Assets

Here comes the interesting part. We know that we can use the fuel cell to produce electricity for the grid when we are not using the car. Per kWh, approximately 50g of H₂ is required, which amounts to 10ct/kWh. Since we already have the fuel cells, no or little additional capital costs are required. The present cost of generation in the UAE is approximately 5-7ct/kWh, depending on the Emirate, mainly due to the low cost of natural gas in the UAE. However, there is shortage of natural gas and future supply will increasingly come from LNG, which is more expensive.

The electricity from the nuclear power plants that are currently being constructed in Abu

Dhabi will also increase the cost, which are only partly offset by the lower cost of solar energy. It should be noted that, although solar power is the cheapest form of power in the region, increasing shares of solar will introduce additional costs for storage or spinning reserves. Having our fuel cell cars fill the gap and eventually replace gas-fired power plants would be a great proposition.

Since solar PV is the cheapest form of electricity but not dispatchable, it makes sense to work towards a combination of solar PV and electricity from the fuel cells. The maximum share of solar PV in the UAE electricity system without major additional balancing or storage costs is

about one third. If we complement that with electricity from the fuel cells, we have mixed electricity costs of 7 ct/kWh, which is in line with the present mix in Dubai. On average, each car would only need to be used approximately 20 minutes every day to produce electricity in this scheme. The hydrogen case can hence compete with the present and planned set-up, which is a combination of gas, nuclear and solar energy, and will improve in the future.

If we convert our cars to fuel cell cars, we clean up the air in the cities, replace conventional power plants by using what we already have a little more, and produce pure drinking water as a by-product. How cool is that?

Towards a New Paradigm

We have described a system, where hydrogen is produced from seawater and low-cost solar energy in the UAE, at a cost of \$2/kg. With increasing efficiencies of the technologies involved, as well as scale effects, these costs could well be reduced by another 30-50% in the next decade. Half of those costs are the cost for (solar) energy, which is among the lowest in the world. Given the availability of ample land in the UAE, the potential to make hydrogen for the world market is massive and hydrogen made in the UAE could well compete on the global market for clean energy.

If we would dedicate 20% of the UAE land area for the hydrogen economy, we could have 665GW of solar PV capacity to produce hydrogen. This solar capacity would produce 28 billion kg of H₂, representing value of \$56 billion per year. The UAE now produces a little more than 1 billion bar-

rels of oil every year, which, at \$50 per barrel, represents revenue of \$50 billion.

Such a scheme would of course require massive investments in infrastructure and would require several decades. The infrastructure would include the solar power plants, the water desalination stations, electrolyzers, gas processing equipment, compressor stations and of course hydrogen storage and distribution infrastructure. At the work place, cars could park in a car park building with supply of hydrogen, and a hook up to the power grid and water network, plus equipment to measure the hydrogen consumed and electricity and

water produced, so the car owner can get paid for the use of the fuel cell in the car. In the near future, cars will be able to drive autonomously, so at night the cars can drive to such a car park nearby to earn some money while the owners are asleep.

The UAE has more than 50 years of experience with commercial oil and gas operations, and the hydrogen economy can greatly benefit from this intellectual and physical infrastructure. Over time, the nation can construct the building blocks for the hydrogen economy, slowly replacing the fossil fuel infrastructure, including export terminals for hydrogen, to continue supplying the world with energy.

The difference is that water and sunshine will always be available. ☀️



Read full article: www.revolve.media



90% Indoors

The Search for Healthy Building Solutions

As a means to tackle climate change and increase energy security, improving the energy efficiency of buildings is well established on the EU policy agenda. But the requirement to create 'healthy' buildings, which enhance the comfort and well-being of inhabitants, receives far less attention. New research shows how natural eco-building materials are uniquely capable of delivering on both fronts.

Writer: James Ling

The buildings sector is one of the most resource hungry in the EU, accounting for the largest share of total final energy consumption (at around 40%) and 35% of all CO₂ emissions. Therefore, switching to more energy efficient methods of construction will be key transitioning to a low-

carbon society. Recognizing this, in 2010 the EU started to regulate the energy performance of new and renovated buildings.

Buildings must be more than simply energy efficient of course. As we spend up to 90% of our time indoors, buildings and the envi-

ronment they create also have a significant impact on our comfort, well-being and even health. This has led to growing calls for the integration of 'healthy' principles into building design and construction, paying more attention to factors such as thermal comfort, air quality, light and noise.

As we spend up to 90% of our time indoors, buildings have a significant impact on our comfort, well-being and health.



Source: Claytec

Breathing Fresh Air

The health implications of indoor air quality in particular are highlighted by a growing body of research. Amazingly, indoor air is on average 2 to 5 times more polluted than outdoor air, and some common indoor pollutants like volatile organic compounds (VOCs) – those chemicals released by cleaning products, furniture and paints – have been found to cause headaches and

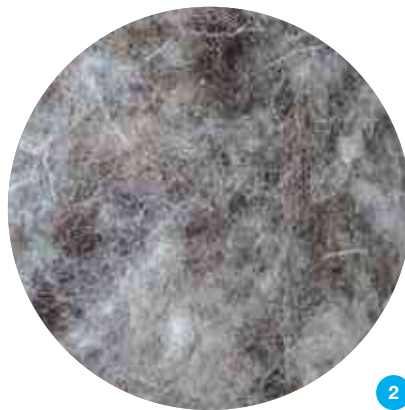
irritate eyes and skin. Issues related to humidity also have serious health implications: the presence of damp and mould almost doubles the risk of asthma or respiratory problems.

However, combining these considerations to create healthy and energy efficient buildings is not always straightforward. In fact, modern energy

efficient building methods have been known to worsen rather than improve indoor air quality. By aiming for greater air tightness in order to reduce heat losses and gains, these buildings are often reliant on mechanical ventilation systems to bring in fresh air. If these systems are not properly used or maintained a build-up of harmful gases can occur.



1



2

Amazingly, indoor air is on average 2 to 5 times more polluted than outdoor air.

Breakthrough Eco-Building Solutions

One solution is to build with natural materials, which are known to have a positive impact on indoor environmental quality. Natural materials, like clay and timber, have been used since time immemorial, but are relatively niche in today's construction industry, unable to compete with mass produced concrete and steel. The EU funded research project ECO-SEE set out to bring natural materials back into mainstream use by showing how their unique qualities make them the ideal solution for modern challenges of energy efficiency and indoor air quality.

The project characterized 21 different natural materials in the laboratory, testing how they influence air quality and humid-

ity. The most promising materials were selected for further development to create new building products for insulation, coatings and panels.

Bio-based insulation from sheep's wool, hemp and recycled paper can already compete with conventional products in terms of thermal performance. And being non-toxic they are also much easier to handle and recycle. ECO-SEE modified and enhanced these materials to enable them to also capture VOCs, substantially improving indoor air quality.

A novel **clay plaster** has also been developed during the project which helps minimize problems related to humidity. Clay

is hygrothermal and vapour permeable, meaning that it is 'breathable', naturally absorbing and releasing moisture to maintain a safe and comfortable humidity level. Keeping relative humidity at a moderate level – between 30-60% – reduces related health problems dramatically.

ECO-SEE has also investigated new methods to enhance the power of nature. Partners have produced an innovative **photocatalytic coating**, using the same nanotechnology as self-cleaning walls or windows. This coating, which is light-activated and tailored to specific application onto timber and lime based internal surfaces, cleans air by removing pollutants like VOCs.

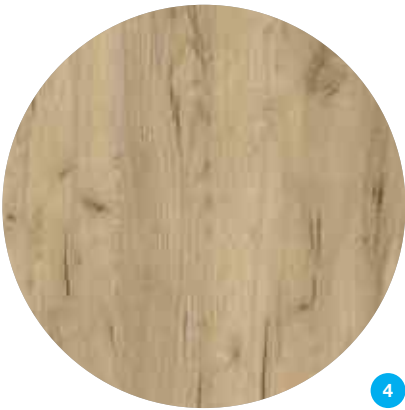
Multiple Benefits of Natural Materials



3

To enable the symbiotic use of these eco-materials, ECO-SEE partners have created internal partition and external highly insulated wall panels incorporating the new solutions. The performance of these wall panels have been evaluated at demonstration sites in the UK and Spain. Testing is still ongoing, but already the levels of harmful gases and contaminants are lower in the ECO-SEE demo building compared to the reference.

Results have also highlighted the exceptional energy performance of natural materials, with the external panel 50% better than reference materials. And it is not only in terms of their operating performance that these materials are extremely energy efficient. Like almost all natural construction materials their embodied energy – the amount needed for their production – is also very low, 20% below reference materials.



4

Change on the Horizon?

Despite their obvious advantages, the market for natural construction materials remains niche. However, people are starting to recognize the large gains to be made through building healthy. In one office redesign, improving indoor air quality was shown to increase productivity by 10%, in another sick days were reduced by

two thirds. Studies of healthy school buildings have found children performing up to 15% better. Considering the overall cost to society of unhealthy buildings – in terms of healthcare, sick days and lower productivity – the case for eco-building solutions like those developed by ECO-SEE becomes even more urgent. 🌱

- 1 Clay and cork. **Source:** University of Bath
- 2 Sheep's wool. **Source:** University of Bath
- 3 Hemp fibre. **Source:** University of Bath
- 4 Timber. **Source:** Kronospan

The ECO-SEE project has developed breakthrough eco-building solutions to improve the indoor environment of energy efficient buildings. Coordinated by the University of Bath, it brings together a multi-disciplinary team of researchers from universities and research organizations with a number of large enterprises and innovative SMEs whose combined expertise and capacity will lead to the commercial development of the products. Having successfully tested and validated the new solutions at locations in Spain and the UK, the project will draw to a close in August 2017.

Learn more: www.eco-see.eu



This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 609234.

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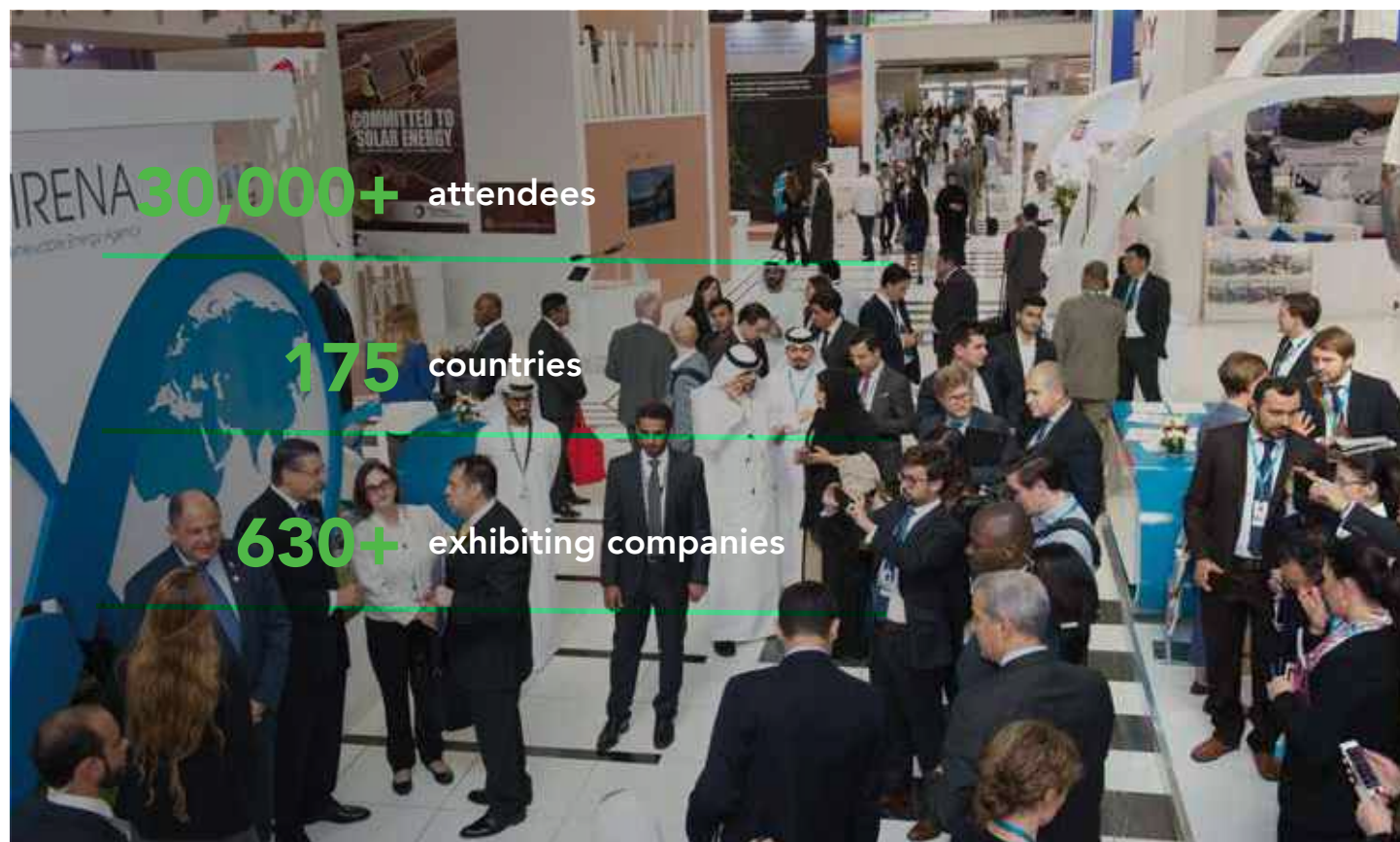
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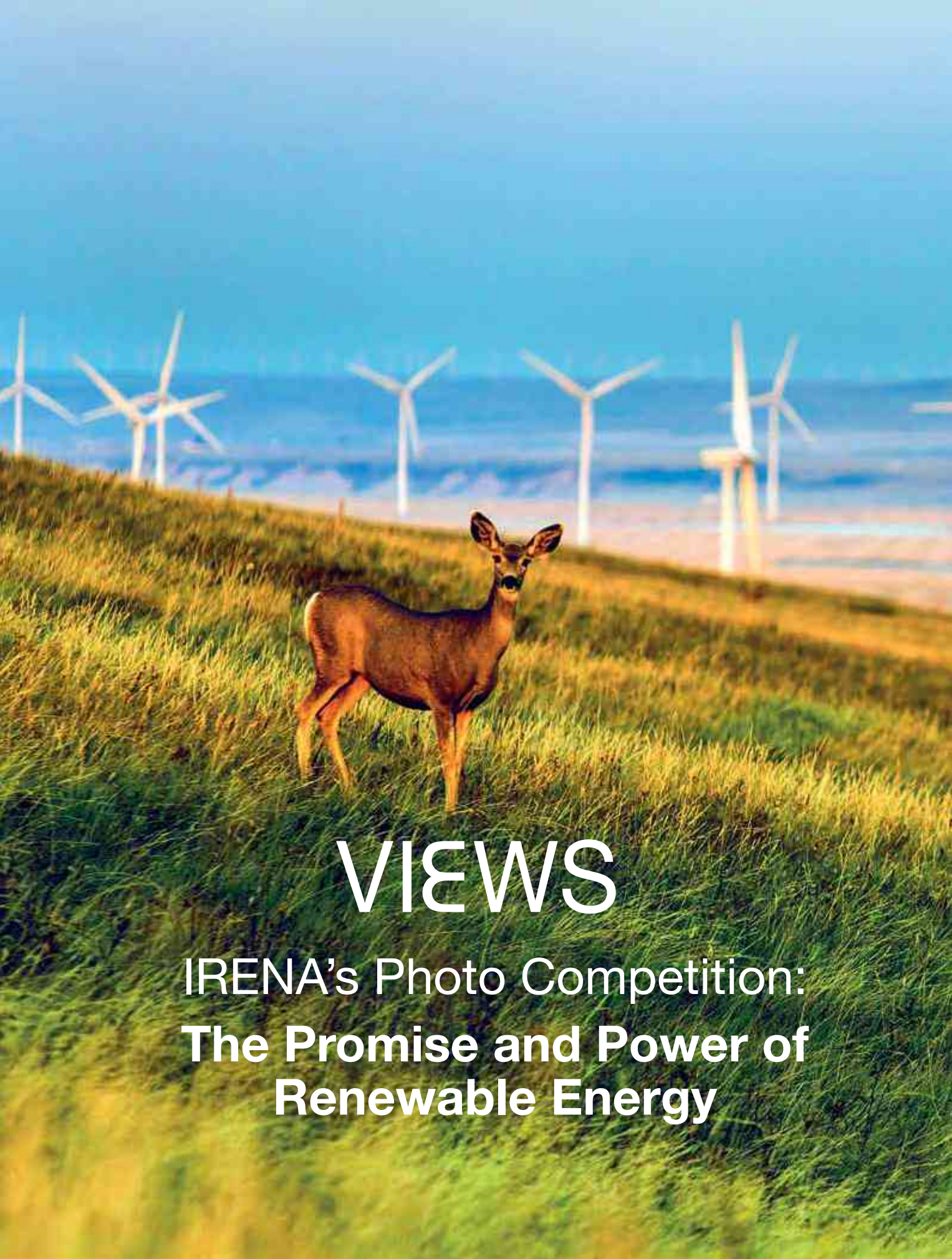
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In 2016, to celebrate its fifth anniversary, IRENA launched an international photo competition. Calling on the global public to submit photos demonstrating “the promise and power of renewable energy,” IRENA received over 350 submissions from around the world. Of these, 12 were selected to be exhibited at the Agency’s seventh Assembly, included in IRENA’s 2017 calendar, and featured here.

Previous page:
Location: Alberta, Canada. **Source:** Keith Arkins





Khuri, Rajasthan, India. **Source:** Sudipto Das



Andújar, Jaén, Spain. **Source:** José Barranco Peña



VIEWS The Promise and Power of Renewable Energy



Block Island, Rhode Island, USA. **Source:** Joan Sullivan



Willcox, Arizona, USA. **Source:** Joan Sullivan



Düsseldorf, Germany. **Source:** Kevin Coellen



Sint Maartensbrug, Netherlands. **Source:** Peter van Veldhoven







(Previous page) Hemis Monastery, Ladakh, India. Source: Debdatta Chakraborty



(This page) West Bengal, India. Source: Supriya Biswas



Bomet County, Kenya. **Source:** Corrie Wingate





Bjørnfjell, Narvik, Norway. **Source:** Doran Talmi



(Next page) Dieng Plateau, Java, Indonesia. Source: Bambang Wirawan



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A Sustainable Future for Façade Lighting

Façade lighting is an increasingly popular feature of landmark architectural projects, but the technology required can be very energy intensive. A European consortium has been researching an advanced and sustainable alternative: the ETFE Multifunctional Module.

Writer: Simon Hunkin

Illuminating Landmarks

Façade lighting is a key aspect of architectural design, and whether highlighting features of historic buildings, or integrated into panels, billboards or screens, lighting makes a lasting impression. While landmarks such as Times Square or Piccadilly Circus may come to mind first, ambitious and innovative projects have found new ways to integrate lighting with building façades.

From the Allianz Arena in Munich, to the Beijing National Aquatics Center, integrated façade lighting is becoming a mainstream feature of landmark installations, and considerations of façade lighting are made at the conception phase, requiring planning and use of innovative materials.





Textile-based Building Materials

The rise of monumental façade lighting has gone hand-in-hand with the use of textile-based building materials. Textiles made from plastics – such as Polyvinyl Chloride (PVC), Polytetrafluoroethylene (PTFE) and Ethylenetetrafluoroethylene (ETFE) – can be used to striking effect in new buildings, while also being more environmentally-friendly and sustainable than traditional building materials.

Perhaps the most promising of these is ETFE, which is a lightweight, transparent and recyclable fluorine-based plastic, weighing only 1% of an equally-sized glass panel. This ‘wonder material’, as it has been called, is a better heat insulator and lets in more natural light than glass, with a comparative energy saving of around 30%. It is dirt and wear resistant, can be easily repaired if torn, and can be kept clean by rain alone.



Multifunctional Building Façades

Monofunctional textiles have been used for buildings such as the O2 Arena in London (PTFE), and the Eden Project in Cornwall, UK (ETFE), but the trend in textile architecture is moving towards multifunctional materials.

When used in buildings as a two or three layered, air-filled cushion, or as a single layered cable-supported structure, ETFE can be given additional functions by integrating technologies, or can be printed on with different colors and designs for elaborate façade decoration and illumination.

One such example is the use of ETFE for Building Integrated Photovoltaics (BIPV), where photovoltaics (PV) are integrated into air-filled ETFE cushions. The cushions are supported by a lightweight aluminium frame, and have a middle layer with PV, wiring and electronics. PV systems are very reliable producers of electricity and require minimum maintenance with a proven life-span of 20-30 years. This makes them suitable for use in buildings where parts are expected to have a long life and not require frequent repair.



Top: The Allianz Arena in Munich is a well-known example of ETFE façade lighting.

Source: Greenovate! Europe

Middle: The ETFE Multifunctional Module is being demonstrated on the ITMA Materials Technology building in Avilés, Spain.

Source: ITMA Materials Technology

Bottom: Roof of the AWM Carport in Munich, comprised of ETFE with integrated photovoltaics.

Source: Taiyo Europe

The ETFE Multifunctional Module

The ETFE-MFM project has developed an innovative solution, powered by photovoltaics, for sustainable façade lighting. The Multifunctional Module consists of ETFE architecture, PV technology, illumination devices (LEDs) and flexible integrated circuits. The Module has been designed to include external batteries for onsite energy storage, but it can also be connected to the grid.

The Module can generate and store electricity from sunlight, which is then used to power impressive visual displays. Current ETFE lighting systems allow for each ETFE module to be illuminated

through internal or external light projection, but there are many limitations to what can be shown. Comparatively, the ETFE Multifunctional Modules have been

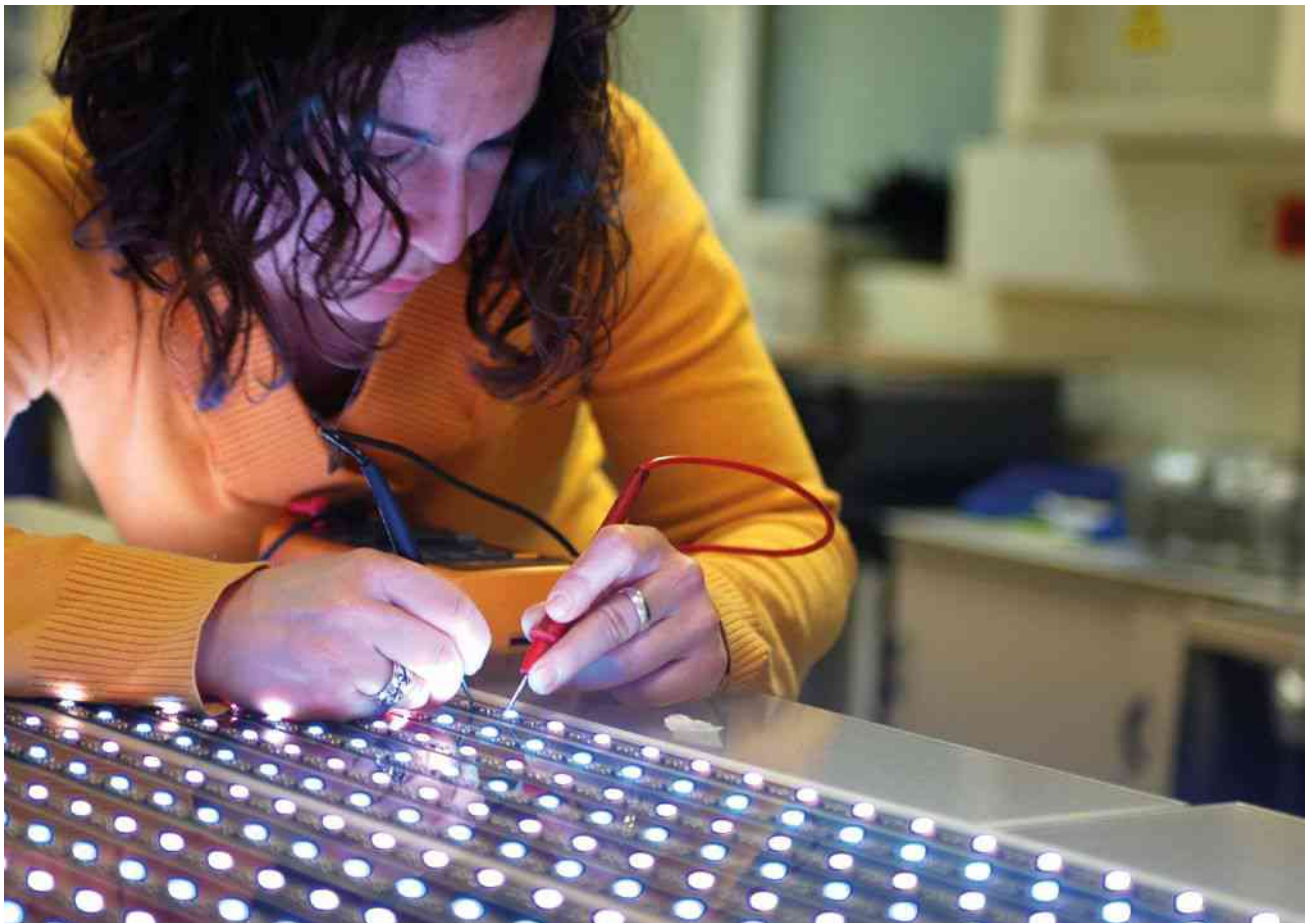
designed with integrated LEDs which are spaced evenly apart, acting as pixels with high enough resolution for displaying images and video.

The ETFE Multifunctional Module aspires to enhance the use of BIPV in the construction industry, providing new architectural façade lighting possibilities. It demonstrates the multiple uses of ETFE architecture, showing it as a versatile material with potentially wide application.

The ETFE Multifunctional Module attributes:

- Light-weight ETFE plastic
- PV module for electricity generation
- Illumination devices (LED) for image and pattern display
- Flexible integrated circuits for control of PV and LEDs
- External battery for electricity storage

The ETFE Multifunctional Module with integrated PV and LEDs. **Source:** ITMA Materials Technology



Demonstrating Sustainable Façade Lighting

To test and monitor the Multifunctional Module in real conditions, four demonstration units were installed at ITMA Materials Technology in Avilés, Spain. Each of the modules consists of two sheets of

ETFE at front and back, with a sheet of LEDs and a sheet of organic PV modules. Two of the modules put the PVs on top, with the LEDs showing between the gaps of the PV, while the other two reverse this

by using different PV designs with the LED strips on top. The aim is to find the optimal configuration for providing a clear façade image, while maximizing electricity production from photovoltaic panels. 

Armando Menéndez Estrada
and David Gómez Plaza

Q&A

ITMA Materials Technology



What are the main challenges for this project?

The main challenge has been integrating all the components while maintaining their individual functionalities. Requirements from architects in terms of aesthetics have also represented a significant challenge.

What are the main uses of the Multifunctional Module?

The main uses are for single buildings such as stadiums, commercial centers and pavilions, for example, but the project has also considered standardization for introducing these elements to a broader market, including through retrofitting.

What impact do you expect to see from the project's research?

Our research will add value to textile architecture, incorporating photovoltaic properties and a radically new lighting concept to the structural material, opening a new market for their use as BIPV. The product will have impact in three emerging fields of modern architecture: BIPV, LED façade lighting and ETFE architecture.

Image: David Gómez Plaza and Armando Menéndez Estrada.
Source: ITMA Materials Technology



ETFE-MFM has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 322459.

For more information on the project, you can visit the website at www.etfe-mfm.eu

Energizing Smart and Sustainable Cities

One of the biggest challenges in creating a sustainable future is remodeling our cities to match both energy needs and climate concerns. ICLEI brings its expertise to several projects working to make cities greener, cleaner, and more accessible to all.

Writers: Kelly Cotel and Helen Franzen

Cities are the forerunners in the transition towards a low-carbon and resource-efficient economy. The idea of the “Smart City” has become a popular answer to the challenge of energy efficiency, echoing societal transformations. Through the digitalization of the urban environment, the concept of the smart city combines the growing demand for transparency with citizen involvement and an awakened environmental consciousness.

As a global network of local governments, ICLEI has been working with cities on local sustainability policies for more than two decades. In Europe, ICLEI supports over 160 members to find sustainable energy solutions through projects, initiatives, and programs. Capitalizing on this experience, ICLEI is taking part in the 2017 EU Sustainable Energy Week, coordinating a “Smarter is Cleaner” policy session

on June 22 in the Residence Palace, Brussels. From June 19 through the 23, ICLEI is displaying photos of sustainable energy workers from four of its member cities as part of Revolve’s Visualizing Energy exhibition that will be on show in the Cinquantenaire Park in Brussels throughout the summer.

Kranhäuser Tag, Cologne. **Source:** ICLEI Europe

ICLEI has been working
with cities on local
sustainability policies for
more than two decades.



Freiburg: Over 25 Years of Sustainable Inspiration

When the ICLEI European Secretariat office first opened its doors in Freiburg, Germany, 25 years ago, the city was already known for its environmental focus. Now internationally-known as the “Green City,” Freiburg has established itself as one of the most sustainable cities in the world. And, as one of the fastest growing cities in Germany, the city is planning its urban development with ambitious energy goals.

With the aim of becoming carbon neutral by 2050, Freiburg is developing a smart city vision as part of its ‘Green City’ concept. The transformation of Freiburg’s largest and oldest industrial area into a Smart

Energy District will provide a nation-wide role model for a future-oriented, sustainable, and energy efficient area. To continue sharing renewable energy and energy

efficiency experiences in the urban realm, Freiburg will once again host the Local Renewables Conference co-organized with ICLEI in 2018.

Freiburg has established itself as one of the most sustainable cities in the world

Ruggedised. Rotterdam. **Source:** ICLEI Europe



European Energy Efficient Cities

Cities like Freiburg are well-placed to lead collaborations that are fundamental to enabling the transition to a low-carbon economy. Cities can learn a lot from each other on this complex matter, and the European Commission promotes a collaborative approach through its Horizon 2020 Research and Innovation funding program. The aim is to unite cities, industry, and citizens to demonstrate

solutions and business models that can be scaled and replicated, and that lead to measurable improvements in energy and resource efficiency, new markets, and new jobs. These projects represent an interesting financing prospect for cities and their partners, providing an injection of funds for the redevelopment of entire neighborhoods and the opportunity to test cutting-edge solutions.

Through Horizon 2020, the so-called “lighthouse” project brings together cities that will test and implement smart solutions and “follower cities” that will observe the project with the aim to replicate the relevant solutions. There are currently 9 lighthouse projects in place, which will take about 5 years to complete. The first projects were put into place in 2015.

Defining Lighthouse Cities

According to the Horizon 2020 specifications, lighthouse cities “must demonstrate solutions at district scale integrating smart homes and buildings, smart grids, energy storage, electric vehicles and smart charging infrastructures, as well as latest generation ICT platforms which must be based on open specifications. This should be accompanied by energy efficiency measures and the use of very high shares of renewables at the level of districts.”

GrowSmarter and RUGGEDISED

ICLEI is involved in two Horizon 2020 lighthouse projects. Since 2015, the GrowSmarter project – with lighthouse cities Stockholm, Cologne and Barcelona – is implementing a range of smart technologies in energy, infrastructure, and transport, which are designed to achieve energy savings and self-sufficiency in urban neighborhoods.

GrowSmarter aims to stimulate city uptake by using the three lighthouse cities to showcase 12 Smart City solutions. These solutions will combine advanced information and communication technologies with better connected urban mobility while incorporating renewable energy sources directly into the city's grid. ICLEI is working with the 5 follower

cities – Valetta, Suceava, Porto, Cork, and Graz – to learn from the lighthouse cities' experiences and identify measures suitable for their specific local contexts.

Launched in November 2016, the RUGGEDISED project aims to test 32

“It’s more than green economy, it’s more than Mother Nature, it’s more than clean air, it’s also about stable societies.”

– Rotterdam Mayor, Ahmed Aboutaleb,
RUGGEDISED Kick-off meeting, November 3, 2016

smart solutions in 3 smart districts in Rotterdam, Glasgow, and Umeå. Three follower cities – Brno, Parma, and Gdansk – will actively track the development of these innovative solutions to learn from the experiences of the lighthouse cities.

EUSEW Session: Sharing Lessons Learned

The 9 lighthouse projects currently funded under the Horizon 2020 program are also working together to link their experiences, expertise, and know-how. In doing so, they aim to enable other cities to adopt and replicate the smart city model as an effective path to achieving climate and energy goals in the urban context.

Coordinated by ICLEI, all 9 Horizon 2020 smart city projects will host a policy session together during the European Sustainable Energy Week in Brussels on June 22, 2017. The session will

focus on the replication potential of the energy-related smart solutions currently being implemented in the lighthouse cities. The aim of this joint event is to equip other cities with the knowledge to replicate the processes and technological solutions already developed. The session will look more closely at smart solutions in 3 areas: smart grids, smart electric storage, and industrial to civic prosumers.

In the GrowSmarter project, for example, one of the low-energy solutions developed in lighthouse city Cologne concerns residential estate management. The solution consists of a virtual power plant which connects local photovoltaic production, heat pumps,

ICLEI believes that citizens should be at the heart of the smart city thinking



and batteries. Additionally, the solution also integrates a charging station for electric vehicles. Based on information gathered from meters installed throughout the building, the virtual power plant can predict future energy consumption by measuring the current energy used in each apartment. This information is then used to optimize energy production

and consumption to reduce the need for external energy from the grid.

Innovative solutions for smart energy management are being implemented in all the lighthouse projects. In RUGGEDISED, the city of Rotterdam is looking at providing high performance servers (Nerdalize Cloud) to home owners as cost-free heating

facilities. The servers are distributed and installed near homes which then receive heat generated from their operation. The decentralized set-up eliminates the need for a large data center, while also providing a valuable service to home-owners. This innovative business model allows for highly distributed computing power while significantly reducing CO2 emissions.

Smart Citizens, Smart Communities

ICLEI believes that citizens should be at the heart of the smart city thinking. New technologies have extended the possibilities for involving people in every step of the decision-making process. Smart cities will produce a wealth of data that can be made available to citizens through open data platforms. Topics such as fuel poverty or public safety can be addressed through the smart use of information obtained from intelligent buildings, street lighting, or connected public transportation. It is an opportunity for people to re-appropriate the environment in which they live and develop a new sense of community.

The use of modern technology creates possibilities, but also challenges that must be addressed. Are smart cities only for the young and connected? In the smarticipate project, an online platform is being created to make data accessible and understandable, empowering citizens

to give input on new public services and solutions to urban problems. They will be asked for input on subjects ranging from the renovation of buildings to their preferred location for public spaces like parks or playgrounds.

The question of how to make the platform user-friendly to all citizens emerged and was addressed through Smartathons (smart hackathons). London, Hamburg

Innovative solutions for smart energy management are being implemented in all the lighthouse projects.

and Rome have already organized local Smartathons inviting residents of different demographic groups to work on making the smarticipate online tool accessible to all.



Ruggedised. Rotterdam. Source: ICLEI Europe

Smart in a Context of Transformation

The innovative solutions developed in smart cities have a technical purpose and aim to make life better for all citizens. This can only work through an inclusive approach in which citizens are empowered by using new technologies rather than being estranged by them. More and more, mayors and city representatives are stepping up and making bold decisions towards creating smart, inclusive communities.

Acclaimed by over 850 participants at the 8th European Conference on Sustainable Cities & Towns in April of 2016, the Basque Declaration reflects the need for ambitious local leaders to find innovative

ways to engage with civil society to accelerate a socio-cultural, socio-economic, and technological transformation.

The Basque Declaration outlines pathways for European cities and towns to support the transformation towards productive, sustainable, and resilient cities for a livable and inclusive Europe. In this context, local leaders have committed to ensuring that the application of smart technologies is demand-driven, and serving the interest of citizens. 

local leaders have committed to ensure that smart technologies serve the interests of citizens

Cities are invited to endorse the Basque Declaration and promote their local transformative actions through the Sustainable Cities website:
www.sustainablecities.eu



Smart Green Tower, Freiburg. Source: Frey Architekten



For more information about ICLEI - Local Governments for Sustainability, visit: www.iclei-europe.org



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Brussels: From Exemplary Buildings to Buildings as Material Banks

Brussels – the Capital of Europe and of Belgium – has reduced energy consumption by 28% and has brought down greenhouse gas emissions per capita by 33% between 2004-2015. This article highlights the EU-funded “Buildings As Material Banks” (BAMB) project and field visits to exemplary buildings in Brussels during the EU Sustainable Energy Week (EUSEW) from 19-23 June 2017.

Over the course of slightly more than a decade, the Brussels-Capital Region has undergone fast and positive change, achieving significant results in the energy sector. Brussels is a densely-populated city with significant population growth and an economic sector oriented towards tertiary functions. Brussels does not have a territory that would permit the mass exploitation of renewable energy sources; the optimal solution therefore

is to follow an ambitious policy aimed at improving the energy performance of buildings. In this context, after six calls for “Exemplary Buildings”, Brussels Environment (the environment and energy administration of the region) has taken the lead of an EU-funded innovation project called “Buildings As Material Banks” that addresses waste, recycling, reuse and resource efficiency in the construction sector.



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Buildings as Material Banks (BAMB)



BAMB VISUAL. Source: Elma Durmisevic

To create a sustainable future, the building sector needs to move towards a circular economy.

The EU-funded BAMB project comprises 15 partners from 7 European countries to enable a systemic shift in the building sector by creating circular economy solutions. Today, building materials end up as waste when no longer needed, with effects like destroying ecosystems, increasing environmental costs, and cre-

ating risks of resource scarcity. To create a sustainable future, the building sector needs to move towards a circular economy. Whether an industry goes circular or not depends on the value of the materials within it: worthless materials are waste, while valuable materials are recycled. Increased value equals less waste, and

that is what BAMB is creating – ways to increase the values of building materials.

BAMB will enable a systemic shift where dynamically and flexibly designed buildings can be incorporated into a circular economy. Through design and circular value chains, materials in buildings sustain their value – in a sector producing less waste and using less raw resources. Instead of being to-be waste, buildings will function as banks of valuable materials – slowing down the usage of resources to a rate that meets the capacity of the planet.

THE BAMB CONSORTIUM CONSISTS OF:

- Brussels Environment (Project Coordinator)
- Environmental Protection Encouragement Agency (EPEA)
- Vrije Universiteit Brussels (VUB)
- Vlaamse Instelling voor Technologisch Onderzoek (VITO)
- Building Research Establishment (BRE)
- Zuyd Hogeschool
- IBM Netherlands
- Sunda Hus i Linköping AB
- Ronneby Municipality

- Technische Universität München (TUM)
- Universiteit Twente
- Universidade do Minho
- Sarajevo Green Design Foundation
- Drees & Sommer
- BAM Construct UK

More information:

www.BAMB2020.eu
linkedin.com/bamb2020
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Contact: info@bamb2020.eu



BAMB
BUILDINGS AS MATERIAL BANKS



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642564.

Putting Materials Passports and Reversible Building Design to the Test in BAMB Pilots

Great progress has been made and rich exchanges have taken place with stakeholders via the BAMB Stakeholder Network and Special Interest Groups, now counting approximately 275 members. Interactions and input from stakeholders have contributed to shape the development of tools within the project such as important steps being taken to achieve the use of Materials Passports and reversible building design tools. A Software Platform has been developed to support the generation of, and

access to Materials Passports, and the first steps have been taken towards generating 300 passports within the project.

In parallel, progress has been made in the development of the Re-use Potential Tool, which will provide a score for buildings' reuse potential as well as address information about disassembly characteristics of building structures, fostering high quality reuse. These and other tools developed as part of the BAMB project

are being put to the test by way of six real-scale construction and renovation pilots. All BAMB pilots have already begun to perform a feasibility study in which the objectives of Material Passports and reversible building design tools are being studied on a theoretical level. The different scenarios and choices will be described, and this study will be used as a basis for prototyping. Currently, two pilots testing BAMB tools are taking place in the Brussels Capital Region.

Circular Retrofit Lab in Brussels: The VUB Van Der Meeren Student Housing

In the middle of the central green space on the main campus of the Vrije Universiteit Brussel (VUB), there are clusters of student housing buildings. Although these 352 student rooms were built as a temporary solution in 1973, they are still in use today and have become a cherished icon of the university. However, they have

comfort levels that are well below current standards, primarily in terms of technical and energetic quality and accessibility. While the initial plan was to demolish the units after they were to be replaced (by 2020), the university recently initiated an exploration into how the housing units could complement its vision for

sustainable development. VUB now wants to demonstrate how reversible building designs can prevent demolition waste when refurbishing existing buildings.

The student housing units designed by Van Der Meeren are ideally suited for this purpose. Each 96 m² unit (4 rooms, a living space with kitchen, toilet and bathroom) is made by combining four prefabricated concrete support modules, and compatible infill components for exterior and interior walls. Arranging these 24 m² standard modules in different ways resulted in a variety of room, unit, and cluster configurations. The pilot project will refurbish selected student housing modules in three stages, each one investigating and demonstrating different reversible refurbishment solutions. These units are highly visible in the epicenter of campus and can be used as demonstrators, workshop spaces or pop-up shops.

The Circular Retrofit Lab : VUB Van Der Meeren student housing. **Source:** Stijn Elsen & Anne Paduart



The pilot proposal builds on a preliminary explorative study looking at different scenarios for the reuse and refurbishment of student housing, including life-cycle impact comparison. While the Horizon 2020 project BAMB includes the design and feasibility studies for all three stages of the pilot, only the first stage of the pilot project (the refurbishment lab) will be constructed using BAMB funding. The

VUB research team will look for alternative funding for stage two and three.

The H2020 project will act as a catalyst to stage two and three by funding the pilot design and embedding the pilot in a consortium of experienced international partners, significantly enriching the scope. As part of BAMB, the pilot will be used as a test case for Reversible Design

protocols and evaluation methods, particularly related to refurbishment. The pilot's design phase will also test the concept of Materials Passports (a way to track the re-use history of building materials throughout their life-cycles). The entire process will be monitored to map opportunities and bottlenecks for the proper implementation of the circular economy in the construction industry. 

EUSEW STUDY TOUR

Towards Near Zero Energy Buildings (NZEB):

Exemplary Construction and Renovation in the Brussels-Capital Region

As in previous years, Brussels Environment offers the opportunity, during the EU Sustainable Energy Week (EUSEW) to visit exemplary buildings. This year, the study tour will take place on 20 June with a visit to a new construction project (office building) and a retrofitting project (swimming pool).

The Oxygen Office Building

The Oxygen Office Building, in the heart of the European Quarter, is an eye-catching architectural addition to the neighborhood. The building presents various unique features such as daylight control and absence detection systems, reduced water consumption and rainwater recuperation techniques, solar panels, extensive roof gardens and easy to use, flexible floors without any central structural elements. Designed by Conix RDBM Architects (www.conixrdbm.com) these sustainable offices comply with the new passive standard of the Brussels-Capital Region. What's more, the Oxygen Office Building is rated BREEAM 'Excellent'. The building was also selected for the '2013 Exemplary Buildings' competition run by Brussels Environment.



The Oxygen Office Building, European Quarter, Brussels.
Source: CONIX RDBM Architects

The VUB Swimming Pool and Student House

The field trip will also include a presentation of the VUB student housing units (in link with the BAMB project above) and of the VUB swimming pool: a high-energy-performance retrofitting with specific attention to sustainability and the circular economy. This retrofitting project is laureate of the "Be.exemplary" call for projects, which in 2016 followed the previous one for "Exemplary Buildings".



For more information on the Study Tour:
<http://eusew.eu/energy-days/visit-exemplary-buildings-brussels-capital-region-1>

Smart Buildings at the Heart of the Cities of Tomorrow

Smart technologies are already shaping our lives and they are becoming more and more environmentally-friendly. Once considered science fiction, smart houses are now becoming a reality. The integration of technology and energy efficiency in the building industry is still underway. BPiE looks at the elements that shape a smartly-built environment and how to inspire green solutions.

Writers: Cosmina Marian, based on a study by Maarten De Groote, Jonathan Volt, and Frances Bean

What will our future cities look like? We may envision futuristic architecture, but we can also imagine a deeper integration of our buildings and the smart technologies we have come to expect in other areas of our lives. Europeans spend 90% of their time indoors, so it is also important that we continue to search for new ways to integrate smart technologies that will lower the ecological impact of the energy used

by our infrastructures. Buildings consume 40% of the EU's energy and are responsible for a third of greenhouse gas emissions. Smart technology in buildings can empower citizens to control their energy consumption while leading the way to transform the EU's energy system.

The potential societal benefits from integrating smart technology into buildings are

numerous: users could control their renewable energy production and consumption, cut energy bills and take better advantage of the traffic on the energy grid through innovative systems that map the energy usage and needs of the occupants, like electric vehicles. These technologies will also create new jobs in expanding markets, facilitating the surge of renewable energy and reinforcing our energy security.



Buildings consume 40% of the EU's energy and are responsible for 1/3 of greenhouse gas emissions.



Berlin, Germany viewed from above the Spree River. **Source:** Shutterstock



Source: Shutterstock

Some countries have already begun to embrace the possibilities offered through smart technology by putting legislation in place that will begin to shape a more environmentally-friendly building industry. This shows a changing mindset that will allow Europe's building sector to see progressive and sweeping changes. Though the possibilities are endless, here are a few measures that have already been taken:

SMART METERS IN SWEDEN

A smart-ready built environment takes advantage of the full potential of ICT and innovative systems to adapt its operation to the needs of the occupant, to improve its energy performance, and to interact with the grid. One of the first steps towards creating a smart and integrated energy system is the use of smart meters. In Sweden, a full roll-out of smart meters was already achieved in 2009. These meters mean that electricity bills are based on consumption data collected hourly by 95% of the meters. 80% of these meters can even facilitate a two-way direct link between the occupant and the energy provider, enabling greater

transparency and smarter energy planning. This transition in Sweden was induced through legal measures requiring that customers be able to see a monthly-meter reading of their energy consumption. For distribution companies, smart meters allowed them to meet this requirement more efficiently.



Source: Shutterstock

DISTRICT HEATING IN DENMARK

Smart urban heating planning is designed around balancing demand with resource availability. Through an efficient distribution network based on renewable energy and waste heat, the user's thermal comfort is maintained. From an economic perspective, this makes the combination of district heating and energy efficient buildings feasible. In a dynamic energy market, smart buildings connected to district heating sell their excess energy, cutting down the heat-load peak, and allowing the district heating supplier to avoid running peak-load boilers. District heating could integrate excess heat (heat recovery of cooling systems or data centers), heat pumps driven by photovoltaic solar panels, as well as geothermal and solar thermal energy.

District heating is a cornerstone for Denmark's smart cities such as Sønderborg where the implementation of district

then oil-dependent country. The government began investing heavily in renewables, energy efficiency, and district heat-

Today most Danes receive their heat from a district heating system.

heating has enabled a greater uptake of renewables and smarter energy use overall. The role of district heating systems has only increased since 1990 and these systems have played a considerable role in reducing national CO₂ emissions. District heating was the Danes' answer to the oil crisis in 1973 that affected the

ing. Even when oil prices dropped, the government increased taxes to support the more environmentally-friendly solutions. Thanks to those efforts, today most Danes receive their heat from a district heating system.

SMART CASE STUDIES

Though the above examples demonstrate several ways in which the use of smart technology can help to improve living conditions through healthy buildings – a prerequisite of a smart-ready built environment – while conserving energy and saving money, there are still more ways that smart buildings can use technology to create a high-quality environment while integrating renewable energies.

The building performance, indoor air quality and the ability to keep the indoor temperature at a comfortable level are vital characteristics of a smart built environment. These environments should empower occupants with control over the

energy flow through connected technical building systems and other appliances inside the building, like smart thermostats and refrigerators, as well as security and access-related systems.

Smart built infrastructures should use energy-system-responsive technologies that coordinate with the energy grid to ensure the maximal efficiency of the grid, especially during peak loads. Through a demand-response system and the integration of energy storage capacities into buildings, the energy grid will be better balanced and able to accommodate a larger population. This would also increase the number of electric cars that could be

used on the grid, which would help to further reduce the reliance on fossil fuels.

Smart built infrastructures can also integrate renewable energy sources into the building, through photovoltaic cells, solar thermal, and geothermal energy sources. Through inter-operating in a small district with many buildings utilizing renewable energy, a district biomass heating system or waste heat distribution could be used as well.

The following examples are case studies detailing building projects that have made use of smart technologies, integrating one or more of the ideas above.

SMART OFFICE BUILDINGS

The Edge office building in Amsterdam is a leading example of the integration of smart technologies. The building uses 70% less electricity than comparable office buildings and is equipped with the largest array of photovoltaic panels of any office building in Europe. These panels are located on the roof a south-facing façade to maximize their efficiency. The Edge has an aquifer thermal energy storage system that provides all the building's energy needs for heating and cooling. A heat pump is connected to this storage system, which further increases its efficiency.

The building and its users are also connected via a smartphone app. This app can direct users to a parking spot, saving them from circling in search of one. The app also helps users locate a desk and stores their individual preferences

Smart urban heating planning is designed around balancing demand with resource availability.

for light and temperature, adjusting those elements wherever the user goes. Through technology, The Edge combines heating and energy solutions with connectivity to make the building a leader in smart building.



Light domes using solar light in Modena Canaletto shopping centre, Italy. **Left:** outside view. **Right:** Inside view. **Source:** BPIE



PV-battery-eV charging station in COOP Grosseto shopping centre, Italy. **Source:** BPIE



RESIDENTIAL STORAGE, LOAD SHIFTING AND FLEXIBILITY

To demonstrate flexibility and grid balancing in action across a neighborhood, a dozen houses in Oud-Heverlee, Belgium, have been equipped with a range of technologies to provide a maximal load-shifting potential. The houses are a mix of old and new, though all have been equipped with an assortment of photovoltaic cells, solar-thermal energy, and heat pumps. Some have a fuel cell, some a battery, and some

both, but all have been equipped with advanced monitoring and control systems. One of the buildings – equipped with all available smart technologies ranging from household appliances to an electric car – can even maintain grid independence for a period of several days. Through a flexible smart-control system, the merits of the different systems will be tested, with results available in late 2017.



Mercado del Val in Valladolid, Spain after renovation works. **Source:** BPIE

SUPERMARKET AND DISTRICT HEATING CONNECTIVITY

In Denmark, district heating networks allow supermarkets to provide heat to private homes. Around 20 supermarkets are connected to the network, with surplus heat from their refrigeration systems integrated into the broader energy system. SuperBrugsen in Høruphav saves more than €25,000 annually on gas, and reduces their CO₂ emissions by 34% just through using the surplus heat from the refrigeration system to supply hot water. With a connection to the district heating network, they can also supply heat to 16 homes annually. The project was inspired

by the vision put forward by Sønderborg to become zero-carbon by 2029.

Work within the European-funded FP7 project CommONEnergy has proven that supermarkets and shopping centers can become energy hubs, playing an active role in their interaction with the smart grid. More than 25 innovative technologies – including solutions for heating, lighting, and ventilation – were developed and installed in demo cases with the aim of improving comfort, reducing operating costs, and reducing overall energy consumption.

Though there are several mechanisms in place around Europe to facilitate the integration of smart technologies, Europe is not ready overall to embrace fully the transition to smart buildings. Technology is rapidly evolving, and so must we. Europe needs to push progressive policies, opening the market for the efficient cities of the future. 

For a more in-depth analysis of the subject, see **BPIE's report "Is Europe Ready for the Smart Buildings Revolution?"** available at:

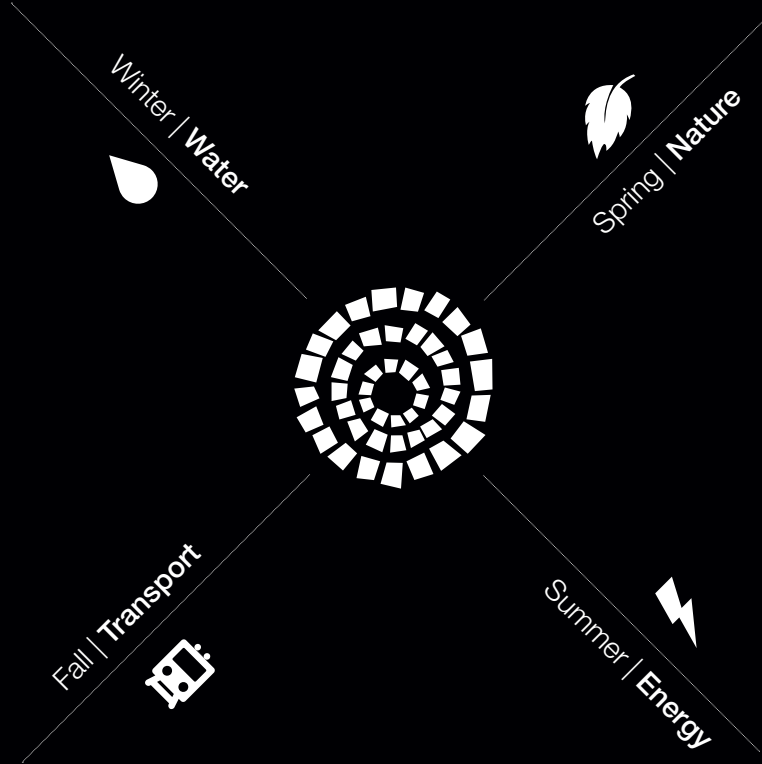
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> Is Europe Ready for the Smart Buildings Revolution?



The Buildings Performance Institute Europe (BPIE) is a European not-for-profit think-tank with a focus on independent analysis and knowledge dissemination, supporting evidence-based policy making in the field of energy performance in buildings. It delivers policy analysis, policy advice and implementation support. www.bpie.eu



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Our Bags

In partnership with **Greenovate! Europe** in 2017, **REVOLVE** is proud to present the first series of messenger and shopping bags made from our exhibition canvases. We are moving towards zero waste and contributing to the circular economy by reusing old material to make new products.

We have been struggling with what to do with the extra canvases after the exhibitions. Sometimes partners request to reuse them for their own promotional purposes or sometimes we reuse them the following year if a partner wants to build on a series of visuals to tell a story. But most of the time, these old canvases have been sitting in storage waiting for a new life...

It is therefore very fitting that for the 5th edition of our flagship annual exhibition Visualizing Energy we have found a way to reintroduce our great visual by reusing the canvases in another format. Partners can now pre-order their bags with their canvases that are waterproof and highly resistant:

1 square meter = 1 messenger bag

0,5 square meter = 1 shopping bag

**1 canvas = 9,5 square meters
= 9 messenger bags or 18 shopping bags**

We could also make yoga bags or beach bags or pencil pouches or what else? What do you think? Feel free to get in touch with some ideas and to order your bag!

info@revolve.media





The Process:

We work with a Belgian company that prints and installs our exhibitions. We curate the exhibition and develop the content with our partners in line with showing the solutions that exist today. We like to show people on projects when possible so that other people to see the real potential for the so-called 'green' economy. We believe that we've had in impact in reaching hundreds of thousands of citizens over the past 5 years. Probably reaching 1 million people (not counting repeats)... Probably the best exhibition on the energy transition that exists..!

So what to do with old canvases? We sent them to a non-profit in Germany that works with people that physically-challenged that are integrated more in the work force with such activities as making new bags: they wash, clean, dry, cut, and sew the pieces of canvases into fresh new beautiful bags that can be used to carry your books or groceries or whatever you like.

This first series are pilot products to share and sell when possible. **If you are at EUSEW, you can drop by our stand at the Networking Village in Residence Palace and pick up a bag.** Donation can be made online at revolve.media if you wish to contribute to the cause. All proceeds go to planting trees in Madagascar and Chile via two different non-profits that involve children in educational activities and tree-planting exercises to combat climate change. We are closing the loop and contributing to reforestation.

We have raised 300 euros this first round which comes out to be between 450-500 trees. Not bad for a start. **Join us and start revolving!**



REVOLVE

From the Oceans to Your Closet

Writer: Elizabeth Shepard

All images are from ECOALF

With the tagline “Because there is no Planet B,” the clothing company ECOALF works to conscientiously repurpose waste. For founder Javier Goyeneche this means using only recycled materials to create their lines of coats, shoes, bags, and other accessories.

Naming the company in part after his son, Goyeneche says that “the concept arose in 2009 from my frustration with the excessive use of the world’s natural resources and the amount of waste produced by industrialized countries. The idea was to create a fashion brand that is truly sustainable.”

This idea of sustainability permeates every aspect of the products designed by the company, with every product available online listing the recycled materials used. Recycled products include jackets made from discarded fishing nets, shoes made from recycled

tires, and even a jacket made with post-consumer coffee. Popular materials for production also include PET plastic bottles and post-industrial cotton and wool.



The company works to ensure that their products are top quality and to maintain their goal of creating products that are made entirely from recycled materials. According to Goyeneche, “most [recycled] fabrics only contain a very small percentage of [post-consumer] material—15-20%” but this percentage is not good enough for ECOALF. Instead, the company consistently aims to create fabrics that are 100% recycled materials.

“Upcycling the Oceans”

Currently the company is faced with their greatest challenge to date: cleaning plastics from the Mediterranean to create a new clothing line. This new endeavor is not content with using salvaged and found waste, but works instead to actively remove waste from the Mediterranean Sea in a project called “Upcycling the Oceans”.

Upcycling the Oceans began in 2015 with a partnership between ECOALF, the HAP foundation, and a group of fisherman off the Spanish coast of Levante. It began with 165 fishing boats in 9 ports, harvesting between 4 and 5 kilograms of waste per day. Ecoembes joined the project in 2016 and since then the project has expanded significantly to 28 ports with 441 boats working on the project.

The fishermen collect the waste from the seabed – where 80% of waste in the oceans is found. While only about 14% of the waste they reclaim from the ocean can be used for production, the company is looking for ways to incorporate the rest of the waste that is removed. Over 59 tons of waste has been removed so far, and a second operation has been opened in Thailand.

The project is just beginning in Thailand where ECOALF has partnered with the Tourism Authority and the company PTT Global Chemical Public. The goal is to involve fishermen associations, NGOs, scuba diving clubs, and other local entities. The target is also slightly different: cleaning the beaches and the areas around them before working on cleaning the seabed.



A Circular Economy for Plastics

After collecting waste from upcycling projects, it is taken to sorting centers where the PET plastics are separated for use in the line. These are the only types of plastics that are usable for production, though research is being done on ways to incorporate other types of waste.

Part of the challenge in creating a circular economy for plastics is achieving uniformity in the final product, as these plastics have been affected differently by water, sun, salt, and time. Though it has taken

time to develop, the ECOALF upcycling process uses 20% less water, 50% less energy, and emits 60% less carbon dioxide than more conventional methods.

One of the main goals of the company is to prove that not only is sustainable sourcing for materials possible, but that a company can actively clean the oceans and use part of the waste collected to produce a sustainable line of products. With high quality fabrics produced from almost entirely recycled materials, ECOALF is well on its way. ♻️



EUSEW WORKSHOP: "YOUTH ON ENERGY"

18-20 JUNE

CHARLEMAGNE BUILDING in BRUSSELS

Gathering 20 young people from around Europe to offer their perspective on the future of energy in Europe, the EU Sustainable Energy Week will kick off with a special workshop "Youth on Energy", inspired by the European Commission's proposed package on "Clean Energy for all Europeans".

Their aim at EUSEW is to compile a list of future steps and viewpoints from the youth regarding current trends in European energy policy. The workshop will address the three '**D**' pillars of the energy transformation: **DIGITALIZATION**, **DECENTRALIZATION** and **DECARBONIZATION**. They will further take into consideration discussions already held within the project "Power Shifts – Reflecting Europe's Energy" by the European Youth Parliament. The results will be presented in a preliminary manner at EUSEW and at the end of the year to the project's patron Vice-President Šefčovič.

The event is coordinated by the Executive Agency for Small and Medium-sized Enterprises (EASME) and organised in conjunction with the European Youth Parliament. The event will take place in the Charlemagne building in Brussels on 18-20 June.

COLLABORATORS

The European Youth Parliament (EYP) is a unique educational programme which brings together young people from all over Europe to discuss current topics in a parliamentary setting. As a network of independent associations, EYP is present in 40 European countries and organises almost 600 events every year. The EYP network organises almost 1.500 days of EYP activity every year, involving close to 35.000 participants. Thousands of young people are active as volunteers all over Europe, making EYP a programme truly for young people, by young people. The EYP's mission is to inspire and empower young Europeans to become open-minded, tolerant and active citizens.

"Power Shifts – Reflecting Europe's Energy" is a project by the European Youth Parliament and the Schwarzkopf Foundation in cooperation with the innogy Stiftung für Energie und Gesellschaft. Throughout Europe it enables young people to monitor, inform themselves and debate about European energy policy. Three focus countries, France, Poland and Germany will each host an international youth forum in the project timeline from 2015 until 2017 involving over 100 young participants each from all over Europe. In 2015 the Academic Power Shifts Forum in Lyon, France, hosted 120 participants from 26 European countries for seven days. Warsaw, Poland followed in October 2016 with 130 participants from 30 countries and the German conference will be organised in Heidelberg from August 9 – 16, 2017.



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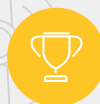
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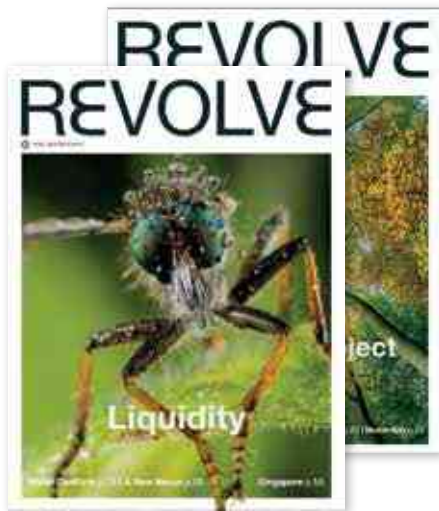
Energy

Colophon

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