WINTER 2022

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RENEWABLE ENERGY AND FUTURE ENERGY CHALLENGES

PORTS & SHIPPING DECARBONISATION

THE HYDROGEN FUTURE

TACKLING ENERGY POVERTY

Includes editorial contributions from:

Mechthild Wörsdörfer
Deputy Director General Energy, European Commission

Christian Ehler
MEP, EPP ITRE Coordinator

Claudia Gamon
MEP

EU PVSEC

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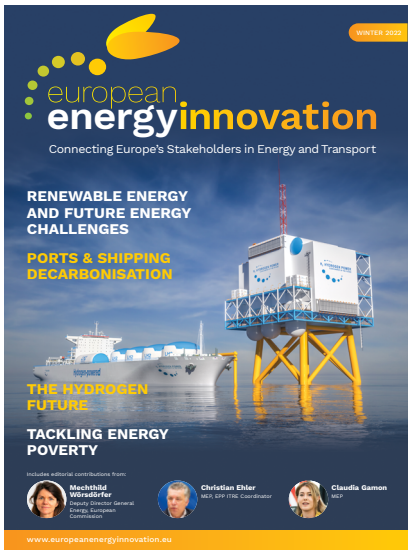

The publishers of European Energy Innovation would like to offer their sincere thanks to all individuals and organisations who have contributed editorial images photos and illustrations to the magazine. Whilst every effort has been made to ensure accuracy of the content, the publishers of European Energy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

European Energy Innovation is published by: Prologue Media Ltd
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Chorleywood,
Hertfordshire WD3 5NQ,
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Design & Production
RayHeathDesign.com

Website design
pulseart.co.uk

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

In association with

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Foreword

As a mild northern autumn recedes and winter tightens its grip, Europeans are naturally turning to the comfort of their central heating systems. And as I begin to write, forecast overnight temperatures in Kherson, in Kharkiv, in Donetsk and in Kyiv, lie between -1˚C and -9˚C. As those temperatures bite, and whatever the problems (and there are many) that loom over us, in this season of goodwill we might perhaps spare a thought (and perhaps more) for those enduring the pitiless barbarity of Russia's attacks upon Ukraine's energy infrastructure. As is made clear many times in this issue, Europe needs to disentangle itself from the thraldom of dependence upon Moscow's oil and gas. And not just for immediate socio-and geo-political reasons, but because of what we learned in Sharm el-Sheikh this November.

And as if reading my thoughts, Mechthild Wörsdörfer discusses how RE not only counteracts Russia's current weaponisation of energy (*at least here in the EU* – Ed.), but also offers a solution to future energy challenges. She says that REPowerEU sets "a higher bar to deliver on the ambitious Fit for 55 Package". More on that ambition in a moment, although these are not merely empty words, since Wörsdörfer articulates commitments to the doubling of PV capacity by 2025, to the installation of 600GW capacity by 2030, and to the use of 20 million tonnes of sustainable hydrogen by 2030. Echoing these themes, Christian Ehler MEP notes that the Hydrogen and Decarbonized Gas Market Package is a crucial counterpart to Fit For 55. Calling for integration of renewable and low-carbon gases into the existing gas grid and the development of a dedicated hydrogen infrastructure and market, Ehler goes on to discuss the need to galvanise the hydrogen economy before concluding that the regulatory and financing packages are in place.... and that actual construction can begin. On the subject of hydrogen, Bart Biebuyck draws upon Ursula von der Leyen's battle cry "hydrogen can be a game changer for Europe" as he sets out the task ahead – nothing less than a "major, systemic transformation of the energy systems, and of the economy". No shortage of ambition, there, and Biebuyck indicates that the Clean Hydrogen Partnership has already allocated over €300m to support renewable hydrogen projects. While commenting that hydrogen production has increased one thousand-fold, he discusses the many challenges that still lie ahead.

The unpredictability of RE-generated electricity is axiomatic, and only emphasises the need for energy storage at scale if energy security is to be improved....and Claudia Gamon MEP explores how investing in it not only supports decarbonisation but also accelerates independence from fossil fuels - and in particular from Russian fossil fuels. Nor are hers mere words, for the 3% increase in global electricity demand during the first half of 2022 was met entirely by RE: 230 Mt of CO_2 emission was prevented. She tackles an obvious, but no less thorny, issue: since electricity consumption will increase sharply if sectors such as transport and HVAC are decarbonised by electrification, it follows that the requirement for both electricity generation and energy storage will also rise steeply – the first doubling by 2050 and the second approaching 600 GW by 2050. This, she says "must be met by appropriate legislative action, now"...which "requires more ambition". That word again.

Jutta Paulus, MEP tells us that, with around 3 percent of global greenhouse gas emissions (more than any single EU Member State), shipping would rank sixth-highest in the world if it were a country. She continues that emissions are expected to be almost twice as high in 2050 as they were in 1990. None of that might surprise you, but her observation that this is currently the only transport sector not subject to any binding climate legislation probably will. "Shipping must contribute its fair share", she concludes "but it is up to law makers to support and steer the sector."

Reminding us that humans should be the focus of our thinking, Dr Marielle Feenstra explores the issue of energy poverty, a complex issue that conflates economic and climate policy (and a lot more besides). Dr Feenstra begins with a description that most of us could readily accept before sharing the challenging statistic that more than 80 million European households are effectively in energy poverty.

I cannot close without noting that energy poverty is indeed an affront to our notion of civilisation. This is something that the proud inhabitants of Kherson, of Kharkiv, of Donetsk and of Kyiv will understand particularly clearly this winter. That they should have to is an affront to us all.

...and there is much more for you to read inside...

Michael Edmund
Editor

European Commission

20-22 JUNE 2023

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Register your Sustainable Energy Day or discover online and physical events taking place around the world, engaging local communities between March and June.

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Organised by the European Commission, the European Sustainable Energy Week (EUSEW) is the biggest annual event dedicated to renewables and efficient energy use in Europe.

On 20-22 June 2023, the 17th edition of EUSEW will take place in a hybrid format, with both participants and speakers able to attend online and onsite, under the theme: 'Accelerating the clean energy transition - towards lower bills and greater skills'.

Since 2007, EUSEW has grown into a vibrant community bringing together a wide range of energy stakeholders, which meets annually to debate the latest developments and ideas in the sector.

Do not miss this year's high-level Policy Conference, the EUSEW Awards or the fourth European Youth Energy Day, as well as opportunities to meet innovative clean energy projects at the Energy Fair.

Renewable energy: a solution to current and future energy challenges

By Mechthild Wörsdörfer, Deputy Director General Energy, European Commission

The revival of productive activities following the pandemic shock triggered larger and simultaneous demand worldwide, driving the prices up for many commodities, including energy. In parallel, Russia's war against Ukraine and its weaponization of energy resources have triggered price volatility and energy insecurity, across the world.

Amid mounting pressures, the Commission has focused on how to transform the energy crisis into an opportunity to accelerate our energy and climate transition by reducing our reliance on fossil fuels. In May 2022, the Commission presented the REPowerEU plan, with the clear aim to reduce dependence from fossil fuels, in particular gas imports from Russia as soon as possible. It built on the idea that the only functioning strategy to phase out fossil fuels is accelerating renewables uptake, increase our energy saving and efficiency efforts, and diversify our energy supplies.

REPowerEU has further levelled up our climate and energy ambitions as set out in the European Green Deal (our long term plan to be climate neutral by 2050), and sends a clear policy signal that renewables and other low carbon fuels will be at the core of the EU future energy system. We intend to deliver on the transformative power of renewables by gathering increasing momentum for their large-scale deployment. In fact, REPowerEU set a higher bar to deliver on the ambitious Fit for 55

Package, our overarching proposal establishing a clear path to achieve emission reduction targets by 2030 in line with the European Green Deal. This concretely means that we proposed an increase of the EU renewable energy target from 40% to 45% by 2030, and from 9% to 13% of the EU energy efficiency target compared to 2020.

Higher-target setting fits with our increased ambition, which is backed up by further initiatives under REPowerEU. For instance, with the EU Solar Energy Strategy presented as part of the plan, we will double solar photovoltaic capacity by 2025 and install 600GW by 2030. Furthermore, on the heels of REPowerEU we also increased our ambition for domestic renewable hydrogen production: the EU and its Member States are now committed to producing 10 million tonnes of renewable hydrogen at domestic level, and to import 10 million green hydrogen from abroad by 2030. Robust hydrogen uptake is consistent with our plan of using it as replacement of natural gas, coal and oil in hard-to-decarbonise industries and some transport sectors.

To release the full potential of REPowerEU, we are working with Member States and stakeholders towards lowering barriers to renewable energy investment. First, under REPowerEU we submitted a Recommendation on accelerating permitting included, and related infrastructure. Lately, on 22 November, we proposed yet another temporary emergency regulation to accelerate the deployment of renewable energy sources as a short term response to the energy crisis. We have also added a RePowerEU leg to our National Recovery and Resilience plans, helping Member States to finance their clean energy transition efforts.

In parallel, we have also worked on the demand side, by proposing earlier this year temporary measures to reduce gas and electricity demand. We have also put forward common gas storage rules to ensure the filling of EU underground storages for this winter and set up the Energy Platform, which will play a key role in pooling demand, coordinating and preparing for joint gas and future hydrogen purchases. Our short-term measures yielded excellent results: by mid-November, EU gas facilities were filled by nearly 95% in average, our gas consumption has declined 10% compared to the average from the period 2019 to 2021, and the share of Russian pipeline gas in EU imports has dropped from 41% in 2021 to 8% as of October 2022.

Looking ahead, sustained growth in renewable energy use will be instrumental in decarbonising and electrifying fossil-reliant sectors, such as transports and heating and cooling, and through increased hydrogen uptake, will also respond to the need to cut down greenhouse gases emissions in hard-to-abate sectors where electrification is not yet a feasible option. Energy storage solutions will be a key enabler of our energy transition, as they are projected to ensure the flexibility, stability and reliability of our entire energy system.

To start with, energy storage solutions are pivotal to manage variable renewable generation output as they smother renewable generation fluctuation and peak demand. Furthermore, their role will be key to integrate low-priced renewables into the energy system and facilitate the electrification of the economy, but also to reduce energy bills and enhance consumers' active participation in the electricity markets. We plan a reform of the electricity market design in the first quarter of 2023.

Confronted with an unprecedented energy crisis, we need to seize this critical juncture for a large overhaul of our energy system, today and looking towards 2030 and 2050. Against this background, together with Member States we are making considerable efforts to speed up the green transition and accelerate the deployment of renewables as a means to bring back energy prices to a lower level and provide a lasting solution for Europe's energy dependence and vulnerability to energy price shocks. Evidence on the ground suggests there is no one-size-fits-all solution that will significantly lower energy prices and ensure our security of supply. We need to keep up our work and our determination on all fronts: energy efficiency and savings, diversification of supplies and a massive deployment of renewables are the long-standing EU recipes out of the energy crisis.

Decarbonisation requires new and creative ways of re-using energy and funding of decarbonisation solutions

Revolutionary green technologies like E.ON ectogrid™ demonstrate that reducing emissions is much more than switching to renewable energy generation.

By Dr. Patrick Ester, Value Pool Public Funding, E.ON Energy Infrastructure Solutions (EIS).

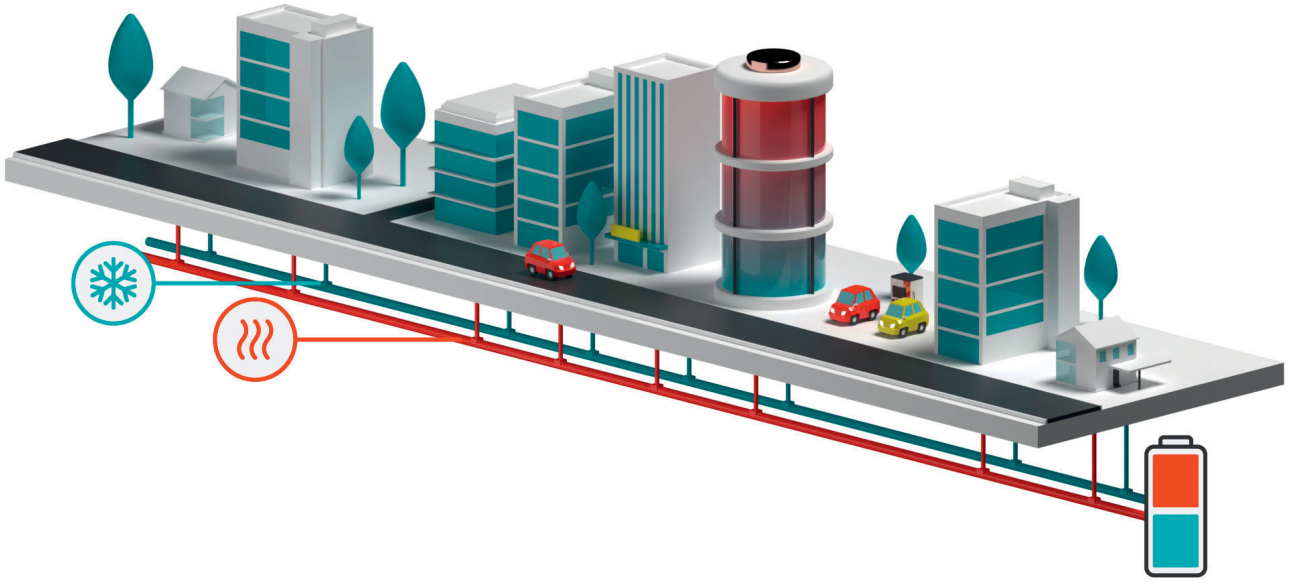
In the long-term, Greenhouse gas emissions cannot be eliminated only changing the way energy is generated. Energy efficiency and other measures of reducing consumption and recovering energy should also be considered as levers for reducing emissions.

That's why E.ON has been much more than just an electricity and gas supplier for many years. As one of the largest operators of energy networks and energy infrastructure in Europe and as a provider of innovative solutions, we now provide more than 50 million customers in 16 countries with smart solutions. By doing this we are decisively driving forward the energy transition in Europe and are committed to sustainability and climate protection.

The focus of all our activities is to ensure that the Europe-wide climate goal formulated in the Paris Climate Agreement does not remain simple "lip service" and to make the biggest possible contribution to the EU for achieving this. Our entire portfolio of solutions is geared towards supporting private customers as well as companies and cities in their decarbonisation efforts.

When you consider that process heat alone accounts for 40% of energy consumption in industry and commerce in Germany, and that around half of the heat used in industry is lost unused as waste heat, it becomes abundantly clear that above all, the energy transition is a heat transition. Therefore, the focus should also lie on the sensible reuse of unused heat. This does not just apply to industries but also to cities, which are responsible for 40% of energy consumption.

The example shows that it is not enough to set targets for individual sectors, but to work out much more creative methods on CO_2 avoidance. Unfortunately, there is no such thing as a single "silver bullet" that will solve all our problems. Rather, it is necessary to analyze all (production) processes. First, it is important to use energy generation methods that



are as carbon-free as possible – electricity first. In a second step it must be checked whether system-related energy, mostly in the form of heat, can be recovered or used in some other way. Sustainability, costs, security of supply and efficiency are all high on the list of requirements and want to be met.

An example of new coupled solutions in this segment is the use of waste heat from data centers for supplying local district heating networks. In the past, the temperature levels were too different and using the waste heat was inefficient. But with the development of our ectogrid™ technology, there now exists a new way of doing that. E.ON ectogrid™ is a complete energy system for heating and cooling that enables the sharing, balancing and storage of energy for entire neighborhoods and cities and can thus help achieve zero emissions. Due to the complexity, new forms of cooperation must be developed first by introducing new actors. For example, municipal heating planning, which introduces further framework conditions into the process, plays a decisive role.

The European Commission and national legislators are pushing the energy transformation with legislative packages and funding programs. We expressly welcome the commitment of the European Commission and the will to shape these transformation processes. At first glance, the road is a rocky one, but it is nevertheless necessary.

Municipalities and industry are closely monitoring the various funding opportunities (like horizon framework, Innovation Fund, Life, CEF,...) offered by the EU. However, it has been shown again and again that these calls are extremely oversubscribed, i.e. the probability of funding is low and at the same time there is a lot of effort involved in preparing application documents. In most cases, this acts as a deterrent to participating in the calls. And it is not only CAPEX funding is important, but OPEX funding as well. Recently, CCfDs (Carbon Contracts for Difference) have been increasingly discussed.

Recently, CCfDs offer the possibility of taking out risk for the operator by means of a fixed contract price. At second glance, however, it is unclear to what extent this funding instrument contributes to planning security. Because it is not possible to create a business case in which there is no certainty about possible repayments. In any case, the funding instruments for both CAPEX and OPEX funding should be further developed.

At the beginning of every transformation process, it is important to demonstrate that a new technology or system can be implemented. The promotion of large lighthouse projects is suitable for this. To create a broad impact on the masses, however, many medium-sized and smaller projects must now also be funded to benefit from scaling. The aim and framework should always be focused on the climate impact. It is necessary that service providers and contractors are also included in the general conditions.

Industries and cities, with their high emissions, face enormous challenges on the road to climate neutrality. We are convinced that the transformation can only succeed with intelligent solutions that are at the same time decentralised, future-proof, and above all, efficient. In the E.ON Energy Infrastructure Solutions unit, we're working to provide industries and cities with tailored energy solutions that meet these requirements – whether it's heating, cooling, power generation, or energy efficiency. We are convinced that strong partnerships can bring ecology and economy together and thus create unimagined joint opportunities – benefit from unconventional ideas, amazing synergies, and lower energy costs.

Contact details

Dr. Patrick Ester has been working on research and innovation topics in the energy industry for more than 15 years. Decarbonisation is the order of the day and the basis for the transition to the solar age. That's why he is very happy to be able to promote the energy and heat transition within E.ON as a change maker. Today Patrick is responsible for the Value Pool Public Funding within E.ON Energy Infrastructure Solutions (EIS).

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More about E.ON Energy Infrastructure Solutions:
http://www.eon.com/eis

Port and shipping decarbonisation

By Jutta Paulus, MEP

After the latest UN climate conference COP27, our planet remains on track for a global heating of at least 2.4 degrees Celsius by the end of this century. Expectations for this COP27 were low from the beginning. Nevertheless, it was shocking that the goal set by the Paris Agreement on limiting global warming to 1.5 degrees Celsius was put on the negotiation table in Sharm el-Sheikh, especially as the consequences of the climate crisis are getting more and more visible. At 1.1 degrees Celsius above the pre-industrial climate, Europe experienced the third warmest summer ever recorded with extreme droughts and fires, in Pakistan, unprecedented flooding took the life of around 1700 people and made millions homeless, tornadoes occurred in France, Great Britain and Germany. In the end, the reference to 1.5 degrees could be saved in the final agreement of Sharm el-Sheikh. However, implementation of policies achieving this goal, is what counts, and every country, every sector must contribute their fair share. This is especially true for the maritime sector.

The maritime sector so far remained widely unregulated concerning climate action, with international shipping being currently the only transport sector not being subject to any binding climate legislation although it causes more greenhouse gas emissions than any single EU Member State. If shipping were a country, it would be the country with the sixth highest greenhouse gas emissions worldwide, responsible for around 3 percent of global greenhouse gas emissions. The International Maritime Organisation (IMO) estimates that global emissions from ships will increase by 90 to 130 percent between 2008 and 2050. For ships calling at ports in the European Economic Area, the EU Commission expects an increase of 86 percent compared to 1990. Hardly any other industrial or transport sector shows such high emission increases.

Nevertheless, efforts at the IMO for introducing greenhouse gas reduction targets repeatedly failed. The EU and US thus changed their approach and now aim to introduce respectively supranational and national measures to bring down emissions caused by ships.

By amending the so-called MRV Shipping Regulation, an EU law on the monitoring, reporting and validation of CO_2 emissions in maritime transport, I introduced, as the European Parliament's rapporteur, measures that went beyond merely monitoring and counting CO_2 emission to actually reducing greenhouse gases in the shipping sector. This included the proposal to include the shipping sector into the European Emission Trading Scheme (ETS). On 29. November, European Parliament and the Council of Member States reached an agreement on the conditions of this inclusion. All intra-EU voyages and half of outgoing and incoming journeys will be subject to carbon pricing not only for CO_2 emissions but also for methane and nitrous oxide, which is especially important regarding the future use of alternative fuels in shipping. Making polluters pay is indispensable but will not suffice to reduce emissions in the sector. Especially huge container ships cannot just be electrified, so research and development of alternative fuels will be essential for the transition of this industry. The Fuel EU Maritime law which is currently negotiated could have been an opportunity to steer shipping on the course of climate neutrality. But a majority in the European Parliament adopted a position that is not compatible with EU climate goals. A greenhouse gas reduction target of 100 per cent by 2050 and ambitious quotas for renewable fuels of non-biological origin are needed to set the sails towards a fully climate neutral shipping sector. Biofuels only will not be able to cover demand of shipping and aviation, both sectors being reliant on fuels with high energy density. But as arable land on the planet is limited, we must foster solutions that use this scarce resource in the most efficient way: the same landmass where we can harvest one energy unit of biofuels is able to produce 40 units of solar energy and even 100 units of wind energy – without needing fertile soil. So even taking into account conversion losses, it is obvious that synthetic renewable fuels are the only solution that is able to cover future demand.

Emissions caused by shipping are not only harmful to the global climate, but also cause environmental pollution. With regard to the health of citizens living in port cities and workers, "zero emission ports" must become the standard. Particulate matter and nitrogen oxide are responsible for more than 400.000 premature deaths in the EU, and while cars have become cleaner due to EU standards, considerably lowering urban pollution, shipping is still steaming below the radar of emission regulation. Only for sulphur oxides, limit values have been set - after decades of discussions. Investments into shore-side electricity or batteries will enable zero emission ships at berth.

At the COP27, I have had numerous discussions with stakeholders from politics, civil society and business about decarbonising the shipping sector. There is a lot of movement at the EU level, but also in the US, where a clean shipping bill has been introduced in Congress. These initiatives can finally mobilise investment in modern technologies for wind utilization and synthetic fuels for the sector. Aiming for a maximum global warming if 1.5 degrees Celsius is not negotiable and must stay our priority. This is our responsibility for future generations. Shipping must contribute its fair share, but it is up to law makers to support and steer the sector.

From “sunray to runway”: hydrogen as a game changer for aviation

By Ron van Manen (pictured), Head of Strategic Development, Clean Aviation

Is green hydrogen worth the hype?
Put simply yes. Green hydrogen is a critical enabler for aviation to reach “net zero” or better: climate neutrality. As an on-board energy source, it can be a real game changer and is also an essential building block for the synthetic, drop-in “e-fuels” that will need to replace fossil fuel for today’s aircraft.

As long as we are using “green” hydrogen, or any other variant with no carbon emissions during its production, hydrogen-based propulsion in aviation will have “true zero” CO_2 emissions. Latest estimates show that hydrogen combustion could reduce the climate impact of flight by up to 75% (depending on the extent of non-CO_2 effects), and hydrogen-based fuel-cell electric propulsion by up to 90%.

When combining hydrogen with CO_2 captured from the atmosphere, the resulting e-fuel will still have “tailpipe emissions” of CO_2 but the life-cycle effect of recapturing this can lead to 80-90% reduction in the net emissions of this greenhouse gas.

Hence using these fuels can reduce aviation's total climate impact by up to 60% (with similar caveats in terms of the non-CO_2 component in the overall warming effects). As these figures show, adapting to e-fuels brings significant benefits, especially considering there is no need for new infrastructure and only modest modifications to aircraft and engines. But hydrogen as on-board energy source has the potential to take us further towards climate neutrality, and to do so with less overall energy demand.

A compelling alternative, if we get it right!

What are the three main challenges to overcome in aviation research regarding hydrogen?
We are facing a triple helix of challenges: aircraft technology, airport infrastructure and supply of green liquid hydrogen (LH_2). To make this work we need a system-level transformation to seek and deliver realistic solutions.

Let's take aircraft technology. To provide just a couple of examples: how can we store LH_2 on board at -253 degrees Celsius? How can we manage the transfer of liquid to gaseous hydrogen in the fuel system?

Turning to supply. There's no doubt that as we move forward in the green transition global demand for renewable energy and clean hydrogen will grow exponentially notably amongst "hard-to-decarbonise" sectors such as steel, cement, maritime and aviation. While hydrogen-based propulsion, using fuel cell or gas turbine technology is potentially a key enabler to climate-neutral aviation, supply of renewable energy and subsequent production of green hydrogen will be critical to their market adoption. How can we guarantee there is an adequate and reliable supply for all?

Finally, airports need to ensure infrastructure is in place in tandem with the fleet introduction, and that efficient and safe refuelling of LH_2 is feasible. Clean Aviation has recently joined AZEA, the Alliance for Zero-Emission Aviation which aims to prepare the aviation ecosystem for hydrogen- and electric-powered aircraft.

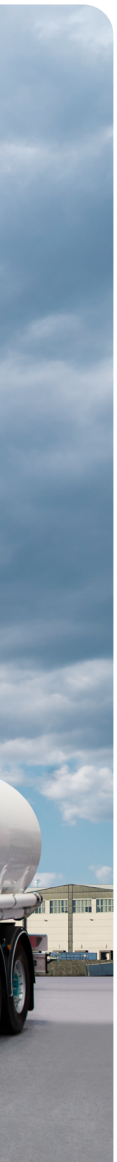
CAJU's research activities are based on three thrusts. Only one of them is linked to hydrogen. Why not dedicate all efforts to H_2?
Hydrogen offers enormous potential but given the scale of the technical, infrastructural and financial challenges we cannot afford to bet on one horse. Regardless of whether green hydrogen is used in drop-in SAF or directly on board as an energy source, the air transport system will require very significant volumes of green hydrogen (and renewable energy to produce this), to support its push to "climate neutral".

Our ambition is to drive a step-change in aircraft performance: we need to squeeze every last ounce of efficiency out of aircraft and fleet performance. We are targeting at least 30% for short-medium range aircraft and 50% for regional, compared to today's very best models. We also want to ensure entry into service before 2035 and ensure that 75% of the world's fleet is composed of ultra high-performance aircraft by 2050. Coupled with low net-carbon SAF this already would lead to a new breed of aircraft with -85 to -90% less net-CO_2 emissions. Coupled with the use of LH_2 "true zero" carbon is in sight.

As the introduction of a disruptive new energy source like hydrogen is likely to take up to 50 years to permeate the full aviation system, we need to play a long game here. Super-efficient aircraft flying on drop-in SAF will most likely need to bridge the gap for several decades and may well remain even beyond the end of the century in some specific use cases like (ultra) long haul flights.

Concerning hydrogen, where will Clean Aviation concentrate its efforts?
A quarter of the EU funding currently awarded will be dedicated to H_2 research focusing specifically on H_2 storage and propulsion systems, notably gas turbine technology and fuel cells as these are key enablers for H_2-powered aircraft. This share of the overall research mix is in line with the Strategic Research and Innovation Agenda ensuring a balanced and "measured risk" approach.

Synergistic efforts are gaining momentum in national research and innovation programmes and the Clean Hydrogen Partnership – a fellow Joint Undertaking under Horizon Europe – will also bring important contributions.



Building energy independence in Europe: what role for gas

By Christian Ehler MEP, EPP ITRE Coordinator

Financing hydrogen energy infrastructure projects to make the European energy system more resilient and scalable

The Russian war in Ukraine requires a reorientation of our European energy policy. This means above all the accelerated expansion of renewable energy, which will have an impact on energy prices in the medium term. A large-scale green power and hydrogen import strategy will also ultimately make Europe less dependent on a few suppliers of fossil energy. Scaling up alternative energy sources and carriers is more urgent than ever. The Pieper report on renewable energies contains, among other things, the proposal that in future these investments are “in the public interest” and should therefore be given preferential approval. The report also calls for a large-scale green power and H_2 import initiative with specific volume targets. The report also proposes transitional low-carbon solutions to reliably meet the CO_2 target.

The biggest step with regards to facilitating the use of hydrogen on the EU level so far has been the Hydrogen and Decarbonized Gas Market Package, published by the European Commission in December 2021, which highlights the importance of hydrogen in the future energy system. This package is a crucial counterpart to the Fit For 55 package to develop this pathway from a regulatory side. It really has to facilitate the integration of renewable and low-carbon gases in the exiting gas grid and enable the development of dedicated hydrogen infrastructure and market, allowing hydrogen to become a key component of the energy sector. This gas package must

be the tool to deliver this ambitious decarbonization trajectory in the gas sector.

Our task is now to accelerate. Europe's hydrogen economy is being built today. Clean hydrogen already proves its value to decarbonize our economy. And – even better – it is beginning to be competitive also from an economic point of view. But we are not there yet. If we are to meet our climate goals, and end our dependence on Russian fossil fuels, we must ramp up our ambition. The European Commission has doubled in its new plan, REPowerEU, the EU hydrogen targets for 2030 to ten million tons of renewable hydrogen produced annually in the EU by 2030. And another 10 million tons in annual imports. We must call on the Commission to increase the coordination of the planning and financing for needed electricity, energy, hydrogen, CO_2 and heating/cooling infrastructure and draw attention in particular to the need for a large-scale green power and hydrogen import strategy. Furthermore, we need to call on the Commission and the Member States to bring down the time needed to issue permits substantially and create fast-track permitting procedures for infrastructure that supports industry in the energy transition. Here we must emphasize the need for the development of a hydrogen backbone in Europe and further develop the interconnections across our continent.

The European Hydrogen Backbone (EHB) plays a key role with regards to accelerate the decarbonization of the European energy system. Since its foundation in 2020, the EHB initiative has already made a break-out to the development of a European hydrogen market through its work. A European Hydrogen Backbone can only create an opportunity to accelerate decarbonization of the energy and industrial sectors whilst ensuring energy system resilience, increased energy independence and security of supply across Europe with the right political framework. We need to ensure investments in the conversion of natural gas networks, which will form an essential basis of the future hydrogen infrastructure. Otherwise, the development of a hydrogen infrastructure connected throughout Europe will not be possible in the long term, as the necessary line sections are not available and accordingly no internal market for hydrogen trading is created.

The EU recovery plan, NextGenerationEU, is worth 750 billion euros over 4 years. Over one third of this will finance the goals set in the European Green Deal to ensure sufficient renewable electricity to produce the renewable hydrogen. 9.3 billion euros of recovery funds are going straight into hydrogen projects. At the same time, the Commission is assessing State Aid for hydrogen projects as a priority. The entire hydrogen transition is about cooperation to de-risk investment, build a massive project pipeline and push the innovation frontier. The recently launched new Clean Hydrogen Partnership will add one billion euros to research and innovation, matched by another one billion from industry. It's a new step to bring innovative technologies from the laboratory to the factory floor and, ultimately, to European businesses and consumers.

Because for this cooperation to intensify and become a virtuous cycle industry and private investors need predictability. The EU is giving targets for 2030. The technology and public investment are getting on stream. The Commission has recently presented, as part of REPowerEU, the hydrogen accelerator. With this, all regulatory measures announced in the European hydrogen strategy have now been completed. This means that the actual construction of an integrated gas and hydrogen infrastructure, including storage and port infrastructure can start.

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domOS: Streamlining the roll-out of smart energy services in buildings

By Dominique Gabioud, HES-SO, Zuzana Taťáková FENIX TNT

Buildings and smart energy services
Collectively, buildings in the EU are responsible for 40% of the energy consumption and 36% of greenhouse gas emissions[1]. Therefore, buildings must do their share in the transition to a more sustainable and resilient energy system. Deep renovation is surely the way to go, but better performance can also be achieved in a much shorter time and with less investment with smart energy services.

Smart energy services improve the energy efficiency or the energy flexibility of buildings.

Energy efficiency services are divided into two categories:

1. **Open-loop services** provide building occupants or facility operators with contextual information helping them to adopt more energy-cautious behaviours or supporting them in their decision to invest.
2. **Closed-loop services** use control algorithms to improve energy transformation or distribution inside the building.

Energy flexibility services use the intrinsic flexibility of energy processes to increase self-consumption, to avoid congestion on distribution grids, or to perform market operations. Heating, cooling, and EV (Electrical Vehicle) charging are typical flexible processes.

Status of digitalisation and smartness in buildings
Digitalisation is progressing in buildings, like in all other sectors: heat pumps, solar inverters, white appliances, thermostatic valves, blinds, lights, and even coffee machines feature nowadays a communication interface. But digitalisation progresses chaotically: each appliance/device comes with its application, generally made available by the manufacturer. While providing some level of smartness, this situation is not optimal for three reasons:

1. Building occupants or facility operators must deal with multiple applications, each one featuring its user interface and access control scheme.
2. Energy management requires the coordinated orchestration of multiple appliances. A silo approach prevents the implementation of such scenarios.
3. Smart services can't be readily deployed over multiple models of a given appliance type.

Larger buildings – typically those used in the tertiary sector – are equipped with building automation systems orchestrating energy, security, and comfort. Those systems are too expensive for smaller buildings, which accommodate independent energy appliances of different generations. For these buildings, costs must be reduced to boost the roll-out of smart energy services. Low costs can only be achieved if appliances of different types and manufacturers can be integrated in a "plug-and-play" manner.

Decoupling the in-building infrastructure and the smart services
Today, buildings accommodate independent appliances and their apps (Figure 1 (a)). The objective is to decouple the smart services and the in-building infrastructure (Figure 1 (b)).

Several approaches can be considered for integration:

1. implement the same communication standard in all participating appliances,
2. develop appliance model-specific drivers in smart services, or
3. personalise a universal driver with appliance-specific configurations.

Approach 1 requires that manufacturers agree on a common communication scheme. Such an expectation is not realistic, at least

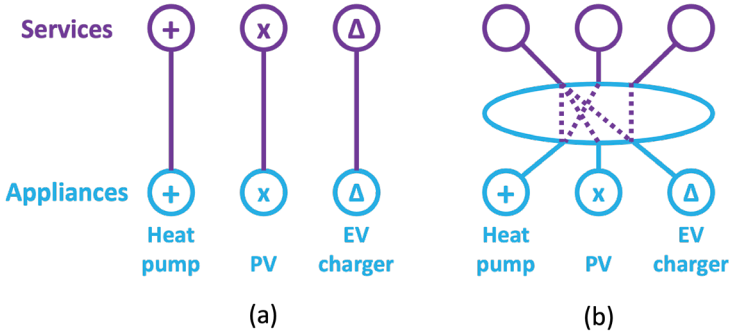

Figure 1 (a) Current silo systems and (b) targeted integrated systems

in the short/mid-term. Moreover, a new scheme would not be able to integrate the large basis of installed appliances. The Matter[2] specification for smart homes promoted by the big internet players uses this approach, which is in this context reasonable as smart home products are comparably newer and less expensive.

Approach 2. requires the development of new drivers – i.e., new software code – to integrate new appliance models. This is the approach used by today's multi-appliance services. The drawback is that the development of drivers requires many resources. Therefore, this approach misses the low-cost objective required for large-scale roll-out.

The advantage of approach 3 is that the integration of an appliance requires only a configuration document whose generation can be assisted. The challenge is the development of a universal parametrizable driver. The domOS approach, which is defined in the so-called domOS ecosystem, belongs to this category.

A glimpse into the domOS ecosystem

The specification enabling the decoupling between in-building infrastructure and smart services is called the "domOS ecosystem". It is made up of two components:

1. **The protocol abstraction component:** Energy appliances or devices speak Modbus, M-Bus, HTTP, MQTT and more communication protocols. To expose a uniform model to services, a component (driver) must translate a given protocol into a uniform model. In the domos ecosystem, this issue, which is not specific to the smart building domain, is handled by the World Wide Web Consortium (W3C) in its Web of Things (WoT) architecture. A WoT-compliant library act as "universal driver". Appliance-specific configuration documents are called Thing Description (TD) in the context of WoT. A TD instructs a WoT-compliant library on how to concretely access the monitoring and control points of an appliance.

2. **The nomenclature component:** In itself, protocol abstraction is not sufficient to enable interoperability: the services and the in-building infrastructure must in addition share a vocabulary, with commonly understood definitions. In the domOS ecosystem, each participating building has a digital twin called Building Description (BD). A BD contains metadata associated with references to monitoring and control points in TDs. BDs are machine-readable documents written in a dedicated language (ontology) named domOS Common Ontology (dCO). Metadata are static description data like building location, size and category, constraints on building operation, features of the heat generation and/or distribution... Metadata elements can be linked to monitoring and control points in TDs.

domOS ecosystem-compliant platforms power the five domOS demonstrators. domOS partners in charge of demonstration contribute to the design of the ecosystem and provide feedback on its applicability in concrete use cases.

Demonstrators in Paris (F), Sion (CH), Aalborg (DK), Skive (DK) and Neuchâtel (CH) deal with multiple energy carriers, with multiple services and multiple IoT platforms with centralized (cloud) or decentralized (edge) architectures. This development process helps to define specifications adapted to the concrete situation of buildings in Europe. ●

Project ID: 894240
Website: https://www.domos-project.eu/
Start date: September 2020
Duration: 36 months
Project coordinator: Dominique Gabioud
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domOS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 894240.

domOS is a collaborative research project supported by the European Commission under the Horizon 2020 Programme for Research and Innovation. The 11 consortium partners from 4 European countries develop activities in smart energy services for buildings, either as a technology provider, as a service operator or as a research entity.

"The specification defined and experimented in domOS allows decoupling the infrastructure in buildings and the smart energy services. For example, an energy management service could orchestrate a heat pump, an electric vehicle charging station and a solar inverter independently of their brands. This is a big benefit for building owners – integration of appliances is seamless – and for the service developer – the service can operate transparently on all buildings with appropriate appliances whatever their brands are" says Dominique Gabioud, the Project Coordinator from the University of Applied Sciences Western Switzerland. He concludes that *"deploying smart services will become easier and therefore cheaper".*

Energy renovation: The light at the end of the tunnel

By Adrian Joyce, Secretary General, EuroACE and Campaign Director, Renovate Europe

A Changing World

A constantly changing world greets us every morning as we scroll through our favourite social media and news channels. Much of the reported change does not bring hope and reassurance but speaks of the latest phase of the latest crisis. So much so, that we have coined a new word in English: permacrisis!

In the energy field, we are in the midst of the most severe prices shock in nearly 50 years, and it has been compounded by the aggression of Russia against Ukraine, with tens of millions of homes and businesses gravely concerned about how to afford their energy bills this winter.

But the world is always changing. In fact, there is no life without change, so we must constantly adapt and adjust our habits, rules, and way of life to cope with our changing world – something we have been so good at, that we are prospering and growing, now counting over 8 billion people on the planet.

A Changing Legal Context

To a large extent, the European Commission's flagship proposal for its current mandate – The European Green Deal – anticipated much of the turmoil we are going through and laid out a vision for a carbon-neutral, resilient, and competitive EU by 2050. It laid the groundwork for the extensive series of revisions and recasts to EU directives and regulations that are currently under negotiation between the co-legislators of the EU.

Those negotiations require skill, tenacity, and vision as they will set the framework for the coming decade in several major fields, including energy efficiency. The natural tendency for policymakers is to focus on what is around us now and act to address what can be seen. Taking this approach will not serve the current negotiations well, as by the time the revised legislation takes effect in two or three years' time, the context will have changed again.

However, we know that large scale, targeted and well-considered investments are going to be needed to achieve the objectives of the European Green Deal. This means that those who will invest – industry, owners, financial institutions – must have confidence that the

legal framework in place will give predictability and clarity on how and where to invest.

This is certainly the case in the buildings sector where the Commission's own estimate is that an additional €275 billion is needed each year to scale up the energy renovation of our building stock and bring the immense energy waste in buildings to an end. Numerous studies have shown (and fresh studies confirm) that doing so will bring multiple benefits, such as greater comfort, higher value, more jobs, increased resilience and better health to society as a whole.

In her recent address (27th of October 2022) to the annual event of the Renovate Europe Campaign, President Ursula Von Der Leyen said: "Faced with war, with a fossil fuel crisis, the arguments in favour of the Renovation Wave have only become more pressing. Investing in renovation is a no regret option." She also added: "So my message is: let's accelerate. Let's put massive funds into renovation. For it is one of the best investments we can make at this moment."

Succeeding in a Changing Context

To enable industry and building owners to act on the words of President Von Der Leyen, several steps to innovate in the energy renovation field will have to be taken in the coming two years, and the recast of the Energy Performance of Buildings Directive can be a great vehicle for those innovations.

Our call at EuroACE is to ensure that the recast directive includes:

1. The introduction of well-designed and ambitious minimum energy performance standards (MEPS) that address all segments of the existing building stock. These standards, which will be introduced by our member states for our member states, will have to ensure that all buildings reach higher levels of energy performance by certain fixed dates in the future, with the final objective of ensuring they are all net zero emission buildings by 2050

2. New approaches to financing that will release private financing on a massive scale. Two key tools that can achieve this are:

   a. Mortgage portfolio standards (MPS) that will require banks and lending institutions to increase the average energy performance of buildings held in their portfolios are upgraded to higher energy performance standards by a certain set date in the future.

   b. A European Renovation Loan (ERL) Scheme, backed by the European Central Bank that can provide long-term, upfront, zero-coupon loans to building owners that have little or no financial headroom to consider taking a standard loan to improve their properties

3. Stimulus to encourage greater innovation in approaches to energy renovation works. This includes better data collection and dissemination, greater use of digital tools all along the value chain, industrialising the renovation process to make it cleaner, smarter and greener, generating new industrial opportunities along the way

4. A revised and strengthened energy performance certification (EPC) framework so that EPC's are more informative, reliable, and comparable across the EU. Transforming EPC's so that they can be relied on for measuring progress in the roll out of MEPS, the ERL, and MPS will bring greater stability and confidence to the stakeholders that must invest in the years ahead

Tackling the medium and long-term challenge of scaling up energy renovation in the EU, at the same time as tackling the crises that surround us, so that the tangible benefits of lower energy bills, greater resilience, comfort and health can be perceived by EU citizens as early as 2025 is an insurance against the potential of social unrest in a world were fossil fuel prices are unlikely to ever be low again.

Investing in energy renovation now, and massively, is the light at the end of the energy crisis tunnel, and it is beholden on all stakeholders in the sector to work assiduously towards that goal.


EPBD

EuroACE Energy Efficient Buildings

Opening the Door to Efficient Buildings

Buildings are responsible for 36% of greenhouse gas emissions and soak up 40% of energy supply. If the EU is to hit its 55% emissions cut target for 2030 and net zero target for 2050, these figures need to be slashed and the EPBD is one of the main weapons to achieve that.

Better performing buildings will lead to multiple benefits such as cleaner air, healthier living and working environments, cheaper utility bills and more. An efficient building stock will increase Europe's energy independence, which given Russia's invasion of Ukraine and the impact on energy markets, is an extremely important objective. The current legislation is under review and policymakers must push for as much ambition as possible during upcoming negotiations to maximise these benefits. Consistency with other parts of the Fit for 55 related to building performance must be ensured. This includes total alignment with the Energy Efficiency First Principle and coherence with pieces of important legislation such as the renewable energy and energy efficiency directives.

We at EuroACE – Energy Efficient Buildings, support the negotiation of an ambitious Directive that plays a central role in the EU's overall climate and energy policy. EuroACE represents all energy efficient technologies and materials, including heating and cooling, insulation, building automation and control, lighting and daylighting, ventilation and so on, all of which needed to make the EPBD a success for EU citizens and stakeholders alike.

What the EPBD update must include

01. Strengthen policy measures to boost energy renovation

Europe needs stronger tools to unlock the benefits offered by building renovations. This includes sufficiently ambitious **minimum energy performance standards (MEPS)**. The Commission's proposal says residential and non-residential buildings need only reach 'E' class by 2033 and 2030. This does not reflect the pressing need to accelerate renovations across the EU. Long-term planning and holistic deep renovations should form the foundation of MEPS design, while national building renovation plans also need to be integrated so that 2050 zero-emissions building stock can be achieved.

The deployment of **renovation passport schemes** must also be accelerated, as MEPS need to be implemented via these instruments. The two initiatives will form a virtuous circle for building renovations when implemented correctly. Well-designed passports will provide investors with invaluable information like timeline of works, the benefits that have been unlocked and technical/financial support that is available.

Energy Performance Certificates (EPCs) should make performance ratings across member states more comparable by 2025 and their coverage should be increased across the EU. EPCs should be better linked to other instruments like renovation passports and smart readiness indicators. New trigger-points that will issue an EPC to a building – construction, major renovation, sale etc – are welcome changes. Stricter financial penalties for member states that do not fulfil their requirements to make checks and upload information to a new centralised database should also be deployed.

Novel H-pattern design improves efficiency of PVT solar collectors

By Sahand Hosouli (MG Sustainable Engineering AB), Siddhi Bagde (MG Sustainable Engineering AB) and João Gomes (University of Gävle)

Photovoltaic thermal (PVT) collectors are a novel renewable energy technology that combine the capabilities of solar thermal collectors with PV cells. Converting solar light into both electrical and thermal energy therefore collects more solar energy per surface area[1]. Much research has been carried out on such hybrid technology and analysing the effect of different designs on the overall efficiency. However, cell cracking caused by thermal expansion remains a critical issue, which results in lower collector efficiency and can reduce output power performance by 10%[2].

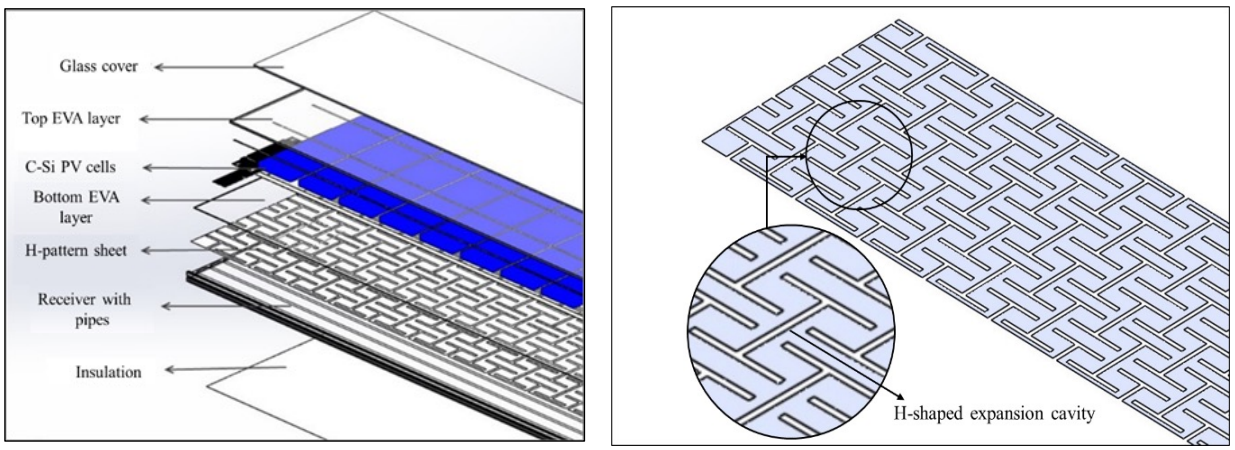
One solution could be to include an aluminium structure between the PV cells and the absorber with a design pattern that can reduce the risk of cell cracking. The approach developed under the EU-funded RES4BUILD project proposes a novel PVT design that decreases thermal stress on the cells. This novel design is called H-Pattern, with an expansion cavity pattern in the shape of the letter 'H' (Figure 1).

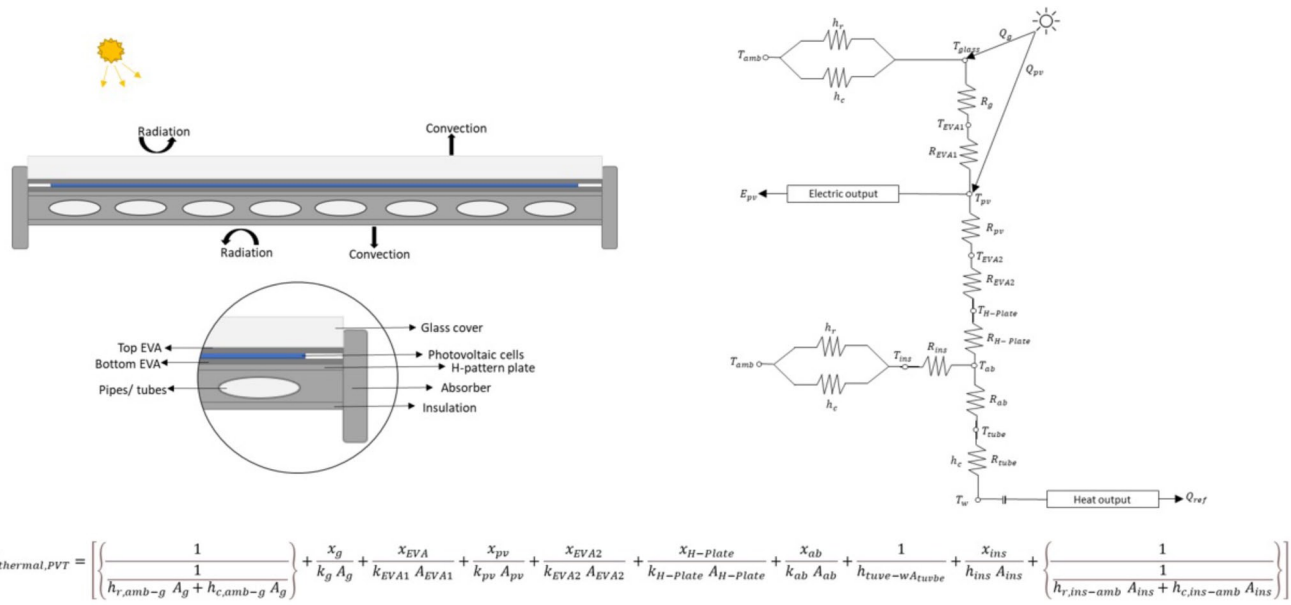
The design allows for thermal expansion in all directions by expanding into its own cavities. This creates a smaller total expansion in any single direction, which in turn is expected to drastically diminish the risk of cell cracking. While the use of metals in thermal applications can bring problems of higher thermal expansion, these can be addressed by the expansion cavities of the H-pattern.

The thermal expansion of the H-pattern plate and other components were evaluated separately and as a whole due to temperature variations in different dimensions. This is particularly important when different materials are considered. The proposed PVT collector was modelled, and the results validated against experimentally derived performance curves. Multiple modes of heat transfer occur in the different layers of a PVT collector (Figure 2). Heat transfer to and from the collector will affect the temperatures attained in the various layers as well as the heat transfer fluid flowing through the pipes[3]. These were all carefully investigated.[4]

The proposed novel PVT collector, with its optimal balance of performance, cost, and ease of manufacture, has the potential to achieve optimal use of solar energy. The expansion cavities help improve the performance by reducing heat

Figure 1. (Left) Novel PVT design and components. (Right) Design of the H-Pattern plate with expansion cavities.





$$R_{thermal,PVT} = \left[\left\{\frac{1}{\frac{1}{h_{r,amb-g}\,A_g} + \frac{1}{h_{c,amb-g}\,A_g}}\right\} + \frac{x_g}{k_g\,A_g} + \frac{x_{EVA}}{k_{EVA1}\,A_{EVA1}} + \frac{x_{pv}}{k_{pv}\,A_{pv}} + \frac{x_{EVA2}}{k_{EVA2}\,A_{EVA2}} + \frac{x_{H-Plate}}{k_{H-Plate}\,A_{H-Plate}} + \frac{x_{ab}}{k_{ab}\,A_{ab}} + \frac{1}{h_{tuve-wA_{tuvbe}}} + \frac{x_{ins}}{h_{ins}\,A_{ins}} + \left\{\frac{1}{\frac{1}{h_{r,ins-amb}\,A_{ins}} + \frac{1}{h_{c,ins-amb}\,A_{ins}}}\right\}\right]$$

Figure 2. Equivalent thermal resistance circuit and equation of the novel PVT collector.

loss and thermal expansion (Figure 3). The proposed H-Pattern with cavities dimension of 2mm helps to reduce thermal expansion by almost 58% in comparison to a standard PVT collector. It can also reduce heat loss by 5%.

Work is ongoing to demonstrate and complete the novel PVT collector. This technology has been developed together with the integrated energy system pilots that are being tested in Denmark and Greece in the RES4BUILD project. Along with a co-design process involving stakeholders, a rigorous life cycle assessment and business analysis, the project hopes to pave the route to market, contributing to the decarbonisation of energy consumption in buildings.

For more information on the project, please visit **www.res4build.eu.** To find out more about the innovative PVT technologies, please contact: **info@mgsust.com.**

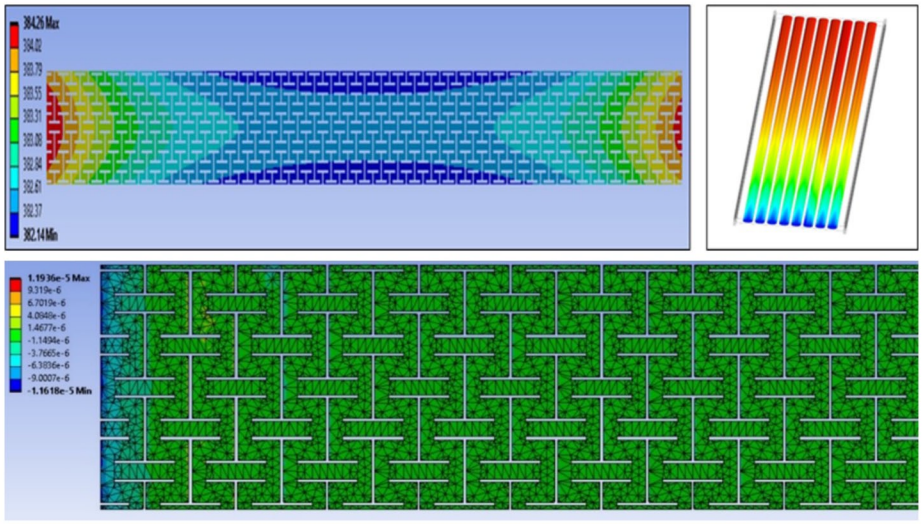


Figure 3. (Above) Temperature distribution on the H-Pattern plate and absorber tubes. (Below) Directional thermal expansion on the H-Pattern plate (expansion cavity of 2mm).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 814865 (RES4BUILD). This output reflects only the author's view. The European Climate, Infrastructure and Environment Executive Agency (CINEA) and the European Commission cannot be held responsible for any use that may be made of the information contained therein.

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The future is now: why we have to invest in energy storage

By Claudia Gamon MEP

It was back in 2019, when the European Parliament first started its work on energy storage – not knowing the extend of relevance it would carry three years later. Europe now finds itself in multiple crises: a war raging in Ukraine, skyrocketing inflation and an energy supply system disrupted in its core. However, as it often is with crises, they also hold the potential to point out room for improvement and change. Especially change that is long overdue.

Russia's illegal invasion of Ukraine has not only shown how fossil fuel dependency poses a threat to our environment but also how it developed into a foreign policy liability.

The war forced us to recognize the issue of energy security and revealed the limitations of our current energy system. At the same time, it highlighted the need for profound change towards a decentralized, renewables-based system supported by sustainable storage solutions.

In sight of the current circumstances, it is evident that the call for increased fossil fuel exploration is being amplified. Although it is crucial to speed up independence from Russian fossil fuels and diversify our energy supply, it is also essential to keep up our ambition towards the green transition. Both goals should go hand in hand.

Current data shows that renewable energy sources are proving themselves - even in times of crisis. According to a report by the climate think tank Ember, a 3% increase in global electricity demand during the first half of 2022 was solely met by renewable energy sources.

Consequently, wind and solar installations as well as hydro power plants prevented a 4% rise in fossil generation, avoiding 230 Mt in CO_2 emissions. However, even with a tendency pointing in the right direction, we as policy makers must continue to prioritize the implementation of renewables in the long-term. Likewise, it is necessary to invest in an infrastructure that supports its deployment. If we talk about renewable energy, we must include energy storage as a fundamental part of our discussion.

Evidently, the sole deployment of renewable energy sources is not enough. Decarbonisation will mainly be achieved through electrification of the biggest sectors such as energy, transport, heating and cooling. A massive increase in electricity demand is expected as a result. Back in 2020, the Commission predicted that the demand in electricity will more than double by 2050. With more renewable energy sources and due to its volatile nature, energy storage will play a fundamental role in securing a stable electricity grid. Estimations provided by EASE further indicate that the European Unions' required capacity for energy storage will reach approximately 600 GW by 2050 - large amounts that must be met by appropriate legislative action, now.

In 2019,I was appointed rapporteur by the European Parliament for an own-initiative report covering the issue of energy storage. The report not only underlines the urgency of a fast transition towards clean and affordable energy but it also highlights the priority of a secure energy supply at all times. Additionally, it addresses the need for a broad range of storage technologies covering all characteristics regarding power, capacity and response. Thus, fostering diverse and innovative storage technologies ranging from batteries, to thermal storage to pumped hydro storage was set a priority.

The Parliament's report also includes the need for broad sector integration – meaning that storage should not only be considered within the electricity sector in isolation as flexibilities would turn out to be limited and very costly. In contrast, smart integration of different sectors, such as power-to-gas or power-to-heat, would make more technologies available for use. This is urgently needed, considering that the EU must be able to store at least six times more energy than today to achieve net-zero greenhouse gas emissions by 2050.

Furthermore, the Parliament also highlights the urgent need of a legislative framework that accelerates the implementation of renewable energy sources. Permitting processes still take up to several years, which prolongs the expansion of renewable energy sources to an extend that Europe can no longer afford. In Austria for example, implementing a wind turbine takes up to eight years, largely due to bureaucracy and administrative barriers. Yet the actual construction only accounts for 12-15 months of this time period. This needs to change: existing administrative barriers have to be slashed down.

A proposal by the Commission within its RePowerEU initiative has taken a first step in addressing this challenge, together with the revision of the Renewable Energy Directive. The proposal aims to fasten permitting processes, focusing on "go-to-areas" with low environmental risk. This ensures that the high environmental standards are taken into account during the permitting of renewables.

Nevertheless, there is still room for improvement: Within the proposal, storage is limited to non-fixated technologies (such as batteries) as it only addresses co-located storage facilities, situated near the energy generator. What we should aim for, however, is the equal treatment of renewables and a broad range of energy storage technologies. Especially if we want to accelerate the transition towards renewables.

Despite the Commission's efforts, we have been lacking concrete storage targets and a comprehensive strategy for years and still are. The European Parliament will therefore continue its push for secure and sustainable solutions, creating awareness among national and local decision makers.

Most importantly, energy storage cannot only remain a theoretical debate but has to transform into practice. Projects such as Lünersee II in Vorarlberg, my home region in Austria, lead the way. At 1970 meters above sea level, the biggest pumped hydro storage installation in central Europe is set to be built. It uses already available infrastructure, follows current environmental standards and with a capacity of 1000 MW/h contributes significantly to the much-needed green transition for the entire cross-border area going into southern Germany. It is now essential to invest in such projects on a large scale and set the foundation for a decentralized, renewables-based system.

The European Parliament is ready, although we all have to show more ambition in general: in terms of speed and the reduction of administrative barriers as well as the development and deployment of energy storage technologies. We have the facts and the data but what we are lacking is time: now it is on us to make a carbon neutral, renewables based energy system our reality.

Project TradeRES

New Market Designs for a near 100% Renewable European Power System

By Ana Estanqueiro[1], António Couto[1], Dawei Qiu[2], Goran Strbac[2], Evelyn Sperber[3], Gabriel dos Santos[4], Johannes Kochems[3] Jos Sijm[5], Nikos Chrysanthopoulos[2], Zita Vale[4]

The electrical power sector landscape was shaped in recent years by the European Union's energy policy and focus on the transition to a decarbonised energy system. Renewable generation has grown significantly in the past decades, and this steady growth will continue in the coming years. Large-scale fossil-fuelled power plants are being phased-out, while variable renewable energy systems (vRES), especially solar and wind technologies, are continuously increasing their shares in the supply mix. In addition, flexible storage resources (e.g. electric vehicles, batteries or heat pumps) are being deployed and an increasing number of end users are changing from passive consumers into prosumers.

At present, it is still unclear if current electricity markets design, which is based largely on marginal costs pricing, will be able to evolve into a form adequate to embed the impact of the rising penetrations of vRES. However, it is already clear that the current design does not favour their fair participation unconditionally, due to the inherent fluctuation nature of vRES generation. The need of R&D assisting to adapt the current electricity market rules to a new trading and power system's paradigm is widely recognized these days.

That was the context in which project TradeRES – Tools For The Design And Modelling Of New Markets And Negotiation Mechanisms For A ~100% Renewable European Power System (H2020 contract 864276) was conceived, having as goals to: i) Identify actual barriers and deficiencies of current energy market and pricing structures; ii) Calculate cost, value, and price structure of electricity in a ~100% vRES-dominated electricity system for 2030 and beyond; iii) Conceive, design and model electricity markets that deal with novel flexibility products; iv) Develop optimization and agent-based market models beyond the state-of-the-art.

To achieve these ambitious goals, existing agent-based market models are being further improved with new features and coupling worksflows, and also new models are being developed, that are applied to five different case studies ranging from local communities and markets (Case Study A) to the European market (Case Study E), passing through the national and regional scales (B – The Netherlands, C- Germany and D-Iberia/MIBEL), as depicted in Fig. 1.

The TradeRES project was conceived with an iterative methodology (Fig. 2), in which the newly developed designs and products are tested by market stakeholders. The second iteration of the studies will apply a new improved version of the market functionalities reflecting the inputs and suggestions received from the stakeholders.

TradeRES' research questions, scenarios and Market Performance Indicators for ~100% RES Power Systems

A deep and detailed exercise was conducted to clearly identify the relevant research questions (RQs) to be addressed by the project, cluster them within classes, as well as to associate them to the capabilities of different models and markets characteristics. Seven different classes of RQs were identified: 1) Improvement of energy-only (EOM) short-term markets; 2) system design and adequacy; 3) ancillary services in ~100% power systems; 4) investment incentives for vRES and 5) for secure capacities (EOM or capacity mechanisms); 6) Incentivizing distributed flexibility and local markets and 7) Incentivizing demand response and sector coupling.

A set of scenarios were developed

Figure 1

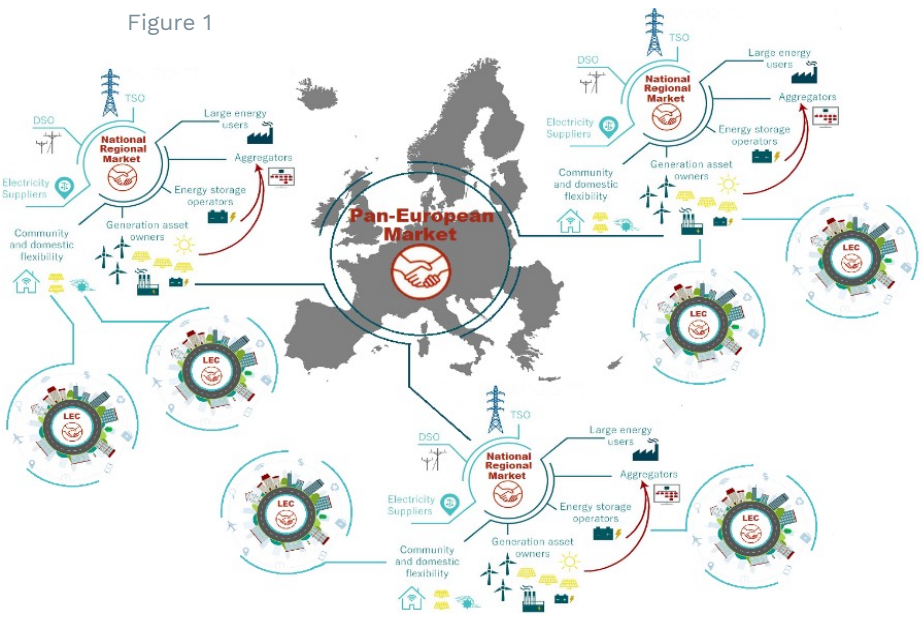
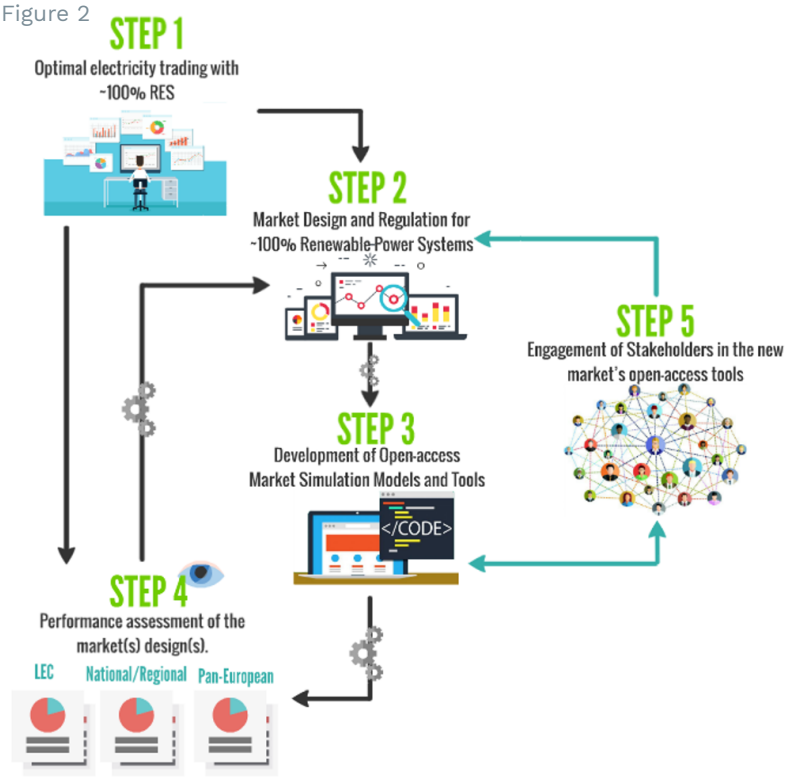


Figure 2



based on optimization models and those were recently simulated for national and regional markets: These include, e.g. scenario S0 to capture key milestones of the energy transition process which is planned to occur by the year 2030. The expected transition until 2050 (when climate-neutrality is to be reached) is addressed through S1-S4 TradeRES Scenarios. These are identified as the "Conservative" (S1), "Flexible" (S2), "Variable" (S3) and the "Radical" (S4) scenarios. The timeline in Fig. 3 positions the scenarios to the key milestone years and also indicates the Starting Point Scenario (SPS) that refers to a historic recent year with stable market and power system performance (i.e., 2019, recently simulated) [see Deliverable 5.3].

Figure 3

The Local, National and Regional European Markets

Although it is not within TradeRES work programme to address the actual volatility of electricity markets, mainly induced by external factors, the recent events further enhanced the need to electricity markets and carefully identify their vulnerabilities, to design new features that are more robust and present a lower level of risk for all the players involved. In that context, it is of particular relevance to study the future evolution of existing electricity markets in Europe, what TradeRES recently successfully concluded.

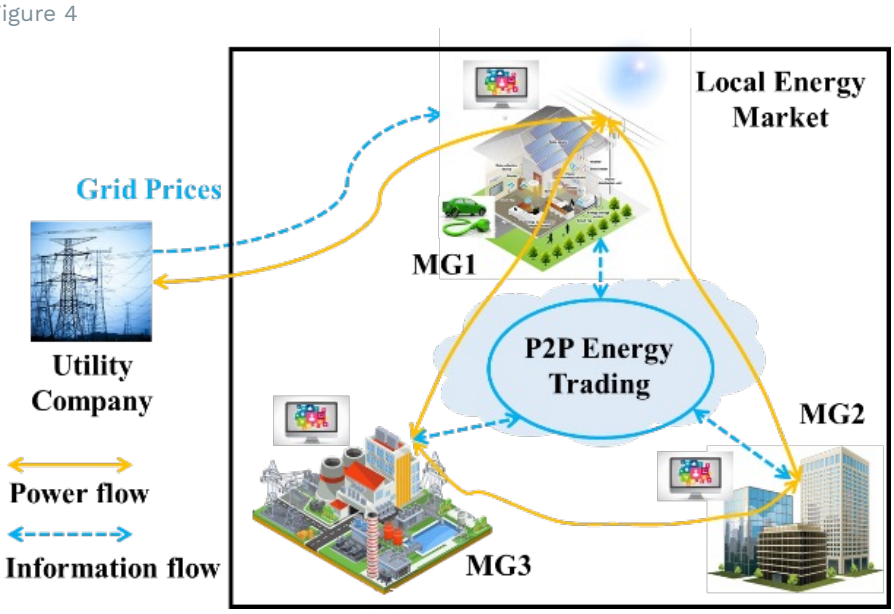
The National and Regional European Markets accomplished the set of simulations by addressing the following aspects: Case Study B – the behaviour of the Dutch electricity market using the soft-linked market models AMIRIS-EMLabpy aiming to analyse both if an energy-only market will be sufficient to achieve the Netherlands' vRES target for 2050 and to analyse if such a system can ensure security of supply. Case study C addressed the German day-ahead market using the agent-based model AMIRIS to analyse the need and possible design of remuneration schemes for vRES; Case study D addressed the Iberian market (MIBEL) with the agent-based models MASCEM and RESTrade to analyse new market features able to mitigate the impact of vRES variability and uncertainty in the market revenues of those power plants.

Given the parameterisation of the SPS (including a moderate CO_2 and commodity price level), for the remuneration schemes examined (an EOM without support, a fixed market premium, a variable market premium, a two-sided Contracts for Differences scheme and a capacity premium), not much difference is observed in terms of most market performance indicators (MPIs) studied. This holds for a system with a moderate RES share (34%) and relatively low average price levels compared to the current high price situation. Given such a price levels it was also found that renewables would not be able to recover their full costs on a pure market basis. The parameterizations assumed in the Iberian case study (D) revealed different market outcomes for Portugal and Spain. E.g., when levelized remuneration supports (the same as described for the German case study) were applied to both countries for the SPS scenario, in Portugal only the two-way contract for differences (CfDs) scheme does not enable players to obtain remunerations above the variable premium, used as reference, whereas in Spain, in what concerns wind energy, none of the support schemes allowed wind investors recovering their (annualised) investment costs.

Economic Benefits of P2P Energy Trading Paradigm

Based on the trading paradigm shown in Fig. 4, within TradeRES a peer-to-peer (P2P) trading platform is coordinating energy trading (quantities and prices) among three microgrids (MGs), independent of the

Figure 4



upstream utility company. MGs in the P2P trading platform can buy/sell their energy deficiency/surplus with each other at local prices rather than trading with the utility companies at the offered grid prices, e.g., Time-of-Use (ToU) tariff and Feed-in Tariff (FiT). More specifically, a MG with an energy deficit can take advantage of other MGs with an energy surplus by purchasing their excess at a lower local price in comparison to the grid's ToU tariff. On the other hand, a MG with excess energy can make more revenue compared to the unattractive grid FiT by participating in P2P trading. In this context, MGs can first share their energy demand and generation internally within an energy cooperation concept and settle the remaining energy deficit or surplus with the utility company. It is expected that the local trading prices obtained are within the range of grid prices (i.e., FiT and ToU), so that the buyers and sellers within the MGs can achieve more trading deals and cost-effective performance locally. Overall, the benefit of P2P energy trading lies in balancing local demand-supply, utilizing local renewables, reducing energy costs and managing local network congestions. The TradeRES project will also evaluate the above P2P energy trading paradigm and assess the role and value of the Local Energy Markets (LEM) in supporting cost effective transition to zero carbon electricity system.

Final notes

All the first simulations applied to national and regional markets are preliminary and it is too soon to extract final conclusions or recommendations for suitable market designs. However, the MPIs obtained so far for SPS scenario (2019), point out energy-only markets seem to be insufficient to give enough incentives to promote investment in a high volume of renewables. For the German case study, this holds for all kinds of RES that showed market-based cost recovery rates below 100% (slightly above 70% for PV, roughly 50% for onshore wind and 34% for offshore wind), which are also affected by the relatively low price levels of the considered scenario. An exception exists, as PV systems in the Iberian electricity market (MIBEL) were found to be profitable on an EOM basis.

The 2019 simulations of MIBEL and the Portuguese and Spanish ancillary services and imbalance settlements enabled to calibrate the MASCEM and RESTrade models to obtain close-to real-world results. For the second iteration of these markets, S1-S4 scenarios will be addressed, assessing the impact of temporal and sectoral flexibilities and the performance of new market design bundles for RES-dominated scenarios. In what concerns ancillary services markets, the Portuguese and Spanish control zones have different rules for vRES market players. In future scenarios, the participation of vRES and demand players in these markets will be addressed for both countries.

Finally, the studies conducted enable to observe a P2P energy trading paradigm contributing to the efficient management of energy supply and demand by promoting direct energy exchange within a local energy market, which would provide significant economic benefits, compared to a conventional retail market.

Readers may find more information about TradeRES project at the link https://traderes.eu/ including the large majority of the deliverables, of public access.

This work has received funding from the EU Horizon 2020 research and innovation program under TradeRES project (grant agreement No 864276).

corewind

The negative effects of climate change have been broadly demonstrated and renewable, carbon-free energy has proved to be one of the most important keys – if not the most – to achieve the transition that will halt human-induced global warming. The effort is well worth it, as there are a number of generation technologies that have been developed in the last decades capable of accomplishing the environmental targets established by governments and other global institutions to fight against climate change. Nevertheless, analysing the evolution of the implementation of these technologies unveils that the time factor is critical and that a slow-paced change will not meet such targets, compromising the well-being of future generations.

COREWIND is the European project that began in this context – back in 2019 – to extend the applicability, reduce the costs and bring closer the commissioning of utility-scale plants of one on these technologies: floating offshore wind. Its implementation unlocks vast areas where wind energy could be generated around the globe with low impact on both human activities and the environment. Finishing next year, the project is in an advanced state already with some results leading to its main goal: reducing the LCOE (Levelised Cost Of Energy) of the technology, while maintaining a low environmental impact.

An example of the innovations conducted by the consortium are the shared anchors and shared mooring lines studies. As opposed to a conventional wind farm design where each turbine is moored independently, these studies aim at sharing certain components of adjacent units to reduce the cost of the system. The technical feasibility of a farm with shared anchors has been proved, but with limited cost benefit as the anchors cost is reduced but the mooring lines cost increases. However, the analysis of shared mooring lines lead to large costs reduction.

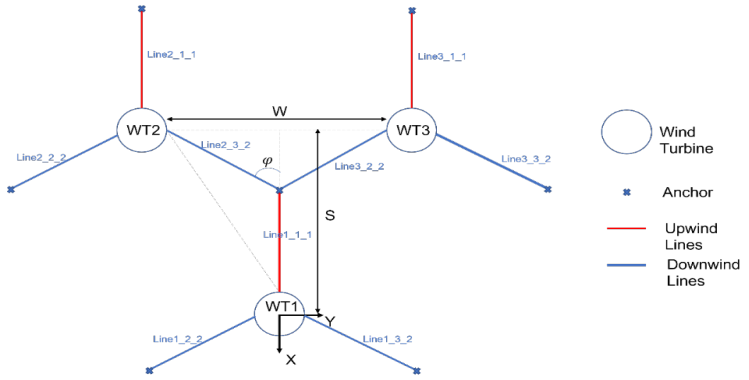


Figure: Shared anchors study

Another potential innovation to further reduce the LCOE of the floating wind farms have been studied by optimising their layout. Instead of following a regular distribution of the wind turbines in the site, a PSO (Particle Swarm Optimisation) has been applied to position the wind farm assets (offshore substations included), achieving reductions up to a 5% of the LCOE compared to the base cases with regular distributions.

The reliability of the results is deemed critical, therefore an accurate model has been implemented; among others, power losses are calculated by means of power flows following IEC standards, the site bathymetry is considered to modify the mooring system costs and restrictions such as minimum distance to shore or avoiding mooring line crossings are ensured.

The different improvements developed by the partners have not been limited to ideas and calculations. Instead, a validation campaign has been conducted to verify the materials behaviour in real conditions, as well as the integrated behaviour of two substructure concepts – ActiveFloat and WindCrete – together with their mooring lines and dynamic cables in a wave basin.

These and additional studies and improvements are being developed in COREWIND, which will be quantified together in the first half of next year to measure their impact. In all, the project is advancing successfully, delivering high-quality insights to the sector and providing a sustained boost required by the technology in order to achieve the ambitious environmental targets we need to stop global warming.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 815083.

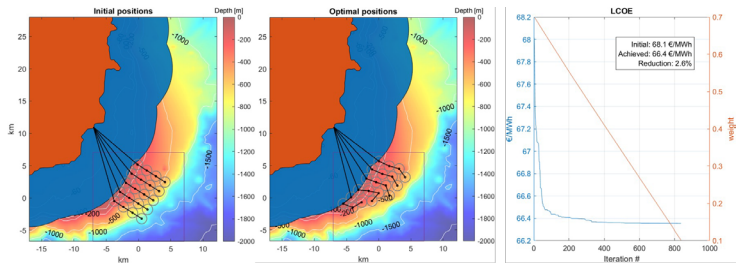


Figure: Layout optimization

Energy poverty from a European perspective

By Paula Pinho (pictured), Director for Just Transition, Consumers, Energy Efficiency and Innovation, Directorate-General for Energy, European Commission

High demand for energy from the post-Covid global economic recovery and the unjustified invasion of Russia in Ukraine have caused high energy prices, jeopardizing people's ability to cover their energy bills. Economists refer to this concept as energy poverty. While there are indications that some middle-income consumers are struggling with their bills at the present time, it is low and lower/middle-income households that are most impacted, because they spend a significantly higher share of their income on energy and have less margin to reduce other costs. Research shows that energy poverty is frequently exacerbated by factors that go beyond low income levels – with low household energy efficiency and energy performance of buildings a major contributing factor, as well as high energy prices. So what is the EU doing to address the situation, in particular in the context of the current energy crisis?

Energy poverty is not a new phenomenon in the EU. Within the European Pillars of Social Rights, energy is considered one of the essential services, which everyone has the right to access at good quality. Indeed, EU policy has already addressed energy poverty on several fronts. It was one of the key concepts in the Clean energy for all Europeans package, adopted in 2019. In broad terms, the updated rules introduced requirements on Member States to define and monitor energy poverty in their country, so that we have a coherent, timely and transparent picture of the problem across the EU. Other changes look for the reduction and mitigation of energy poverty in energy efficiency, decarbonisation and clean energy policies to support a just energy transition for all. In 2012, 10.8% of Europeans were reported

to be unable to afford keeping their home adequately warm, with large geographical variations across the EU. This figure reduced in the years that followed, and in 2021 the EU recorded 6.9% of people not able to pay to keep their home adequately warm. The surge in wholesale prices since autumn 2021 is expected to show much greater numbers now facing problems with their bills.

In a context of high inflation and increasing living costs for households, higher energy costs are being felt significantly, with households having to make ends meet by cutting on other essential expenditure. Between 2019 and 2022, on average across EU Member States, the share of energy expenditure in overall household spending increased by more than one third, almost doubling in some countries[2]. Between 2019 and 2022, low income groups spent on average 10-13% more on energy compared to the highest income groups, who spent 5-7% more.

Strengthening of the EU legal framework

One aim of the EU energy policy legal framework is to protect energy poor households and vulnerable customers. The laws set out obligations for Member States to address energy poverty predominantly through structural and energy efficiency measures. Disconnecting vulnerable customers from the grid is explicitly prohibited[3] and, where necessary, Member States can even regulate energy prices for a limited amount of time (also known as 'social tariffs'). In the toolbox on energy prices adopted in October 2021, the Commission provided guidance on the application of the relevant legal provisions, and stepped up cooperation with and among Member States to exchange good practices and concrete cases of alleviating energy poverty.

Over the past months, the Commission has been working on expanding the toolbox further, including direct price interventions in retail markets, below-cost tariffs for households and direct support for business. In this context, emergency legislation has been agreed enabling EU countries to collect excessive revenues from fossil fuel companies and inframarginal electricity producers and to redistribute these funds to end-consumers. The Commission also facilitated and endorsed the joint declaration between suppliers, distributors, regulators and consumer organisations on additional voluntary consumer protection measures, which go beyond the existing regulatory framework until at least end of March 2023, including on prevention of disconnection, deferral of payments, careful use of unilateral contracts and provision of clear information[4].

But EU efforts to address energy poverty are not just linked to the current crisis. There's still a lot to do not only to protect vulnerable or energy poor consumers, but also – and more importantly – to tackle the root causes of energy poverty. In this sense, it's worth noting that there are specific provisions proposed on energy poverty in the ongoing reforms of EU legislation for energy efficiency, building renovation and social protection[5], which all contribute to the goal of reaching a 55% greenhouse gas emission reduction by 2030. The proposed provisions aim to facilitate access to renewable energy and to energy efficiency services, and to boost energy efficient housing. The EU also plans to provide financing for these objectives: The proposed Social Climate Fund would allocate a significant amount of the available EUR 72.2 billion to energy efficiency and building renovation investment. Moreover, the Recovery and Resilience Plans approved so far allocate 15% of the total expenditure[1] to energy efficiency, with €64.5 billion to be invested in energy efficiency in the building stock.

The Importance of local level and local solutions

The factors that influence energy poverty and its impacts are particularly visible at household level. For this reason, local governments and local actors are important agents of change and best placed to act on the ground. To support these local actors, the Commission has launched an Energy Poverty Advisory Hub[6] as an initiative on local action. The advisory hub acts as a central platform of expertise for local authorities and all stakeholders interested in taking action to combat energy poverty in Europe.

It provides direct support, training, and research results and builds a collaborative network of stakeholders interested in taking action to combat energy poverty in Europe. The hub also provides technical assistance to municipalities to tackle energy poverty, for example by identifying energy poverty in the community or designing information campaigns. The goal is to empower vulnerable and energy poor consumers to become active players in the electricity market and the green transition.

Citizens are the EU's greatest asset in energy transition and their involvement is crucial for the EU Green Deal to be successful.[1]

1 This does not include transport fuel costs
2 Source: Energy prices and costs report, planned for publication by the European Commission in December 2022
3 Article 28 of Electricity Directive 2019/944
4 Enhanced crisis response: strong push for consumer protection this winter (europa.eu)
Declaration for enhanced consumer protection this winter (europa.eu)
5 Revision of the Energy efficiency Directive 2018/2002/EU (COM(2021)558), the revision of Energy Performance of Buildings Directive 2018/844/EU (COM(2021) 802 final)and Social Climate Fund (COM/2021/568 final)
6 Energy Poverty Advisory Hub (EPAH) (europa.eu)

Tackling Energy Poverty We are all concerned!

By Dr Marielle FEENSTRA, scientific director @75inq and COST Action Chair of ENGAGER European Energy Poverty network (2021-2022)

Living in energy poverty adversely affects people's health and well-being. This has serious economic, political and social consequences for the countries where it is more widespread, particularly in Southern and Eastern Europe.

Energy poverty (EP) – commonly understood as a household's inability to secure socially- and materially-necessitated levels of energy services in the home – is prevalent across Europe. Today, more than 80 million European households are struggling to attain adequate warmth, pay their utility bills on time, and live in homes free of damp and mould.

Energy Poverty has increased during the pandemic. European households were spending more time working from home increasing their energy consumption. Additionally, the current war in Ukraine and the rise of energy cost further increase precariousness.

Because of the complexity of the topic and the fact that it has been studied from different perspectives, a research network led by outstanding scholars on energy poverty, like prof. Stefan Bouzarovski (ENGAGER chair from 2017 to 2021) and Dr Harriet Thompson was set to tackle the issue. The European Energy Poverty research network: Agenda Co-Creation and Knowledge Innovation (Engager) brought together more than 200 members based in universities, government bodies, think tanks, companies, advocacy groups, from 41 EU and non-EU countries

to focus on the roots and potential solutions to tackle this challenge.

"Energy poverty as an under-researched and relatively unknown phenomenon in 2017, became a high priority on today's policy agenda. The insights, knowledge and network of ENGAGER created the perfect feeding ground for early-career researchers, senior scholars and policymakers to exchange and co-create research and policies to respond to ongoing crisis affecting the affordability and availability of sustainable energy services for many Europeans." says Dr Marielle FEENSTRA, the Action Chair since 2021.

Principle 20 ● EU Pillar of Social Rights
Everyone has the right to access essential services of good quality, including water, sanitation, energy, transport, financial services and digital communications. Support for access to such services shall be available for those in need.

The network ran from 2017 to 2022 and investigated the impact on consumers of environmental, technological and regulatory developments, like smart systems that use pricing to regulate energy demand. ENGAGER draws together scholars and practitioners based both within and outside Europe who focus on various aspects of complex energy poverty challenges.

The Action has developed toolkits and manuals to advice consumers, get help and switch providers if necessary. This toolkit provides key inputs for EU, Member States and all relevant actors to set up comprehensive and out-of-the-box responses to energy poverty.

It is aimed at developing and strengthening an international community of researchers and practitioners focused on combating energy poverty – (such as heating, lighting, cooling, appliances).

The EU has already addressed some energy poverty issues, such as the Energy Performance in Buildings Directive under the Energy Union strategy.

In 2018, the EU Energy Poverty Observatory, was set by the European Commission in order to catalogue and share data on energy poverty. It also provides "A Guide to Understanding and Addressing Energy Poverty". It presents the concept of energy poverty with a close look on its main causes and vulnerability factors that can lead households or individuals into energy poverty.

Recent policies envisaged by the European wave of renovation are partly helping to address this challenge, but there is a need for much more comprehensive efforts in the future.

The Action had produced several Policy Briefs to help understand and address energy poverty with their results and recommendations. In addition, the network initiated the EP Pedia platform, which provides researchers and policy makers articles written by experts and state of play of energy poverty related topics in the world. Since most of the information on energy poverty-related policies and approaches is available only in national language, this provides analyses on national and local policies in English. During the Covid crisis an interactive map was developed by the Action members to map the energy poverty mitigation measures implemented across the globe to counter the pandemic-related energy needs. ●

ENGAGER
ENERGY POVERTY ACTION

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EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Further reading

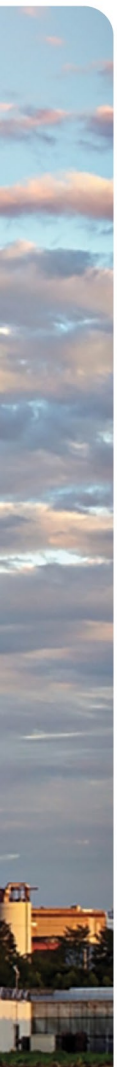
Publications and articles

Additional information

View the Action website

View the network website

The 75inQ Foundation



Moving forward to the hydrogen future

By Bart Biebuyck (pictured)

With 2022 soon behind us, it's good to stop for a minute and acknowledge the remarkable changes – and challenges – that the past 12 months has brought for Europe and for its energy systems. One crisis after the other, clean hydrogen power has emerged as indispensable to Europe's competitiveness, for its economic recovery, for its energy sovereignty and – of course we should not forget the overarching climate goal of limiting global warming to 1.5°C.

As President Ursula von der Leyen said in her State of the Union speech in September (2022), "hydrogen can be a game changer for Europe." But we need to move our hydrogen economy from niche to scale and we need to do it fast. We need solid investments; we need to increase production of clean hydrogen and get big projects up and running and we need to educate and train people.

If it sounds like a lot – you are correct; it is indeed a major, systemic transformation of the energy systems, and of the economy – we need to REPower the EU and we now have the instruments, and we build on years of research and project development which are now bearing fruit. So, we're in a good position to achieve the objectives.

As calls mount for faster deployment of hydrogen technology, the Clean Hydrogen Partnership is ready to contribute. We have already started this year with our first call for proposals, which has allocated over €300m for supporting projects that boost renewable hydrogen production, reduce its costs, develop its storage and distribution solutions, and stimulate the use of low carbon hydrogen in hard to abate sectors, such as energy intensive industries, aviation or heavy-duty transport. We also continue the development and deployment of "hydrogen valleys" across Europe, complex projects that cover the entire hydrogen value chain in a specific region, scaling-up hydrogen deployment and creating interconnected hydrogen ecosystems across Europe. The targets are clear: we must double the number of Hydrogen Valleys in Europe, to reach 50 valleys by 2030. Currently, there are 23 European hydrogen valleys at different stages of development ; they have been identified in the Mission Innovation Hydrogen Valleys Platform, developed for the Clean Hydrogen Partnership (and its predecessor, the FCH JU).

Among others, REPowerEU sets a target of 10 million tonnes of domestic renewable hydrogen production and 10 million tonnes of renewable hydrogen imports by 2030. We need to work in synergy to be able to do this. Decisions on large investments must be synchronised and we must work in synergy to connect projects, to create a snowball effect and build a strong market. We (the Clean Hydrogen Partnership and its predecessor, FCH JU) have focused a lot in our projects on H2 production and we have managed to bring it from 100KW to 100MW – that's fantastic but we need as well the network infrastructure that will help us "connect the dots." Let's not forget that in order to achieve our targets we also need cheap and abundant renewables – and we hope that the infrastructure for that will develop accordingly, in parallel.

Another challenge is that the hydrogen technologies have developed at a very fast pace, but we also need an adequate regulatory framework to follow and to provide the clarity and the order needed for the investments in hydrogen to continue to the rate that they are needed. Many developments are expected in this area next year in the EU (the delegated acts clarifying EU rules applicable to renewable hydrogen, AFIR, the Gas Package, RefuelEU Aviation package – to mention a few).

It's also important to recognise that more and more professionals are or will soon be involved in the hydrogen roll-out. That is why in the next years we need to pay special attention to education, professional development and raising awareness towards hydrogen technologies and their benefits.

Last but not least, we cannot overlook the fact that we have reached this point following years and years of cutting-edge research and innovation, we need to join forces with other available programmes to continue to support research at an early stage and ensure that we share learnings and maximise efficiency.

About the Clean Hydrogen Partnership

The Clean Hydrogen Partnership, launched in November 2021 is a unique public private partnership supporting research and innovation activities in hydrogen technologies in Europe. Its aim is to accelerate the development and deployment of advanced clean hydrogen applications and strengthen the competitiveness of the clean hydrogen value chain across the European Union. The members of the Clean Hydrogen Partnership are the European Commission, fuel cell and hydrogen industries represented by Hydrogen Europe and the research community, represented by Hydrogen Europe Research.

The Partnership builds on the results of years of cooperation driven by its predecessor the Fuel Cell and Hydrogen Joint Undertaking and takes this to the next level in order to accelerate the development and deployment of a European value chain for clean hydrogen technologies. It will focus on producing, distributing and storing clean hydrogen and on supplying sectors that are hard to decarbonise, such as heavy industries and heavy-duty transport applications.

The World Sustainable Energy Days 2023
Energy Transition = Energy Security

The price crisis, increasing consequences of climate change and threats to energy security urge us to act like never before. The upcoming "World Sustainable Energy Days" (WSED) from 28 February – 3 March 2023 in Wels/Austria, focus on how to deal with the multiple crises by accelerating the energy transition.

The WSED are one of Europe's leading annual conferences on the energy transition and climate neutrality. They bring together over 650 participants from more than 60 countries with business, research and public policy expertise to demonstrate concrete policies, technologies and markets for this crucial transition.

Comprehensive Programme: Something for Everyone

In today's very dynamic world, up-to-date information is imperative and time is limited. Over the course of just a few days, the WSED offer a unique combination of stand-alone but complementary conferences and interactive events that cover key topics on energy security, policy, markets and technologies, empowering people to embrace the clean energy transition. This high-level event includes contributions from the EU Commission and leading international experts. Start-up sessions and a major tradeshow on energy efficiency and renewables round up the programme by showcasing products and innovations from Austrian and international companies.

European Energy Efficiency Conference: Energy Transition = Energy Security

In our current geopolitical climate, energy efficiency and energy security go hand in hand, forming the core of Europe's commitment to a clean energy transition. Achieving a sustainable energy system requires strong policies, competitive businesses and technology innovation. The European Energy Efficiency Conference – with policy, industrial efficiency and smart mobility as focal points – is dedicated to creating a thriving economy for the success of the global clean energy transition.


Picture: OOe Energiesparverband

Picture: OOe Energiesparverband

European Pellet Conference: Clean and Climate Neutral

Differentiating bioenergy facts from fiction is currently a hot topic. Pellets are a clean, CO_2 neutral and convenient fuel with growing market shares worldwide. The European Pellet Conference, the largest annual pellet event in the world, offers an opportunity to learn about market trends, innovative technologies, projects, and concrete solutions for pellets across the bioenergy value chain!

Young Energy Researchers Conference: The Next Generation

Achieving the global clean energy transition needs young and innovative thinkers! At the Young Energy Researchers Conference, bright young minds present their work and achievements. The best contributions are honoured with the “Best Young Energy Researcher” awards. The WSED offer a platform for researchers and industry experts from all over the world to meet young professionals and budding scientists.

Upper Austria – a leading European region in the clean energy transition

The World Sustainable Energy Days are organised by the OÖ Energiesparverband, the energy agency of Upper Austria. Upper Austria has established itself internationally as a pioneer region for the development and uptake of innovative energy technologies (Find out more at www.wsed.at/energyleaders). Through significant increases in energy efficiency and renewable energy, greenhouse gas emissions from buildings were reduced by 39% in 10 years. 60% of all space heating and 33% of the primary energy in the region already come from renewables. Over €2.8 billion are invested annually in the energy transition. This makes the region an ideal location for this event.

Mark your calendars, register online today (www.wsed.at) and come join us at the World Sustainable Energy Days!

World Sustainable Energy Days 2023

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Never waste a good crisis

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

Since the beginning of 2020 we are experiencing world crises that most of us would have considered before as unrealistic and never to happen (again). Both the pandemic and the Russian invasion in Ukraine are turning our economy and society upside down, without precedent.

But these crises have also uncovered some realities that one might have overseen during the last decades. The perfect storm we are going through has put the finger on the essential and critical role seaports are playing and will have to play in the future. And here we must maybe recall Churchill's "Never let a good crisis go to waste".

During the pandemic, ports have deployed all possible means and efforts to remain open and keep on moving. Contingency plans were set up to ensure that contaminations in the essential operational units would not stop the port functioning. Many ports played an import buffering role when shops remained closed. Vaccination plans were set up for seafarers. As mission driven entities, ports have often been punching above their weight to make this happen. Sometimes at a high price, since strengthening its resilience does not come for free. And port charges did not go up, on the contrary.

Since the Russian invasion in Ukraine on 24 February, ports have been again in the frontline to find solutions. Sudden changes in the supply of energy, the Ukraine solidarity lanes to help exporting the Ukrainian grain, the impact of the different sanction packages have again put the ports'

agility and adaptability to the test. Ports play again an essential role in getting through this energy crisis. Even if in the short term some of the ports see throughput increasing – due to LNG imports increase, coal trade has unfortunately restarted - these might come with some new investments to make it happen. These are short term, non-expected investments which will not help in achieving the long term challenge to decarbonise Europe, more on the contrary.

The short term agility ports have to demonstrate does not come instead but on top of the long term decarbonisation goal Europe has put forward and ports are fully supporting; While the negotations between Council and Parliament on the legislative proposals regulating the demand and supply of alternative fuels, the integrating the maritime sector in the emission trading system and reviewing the renewable energy directive are advancing, Europe's policy makers are already discussing the Commission's REPower EU plan, published in May of this year. It aims at enhancing Europe's energy independence. Stepping up renewable energy deployment seems to be the recipe to both becoming independent from Russia and speed up decarbonising. A new renewable energy target of 45%, a solar rooftop initiative for big commercial and public buildings, a more ambitious target for the production and import of hydrogen and a proposal to define "go to areas" for renewable energy projects which would come with a planning and permitting ease are some of the main proposals of importance for ports.

The policy intentions are very good. Europe becoming a carbon neutral continent must remain the main goal and objective. And while the current geopolitical and economic context will make it more than difficult to realise it, we must remain on this pathway, even if it might become now and then a bumpy ride. But allow me in this context to express some concerns.

Ports are heavy infrastructure, port investments have long lead times, because of the time needed to get around the financing and the needed authorisations. At the same time uncertainty is all around: technological uncertainty (what will be the fuel of the future), price uncertainty (energy prices are fluctuating as never before, inflation is pushing prices of raw material at never seen heights), economic uncertainty (are we at the start of a deep and long recession?). In this context it is impossible for ports to make long term plans, it is extremely tricky to make the right choices. If not careful, one's investments could prove to be outdated when all is set for realising the project.

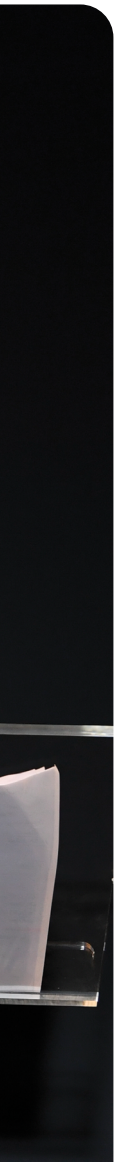
Moreover, in the current context with a inflation rate we did not have seen since the 70's, it will become even more difficult to find the necessary funding for the needed investments. The budget plans developed last year have become completely worthless.

Another challenge in preparing for a carbon fee economy and society is space. Cleaner and renewable energies require more space than fossil energies. Their energy density is lower, safety perimeters are to be respected and there is a need for more storage capacity. ESPO commissioned a study in beginning of 2022 on the impact of the energy transition on port infrastructure and investments. The study explains that LNG require two times the space of fossil energy, hydrogen up to five times. And space is scarce in Europe, not at least in and around Europe' ports. Ports are often in competition with the nearby city in their demand for more space.

So how to solve that? What is needed to progress and pursue our decarbonisation goals in the current challenging environment?

Let it be clear, for Europe's ports, realising the green transition is a first priority and ports want to a partner in making this happen. The questions is not "if" but "how".

It will be important to continue to work on a legislative framework that is as much as possible goal oriented, that is flexible enough to allow ports to make the best and most efficient choices, to remain agile. There is no money, no time for mere ticking-the-box solutions. Progressing on the greening path must be the main driver. Moreover, policymakers, at European, national and local level, must recognise the critical and strategic role ports have both as nodes in the supply chain and as hubs of sustainable energy and must be ready to support Europe's ports both politically as financially. Finally, European citizens will have to understand that decarbonising Europe, deploying renewable energy, also implies building infrastructure to produce, connect and store energy. If renewable energy projects and – more in general – greening investments cannot get the needed permits, decarbonisation will not happen.



Supporting Maritime Decarbonization: A European Perspective

By Lau Blaxekjær and Connor Bingham

Recently, the EU Commission, Parliament, and Council preliminarily agreed to include greenhouse gas emissions (GHGs) from ships into the EU Emission Trading System (ETS). This development will be the first time in history that a price has been put on the climate pollution of ships, representing an important step in potentially developing a global framework capable of supporting the full decarbonization of global maritime activities.

Decarbonizing the maritime ecosystem is vital to ultimately limit global warming to 1.5 degrees Celsius above pre-industrial levels and ensure that people can thrive on this planet. This means reducing GHG emissions and phasing out the use of fossil fuels across the whole economy – including harder to abate sectors like international shipping.

Over the last few years, knowledge about how shipping can decarbonize has significantly increased, helping to narrow down potential fuel choices and future solutions. Notably, we have seen a sharp rise in pilot and demonstration projects, totalling at least 200 projects globally, with 114 projects now active in Europe.

With the latest Intergovernmental Panel on Climate Change's 6th Assessment Report reminding us that the time to act is now, we need to implement and scale these solutions at the requisite speed. To do this, effective policy and regulation will be required, helping to close the competitiveness gap between incumbent fossil fuels and new scalable zero emission fuels (SZEFs) derived from hydrogen, such as ammonia or methanol. This will ultimately create the conditions necessary for supporting an urgent transformation of the maritime supply and value chains.

Fortunately, there is still time to decarbonize maritime transport in line with the 1.5-degree temperature goal. In July next year, the International Maritime Organization (IMO) – the international body responsible for regulating international shipping emissions - could address this and set much needed 1.5-aligned short and long-term GHG emissions reduction targets. Member States will then decide on specific policy measures to reach those targets, for example a global GHG fuel standard and a GHG price mechanism. These policy decisions, if 1.5-aligned, will send a clear signal to the wider maritime

transport and energy ecosystems, helping to unlock the investments needed into fuel production, infrastructure, and vessels.

The EU has a key role to play in supporting these developments, promoting action and supporting the ambition for the IMO to set targets in line with the Paris Agreement. This is possible through both disincentivising pollution by placing a regional price on carbon through the ETS, in addition to distributing revenues and supporting action. This could be achieved through supporting the implementation of measures such as contracts for difference (CfDs), which would target revenues towards meeting the difference between the market price for a fuel or technology, and the price required for its financial returns to be sufficiently attractive to developers and investors.

Distributing revenues in this way has wide potential to support the uptake of at least 5% SZEFs in EU shipping by 2030, which will be needed to ensure alignment with the Paris targets. In total, this would cost around 1.2 billion euros annually in the form of a CfDs program, which can comfortably be funded using shipping related ETS revenues which are estimated at between 5-9 billion Euros annually depending on the ETS price.

Measures like CfDs could specifically be used to help support green corridor projects between the EU and other geographies such as South Africa, China, and the US, helping to further stimulate the proliferation of zero emission shipping globally. This would support the development of specific trade routes between major port hubs where zero-emission solutions are supported and demonstrated. Promoting maritime decarbonization through establishing these green corridors has recently become recognized as one of the most important tools to aid industry and governments in decarbonization efforts. In addition, applying revenues in this way could further be used to facilitate the development of projects in third countries, helping to boost the supply of green fuels, in addition to supporting a just and equitable transition.

Moreover, promoting the development of green fuel production in third countries will be an important component for the EU to effectively contribute towards global maritime decarbonization. This is due to the fact that around 87% of the required investment needed will be on the land-side, mostly in countries with excess capacities of renewable energy. Due to Europe's lack of a renewable surplus, revenues raised from an ETS scheme could thus also help to develop projects outside of Europe. This will also create a future opportunity to potentially import these fuels for use in other sectors which will require additional renewable energy to decarbonize such as heavy transport, cement and steel.

Moreover, ensuring that emerging markets and developing countries are included in the transition will be vital to ensuring that the transition is truly global. This will be needed to secure buy-in from less developed countries at the IMO who could be supported through the provision of financing and expertise for relevant projects.

We ultimately welcome these recent developments from the EU as an important step towards a fully decarbonized maritime ecosystem. Ultimately, it is our hope that such ambitious action will help to send a strong message to the IMO and its members on the imperative to set ambitious emissions reduction targets when revising the IMO's GHG strategy next year.

Decarbonising European Ports – HAROPA PORT's OPS strategy

HAROPA PORT, Major river-sea Port of the Seine axis, is France's first port and the single port authority of the Seine Axis comprising the three area managements of Le Havre, Rouen, and Paris. The briefly discuss Article presents the role of European ports in the current ecological and energy transition, underlining HAROPA PORT's major actions towards decarbonisation in the context of Onshore Power Supply (OPS) projects.

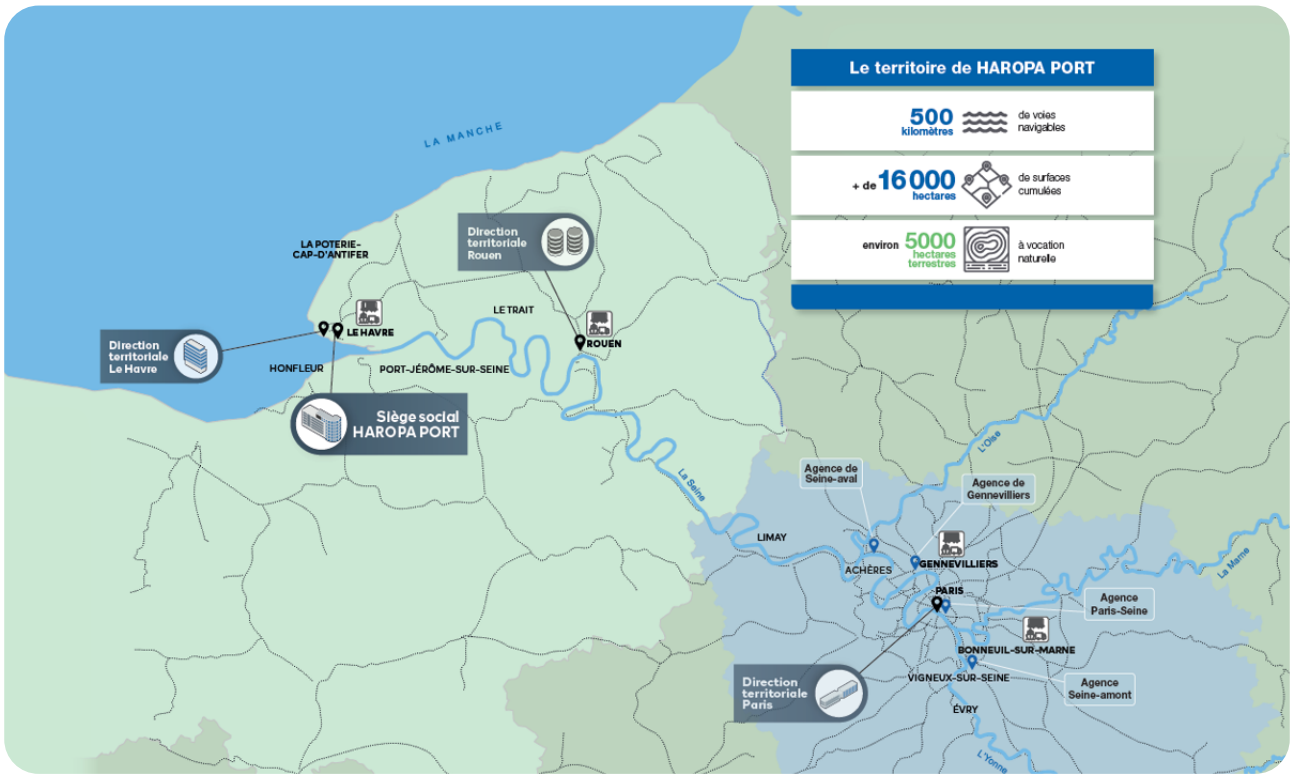
The new role of Ports and the EU Green Deal

The role of port authorities is at a crossroad. While remaining essential actors in the logistic chain, ports are increasingly evolving to undertake newer tasks and activities – becoming hubs for energy transition projects, intermodal interfaces and driving forces in urban development plans together with local authorities.

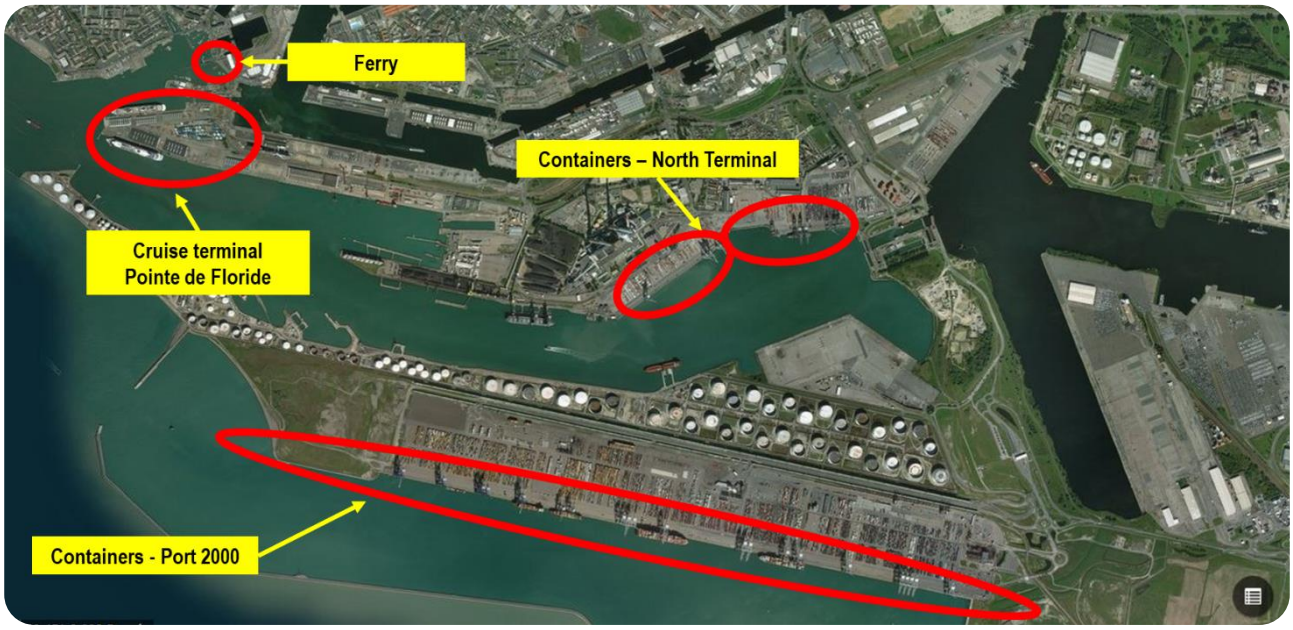
This change of paradigm comes with both acknowledgments and responsibilities, opportunities, and challenges. On the one side, the significance that ports carry as key players in the global economy is unambiguously recognized. On the other, ports find themselves at the forefront in taking decisive emission-reduction actions against pollution and climate degradation at large.

A momentous political context has also been taking shape in the latest months. At EU level, the European Commission has put forward the most ambitious regulatory package to fulfil the Green Deal's ambitions towards a climate neutral continent by 2050. The so-called "Fit for 55" Package[1] includes legislation aiming at putting the entire maritime and shipping sectors on a comprehensive decarbonisation path.[2] This is having and will bring repercussion at national level too, as several Member States have been raising the stakes on sustainable strategies for ports and waterborne transport.

HAROPA PORT, the major river-sea Port of the Seine axis, is experiencing firsthand such shift towards new functions and responsibilities. As first port of France – one single authority gathering the harbour



HAROPA PORT and the Seine region (Copyright: Grand Pot fluvio-maritime de l'axe Seine)



Onshore Power Supply (OPS) projects in harbour area management Le Havre (Copyright: Grand Pot fluvio-maritime de l'axe Seine)

areas management of Le Havre, Rouen, and Paris – we fully share the commitment towards the decarbonisation of our activities and across our wide port ecosystem. At the heart of global supply chains, cluster of energy, industry, and blue economy, HAROPA PORT is a strategic partner fully committed to make the European Green Deal happen.

Ports at the centre of the sustainable transition – The importance of Onshore Power Supply (OPS)

Ports have a vested interest in the ecological transition. First and foremost, they have traditionally been perceived as a source of pollution. Moreover, physical infrastructure and port activities are vulnerable to climate change, especially sea level changes, shifts in the level or pattern of shipping and extreme weather events, which all contribute to business disruption. Eventually, the volatility of the energy market – exacerbated by the Russian aggression against Ukraine – have made the energy transition a political urgency and a chance to drive decarbonisation further, with ports finding themselves at the centre of alternative fuels development.

In its annual Environmental Report 2022 – EcoPortInsights[3], the European Sea Ports Organisation (ESPO) shows indeed that the environment – at large – and energy are increasingly becoming top priorities for ports. Port authorities continue to improve their environmental management with a long-term outlook for investments. HAROPA PORT is no exception; the "transition ecologique" is at the very heart of our Strategic Project 2020-2025.

Regarding energy, it is well acknowledged that it is both part of the problem and the solution for greenhouse gases (GHG) emission reductions. In another Study, "The new Energy landscape"[4] (prepared with the Consultancy Royal Haskoning DHV), both associations ESPO and EFIP (European Federation of Inland Ports) argue that ports can contribute positively to a sustainable economy as clean energy hub, playing an instrumental role in Europe's greener energy landscape. What emerges indisputably is that energy transition is a gamechanger which will increasingly have a very significant impact on ports and the role of port authorities.

At HAROPA PORT we consider rather unsettled, at the current stage, to predict which one would be the actual energy mix to be leading decarbonisation strategies. Granted, one of the most effective solutions to improve vessels emissions in ports is the provision of access to shore-power through the system known as Onshore Power Supply (OPS)[5]. Ships at berth use their auxiliary generators to provide power for crucial systems such as lighting, ventilation, and fire prevention. OPS allows ships to shut down its engines, drastically eliminating emissions (NOX, SOX, CO_2, and other particulates) as well as vibrations and noise. Beyond the proven environmental benefits, in particular regarding air quality, OPS-related technology can additionally reduce vessels' fuel consumption and possibly lower costs for their operation.

It should not be overlooked that

Overview of the charging stations to be deployed along the Seine axis through the project "Bornes & Eau"
(Copyright : Grand Pot fluvio-maritime de l'axe Seine and Voies navigables de France)

the installation of OPS technology requires considerable financial resources to be channeled into physical infrastructure. Thus, each port should evaluate case-by-case the opportunity of their investments, always against other green solutions in the context of the rapidly evolving zero-emission propulsion technologies. The continuous cooperation with the shipping industry would, moreover, be fundamental in order to the ensure a foreseeable economic return for such investments, as well as the technical and operational compatibility of the OPS systems.

OPS projects across the Seine valley

AT HAROPA PORT we acknowledge that power-to-ship has the clear potential to enhance air quality and reducing emissions in the port areas[6]. Several OPS-related projects (referred to as "RENAQ-Raccordement électrique des navires à quai") are in the pipeline to be deployed along the Seine axis with the outlook to 2030. A high degree of attention will be given to the availability of electrical power and to the connection to the French public distribution network.

In the port area management of Le Havre, four different sites have been identified to deploy OPS infrastructures with the first phase of works to be starting in 2023.

1. On the Cruise Terminal, an investment of €20 million has been earmarked to gradually equip three quays with OPS between 2024 and 2026 in order to supply cruise ships (6.6kV-11kV / 50Hz-60Hz / 16 MVA). The call for tenders for the work on the quays and the construction of the high voltage electrical distribution is in progress for a start of work on the first quay in Q2 2023. The ambition is to be the first port in northern Europe to be able to supply cruise ships with 30MW.
2. On Port 2000[7], four kilometres of quays are to be equipped with OPS infrastructure by 2028. Studies are ongoing to fulfil the connection to the public distribution network and quantify the expected electrical power needed – which is expected to be more than 20MW.
3. On the Terminals Nord, studies are in progress with regard to installations on two quays to supply container ships (6.6kV / 50Hz-60Hz / 7,5 MVA)). The call for tenders is expected to be launched in 2024 for works to start off in 2025 and 2026.
4. Pre-studies are also being carried out for the Terminal Ferry, envisaging the opportunity to supply one ferry (6,6kV / 60Hz / 6,5MVA) by 2030.

In the harbour management area of Rouen, the electrical connection

of cruise ships at berth is part of a more global approach between the interface of the port of Rouen and the Métropole Rouen Normandie, as well as the city of Honfleur. Works on OPS infrastructure in the Cruise Terminal in Honfleur started this year, and the commissioning of two quays is expected in 2026. The total budget earmarked is €14 million.

Finally, together with Voies Navigables de France (VNF)[8] and with the financial support of the European Commission (through the Connecting Europe Facility Programme), HAROPA PORT has been managing the project "Bornes & Eau" since 2018. A total budget of €9.24 million has been mobilised for the deployment of 78 charging stations ("bornes"), for both freight and passenger waterborne transport, along the whole Seine axis by 2025[9]. The objective is to save not less than 5,300 tons of carbon equivalent each year once all stations are operational.

Following this further, HAROPA PORT has been strengthening its environmental ambitions on the international stage. On June 21, 2021, we joined forces with the ports of Antwerp-Bruges, Hamburg, Rotterdam, and Bremerhaven to sign a Memorandum of Understanding[10] (MoU), setting out their common commitments regarding to Onshore Power Supply (OPS) and continuing actions in terms of ecological transition.

The five ports of the Northern Range jointly committed to deploying the OPS in order to receive the ultra large container vessels (ULCV) by 2028. This is a more ambitious target than the one set by the European Commission itself[11] and will ensure that all major European ports adopt OPS solutions at the same time.

HAROPA PORT is definitely ready to contribute to the EU Green Deal strategy!

HAROPA PORT Le Havre Rouen Paris

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1. "Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality" – Communication from the Commission tot the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Region; 14/07/2021; https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0550
2. Notably, the reference goes to:
   - Proposal for a Regulation "on the deployment of alternative fuels infrastructure" (AFIR); 14/07/2021; COM(2021) 559 final; https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52021PC0559
   - Proposal for a Regulation "on the use of renewable and low-carbon fuels in maritime transport" (FuelEU Maritime); 14/07/2021; COM(2021) 562 final; https://ec.europa.eu/info/sites/default/files/fueleu_maritime_-_green_european_maritime_space.pdf
3. ESPO Environmental Report 2022; October 2022; https://www.espo.be/media/ESP-2959%20(Sustainability%20Report%202022)_V8.pdf
4. "The new energy landscape – Impact on and implications for European ports"; Royal Haskoning DHV for ESPO and EFIP; 3rd June 2022
5. Onshore Power Supply (OPS) can be equally referred to as "Shore Side Electricity (SEE) or "Alternative Maritime Power (AMP)" or "Cold ironing". For the purpose of this Article, we shall only refer to the terminology "Onshore Power Supply" or "OPS" hereafter.
6. HAROPA PORT is a member of the European Platform for Electro-Mobility. It brings together over 40 organisations from across civil society, industries, cities and across all transport modes. The Platform aims to promote electromobility and develop solutions to electrify European transport. https://www.platformelectromobility.eu/
7. Port 2000 is HAROPA PORT's largest container hub – a "deep water rapid port" – located in Le Havre. Inaugurated in 2006, it encompasses three multimodal terminals across 200 hectares and 4,2 kilometres of quays. Its 12 berths can accommodate the largest container ships in circulation 7 days a week, 24 hours a day, without tidal constraints.
8. Voies Navigables de France is the French navigation authority responsible for the management of the majority of France's inland waterways network and the associated facilities—towpaths, commercial and leisure ports, lock-keeper's houses and other structures.
9. All these stations are equipped with 2 water taps and 4 electrical outlets ranging from single-phase 220V 16A to three-phase 440V 63A. The tariffication is to be harmonised along the whole Seine axis.
10. Memorandum of Understanding "Onshore Power ambitions for Container Terminals in Ports"; 18th June 2021; https://www.portofrotterdam.com/sites/default/files/2021-07/mou_ops_ports_of_antwerp-bremerhaven-hamburg-haropa_port-rotterdam_-_final_20210618_003.pdf
11. The proposals for Regulations « Alternative Fuels Infrastructure Regulation (AFIR) » and « FuelEU Maritime » set objective to 2030.

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