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ELECTROMOBILITY

GAS DECARBONISATION AND HYDROGEN

BIOMETHANE

Includes editorial contributions from:

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MEP

Jutta Paulus
MEP

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Keeping your eye on the ball

"The ability to focus attention on important things is a defining characteristic of intelligence"

- Robert J. Shiller

Of late, our community has rightly been preoccupied by events in Ukraine and by the seemingly limitless capacity of those invading it to inflict destruction, brutality, misery, and horror. The invasion has shone a harsh spotlight upon Europe's energy policy, and with it a similarly limitless capacity for compromise – this time focused around the Druzhba pipeline.

It is fair to point out that oil and gas prices exert significant effects across huge swathes of the European economy, and that these effects are felt most keenly by those least able to respond. But events elsewhere indicate that we must not lose sight of what is happening to the climate, and in this issue Clara de la Torre signals an alarming prospect that simply demands our focus and our attention. "There is", she says, "a fifty-fifty chance that the annual average global temperature will reach 1.5°C above the pre-industrial level within the next five years, according to the World Meteorological Organisation."

De la Torre pulls no punches, and her own focus upon transport is clear: "slashing transport emissions" requires stronger legislation: all new cars and vans will be zero emission by 2035, supported by fleet-based targets for charging capacity. Another eye-catching initiative is a proposed second Emissions Trading System, geared to road transport and buildings. Aviation is in her crosshairs, too: ReFuelEU, the phasing out free allowances to airlines under the present ETS, a new tax system based on the energy content of jet fuel and an obligation to supply stationary aircraft with electricity to avoid burning jet fuel on the ground are backed up with €1.7 Billion worth of investment.

Jutta Paulus, MEP keeps the focus on aviation with her discussion of energy efficiency. Perhaps surprisingly, the EED does not cover transport and she comments that the sector responsible for 30 percent of Europe's final

energy consumption shows an "exceptionally poor" conversion from primary energy consumption. She too points to the Green Deal and REFuelEU as potential ways to reduce emissions, but argues that what is really needed is a modal shift away from aviation to more energy efficient and sustainable transport.

Ismail Ertug, MEP reminds us of the role of transport in everyday life, which only emphasises the importance of decarbonising it. Charting a pathway for electromobility, he calls for legally-binding minimum requirements for alternative fuel infrastructure; for strengthened distance-based and fleet-based targets for light vehicles, focused around the TEN-T core; significantly uprated recharging capacity for heavy-duty vehicles; "easy, efficient, and accessible" recharging for all, including transparency and quality of information and an EU-wide interface. Though clear that Ertug's focus is recharging, he has proposals regarding both LNG and clean hydrogen.

In his well-referenced article, Pedro Verdelho explores how hydrogen can help regulators facilitate decarbonisation of the energy sector. He proposes flexible regulation to account for the state of the industry, efficient systems that offer investor security, and empowerment and protection of consumers.

Several technologies already provide near-zero emission electricity, but as these are ramped up, interactions with other elements of the energy system become more important. Could the future lie in energy system optimisation? Kees van der Leun thinks so, and tell us how. He cites several examples, such as integrating green hydrogen and biomethane into industrial processes, and offshore wind into international energy hubs and heat pump into district heating.

Shiller had a serious point about focus. Right now, it seems as likely as not that we will have failed to meet the more ambitious Paris target within five years, while atmospheric CO_2 levels now stand higher than at any time in the last 650,000 years and are still rising. Russian fossil carbon, both Scylla and Charybdis perhaps, shows how setting priorities, while never more important, is a truly invidious exercise.

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

AFIR: The future pathway for electro-mobility in the European Union

By Ismail Ertug, MEP

Transport and mobility is the lifeblood of society and an essential part of everyday day life, affecting the wellbeing of European citizens. Simply put, it concerns all of us. Sustainable alternative fuels and their infrastructure play a key role in the transition to ensure the successful decarbonisation of the transport sector.

New elements to the current status of alternative fuels infrastructures in the EU

I deeply welcome the European Commission's proposal to turn the Directive into a Regulation. Legally binding minimum requirements for Member States to deploy this infrastructure will give the Union the best possible capability to support the required uptake of alternative fuel vehicles, in all Member States and across all transport modes. Harmonised provisions will ensure the required accessibility to recharging and refuelling stations, facilitating the mobility of citizens in daily life, while also strengthening territorial cohesion and helping all regions in their transition towards a greener, climate neutral future.

Furthermore, transparent and fair pricing, combined with uniform and easy-to-use payment solutions for users, are necessary to guarantee full accessibility for all citizens and to make it easier to switch to sustainable transport solutions.

The Commission's proposal is a good starting point in many aspects, but I believe that there is room for further improvement and therefore, I propose to strengthen the policy framework as follows:

On light duty vehicles

Distance-based targets along both the TEN-T core and comprehensive networks must apply by 2025. In order to fully support and maximise the increasing share of electric vehicles on the market, it is also important to strengthen the fleet-

based target through a higher minimum power output per vehicle. This will be particularly important in the short- and medium- term, to ensure a basic coverage enabling users to charge wherever they are driving. Therefore, the power output requirement per vehicle should be linked to the share of electric vehicles in the fleet, with higher output requirements in the beginning, which would decrease over the years, since the share will increase.

On Heavy Duty Vehicles

I believe that the proposed targets must be significantly strengthened. This means a significant increase of the minimum power of output chargers in order to enable drivers to charge during rest periods. In addition, we need an increased capacity for charging stations in safe and secure parking areas. Likewise, the proposed rollout of recharging stations along the TEN-T network must be done more coherent than in the Commission's proposal in order to support the market penetration of battery electric or fuel cell trucks.

With regards to LNG in road transport, on the other hand, I do not believe that this fuel has any significant potential to reduce GHG emissions from heavy-duty vehicles. Consequently, the Union should not encourage any further development of this infrastructure, which would risk stranded assets and detrimental lock-in effects in fossil technologies at the expense of sustainable alternatives with a higher potential to reduce emissions. Thus, LNG refuelling infrastructure for HDVs should not be part of this regulation.

Ensuring user-friendly and accessible recharging

Recharging of vehicles must be easy, efficient, and accessible for everybody in society. Therefore, all publicly accessible charging and refuelling stations need to be fully accessible to persons of reduced mobility. Furthermore, operators of charging stations shall be obliged to display the ad hoc price in 'price per kWh' before the start of a recharging session and ensure that electronic card payment is always possible. To enable better management of the electricity grid and ultimately trigger lower electricity prices for consumers, all charging points should be capable of smart charging.

I am convinced that it is important to improve the transparency and quality of the data, which operators of recharging and refuelling stations will gather. Therefore, the Commission should establish a European Access Point by connecting all National Access Points. The goal here is to set up an EU-application or interface enabling users to access an exhaustive EU-wide map and route planner, which contains all publicly accessible recharging and refuelling stations.

Hydrogen refuelling infrastructure

Clean hydrogen will be essential to reach the Union's objectives under the European Green Deal as well as climate neutrality by 2050. A rapid technology development is taking place and Europe must harness the full potential of the hydrogen refuelling ecosystem for heavy duty road transport, which will require both gaseous and liquid hydrogen. Therefore, I propose to increase further the deployment of distance-based refuelling stations for HDVs along the TEN-T network.

Background

MEP Ismail Ertug was born in Amberg, Germany in 1975. After his studies, he held several different positions at the Health Insurance Scheme AOK. In 2009, he was elected to become a Member of the European Parliament for the first time, and he was re-elected in 2014 as well as 2019.

Since then, MEP Ertug has been a Member of the Committee on Transport and Tourism (TRAN). In 2019, he was called to hold office as Vice-President of the S&D Group until December 2021. Besides his full membership in the TRAN committee, he is a substitute for the Committee on Industry, Research and Energy (ITRE). He is also a full Member of the Delegation for relations with the People's Republic of China and a substitute of the Delegation for relations with the Arab Peninsula.

MEP Ertug is involved in topics such as the future of mobility, the reduction of CO_2 emissions, the introduction of alternative and cleaner means of propulsion as well as the increase of automation and digitalisation. Furthermore, he stands for the rights of rail passengers, aims for simplifying cross-border travel as well as the regulation of guidelines for the development of the trans-European transport network.

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How can hydrogen technologies power the clean aircraft of the future?

By Axel Krein, Executive Director of Clean Aviation

Clean Aviation Joint Undertaking, the European Union's public-private partnership dedicated to supporting European aviation industry's path towards climate neutrality, has launched its first Call for Proposals for innovative solutions powering the next generation of climate-neutral aircraft of the future.

A key part of the solution is hydrogen

Hydrogen eliminates CO_2 emissions in flight completely and can be produced carbon-free. Considering non-CO_2 emissions as well, the latest estimates show that hydrogen combustion could reduce the climate impact of flight by up to 75%, and fuel-cell propulsion by up to 90%.

Faced with a rapidly advancing energy crisis, the EU is investing heavily in clean hydrogen – outlining hydrogen as one of the promising renewable energy sources that will help phase out the use of fossil fuels under the new REPowerEU plan.

However, adapting aircraft designs and systems to hydrogen as a fuel or energy source will require significant research and development, fleet and infrastructure investment, and the development of accompanying regulations to ensure safe and economically viable hydrogen-powered air transport. That's where the innovative brain-power of the Clean Aviation and Clean Sky community will come into play!

Hydrogen is radically different to kerosene, with different properties and consequently, different requirements. Hydrogen fuel has a very high energy content by mass, 4 times higher than kerosene. A particular challenge is that it occupies 3 times the volume of kerosene for an identical amount of energy in liquid form and 2-4 times more in compressed gaseous form, hence storing enough of it for an aircraft to have a useful operating range requires out-of-the-box thinking. Add to that the need to store liquid hydrogen at -253°C and it's clear that there are still some major challenges to be addressed.

Several technological challenges are ahead: enhancing the overall efficiency of using hydrogen fuel with lighter tanks and fuel cell systems, distributing liquid hydrogen throughout the aircraft, building gas turbines capable of burning hydrogen with low-NOx emissions, and the development of efficient refuelling technologies enabling flow rates comparable to kerosene.

A study that was commissioned together by the Clean Aviation and the Clean Hydrogen Joint Undertakings in 2020 found that hydrogen – as a primary energy source for propulsion, either for fuel cells, direct burn in gas turbine engines or as a building block for synthetic liquid fuels – can feasibly power aircraft with an entry into service by 2035 for short-range aircraft. Costing less than €18 extra per person on a short-range flight, and reducing climate impact by up to 90%, hydrogen can play a central role in the future mix of aircraft and propulsion technologies.

The study showed that hydrogen propulsion is best suited for commuter, regional, and short- to medium-range aircraft within the considered time frame, which is one of the reasons why our current Call

– as well as Clean Aviation in general – focuses on these segments of the aviation market.

There is another reason why we focus on these aircraft: flights below 4000km in length – which are largely performed by these aircraft – are currently responsible for approximately 2/3 of world-wide aviation CO_2 emissions.

The study assumes that hydrogen-powered short- to medium-range, commuter and regional aircraft could account for 40% of all aircraft by 2050, with this share further increasing after 2050. The other 60% of aircraft will be powered by drop-in sustainable aviation fuels [SAF] – basically biofuels and so-called e-fuels. These too can help reduce aviation's net-CO_2 emissions but will have a less dramatic impact compared to hydrogen-based propulsion.

Through our Call, we are searching for disruptive technologies and breakthrough innovations that can make the best use of hydrogen fuel possible in the aircraft of the future. Fresh, big-picture thinking will be needed and we are looking for the best solutions to the technological challenges posed by hydrogen!

With a budget of €736 million for this first Call alone, our new aircraft concepts will be able to decrease aircraft carbon emissions by no less than 30% by 2035, compared to 2020 state-of-the-art technology, which will pave the way towards climate-neutral aviation by 2050.

As part of this First Call for Proposals, amongst others, we are searching for a team that can develop a ground test of a Hydrogen Integrated Propulsion System based on state-of-the-art components targeting identification of failure modes by a full "virtual flight test".

We are also scouting for a consortium that can put together a complete drive train system iron bird including propulsive and non-propulsive loads at a high Technology Readiness Level. As well as that, we would like to see a flight test of a small-scale liquid hydrogen integral tank.

The full list of the 14 different technological challenges, spread out across our three main thrusts – disruptive technologies for hydrogen, hybrid and full electric concepts, and ultra-efficient aircraft architectures – have been identified for innovators to address and can be found on the Clean Aviation website at www.clean-aviation.eu.

To find out more about Clean Aviation and the work that we do, I encourage you to visit our website. Here you will also find information about the demonstrators and the progress made in the Clean Sky 2 Programme, as well as our ambitions for a future, greener Europe. We believe that disruptive innovation will enable us to fly clean and carbon-neutral aircraft by 2035, allowing us to continue to reap the benefits that aviation can bring, without jeopardising the environment

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Efficiency in aviation

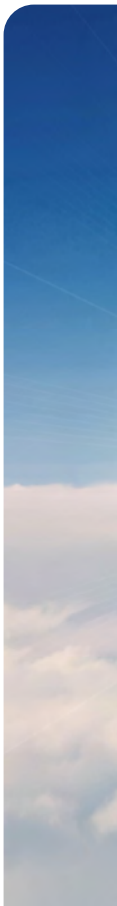
By Jutta Paulus, MEP

The cheapest energy is the one that is not being used. It does not have to be produced, processed, and transported. As energy efficiency has been ignored for far too long, the climate crisis and Russia's invasion and war in Ukraine now require quick and far-reaching adjustments of the efficiency performance in all sectors and member states. Unfortunately, the transport sector was excluded from the application of efficiency targets in the past. Though this is slowly beginning to change, it is particularly challenging for the aviation sector.

The EU's Energy Efficiency Directive (EED) sets EU energy targets to reduce the bloc's energy consumption. I am currently involved in the negotiations for its revision and my aims are to raise the energy saving target and reduce the primary and final energy consumption. Increasing energy efficiency by one percent alone reduces 2.6 percent of gas imports, but our ambition should go further. The one sector where emissions have not decreased but increased since 1990, transport is not covered by the EED. However, I am currently working towards a sub-target here together with my fellow negotiators.

The transport sector is responsible for 30 percent of Europe's final energy consumption, and the rate between final and primary energy consumption is exceptionally poor here. After a long time of ignorance, the European Commission finally made proposals to increase the transport sector's efficiency within the REPowerEU package which aims to reduce European dependency on Russian energy imports and enhance the bloc's energy sovereignty. In light of the war in Ukraine, this must go fast, which is probably the reason why the Commission included the transport sector into its proposals for efficiency measures after all. Next to recommendations for voluntary behavioural change by individuals and societies, as , walking or biking for instance or reducing the maximum speed on highways, the Commission announced to suggest new proposals for the electrification of road transport, the greening of freight and the support of public transport. These are urgently needed steps forward, however, they do not apply to aviation. Even worse, there are no efficiency requirements for the aviation sector at all.

With regard to the climate crisis, but also to European energy sovereignty, it is hard to imagine that efficiency levels in the aviation sector can stay the same as today. As part of the European Green Deal, the new EU



Regulation ReFuelEU Aviation aims to reduce harmful emissions of air transport. Unsurprisingly, the main problem is the reliance on fossil fuels, as biofuels cannot be produced at such large scale and a synthetical fuel industry has yet to evolve. Therefore, reducing the overall aviation fuel demand could significantly reduce flying's climate impact. This could be achieved by fuel efficiency measures, cutting fuel waste and mandatory trainings for pilots, or by creating synergies with other transport modes to facilitate a modal shift to viable sustainable alternatives where they exist. Incentives to adapt could be furthermore achieved by eliminating direct and indirect subsidies to the aviation sector, such as ending jet fuel tax and flight ticket VAT exemptions or cutting free allowances in the EU's emission trading system.

When produced from renewable electricity and carbon captured directly from the air, synthetic aviation fuels can achieve as high as 100% emissions savings compared to conventional aviation fuel. As wind and solar energy have much higher harvest factors per area than biofuels, synthetical aviation fuels are the only solution that can be developed at the necessary scale, quotas for the use of synthetic aviation fuels are necessary to incentivise investment.

In order to meet the European Union overall emission reduction targets, there is a particular need for modal shift. Where sustainable alternatives exist, short-haul flights should be subject to higher mandates of sustainable fuels. Aviation is one of the most inefficient means to transport weight over distances. It is therefore important to reduce air traffic and switch to more energy efficient and sustainable transport modes like rail or water transport where possible. If societal and environmental cost were included in ticket prices, at least short-haul flights for travel distances below 500 km would instantly cease to be economically viable.

The effects of non-CO_2 emissions which make up to two thirds of aviation's climate impact were ignored for far too long. We Greens/EFA managed to include paragraphs on the need to decrease them in the opinions of the European Parliament's industry and environment committees on the ReFuelEU Aviation legislation. The transport committee should take these concerns seriously and include these paragraphs in its position. The non-CO_2 impact of aviation is highly correlated to the aromatics and sulphur contents of jet fuel. Therefore, we call for a reporting obligation for fuel suppliers and, ultimately, a legislative proposal to limit their content. This would not only lower aviation's climate impact, but at the same time improve air quality in the vicinity of airports.

A future without aviation is unthinkable. However, the time for sustainable aviation has come. Researchers and developers all over the world are working on electrical and hydrogen planes for short haul flights, technologies for the production of synthetical fuels are waiting for investors. As one of the last sectors left for sustainable adjustments, aviation must start its journey into the future.

Objective Skygreen is EUROCONTROL's answer to the question:

Can aviation reduce CO_2 emissions by 55% by 2030 and how much is it going to cost?"

By Marylin Bastin (pictured), Head of Sustainability, EUROCONTROL

As a civil-military intergovernmental organisation EUROCONTROL's role is to support European aviation with our data and expertise and actively facilitate a collaborative approach to the aviation sector's challenges. Transforming the sector towards more sustainability and achieving a CO_2 emissions reduction by 55% by 2030 compared to 1990 levels is a strategic priority to which EUROCONTROL contributes by improving air traffic performance, supporting States and aviation stakeholders in their emission reporting obligations, carrying out environmental impact assessments and many more activities. Our new Objective Skygreen Think Paper and companion report examined a key question for the sustainability transition: can aviation achieve its emission targets and how much is it going to cost? The results show yes, it can, but only if it relies heavily on marked-based measures mainly via the EU Emissions Trading System (ETS) and CORSIA, which will make an 83% contribution to the net reduction in 2030.

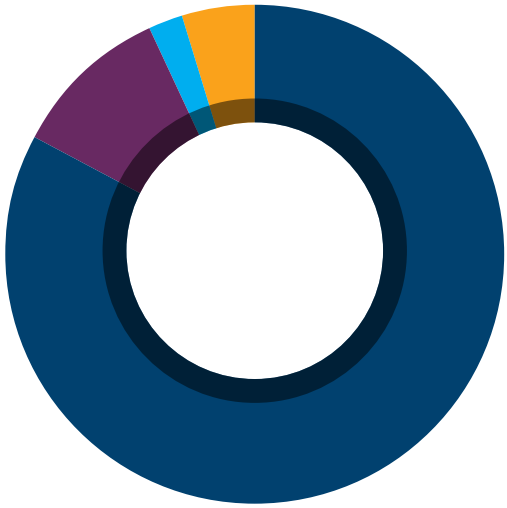
We have looked closely at the impact of decarbonisation policies up until 2030 to assess the extra cost of Sustainable Aviation Fuel (SAF) uptake, the impact of ramping up kerosene taxes, and the phasing out of free emissions allowances. Our estimates show that the cumulative extra cost of these decarbonisation measures to the aviation industry over the period 2022-2030 will amount to €62 billion, made up of: €29 billion in tax costs on kerosene (applied to intra-EU flights), €23 billion in extra ETS costs (applied to intra-EEA flights + flights from UK & Switzerland), €10 billion in extra fuel mix costs (based on a 5% SAF / 95% kerosene mix in accordance with the ReFuelEU Aviation proposal).

The extra cost to the airline industry in 2030 alone is estimated at €14 billion. However, improvements led by the aviation industry (operational measures and modernising airline fleets) are capable of bringing the extra cumulative costs over 2022-2030 significantly down from €62 billion to €29 billion.

Objective Skygreen is based on the three possible scenarios of our long-term air traffic forecast EUROCONTROL Aviation Outlook 2050 (EAO 2050) which predicts 13.8 million flights across the European Network by 2030 and 16 million flights by 2050 (both baseline scenario) and estimates the impact of industry driven and regulatory

measures. Counterintuitively, the high scenario with the most traffic is most efficient to reach net zero emissions by 2050 at lower cost, as higher revenues will drive increased investment in new technology.

Contribution of policy and industry-driven measures in reaching -55% in 2030
(Base scenario EAO 2050)



Up until 2030 and beyond the use of Sustainable Aviation Fuel (SAF) must increase

The European Commission's ReFuelEU Aviation initiative is essential in enabling a swift ramp up of sustainable aviation fuel (SAF) production and usage. Directed at fuel providers it requires that conventional kerosene for aircraft is blended with SAF starting in 2025 with 2%, and then gradually increasing to 63% by 2050. The proposal also includes a sub-obligation for synthetic aviation fuels starting in 2030 with 0.7%, and progressively getting to 28% of e-fuels in 2050. To avoid fuel tankering and carbon leakage, an obligation is also placed on aircraft operators to uplift at least 90% of the yearly fuel required at EU airports. Increasing the use of SAF in aviation will require significant technological investments, availability of feedstocks and other developments from SAF suppliers.

Depending on the SAF production technology pathways, the range of SAF production costs is from €1,000/tonne to more than €4,500/tonne. SAF is today typically two to six times more expensive than kerosene. Assuming an increased demand will reduce production cost, the extra cost of a 5% SAF blending share compared to 100% kerosene is estimated to be €10 billion by 2030 in the base scenario, reaching €2.6 billion in 2030 alone.

The extra costs for increasing the share of SAF are relatively low compared to EU-ETS and kerosene taxation costs. The latter, applied to intra-European flights, will e.g. increase aircraft operator costs by €28.8 billion in the period 2022-2030. Comparing these costs, it is evident that the ReFuelEU Aviation initiative brings net emissions savings at an affordable cost.

Under the EU ETS, all airlines operating in Europe, European and non-European alike, are required to monitor, report and verify their CO_2 emissions, and to surrender allowances against these emissions. They receive tradeable allowances covering a certain level of emissions from their flights per year (in 2012, 85% of allowances were allocated for free). In the revision of the EU ETS Directive, the current level of free allowances will be cut by 25% annually starting in 2024, resulting in a complete phase out by 2027.

The phasing out of aviation's free emissions allowances will result in a significant increase of allowances to be auctioned (2024-2030). Given current political developments and pressure on the energy sector, we have assumed a high carbon price of €200/tonne costing airspace users between €24.1 billion (low traffic scenario) and €19.6 billion (high traffic scenario) between today and 2030.

Only if their revenue is high will aviation be in a position to put in place the investment needed for the sustainability transition. In fact, operational improvements and fleet upgrades could reduce airline fuel consumption by 9.5%-15.4% in 2030. To reduce CO_2 emissions quicker, accelerated refleeting would result in significant additional CO_2 emissions reduction (savings ranging from 1.7% to 5.3% over 2028-2030).

EUROCONTROL

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Driving Europe's decarbonisation on the road and in the skies

By Clara de la Torre, Deputy Director-General of the European Commission's Directorate-General for Climate Action

There is a fifty-fifty chance that the annual average global temperature will reach 1.5°C above the pre-industrial level within the next five years, according to the World Meteorological Organisation. We must do everything in our power to keep emissions as low as we possibly can. That means slashing transport emissions by at least 90% by 2050 compared to 1990 levels. Transport is responsible for almost a quarter of Europe's greenhouse gas emissions, and one of the only sectors where emissions are still increasing. The lion's share of those emissions come from road transport at three quarters, with aviation coming in second at 12%.

The recent past has been turbulent for these sectors. During the height of the pandemic, international transport, and aviation in particular, suffered severe disruption. On top of that, the war in Ukraine has revealed the cost of our dependence on Russia's fossil fuels and its impact on our economy, giving us all the more reason to accelerate the decarbonisation of our society at large, and transport in particular. The European Commission has made proposals to achieve this goal.

For road transport, we are proposing to introduce stronger emissions standards for cars and vans. From a 2021 baseline, we want to cut the average emissions of new cars by 55% as of 2030, and by 100% from 2035 (for new vans, the reduction targets are 50% and 100%). This means that as of 2035, all new cars and vans would be zero emission vehicles.

But zero emission vehicles cannot become mainstream without new infrastructure. If we are going to make the leap to sustainable vehicles, people will need new charging points. We are therefore proposing that Member States expand charging capacity, and install public charging and fuelling points at regular intervals on major motorways. We propose fleet-based targets that would ensure that 1 KW of charging capacity is installed for each battery electric car or van registered in a Member State.

Even while cleaner vehicles join the market, we must continue to decarbonise the fuels of the existing fleet and incentivise the move to zero-emission vehicles. We are therefore proposing to create a second EU-wide Emissions Trading System (ETS), which would put a price on carbon emissions from road transport, as well as from emissions from buildings. In practice, the system would not apply to drivers, but to fuel suppliers. The ETS works on the principle of 'cap-and-trade': for every ton of CO_2 (or equivalent) emitted, fuels suppliers would have to surrender one carbon allowance. Companies can buy these allowances at auctiown, but there is an annual cap on the total number of them, which is reduced over time. A portion of the revenues from this new ETS would be channelled into the Social Climate Fund, worth €72.2 billion, with which Member States can support vulnerable households, transport users and microenterprises by helping them financially to reduce both their emissions and their costs.

For aviation, the Commission is proposing ambitious measures too. One major difference with road transport is that zero-emission aircraft are technologies in their infancy, which are not yet available on the market. Our focus is therefore on decarbonising aviation fuels while supporting research and development. ReFuelEU is our policy to ensure that increasing levels of sustainable aviation fuels (SAFs) are available at EU airports, with airlines obliged to use SAF-blended aviation fuel when departing from EU airports. ReFuelEU would also make it mandatory for fuel suppliers to include more SAF into jet fuel from 2030 to 2050: 20% by 2035 and 63% by 2050. This obligation is flanked by the economic incentive of the EU ETS

whereby SAFs are attributed a zero emission factor.

Unlike road transport, emissions from aviation within the EU are already covered under the EU ETS. As part of our ETS reform, we would gradually phase out the granting of free allowances to airlines. In parallel, for international flights, the Commission proposed to apply the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), according to which airlines will offset any growth in CO_2 emissions once collective international emissions exceed the average of 2019-2020 emission levels. It will also be important to tackle non-CO_2 impacts as those represent a substantial share of global civil aviation-induced climate warming.

The EU also wants to introduce minimum tax rates on aviation fuel, which would gradually increase over a ten-year period to reach a minimum rate of €10.75 per gigajoule EU-wide. This would encourage airlines to use more energy-efficient aircraft. Under our proposal, SAFs would not be subject to a minimum tax rate for a transitional period of 10 years and a reduced rate thereafter.

In addition, we want to introduce an obligation to supply electricity to all stationary aircraft in TEN-T core and comprehensive network airports instead of the aircraft burning jet fuel to produce that electricity.

For the transition to work, we need the full commitment of the private sector. That is why we are proud to be investing €1.7 billion in the Clean Aviation Joint Undertaking, for instance: a public-private partnership with the European aviation industry, to develop innovative aircraft that can cut fuel burn and related CO_2 emissions by 20% to 30%. History shows us that innovations can hold the key to huge leaps in progress. And we need to take these leaps forward to crack these sectors, in which it has been so difficult to cut our emissions so far.

Carbon neutrality and beyond

By Henri Werij (pictured), Dean Faculty of Aerospace Engineering, TU Delft

The task we have on our shoulders to make aviation truly sustainable is a formidable one. We have to act now, while facing technical challenges that sometimes might make you feel desperate. However, when looking back in time we see what can be achieved even though we once thought that we reached the limit of our possibilities. Just before the famous first flight of the Wright Brothers, most people did not think that heavier-than-air motorized planes would ever take to the sky and now see what has been accomplished since then. The quest for climate-neutral aviation is something I consider at least comparable to the task the Wright Brothers took upon themselves, while we cannot wait another century to make the required leap into the sustainable future. Fortunately we learned a few things along the way and we have tools available (and soon get even better ones, e.g. automated design approaches) our ancestors could not have dreamed about.

When talking about sustainable aviation we first think of carbon neutrality. And for true carbon neutrality, all should start with “fossil-free” electricity, preferably from renewable sources. This energy should somehow be stored aboard the aircraft and finally used for propulsion. The main options the aviation sector now considers involve 1) full-battery electric, 2) hydrogen-fuel cell electric, 3) hydrogen combustion and 4) sustainable aviation fuel (SAF). In view of the scarcity of renewable energy, the overall efficiency of converting electricity into propulsive power is a key driver for choices to be made. In terms of this efficiency batteries are the big winner, since more than 80% of the original electrical power will make it into propulsion. An assessment carried out by a group of scientists from different institutions led by TU Braunschweig and TU Delft showed that this number is expected to be in the range of 26-31% when using liquefied hydrogen and fuel cells, and about 22-26% when using hydrogen for combustion. When going the SAF route, the overall efficiency ends up in the 15% range.

However, this clearly is not the full story. For instance, weight comes into play right away. The heavier an aircraft, the more energy is needed to carry it a given distance. In other words, if the weight per passenger increases, the energy needed per passenger increases as well. We therefore, should not simply look at electricity-to-propulsion efficiency, but instead consider the primary energy needed per passenger-kilometre. When using batteries the specific energy (Wh/kg) turns out to be a limiting factor, which will affect

the amount of energy required per passenger-kilometre, a consideration that is often neglected. In case of fuel cells it is the specific power (W/kg) that plays an equivalent role. As a result, battery-electric aircraft will be limited to a range of a few hundred kilometres, unless technical breakthroughs in batteries are achieved that are not on the horizon yet. For hydrogen planes the verdict is still not out. Most likely different energy carriers will be selected for different flight ranges and aircraft sizes, all requiring specific adaptations to the aircraft designs.

Regardless whether we use batteries, hydrogen or SAF, the planes themselves must be as light and aerodynamically efficient (high lift, low drag) as possible. We will need novel materials and structures, for instance based on bio-inspired engineering, to reduce weight and noise. Cryogenic tanks for hydrogen are a well-known example involving extensive materials research, but more areas could be improved. Better topology of structures (possible thanks to new manufacturing techniques) or drag-reducing surfaces. Think of wings that sense the airflow pattern and adapt their shape autonomously, thus reducing both drag and mechanical loads, which might lower load margins and thus save weight. New propulsion systems, such as open rotor or based on boundary layer ingestion, turbines capable of burning hydrogen to name just a few topics. And finally the basic aircraft itself, which could look vastly different from the conventional tube and wing design, compliant with requirements to carry liquid hydrogen, the Flying V being an example. And when talking about sustainability, a proper lifecycle analysis should be part of all our design activities, which involves considering where materials come from, how much energy they require and what happens at end-of-life, since we cannot transfer problems elsewhere.

Earlier I mentioned that carbon neutrality was the first thought coming to mind when talking about sustainability. However, climate neutrality for aviation requires that we also consider non-CO_2 effects. The emission of NOx, leading to production of ozone (a greenhouse gas) in the upper troposphere, and the production of contrails and cirrus clouds will have to be taken into account from the very start when developing the aircraft of the future. This not only requires further optimization of engines, but also design of the aircraft itself, since flying at different altitudes is a way to prevent cloud formation, while flying slower could further reduce emissions, thus minimizing climate impact. This implies that air traffic management will also have to be adapted to optimize flight routes and altitudes under changing atmospheric conditions in order to minimize overall climate impact.

From the above it should be clear that achieving our sustainability goals in time requires the interplay, combined knowledge and true collaboration between all parties in the aviation ecosystem. This does not only involve technical expertise, but also a different approach to certification as well as input from the social sciences in view of e.g. public acceptation.

CO_2 Capture and Utilization (CCU) Matters

Positioning in the Sustainable Transition Landscape

Seven years ago, the Intergovernmental Panel for Climate Change (IPCC) proposed a pathway for the global reduction of CO_2 emissions, to limit the expected temperature increase to an anomaly of 2, ideally 1.5°C, by the end of this century. The CO_2 emissions originate from the burning of fossil fuel, industry and land-use[1] and should be rapidly reduced (>350 Mton CO_2/year), while 'negative' CO_2 emissions are gradually introduced, starting from 2030. This last strategy consists of the capture of CO_2 from the air and its permanent storage under the ground or in materials, for which an 'eternal' lifetime can be assumed.

Which CO_2 reduction strategies exist? The International Energy Agency (IEA) investigated possible strategies, e.g. the more efficient use of fossil-based feedstocks and fuels in our industry and energy sector, which represents the 'low-hanging fruit'. They described their contribution in the CO_2 reduction pathway towards a net-zero CO_2 emission in 2070[2]. In parallel, the IEA elaborated a more stringent roadmap, to achieve a net-zero emission by 2050. Important examples of such strategies are electrification, green hydrogen production, the use of renewable feedstocks and CCUS (incl. storage of captured CO_2). Together, they lead to a cumulative yearly reduction of CO_2 emissions by 35 Gt in 2070.

On which CO2 reduction strategy should we focus? Part of the proposed sustainable strategies rely on the use of renewable electricity. If we take into account a local scarcity of renewable electricity today and in the future, strategies should be prioritized. A first fair set of criteria would simply consist of the 'MWh of renewable electricity' or 'the EURO's' invested in a strategy, in order to reduce the yearly emission by given ton of CO_2. In addition, the anticipated potential for CO_2 reduction, related to the market size of given CO_2-based fuel, chemical or other products, should be included in the screening. Last but not least, the corresponding renewable electricity required to supply such a market could even become the most important criterium.

However, the former criteria may not suffice and other factors should be taken into consideration in such a decision-making framework: the application's 'readiness level', with regards to the technology development, its deployment in the market, compatibility with the existing energy and industrial system, amongst others. Also, possible local synergies between stakeholders, legislative frameworks to close possible financial gaps in the business case, availability of infrastructure, geography for deployment should not be overseen. To conclude such screening, the strategies should be ranked not only within, but also between different sectors, such as energy production, buildings, mobility and industry. As internationally active research institute, the Flemish Institute for Technological Research (VITO) combines its competences to tackle these cross-border, cross-sector and cross-vector challenges, within the field of CCU.

How to evaluate value chains, that rely on CO_2 feedstock, in practice? Three CCU-based value chains were assessed by VITO. They all start from the capture of fossil-based, post-combustion CO_2 from chimneys. It is used as feedstock in the production of CO_2-based products, alongside the application of zero-carbon energy to fulfill the process' electricity need. In a next step, they are replacing a fossil-based product in one or more use cases:

1. CO_2-to-fuel route: To deliver an equal amount of energy 2.25 ton CO_2-based methanol can replace 1 ton diesel or 1.07 ton bunker fuel in the marine fuel combustion.

2. CO_2-to-chemicals: the production of 1 ton grey methanol is replaced by 1 ton CO_2-based methanol in the chemical industry.

3. CO_2-to-building material: the production is based on the spontaneous reaction of stainless steel slags or other alkaline (waste) material with the CO_2 gas, forming an alternative for the classical cement binder. This implies a permanent CO_2 fixation. The resulting product replaces concrete-based building materials, which are based on cement. The process of cement production emits significant quantities of CO_2.

The following conclusions can be drawn from resp. Figure 1 and 2:

1. In the marine fuel and chemical use cases, the replacement by CO_2-based methanol results in a factor 15 higher CO_2 reduction potential than in the building material case. However, the production of methanol requires large amounts of electricity. Conversely, the corresponding CO_2 reduction potential per unit of renewable electricity, applied in the CO_2-to-methanol conversion process, is significantly lower.

2. The total replacement of European marine fuel results in a CO_2 reduction potential in the range of 100 Mton CO_2/year. This is a factor 15 higher than in the smaller chemical

use case, related to the European methanol production capacity. The building material use case also shows a significant potential, based on the availability of alkaline waste material in Europe. As a yearly renewable energy production of 3400 TWh is anticipated in Europe by 2050[4], the European marine fuel use case becomes restricted by its yearly renewable electricity need of 1000 TWh.

It is clear that no unambiguous selection of a viable scenario can be made in this exercise, focusing on only the CO_2 reduction potential and one use case, in extremis. A balanced combination of different CCU strategies is preferable. It starts from the current and future availabilities of renewable electricity as conditio sine qua non, with deployments spread over time. The production of CO_2-based fuels with electrified systems can support the renewable energy transition in an energy storage strategy. The production of CO_2-based building materials is a feasible short-term pathway, if proper supply chains for alkaline waste feedstock can be guaranteed. In the meantime, opportunities arise in the field of energy import, which influences the boundary conditions for CCU: Renewable electricity can be produced in an economic feasible way, at far locations in the world, where solar and wind energy are abundant. In such scenarios, CCU not only serves as a storage strategy for the low-carbon and low-cost energy, but also facilitates its transport towards Europe, in the form of molecules with a high energy density.

Figure 1: Illustration of ton CO_2 avoided per ton product replaced in given use case (blue bars) and corresponding ton CO_2 avoided per MWh renewable electricity in the production of the renewable alternative [3, 4, 5, 6, 7, 8]

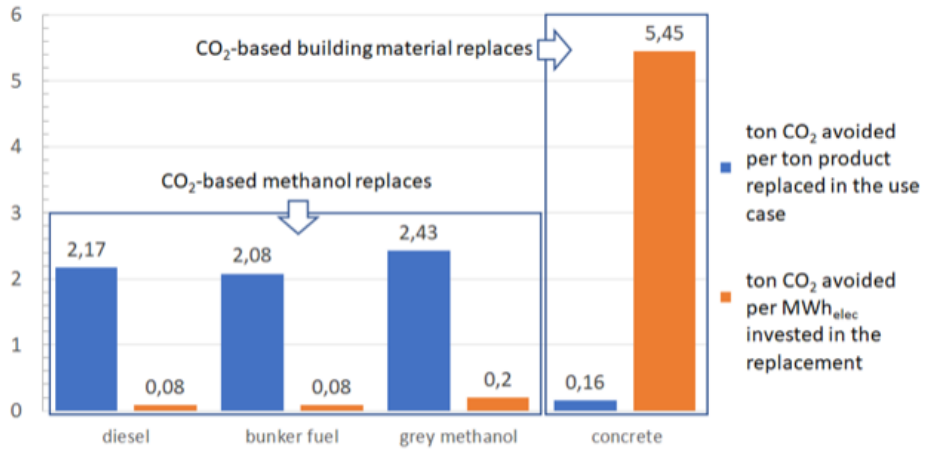
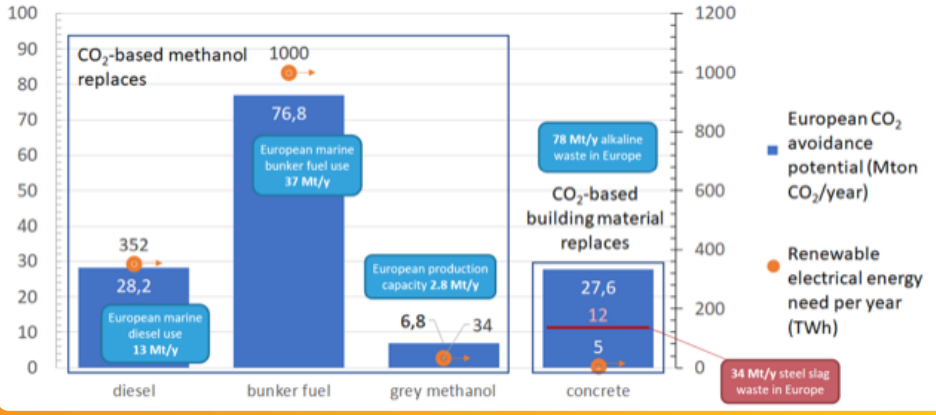


Figure 2: Illustration of the European CO_2 avoidance potential (Mt/y) and corresponding renewable electricity use (TWh) [9, 10, 11, 12]



Indeed, the role of methanol as fuel or platform chemical could then be extended to an 'easy-to-transport' liquid energy carrier. Therefore, VITO concludes that the positioning of CCU within the Sustainable Transition Landscape not only rests on many, different pillars, but also on global trends and the dynamic nature of its boundary conditions. ●

1) Anderson, K.; Peters, G., Science 354 (6309), 2016, 182–183.
2) https://iea.blob.core.windows.net/assets/181b48b4-323f-454d-96fb-0bb1889d96a9/CCUS_in_clean_energy_transitions.pdf
3) CRI process with 75% H_2 prod. efficiency: 11.8 MWh/t MeOH and 1.38 t CO_2/t methanol [see (5)], incl. capture: heat use = 1178 MWh/t CO_2 → 0.44 t/t methanol @ 0.27 t CO_2/MWh, elec. use = 196 kWh/t CO_2, DSP = 0.33 t CO2/t methanol
4) Dechema Technology study (2017): Low carbon energy and feedstock for the European chemical industry
5(per t Carbstone: 480 kg SSS, 480 kg sand, 107 kg water, 92 kg CO_2, drying 63 kWh heat, mixing electricity 27 kWh, curing electricity 2 kWh , footprint extracted from LNE study see below
6) https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf, from CO2 emission factor list
7) https://www.egcsa.com/wp-content/uploads/CO_2-and-sulphur-emissions-from-the-shipping-industry.pdf, https://www.engineeringtoolbox.com/co2-emission-fuels-d_1085.html
8) LNE study (2016): Onderzoek naar mogelijk ondersteuningsbeleid m.b.t. nieuwe toepassingsmogelijkheden van CO2 als grondstof
9) https://www.concawe.eu/wp-content/uploads/2017/01/marine_factsheet_web.pdf
10) https://www.icis.com/explore/resources/news/2019/01/31/10313703/chemical-profile-europe-methanol , 2019 data.
11) https://www.eurofer.eu/assets/Uploads/European-Steel-in-Figures-2020.pdf , total slag utilization 34.1 Mt in 2019
12) https://www.science.org/content/article/industrial-waste-can-turn-planet-warming-carbon-dioxide-stone , extrapolation of 43.5% steel slag contribution on global level to European market of alkaline waste materials (fly ash, cement waste, ...) and taking into account a similar stoichiometry of alkaline waste/CO_2 in building material, as for the Carbstone building material

The key to transport electrification? Smart and flexible solutions

By Michelangelo Aveta, Eurelectric Advisor, Electromobility & Energy Efficiency, Electrification Lead

Decarbonising road transport is one of the key challenges of the European Green Deal. Moving towards carbon neutral mobility by 2050 and ultimately healthier streets will require a strong and concerted set of actions from different industry sectors, policymakers and society.

The electricity industry is fully aware of its role in the decarbonisation of road transport and is committed to playing its part in paving the road to climate neutrality. As we increase the number of electric vehicles (EVs) circulating on our streets, it becomes imperative to ensure that decarbonised electricity powers them. We are on our way to do so: 85% of the power provided in Europe already in 2030 will be coming from zero-emission sources.

Time to cut the carb(s)

Nonetheless, efforts are required from different sectors: zero- and low-carbon power generation and distribution, smart grid solutions and zero-emission vehicles. All these industries need strong signals from policymakers creating the right conditions for investment in zero-emission and carbon-neutral solutions.

This implies a multifaceted range of complementary policy instruments, and ultimately full coherence between all legislative proposals under the 'Fit for 55' package. Four enabling measures must be taken in parallel.

First, setting ambitious emission reduction targets for cars and vans, aiming at 2035 for the phase-out of the internal combustion engine.

Second, rolling-out recharging and refuelling infrastructure through the Alternative Fuels Infrastructure Regulation (AFIR) and the Energy Performance of Buildings Directive (EPBD).

Third, supporting the decarbonisation of transport, by incentivising the uptake of renewables through the Renewable Energy Directive.

Fourth, stimulating demand for zero- and low-carbon solutions through the carbon pricing mechanism in the Emissions Trading System, as well as the greenhouse gas content-based ranking of taxation in the Energy Taxation Directive.

Taking charge

As the number of EVs on the road meets and exceeds targets, the deployment of charging infrastructure needs to keep pace. Minimum binding targets for public charging infrastructure deployment, based on the size of the EV fleet, will prove crucial to reach the number of chargers estimated necessary by Eurelectric and EY : 13 million by 2025, 34 million by 2030, and 65 million by 2035. Nonetheless, higher ambition than the current AFIR proposal is needed to kickstart national investment in the charging network and bring it to where it needs to be to support mass EV adoption.

Despite positive signals given by a European public-charger network expanded by 36% in 2021 compared to 2020, multiple hurdles obstruct infrastructure rollout, affecting the user experience, and slowing down EV adoption. Hence, local authorities should be empowered to address long permitting delays, simplify administrative procedures, and accelerate the installation of public and private charging infrastructure.

With regards to the latter, as 29

million chargers in 2030 and 56 million in 2035 will be residential, the minimum requirements in the EPBD proposal must be ambitious, to make all European buildings EV-ready.

Europeans need a dense, seamless, accessible, and interoperable European charging network. So, what needs to happen?

On one side, it is essential to foster the synchronous ramp-up of electric vehicles and infrastructure. To reach this objective, the fleet-based targets proposed by AFIR will be crucial for the creation of a harmonised and coherent rollout of charging infrastructure across Europe. Also, easing the pre-cabling and installation of charging points in private buildings via the EPBD are our other crucial levers.

On the other, it is crucial to strengthen the existing consumer-friendly and affordable European charging market, without prejudice to the contractual freedom of this market's operators.

Building a consumer-friendly and affordable European charging market requires getting rid of burdensome technical provisions which could undermine our efforts. For instance, retrofits for smart charging capabilities on all EV chargers and retrofit with regards to payment options, can turn into higher prices for consumers due to the costly equipment of payment units.

These requirements need to be removed. Finally, interfering in the contractual freedom between the different market operators even when non-discriminatory access is guaranteed is not well-placed as it does not recognise the complexity of the interactions among e-mobility ecosystem players.

The road ahead

The electricity industry has undeniably a crucial role to play. EV penetration will see electricity demand grow by 11% per year, exacerbating the risk of congestion.

Fortunately, smart, and flexible solutions already exist and will be able to mitigate this risk. Managed charging, either via supplier-managed smart charging or a user-managed response to time-of-use tariffs, will allow for load shifting, dampening the spike in peak load by up to 21%, compared to unmanaged charging.

Additionally, smart meters and grids will increase monitoring capabilities and therefore contribute to a more accurate understanding of where grid modernisation investments are needed or can be avoided. Hence, accelerating the deployment of smart charging capabilities for newly built public and private chargers remain fundamental.

Moreover, energy storage systems provided by EVs and stationary batteries could provide valuable balancing services, reducing charging operations' dependency on local grids. In recognising this role, we should avoid the double taxation of electricity storage.

Finally, a forward-looking regulatory framework for distribution system operators that encourages adequate investment is needed, recognising their key role in the deployment and integration of EV charging infrastructure. If done properly EVs can play a big part in improving grid stability by providing flexibility services such as load balancing, peak shaving, regulation of frequency, and support for the incorporation of renewable energy.

Biomethane's contribution to REPowerEU

By Angela Sainz Arnau (pictured), EBA Communications Manager

On 18 May, the European Commission outlined the details of the REPowerEU plan. It is the categorical response of the EU to break free from Russian energy imports while keeping up with climate targets. The REPowerEU is partly underpinned by the expansion of renewable energy production and use, including biomethane, one of the renewable gases available now and ready for further scale-up.

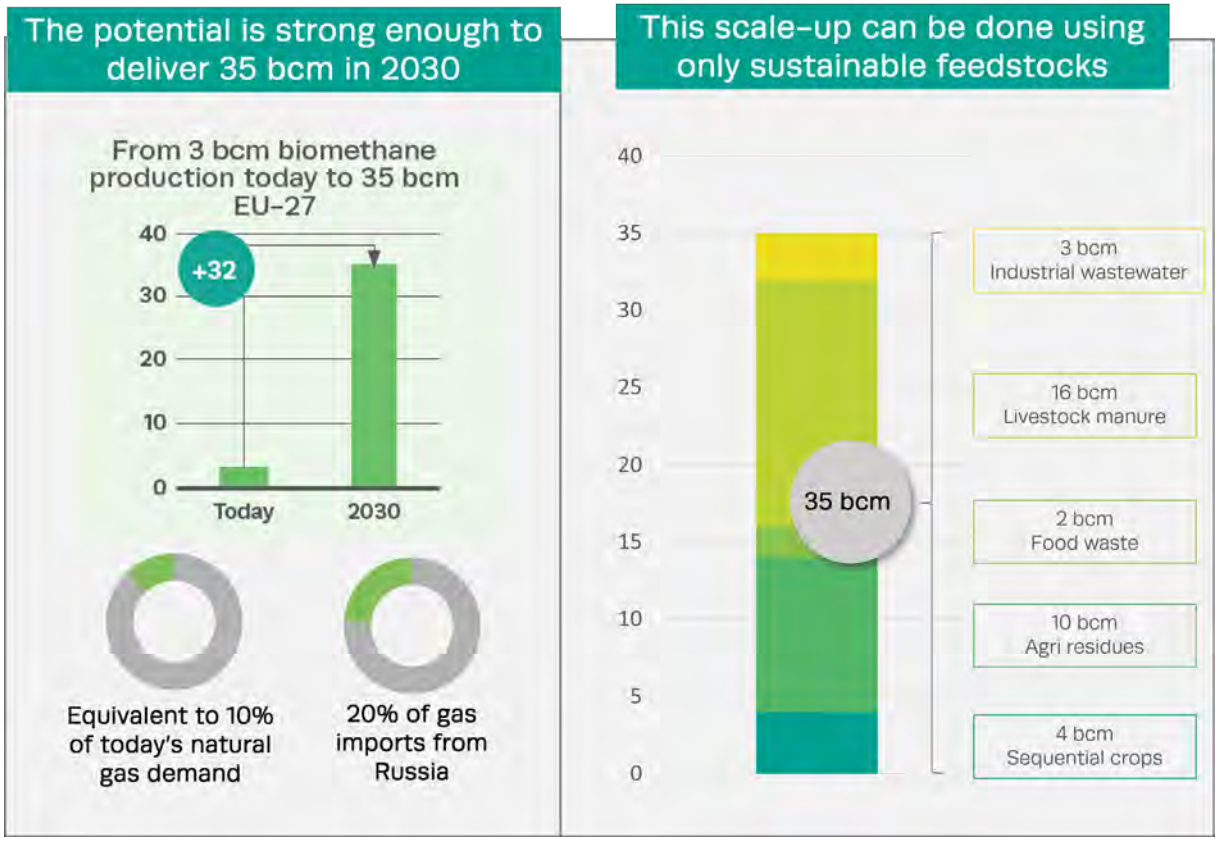
After the communication released last March, the new package of the REPowerEU provides a set of tools to disentangle the EU from Russian fossil fuels, as well as to boost the EU Green Deal and drive investment to a more sustainable and resilient energy mix. The plan is structured around 3 key areas of action: diversification of energy sources, acceleration of the clean energy transition and increase of energy savings.

In terms of legislation, the plan has put forward a targeted revision of the Fitfor55 energy efficiency and renewable targets. It also proposes instruments to accelerate RES permitting and recommendations to facilitate renewable gas injection. This is a stepping stone to the achievement of climate-targets, the circular bio-economy and security of supply across Europe.

Targeted measures for the biomethane sector

The plan will have a direct impact in the development of the renewable gas. The biomethane sector is among the ones prioritized by the European Commission in reaching a more sustainable and sovereign energy system. The REPowerEU introduces a Biomethane Action Plan with targeted measures to promote sustainable production and use of biogas and biomethane at EU and national level, as well as the injection of biomethane into the gas grid. It also proposes the setup of a Biomethane Industrial Alliance to mobilise the entire value chain and a specific target for biomethane production: 35 bcm by 2030. Additionally, the plan puts forward incentives for biogas upgrading into biomethane, support to innovation and direct access to funds, loans, grants and other financial instruments.

"The industrial alliance proposed by the REPowerEU is an essential instrument to steer cooperation between policymakers, investors and the biomethane value chain to drive technological innovation, address bottlenecks, such as cross border trading, and ultimately speed up the expansion of the sector. The targeted investments proposed by the Commission can support the



development of new capacity and infrastructure to accommodate biomethane into the gas grid and create energy communities." Harmen Dekker, CEO of the EBA.

"The targeted revision of EU energy efficiency and renewable energy targets will speed up the green transition and contribute to a more resilient energy system. Shorter and more transparent permitting are a key conditions further development of the biogas and biomethane sector. However, high targets should be accompanied by long-term perspective and clarity on the sustainability requirements for renewable energy production." Giulia Cancian, EBA Secretary General.

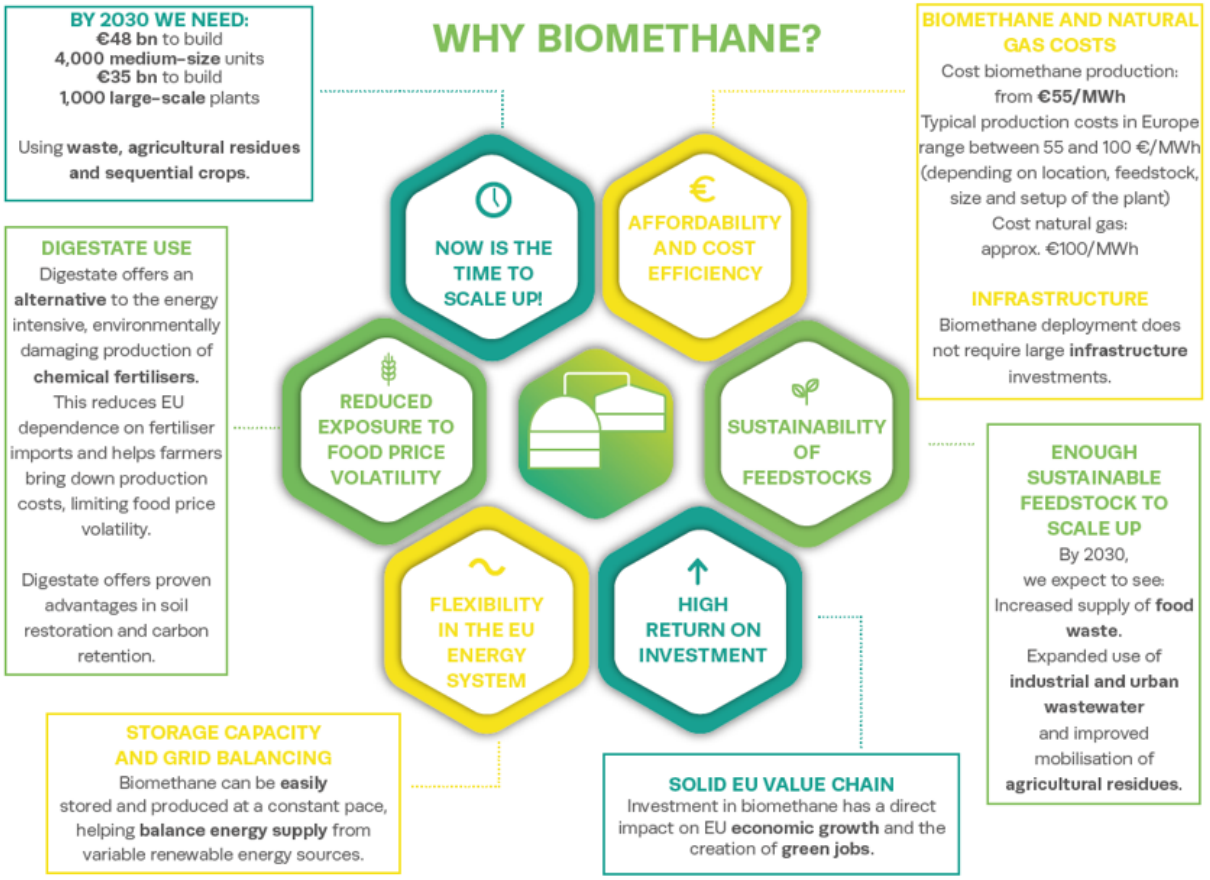
What will this bring to Europe?

The ambition is high, but the target is feasible: Europe is producing today 15 bcm of raw biogas and 3 bcm of biomethane (upgraded biogas) from approximately 20,000 biogas and biomethane plants. By 2030, the proposed expansion will replace 20% of the current fossil gas imports from Russia. Biomethane can be directly injected into the gas grid with no need for large infrastructure investments. It is also a good complement of wind and solar energy, as it can be easily stored and produced at a constant pace, helping balance energy supply from variable renewable energy sources.

Biomethane deployment is also economically viable. Earlier this year, natural gas prices went over €200 and are today around €85. While this happens, biomethane production costs are getting lower. Typical biomethane production costs in Europe range between 55 and 100 €/MWh, depending on location, feedstock, size and setup of the plant.

What will it take to deploy 35 bcm by 2030?

The implementation of the REPowerEU will require a smart combination of investments and reforms starting from this year. The full value chain of biomethane producers, and users, will need to cooperate with public authorities and civil society organisations to identify current bottlenecks and propose solutions for a sustainable scale-up. The sector will need guidance, including relevant legislative and financial support in the coming years. To meet the 2030 target, the EBA foresees the need for additional capital investments. Europe will need €48 bn to build 4,000 medium-size units and €35 bn to build 1,000 large-



scale plants in 8 years. It is a realistic objective: Germany alone built 6,000 plants in 9 years.

Expanding biomethane production is possible using sustainable feedstocks, including waste, agricultural residues and sequential crops. By 2030, the EBA foresees increased feedstock supply for biomethane production from food waste, industrial and urban wastewater and agricultural residues.

Beyond energy security

The expansion of biomethane will not only strengthen energy independence, it will also bring socio-economic and environmental benefits. The EBA estimates that the production of biogas and biomethane has already created 210,000 green jobs in Europe and is saving every year 60 Mt of GHG emissions (CO_2 equivalent).

Additionally, the production of biogas and biomethane is fully in line with the principles of the circular economy. On the one hand, waste is valorised and used as feedstock for energy production. On the other hand, we obtain digestate as a sort of “residue”, that we call co-product. Digestate is an excellent organic fertiliser and its use helps replacing energy intensive, environmentally damaging production of mineral fertilisers.

This reduces EU dependence on fertiliser imports and helps farmers bring down production costs, limiting food price volatility. Digestate offers also proven advantages in soil restoration and carbon retention. This is just an example on how renewable biogas/biomethane production can complement and support sustainable farming.

Biography: Angela is the Communications Manager of the EBA. She coordinates the communication strategy of the association. She has worked in the communication unit of different European or-ganisations and has spent the last 10 years of her professional career in the energy sector.

Her responsibilities include press re-lations, content editing, design of publications, management of EBA’s online presence, communication support to EU projects and organisation of events. Angela holds an Executive Master in Communication and EU Policies and a Master in Journalism from the Universitat de Valencia (Spain).

SFERA-III: Solar Facilities for the European Research Area

The SFERA-III project addresses advanced science challenges and integrated research activities in the field of Concentrating Solar Thermal by integrating key European research infrastructures into an ambitious wide project aiming at offering to the R&D community a new level of high-quality services.

One project, three main activities

The SFERA-III overall objective is to continue with the work done in SFERA and SFERA-II projects and reinforce the sustainability of the activities of the European advanced Concentrating Solar Power (CSP) research infrastructures.

The project offers researchers in the private or public sector worldwide free Transnational Access to the best facilities and expertise in Concentrated Solar Technologies (CST). Applications can be submitted online to https://sfera3.sollab.eu/ for one of the 15 laboratories in Europe, where applicants can request access to laboratories located in a different country than the applicant institution.

SFERA-III partners also develop Joint Research Activities, with the entire spectrum of current CST research themes in line with the EERA Joint Programme:

1. Thermal Energy Storage for CST plants
2. Desalination and solar water treatments
3. Solar fuels production
4. Materials for solar receivers and CST components
5. Linear and point CST technologies.
6. The design of an e-infrastructure aiming to provide virtual access to infrastructures and support the creation of new services.

Additionally, SFERA-III deploys education and training by organizing schools, workshops and webinars as Networking Activities, where upcoming events are announced at the SFERA-III website.

Some key actions

In 2021, SFERA-III has so far provided access to more than 80 projects, and many of them with great success, through the Transnational Access, which shows the necessity towards access to CSP infrastructures in Europe and proves that SFERA-III is a solid network to support the European solar energy community.

SFERA-III is leading excellent Joint Research Activities that aim to increase in the efficiency of both multiple-effect distillation and membrane distillation technologies and improve the process reliability for water treatments and disinfection; to improve testing procedures for chemically active materials used in solar thermochemical fuel production technologies, as well as standard KPIs for assessing the performance of solar fuel production reactors; to increase of accuracy in optical, thermal and mechanical measurement services, allowing better optimization of components of the solar field and receiver.

Finally, SFERA-III participates in major events such as the SolarPACES Conference and organises events such as free Short-Term Trainings and Trainings for Industries, More information is available on our website, Linkedin: @SFERA III – CSP Facilities for the European Research Area or and Twitter @H2020CSP.

Coordinated by Ricardo Sanchez from CIEMAT-PSA, SFERA-III brings together a consortium of 15 partners from 9 countries and runs from 2019 to 2023.

This project has received a €9.1 million EC grant from the European Union's Horizon 2020 research and innovation programme under grant agreement No 823802

How national energy regulators can promote gas decarbonisation with the help of hydrogen

By Pedro Verdelho, CEER Vice-President and Chair of the ACER and CEER Gas Working Groups

In the past few months, Europe's energy sector has absorbed several heavy shocks which have sent energy prices skyrocketing and sparked unprecedented concerns over energy security in the EU. In response, the European Commission has come forward with a new set of legislative proposals, the REPowerEU Plan, which will restructure the energy sector as we know it and reaffirms the EU's long-term objective of decarbonising the energy sector.

However, in order for the energy transition to be successful, an electricity-only approach will not be sufficient. It will have to go hand in hand with the integration of renewable and low-carbon gases, including hydrogen, into Europe's energy mix.

A new player in a changing market

While policy objectives such as the development of hydrogen are set by policymakers, energy regulators can provide their support as defined by their mandate. One of their key tasks is to allow new players to enter and compete in the market, while at the same time maximising system efficiency.

Differently from recent years, when market integration was pursued in relatively stable circumstances, regulators now face a sector undergoing profound changes. Guaranteeing stability for investors and security of supply for consumers becomes even more challenging in this context.

Here are three ways energy regulators can help support the deployment of hydrogen in our energy markets, with the aim of advancing toward decarbonisation targets and addressing emerging challenges.

1. **Enable dynamic regulation and flexibility**
   The hydrogen sector is still in its early development phase and its regulation requires a sufficient level of flexibility and subsidiarity to allow innovation to take place. At the same time, the current heterogeneity of energy mixes across Europe has to be taken into proper consideration. This dynamic approach should also ensure a regulatory framework that enables markets and competition to work properly, ensuring efficient price signals and robust consumer protection – as stated in CEER's 2022-2025 Strategy.

   In other words, energy regulators' main task is to promote the technical, regulatory and market conditions that will enable hydrogen's integration into the energy system. The specific regulation of the hydrogen sector will depend on the future location of production and consumption facilities, and on how the corresponding network infrastructure will develop. Regulators have the responsibility to identify and overcome any possible market barriers and to provide a clear framework to support the development and integration of such installations.

2. **Ensure efficient system development and provide certainty for investors**
   In order to preserve the affordability of energy services for both industrial and household consumers, energy regulators must promote the emergence of competitive markets, and achieve efficiency in the energy system as a whole. Their role in overseeing the effectiveness, integrity and transparency of the market is key to building trust in the competitive process and fostering market participation. Non-discriminatory

access to network infrastructure is also fundamental to promoting market integration.

To strike the right balance between enabling cost-effective development of the new hydrogen market and providing stability and certainty for investors, regulators should design efficient and stable cost-recovery principles for infrastructure. At the same time, these principles should not prevent the adoption of market-based approaches and the possibility of competition among market players where possible.

3. **Empower and protect gas consumers**
The transition to a decarbonised energy system must safeguard reliable and affordable energy services to consumers. However, the concept of affordability extends beyond energy regulators' powers and must be addressed, among others, through social policies that do not distort energy markets, whilst promoting consumer awareness and protection.

There are a range of policies that can be influenced and monitored by energy regulators, such as the right to freely choose a supplier, and the pursuit of competitive, consumer-centred, flexible and non-discriminatory markets for gases. Along the same lines, the European Commission has proposed to mirror certain core consumer protection and empowerment rules from the electricity sector to the gas market (including hydrogen). The proposals take into account the expected use of hydrogen by different consumer groups, assuming that the hydrogen sector will initially concentrate on industrial and/or transport use, rather than household use.

In summary, national energy regulators have an important role to play in enabling and facilitating the achievement of the energy transition. This role is underpinned by the protection of the consumer interest. They must also ensure a gradual and dynamic regulation of the hydrogen sector to enable this new energy vector to contribute to the EU's decarbonisation goals, whilst reinforcing market principles and strengthening security of supply for all consumers.

The Council of European Energy Regulators (CEER) is a partner of the European Sustainable Energy Week (EUSEW)of which European Energy Innovation is a media partner. Registrations for this hybrid event are now open – on-site spots are limited.

Short biography/online profile:

Pedro Verdelho serves as Vice-President of the Council of European Energy Regulators (CEER) and chairs both the CEER and EU Agency for the Cooperation of Energy Regulators' (ACER) Gas Working Groups since 2019. Mr Verdelho also serves as the President of the Board at the Portuguese Energy Regulatory Authority (ERSE – Entidade Reguladora dos Serviços Energéticos). He holds a PhD, Master's and Undergraduate degrees in Electrical Engineering from the Instituto Superior Técnico in Lisbon.

Recommended links

1. ACER-CEER Position Paper on the Key Regulatory Requirements to Achieve Gas Decarbonisation
2. ACER-CEER White Paper on the Regulation of Hydrogen Networks
3. ACER-CEER White Paper on Regulatory Treatment of Power-to-Gas
4. The Bridge Beyond 2025

Innovative financing for building renovations using Pay-for-Performance

Today, buildings account for approximately 40% of Europe's final energy consumption, which can be significantly reduced by implementing energy efficiency (EE) measures coupled with renewables such as PV panels in buildings and automation systems that respond to the needs of the power grid. Despite the direct benefits related to these measures, renovation rates remain low due to the difficulty of attracting investments.

Benefits for the Power System Operators

Large scale renovation programmes generate multiple benefits, including avoided network and capacity extension costs for Power System Operators and the achievement of energy and carbon emission reduction goals for public authorities. Power System Operators or other public entities could thus be inclined to support building renovations in order to reap system benefits. Such a move would further increase the bankability and attractiveness of energy efficiency and flexibility investments for third party investors.

Using Pay-for-Performance to capture system benefits

To help the market take advantage of this approach for the purpose of reducing building's energy consumption and securing the stability of the power grid, the EU-funded SENSEI project explores how to reward energy efficiency in buildings as an energy resource and/or grid service. It examines how aggregating individual renovation projects (financed through Energy Performance Contracting agreements) towards a portfolio of buildings can offer their cumulative demand reduction as a service to the grid. This is based on the Pay-for-Performance (P4P) approach, where indirect beneficiaries of renovation measures (e.g. TSOs) would distribute payments to Aggregators of renovation projects, based on the measured reductions or shifts of energy demand at the grid level. This measurement of energy savings can happen with advanced Monitoring & Verification algorithms of tools sometimes referred to as M&V 2.0 such as CALTRACK, IPMVP, or EENSIGHT. The use of M&V 2.0 creates numerous possibilities in the field including the accurate monitoring of energy savings from public renovation programmes, the automated reporting of savings from Energy Efficiency Obligations, or the ability to set up contracts and financial products linked to achieved energy efficiency and flexibility services.

The SENSEI project has therefore developed a model based on Pay-for-Performance (P4P) depicting how renovation projects can be aggregated to attract interest from financial institutions that wish to invest in large scale projects. A P4P programme could be found in many configurations, but in essence is a multi-actor arrangement in which financial compensation is rewarded based on metered energy savings.

Financing for renovation projects

In the EU, we mostly see energy retrofits financed through credit financing, leasing financing, project financing, cession and/or forfaiting on a project-by-project basis. As more EE finance projects become 'bankable' through aggregation due to (i) the derisking of investments through guarantees of financial payback of EE measures for investors or public subsidy providers at the programme level and (ii) the generation of income from providing benefits to the power system thereby improving the business case of energy retrofits in buildings, innovative energy efficiency contracting and financing options such as P4P may find fertile soil.

In order to understand the basic European P4P model suggested by the SENSEI project, one must become familiarised with the main actors involved, including Aggregators, ESCOs, Economic Agents, the Public Authority, the System Operator, the Fund and the Private Third Party Investors. The configuration of actors proposed by the project foresees Aggregators at the center of the model, coordinating the realization of renovation projects in different sectors, for which they receive an agreed remuneration (e.g. EUR/kWh or EUR/tCO2) from the Public Authority based on the Aggregator's offer and dependent of metered reduction.

As the Aggregators receive public money (A), a public procurement and tendering procedure must take place. The Aggregator with the best offer for a sector will implement the P4P programme. With this, the aggregator funds an ESCO's investment in energy efficiency projects (B), and thus should conclude a funding agreement with the ESCO. The ESCO in turn concludes an energy performance contracting agreement with an Economic Agent (e.g. a building management company or the building owner) for the specific project (C). This lays out the minimum energy cost savings that the ESCO

guarantees, via a bonus or malus system. The building owner does not have to fund the investments of the energy efficiency project and only pays the ESCO a yearly remuneration, composed of repayment, maintenance and management fees and a bonus/malus fee.

The Public Authority capitalizes the Fund at the required equity level, especially at the start of the Fund in order to attract Private Third-Party Investors and financial institutions at senior or subordinated debt levels. The Fund can be part of the Public Authority or can be an autonomous public entity found by the Public Authority.

The Public authority acts as primary shareholder and receives a double dividend (D), namely the financial dividend and policy dividend via energy demand or CO_2 reduction. Additionally, it holds the starting equity of the Fund and possible additional debt. Private Third Party Investors finance the Fund (E) and receive repayment according to the risk level and market conditions. Lastly, Fund managers provide general corporate services to the fund such as accounting, taxes, auditing, asset and liability management, as well as tasks related to the EE projects' funding position.

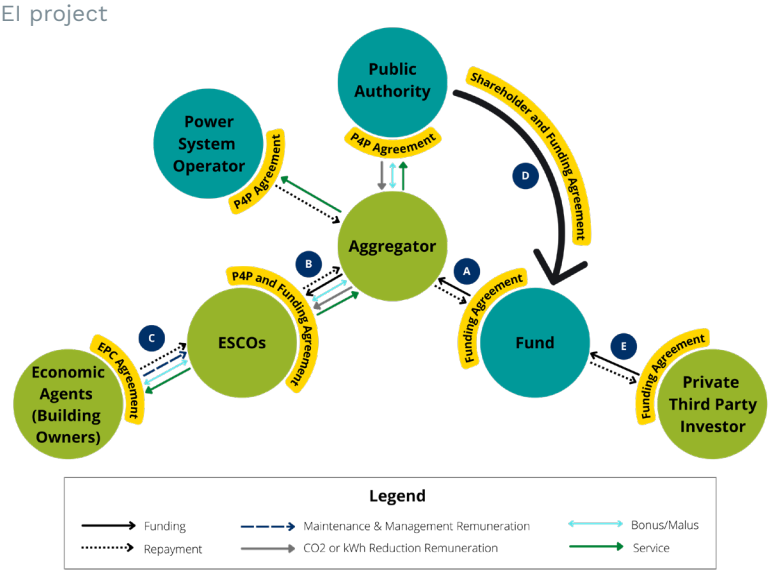
Within the P4P model, there is a certain degree of flexibility in terms of funding opportunities, such as direct funding of Aggregators by Private Third Party Investors, of ESCOs by the Fund, or of Economic Agents by the Fund. The feasibility of a particular financing programme often depends on a combination of factors, from project size and anticipated payback period to utility incentives/rebates and security features.

A stepwise approach to piloting Pay-for-Performance programmes

The above-mentioned advancements in metered savings and energy efficiency project finance create the possibility of setting up innovative financing programmes based on the Pay-for-Performance approach. These programmes would help increase renovation rates and make buildings more responsive to the needs of the power system. Based on experience from the US, where Pay-for-Performance programmes have been running for about a decade, the SENSEI project proposes a process for establishing the first EU Pay-for-Performance pilots using a stepwise approach:

- Securing high-level commitments to pilot EE programs from actors such as ministries, public authorities and power system operators;
- Facilitating the design of a P4P programme including all market parties involved, role descriptions and contractual and financial flows in collaboration with a competent managing authority and/or a system operator;
- Selecting an existing energy efficiency programme with plentiful availability of energy performance data for which energy savings are conventionally calculated and rewarded;
- Using performance data to estimate probable energy savings if the programme had been organized as a P4P programme and analysing the results to improve the initial P4P model;
- Launching tenders for EE projects with a compensation structure bases on metered savings; and
- Setting up a first P4P pilot programme by upgrading an existing EE programme in collaboration with various stakeholders.

Explanation of the P4P programme and financing model proposed by the SENSEI project



To learn more about the benefits and opportunities of Pay-for-Performance schemes in the EU, please visit SENSEI's website at https://senseih2020.eu/, or contact SENSEI's project coordinator Filippos Anagnostopoulos at filippos@ieecp.org.

This project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement No 847066.

PV – EV: A powerful duo to make Europe drive clean

The three keys for a join deployment of solar power and electric vehicles

Electric vehicles (EVs) deployment needs to significantly accelerate in the coming years. However, challenges to its deployment (lack of distribution grid availability, low consumer engagement, challenges to the deployment of the infrastructure during renovation, etc.) show very close similarities with those posed by the deployment of distributed photovoltaic solar power plants (PVs). Therefore any successful solutions should benefit both EV and PV deployment.

The uptake of EVs, together with PVs deployment (mainly via rooftop solutions), opens **an important opportunity for unlocking a European 'prosumer' potential**.

'Prosumer' refers to a model where individuals manage their own energy supply and consumption. Prosumer models can become a powerful enabler of Renewable Energy Sources (RES) integration, including photovoltaic solar power plants (PV). The joint integration of PV and EV will also have a significant impact on citizen carbon footprint (for their home energy and transport), by ensuring EV charging take place during periods of highest renewable content.

The rapid, massive uptake of EVs has the potential to become both **a flexible asset for grid management and an opportunity for prosumer business models**. EVs will also provide a boost to increasing the cost-effective penetration of renewable energy - like PV - within the electricity system. The combination of EVs, their batteries and smart-charging functionalities as sources of ancillary services for the distribution grid will bring clear benefits, in terms of RES integration, for both individual and collective projects. Electromobility and renewable energy therefore offer a win-win partnership. The benefits of smart and bidirectional charging in regions with high solar capacities are clear: when sun sets and falls, EVs can optimise consumption and grid constraint and avoid polluting at peak times.

Recent European legislation, through the 'Fit for 55' package, leverages

these opportunities, notably in the revision of the Renewable Energy Directive, but there is still more that can be done to increasingly make cars in Europe run on renewable energy. To enhance synergies and solve common challenges between EVs and PV, the Platform for electromobility recommends:

Developing an enabling framework for EV drivers to become prosumers

A significant share of EV drivers (30-50%) charging at home are usually interested in installing PV panels as part of their broad decarbonation objectives and to maximise their contribution to climate change objectives.

This offer considerable potential for encouraging prosumer behaviour, but in order to realise this potential, an appropriate regulatory and technological framework is needed. To make this a reality, the EU should develop a distributed energy strategy capable of empowering and boosting prosumers with solar PV, battery and EV, and, at the same time, ensure that the electricity distribution grid can connect distributed RES. It should be noted here that the adoption of these distributed loads does not pose a problem for the distribution grids in the short- and medium-term, since the most significant impact will occur principally in very specific areas and at a later stage, when greater investment will be needed.

Rooftop solar, EVs and other local flexibility resources will only realise their full potential once they are able to also provide grid services via flexibility markets. This will require the full implementation of the Clean Energy Package across Europe. However, because this is not yet the case – despite the deadline expiring – the EU should look into options for applying greater pressure on Member States. A full implementation would allow entry into the next phase, which will see the designing of local flexibility markets, together with the European DSOs, to find appropriate flexibility signals for EV users.

Ensuring an enabling framework for solar PV deployment

To support the use of renewable energy in electric mobility, an enabling framework must be build. PPAs contracts must be facilitated, through clear frameworks and financing support – the guidelines on PPAs will be critical here. In addition, the stability of investment signals and market rules will be key.

In addition, permitting still pose significant barriers to solar PV project development. Here, the RED II provisions must be implemented, and the Commission should support the exchange of best practices.

Helping transition to needed new skills

With the development of new economic sectors, boosted by EV uptake such as PV industry, the transition to electromobility does not pose a threat but rather an upskilling opportunity for workers. New skills will indeed be needed, both to adapt the manufacturing of vehicles and to install the required infrastructure across Europe. We recommend the launch of a Skills Initiative on Solar installers, in synergy with CP operators and installers, as well as a Distributed Energy Installers Skills Initiative.

From a forward-looking perspective, it will be possible to identify specific initiatives for integrated retrofits.

In highly specific use cases, new approaches could be explored to reduce the installation and integration cost related for the combined installation of Solar PV, Home Storage and V2X charging.

Early-stage experience has shown that the integration of AC-DC conversion technologies across the different voltage levels could be a solution for reducing PV and EV integration costs in certain use cases, such as isolated houses or rural areas (up to 30%-50%). From that perspective, we would suggest identifying how the application cases can be addressed through Horizon Europe or similar calls in the areas of R&I identified above.

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European Urban Mobility Days 2022 to address key mobility challenges

Cities face critical challenges on the path to sustainable mobility, yet they also hold the key to action. More than 70% of Europeans live in cities, and urban areas account for around 23% of EU greenhouse gas emissions from transport.

At the same time, European cities are home to some of the boldest and most innovative solutions for passenger and freight transit. This year's edition of the Urban Mobility Days will address these key challenges.

From 20 to 22 September, the city of Brno (Czech Republic) will host the Urban Mobility Days 2022 event. This biennial conference, jointly organised in 2022 by the European Commission, and the Czech Presidency of the Council of the EU, is a major event in the urban mobility calendar. Participants will have the change to meet in person, whereas at the same time there will be a virtual option available.

This edition's theme is 'Moving people and goods more sustainably' and, across three days, participants will traverse the length and breadth of sustainable urban mobility, examining the latest challenges and solutions.

Urban Mobility Days provides a unique forum for policymakers, local authorities, academics, NGOs, urban transport practitioners, and urban planners to connect and discuss the way forward for a sustainable, innovative, and equitable future for Europe's urban mobility.

As 2022 is the European Year of Youth, Urban Mobility Days puts the spotlight on young voices and views, to involve Europe's young people on the path towards climate resilience.

Plenary sessions will cover topics such as 'active modes and public transport first: the core of EU urban mobility and the way forward to reduce oil dependency' and 'Funding and financing climate-neutral and energy-efficient urban mobility'. Other topics included in the programme are smart urban mobility, zero-emission urban logistics and the power of behavioural change.

To link the European Commission's urban mobility initiatives, this year's conference coincides with EUROPEANMOBILITYWEEK, which takes place from 16-22 September every year in over 3000 towns and cities in 50 countries worldwide.

To register, visit here: www.eumd.org

“We are increasing the sustainability of how we move around in cities from several angles to tackle the different challenges”

Interview with Herald Ruijters, Director responsible for Investment, Innovative & Sustainable Transport in DG MOVE

In consideration of this year’s UMD 2022 theme on moving people and good more sustainably, how can we ensure sustainable movement takes place also beyond cities (e.g. between European cities and countries)?

We are increasing the sustainability of how we move around in cities from several angles to tackle the different challenges involved: congestion, greenhouse gas emissions, air and noise pollution, road safety, and pressure on urban space.

Last December, we presented a new EU Urban Mobility Framework which emphasises active mobility and public transportation along with Sustainable Urban Mobility Plans as well as a proposal for a revised TEN-T Regulation.

The new TEN-T Regulation will significantly step up efforts to build a sustainable, seamless and resilient Trans-European Transport Network of the highest quality.

Cities on this network are the starting point or final destination for passengers and freight. They are points of transfer within or between different transport modes, and points of last-mile connections. We need to avoid capacity bottlenecks and poor connectivity within them.

The European Commission proposes that each of these cities should develop a Sustainable Urban Mobility Plan (SUMP) by 31 December 2025. The plan should set out how the city will improve accessibility to the urban area, and mobility within it, for people, businesses and goods.

We hear from cities that people often know that sustainable mobility is beneficial for a variety of reasons, including environmental. The challenge remains, however, in getting people to actually change their habits and travel more sustainably. What advice do you have for cities in how to better tackle this challenge and accelerate the rate of this behavioural change?

EUROPEANMOBILITYWEEK (16-22 September 2022) is an annual awareness-raising campaign on sustainable urban mobility, which provides towns and cities across Europe, and indeed further afield, with an opportunity to try out innovative sustainable urban mobility planning measures, promote new infrastructure and technologies, measure air quality, and get feedback from the public.

Through providing participating towns and cities with an opportunity to test and implement sustainable mobility solutions, the campaign helps facilitate a behavioural shift toward sustainable urban mobility modes, in turning helping reach the EU Green Deal’s carbon-neutrality target. At the same time, it is crucial to involve all stakeholders in planning of sustainable urban mobility solutions, as this involvement and consultation is an integral part of the SUMP approach; if done properly, acceptance and ownership of solutions are much higher, inducing behavioural change.

In parallel to awareness raising campaigns, public and private organisations such as companies, hospitals, schools or tourist attractions, should be encouraged to develop incentive schemes and actions that promote the most sustainable forms of mobility.

Energy System Optimisation: the next level in the energy transition

By Kees van der Leun (pictured), Common Futures

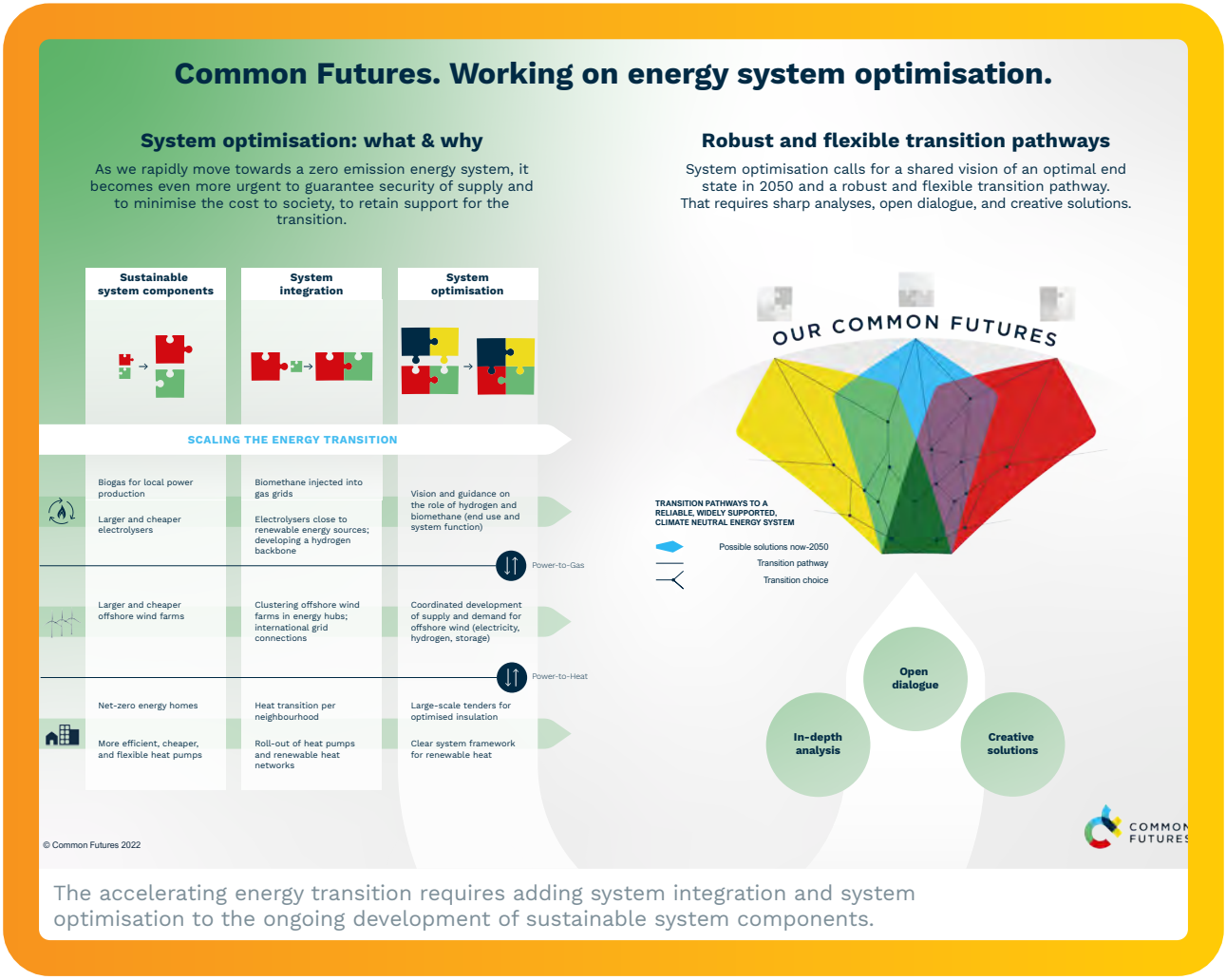
Now we are accelerating the European energy transition towards zero emissions, it becomes increasingly important to guarantee security of supply, minimise societal cost, maximise societal benefits, and retain public support for the transition. For that, we need to connect developments on the supply and demand side, and work on energy system optimisation!

So far, we have been working on developing the necessary components for a sustainable energy system. Important technologies like solar PV and wind power have already reached a mature stage, producing zero-emission electricity at low cost, and ongoing development still keeps improving those. Other technologies such as electrolysis and industrial electrification are still in their early stages of development.

As the components grow bigger, they start to interact with other parts of the energy system. We have only just begun to connect those developments via system integration. And now we already need to move on to add energy system optimisation, enabling and steering developments from an overall view on the net zero-emission energy system that we'll need within a few decades. I will show what this means in three big areas of the energy transition.

Renewable gases: putting biomethane and green hydrogen to use

Biomethane and green hydrogen can be a great complement to (renewable) electrification, e.g. in



The accelerating energy transition requires adding system integration and system optimisation to the ongoing development of sustainable system components.

industrial processes and hybrid heat pumps. And we will need them as fuels for the dispatchable power generation that we need when there's little wind and solar electricity too. So far, most biogas installations produce baseload electricity and some heat locally; now we need to move on to purify the biogas to biomethane and use our grids to enable full use of the value it can have for the system, including its storability. At the same time, we are scaling up electrolysers for the production of green hydrogen; the next step is to site them close to large sources of renewable electricity production, to help integrate all that energy into the system.

The final step of energy system optimisation here means developing a vision on the optimal role of hydrogen and biomethane in the system, and steering towards that.

Integrating offshore wind

There has already been a great development in scaling up offshore wind farms, and making them cheaper, which has made them into workhorses of the energy transition in Europe. Next step is to cluster offshore wind farms in energy hubs, possibly including offshore electrolysis, and to connect those internationally. The same connections can then serve as additional interconnectors between countries, much needed in an electricity system largely based on wind and solar.

In the system optimisation step, it is all about a coordinated development of supply and demand, for electricity and hydrogen, taking into account the options to store energy for weeks and months.

Emission reduction in buildings

Valuable components for the energy transition in buildings have already been developed, such as insulating glazing, insulation systems for roofs, walls, and floors, and more efficient, affordable and flexible heat pumps. Given the many millions of buildings that need an energy renovation, however, much more is needed to reduce their cost and ease of installation.

In a system integration step, concepts for whole housing districts are being developed, with a roll-out of heat pumps and renewable district heating. Hybrid heat pumps come into play as well, to take away the need to renovate the building first, and to reduce the additional power system investments associated with high winter peak demand.

The optimisation step will require new approaches, such as large-scale tenders for optimised insulation and clear frameworks for the development of sustainable heating, taking local, regional, and national system considerations into account.

All together now

For the overall energy system transition, we will need to apply this optimisation to the system as a whole. To take the three examples above: the vision on the optimal role of renewable gases will have an impact on the role that hydrogen plays in integrating offshore wind, and on the role that hybrid heat pumps play in achieving emission reduction in buildings. Another major factor will be the transformation of heavy industry to reduce its emissions to near zero; choices made here will have a big impact on electricity and hydrogen demand. Reaching an optimal system will require much more coordination between sectors and between member states than ever before.

There is a lot to gain, in terms of societal costs, societal benefits, and in the end, the speed at which we succeed in getting to net-zero emissions!

Kees van der Leun is a Digital Ambassador of the European Sustainable Energy Week (EUSEW)of which European Energy Innovation is a media partner. Registrations for this hybrid event are now open – on-site spots are limited.

Short biography/online profile: Kees van der Leun has been an energy transition consultant for over 35 years, after joining the start-up Ecofys in 1986. In recent years, he has focussed on strategies for energy system integration, including work for Gas for Climate, the European Hydrogen Backbone, and North Sea Wind Power Hub. Last September, he founded the new consultancy Common Futures together with Daan Peters. The growing team fully focusses on energy system optimisation.

Recommended links

1. www.ehb.eu
2. https://offshorewind.rvo.nl/blog/view/76e606cb-45c6-4fd3-85d8-77c768ce34d6/study-system-integration-offshore-wind-2030-2040-in-english
3. https://www.commonfutures.com/en/insights/commission-announces-groundbreaking-biomethane-target-repowereu-to-cut-dependence-on-russian-gas

Celebrating 10 Years

european energyinnovation

Connecting Europe's Stakeholders in Energy and Transport

EUSEW Special Issue – Autumn 2022

EU Sustainable Energy Week (EUSEW) will take place on 26-30 September 2022 and European Energy Innovation will be one of the official publications for the event.

This special edition of the magazine will focus on the energy transition, digitalisation, energy efficiency, renewables and decarbonisation. It will include key editorial contributions from MEPs, senior EU Commission officials and industry experts.

To keep our readers fully informed on the Week's events, sessions and meetings, the full EUSEW programme will be published in this issue.

OCEANERA-NET COFUND

Celebrating five years of collaborative innovation in ocean energy

After five years of supporting the European ocean energy sector to carry out collaborative innovation, the OCEANERA-NET COFUND project comes to an end in June 2022. Led by Scottish Enterprise the project has partners from across Europe – Basque Energy Agency, Region Bretagne, Sustainable Energy Authority of Ireland, Region Pays de la Loire, FCT (Portugal), CDTI (Spain) and the Swedish Energy Agency.

OCEANERA-NET COFUND will conclude with a Final Conference and on-line events in June 2022, to include presentation of project results and roundtable discussions on key learnings and future collaboration. Look out for the Final Conference, planned to take place at the Seanergy Conference in Le Havre, 15-17th June. Details will be published on the OCEANERA-NET COFUND website when dates are confirmed.

The 9 demonstration projects under the Co-funded Joint Call 2017 have now been completed These projects were awarded €7.8m, including €2.6m from the EU through Horizon 2020, co-funding with national and regional funds, supporting €14.5m of investment. Projects funded under the Second Joint Call, launched in January 2019, are ongoing.

The projects have allowed leading ocean energy developers in wave, tidal and ocean thermal technologies, together with supply chain companies, test centres and research institutes, to carry out key research and demonstration projects. These have both contributed to development, improved performance and reduced costs of the generation technologies and created new products and tools which can be used across the sector and beyond.

For example, Scottish tidal turbine developer Orbital Marine Power has worked on two key elements for the Orbital O2 2MW commercial demonstrator turbine, now deployed at EMEC and demonstrating great results. On TOPFLOTE, Orbital worked with global drivetrain solutions provider SKF to deliver a controller for floating tidal turbine, facilitating a significant increase in yield. On SEABLADE, Eire Composites have manufactured and evaluated new blades for a floating tidal energy converter, testing to validate a 20-year design life, now being tested on the O2.

In terms of enabling technologies, Brittany-based tidal company Sabella led the CF2T project to design and test an innovative hybrid foundation, combining steel and concrete. UMACK, led by Swedish wave energy developer CorPower Ocean, has develop a generic anchor-foundation-mooring-connectivity system, applicable to a wide range of wave and tidal energy converters, with potential for use in floating offshore wind. Similarly, TIM, led by Geps-Techno, has worked on single point moorings systems, including developing the design process and two new mooring solutions, for floating production plants and offshore monitoring buoys.

RESOURCECODE, led by the European Marine Energy Centre, has developed an open access, high resolution, North West Europe wave energy resource dataset, software toolbox and on-line portal. This will provide designers with the information and tools needed to push forward new marine renewable energy projects, improving cost, quality and time to market.

For further information, please contact:
Details of all the projects can be found on https://www.oceancofund.eu/
Karen Fraser, OCEANERA-NET COFUND Coordinator
karen.fraser@scotent.co.uk

Sustainable networks can build circu

By Prof. dr. Wouter Schroeyers (pictured), Associate Professor, University of Hasselt in Belgium

Facilitating networking is at the core of COST Actions. The collaborations and connections established are often very long-lasting and the starting point for sustained threads of research activities.

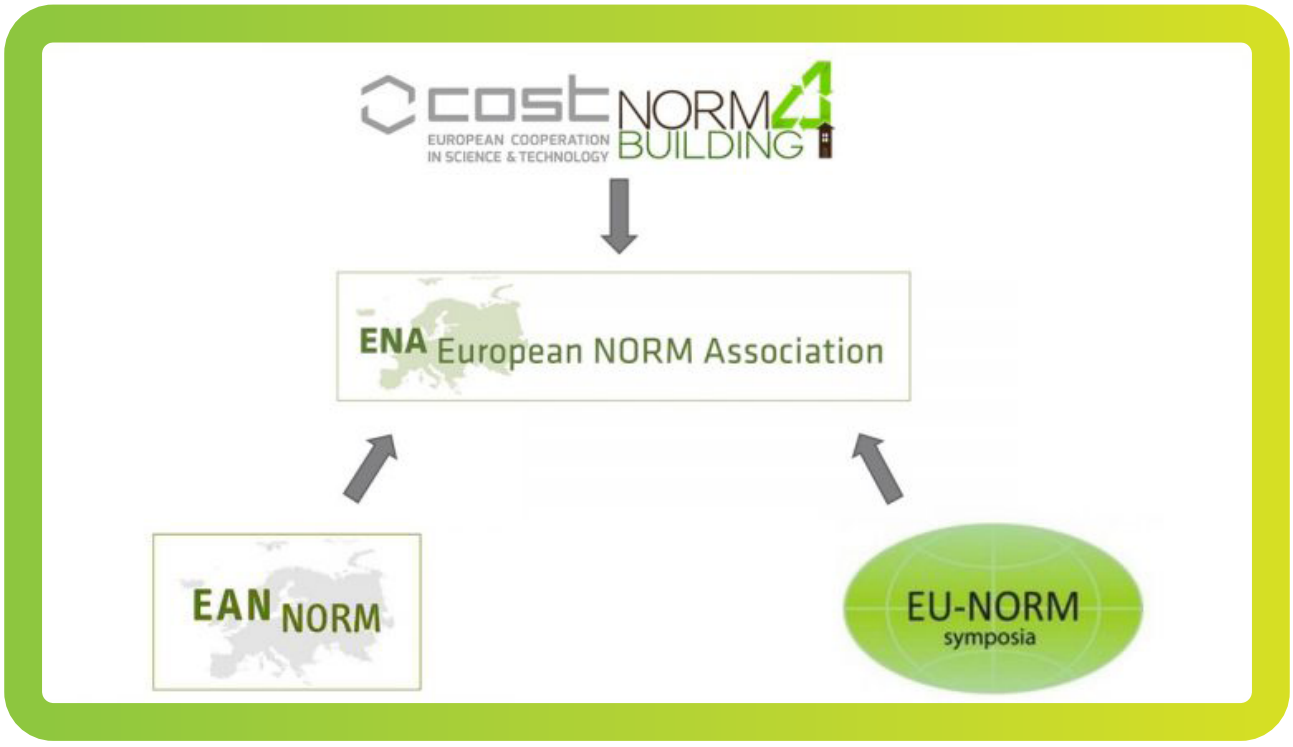
Introducing COST Action NORM for Building materials (NORM4BUILDING)

This Action stimulated a continuing collaboration between scientists, industry, and regulators to gather appropriate knowledge, experiences and technologies, and boost research on the safe reuse of waste streams containing enhanced concentrations of Naturally Occurring Radioactive Material (NORM).

In the context of establishing a viable circular economy and the European Green Deal, there is growing interest in the development of new construction materials from a range of industrial waste streams. However, any recycled waste materials must be safe for reuse and many processes concentrate toxic or harmful substances in their waste streams including NORM.

Professor Wouter Schroeyers, the Chair of the Action from the University of Hasselt in Belgium describes two main research outputs from the Action.

"Firstly, we published a holistic evaluation of NORM reuse practices in a book 'Naturally Occurring Radioactive Materials in Construction' with contributions from over 50 COST Action partners," he explains. "And secondly we developed a semi-automatic data mining tool for gathering information and established an accessible, updatable database containing all the available knowledge in the field."



ular society

> *"There is now much more connection between industry and research."*

In addition, the main continuing outcome of the Action was the formation of a new European NORM Association (ENA) through the merger of two existing networks that was effectively catalysed by the Action's activities.

The establishment of the new association was a significant step. "The size of the organisation means it can have more impact. ENA provides a clear, single voice towards the legislators to enable them to better understand feasible reuse options for NORM," says Wouter.

Concrete solutions

Under the umbrella of ENA, research initiated by NORMFORBUILDING is continuing. "The Action stimulated lots of new research and collaborations resulting in a big boost of publications in the field," explains Wouter.

The main findings from the Action are leading to new types of production processes, complemented by suitable separation and pre-treatment techniques, that are providing novel materials for the construction sector including research towards new types of phosphor-gypsum-based construction materials.

"There is now much greater connection between industry and research. Industry comes to us for specific solutions and there is a much more integrated approach," comments Wouter. "And we want to go further: in Belgium, currently, we are making a first attempt at enhanced landfill mining that could produce safe and high-quality materials from an extremely heterogeneous waste source."

2021 saw the launch of the RadoNorm project under the EURATOM Horizon 2020 programme involving several of the Action's partners. The project aims to answer open questions related to radon and NORM exposure of humans and the environment and provide a range of solutions for radiation risk reduction that should be widely acceptable to society.

And in 2022 the NORM-X event, the largest international NORM conference co-organised by ENA, took place in The Netherlands. "This featured the future of residues in the circular economy and the impact that the Action – and the continuing work of its network – is having," concludes Wouter.

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Additional Information

Read more about COST Action "TU1301 – NORM

An industry starting to wake up to the cyber threat

Cyber-attacks on industrial sectors are becoming more common, complex, and creative as critical infrastructure becomes increasingly networked and connected. Energy companies have been tackling IT security for several decades. However, securing operational technology (OT) – the computing and communications systems used to manage, monitor and control industrial operations – is a more recent and increasingly urgent challenge.

As OT becomes more networked and connected to IT systems, attackers can more easily access control systems operating critical infrastructure. Life, property and the environment are at stake. It is now possible for attackers to disrupt energy supply in a power grid, shut down a wind farm, and disable the safety systems in pipelines, refineries or oil and gas platforms.

Latest research by independent risk management and quality assurance provider, DNV on the state of cyber security in the energy industry, reveals that the sector is waking up to the rapidly emerging cyber threat. But defensive action is lagging.

The research *The Cyber Priority* revealed, fewer than a third (31%) of energy professionals asserted confidently that they would know exactly what to do if they were concerned about a potential cyber risk or threat.

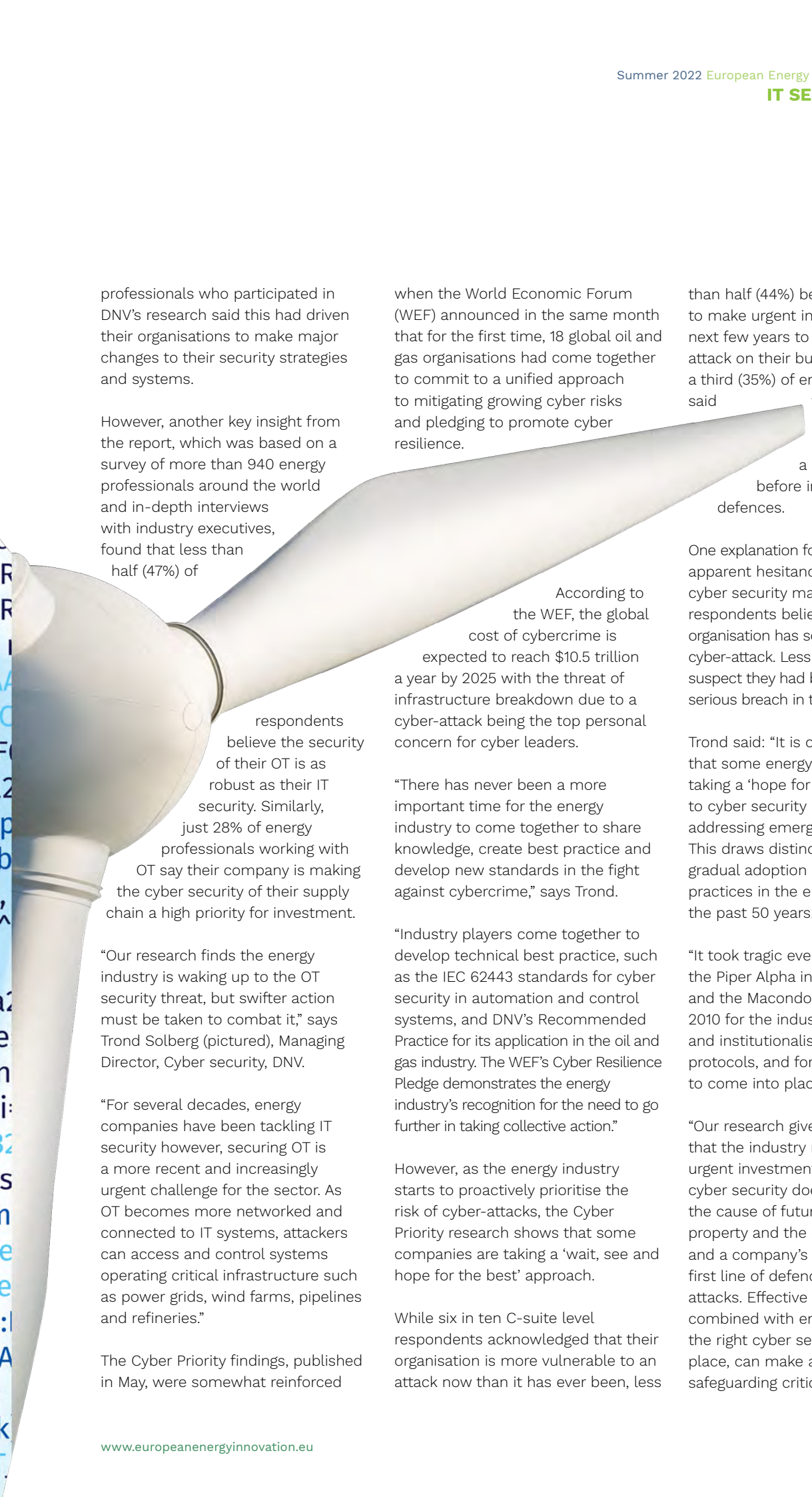
Despite this, the research found that most energy executives anticipate life, property, and environment-compromising cyber-attacks on the sector within the next two years.

More than four-fifths of professionals working in the power, renewables, and oil and gas sectors believe a cyber-attack on the industry is likely to cause operational shutdowns (85%) and damage to energy assets and critical infrastructure (84%) while three quarters (74%) expect an attack to harm the environment and more than half (57%) anticipate it will cause loss of life.

Against this backdrop, rising fears over new and more extreme consequences of cyber-attacks including the growing threat following Russia's invasion of Ukraine has led to a sharp shift towards the industry prioritising cyber security. Two-thirds (67%) of energy

professionals who participated in DNV's research said this had driven their organisations to make major changes to their security strategies and systems.

However, another key insight from the report, which was based on a survey of more than 940 energy professionals around the world and in-depth interviews with industry executives, found that less than half (47%) of respondents believe the security of their OT is as robust as their IT security. Similarly, just 28% of energy professionals working with OT say their company is making the cyber security of their supply chain a high priority for investment.



"Our research finds the energy industry is waking up to the OT security threat, but swifter action must be taken to combat it," says Trond Solberg (pictured), Managing Director, Cyber security, DNV.

"For several decades, energy companies have been tackling IT security however, securing OT is a more recent and increasingly urgent challenge for the sector. As OT becomes more networked and connected to IT systems, attackers can access and control systems operating critical infrastructure such as power grids, wind farms, pipelines and refineries."

The Cyber Priority findings, published in May, were somewhat reinforced when the World Economic Forum (WEF) announced in the same month that for the first time, 18 global oil and gas organisations had come together to commit to a unified approach to mitigating growing cyber risks and pledging to promote cyber resilience.

According to the WEF, the global cost of cybercrime is expected to reach $10.5 trillion a year by 2025 with the threat of infrastructure breakdown due to a cyber-attack being the top personal concern for cyber leaders.

"There has never been a more important time for the energy industry to come together to share knowledge, create best practice and develop new standards in the fight against cybercrime," says Trond.

"Industry players come together to develop technical best practice, such as the IEC 62443 standards for cyber security in automation and control systems, and DNV's Recommended Practice for its application in the oil and gas industry. The WEF's Cyber Resilience Pledge demonstrates the energy industry's recognition for the need to go further in taking collective action."

However, as the energy industry starts to proactively prioritise the risk of cyber-attacks, the Cyber Priority research shows that some companies are taking a 'wait, see and hope for the best' approach.

While six in ten C-suite level respondents acknowledged that their organisation is more vulnerable to an attack now than it has ever been, less than half (44%) believed they needed to make urgent improvements in the next few years to prevent a serious attack on their business. More than a third (35%) of energy professionals said their company would need to be impacted by a serious incident before investing in their defences.

One explanation for some companies' apparent hesitance to invest in cyber security may be that most respondents believe that their organisation has so far avoided a major cyber-attack. Less than a quarter (22%) suspect they had been subject to a serious breach in the last five years.

Trond said: "It is concerning to find that some energy firms may be taking a 'hope for the best' approach to cyber security rather than actively addressing emerging cyber threats. This draws distinct parallels to the gradual adoption of physical safety practices in the energy industry over the past 50 years.

"It took tragic events such as the Piper Alpha incident in 1988 and the Macondo disaster in 2010 for the industry to prioritise and institutionalise global safety protocols, and for tighter regulation to come into place.

"Our research gives a strong signal that the industry needs to make urgent investments to ensure that cyber security does not become the cause of future damage to life, property and the environment, and a company's workforce is its first line of defence against cyber-attacks. Effective workforce training, combined with ensuring you have the right cyber security expertise in place, can make all the difference to safeguarding critical infrastructure."

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