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BALTIC RIM ECONOMIES

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BALTIC RIM ECONOMIES

BRE REVIEW

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EXPERT ARTICLES

KADRI SIMSON

The European Green Deal and its impact on the Baltic Sea Region

Expert article • 3147

The European Commission confirmed the European Green Deal as the top priority of this Commission already in December 2019. It sets out the key priorities to achieve net-zero greenhouse gas emissions by 2050, while ensuring that the transition is just and inclusive for all. This is, like President Ursula Von der Leyen said, Europe's "man on the moon moment". To get there, the EU has put into the law the higher target of reducing greenhouse gas emissions at least 55% by 2030, compared to 2020 levels.

To meet our mid-century goal, it is vital that we make meaningful progress already in this decade. Throughout 2021, the European Commission has been overhauling EU legislation to make sure it is well-aligned with our climate and energy targets.

In July last year, we tabled a historical package of legislative proposals to implement the European Green Deal. It covers not only the energy sector - which is accountable for 75% of the EU greenhouse gas emissions - but also other fundamental policy areas such as climate, transport and taxation. The package proposes to revise current EU legislation on energy efficiency and renewable energy. For instance, by increasing the EU target of renewable energy in our energy mix to 40%, compared to 32% current target. And, setting a higher, binding energy efficiency target of 9% by 2030 (compared to the previous, 2020 projection).

We have progressed well. In 2021, renewables overtook fossil fuels as the EU's main power source for the first time: 38% of the EU electricity came from renewables, 37% from fossil fuels and nuclear energy accounted for 25%. This information can be seen in the Commission's State of the Energy Union Report published in October 2021.

In December 2021, the European Commission presented a second set of proposals, this time focussing on decarbonising the gas market including renewable hydrogen. It also includes measures to reduce methane emissions and step up renovations of buildings to make them more energy efficient. As is known, the cheapest energy is the energy we do not use.

There is still a high dependence on fossil fuel supplies coming from the east, particularly in the Baltic States, Finland and Poland. Overall, the EU spends almost EUR 300 billion a year on fuel imports. The legislative package therefore also proposes improvements on energy independence and affordability as well as on the resilience of the EU energy system and security of supply.

It also aims to strengthen solidarity between Member States, including those around the Baltic Sea. In case of gas shortages, neighbouring countries in the EU could step in faster to help so that no household is left in the cold. The recent surge in energy prices also illustrates the importance of improving storage facilities. It also shows that the synchronisation of the electricity system with continental Europe remains a strategic priority for the Commission and for the Baltic region.

The EU is proud to support investments in infrastructure of the internal energy market in a way that will accelerate the clean energy transition, e.g. Connecting Europe Facility and Projects of Common Interest. For example, a number of Projects of Common Interest have been completed as part of the Baltic Energy Market Interconnection Plan (BEMIP) to improve integration in the Baltic region. Infrastructure projects support market diversification, which, in turn, makes the Baltic States and Finland less vulnerable to price fluctuations, less dependent on imports and improves security of supply.

The planned electricity highways will also create an opportunity for offshore renewable wind energy in the Baltic Sea, which, of course is a priority in the region. According to our estimations in the European Offshore Renewable Energy Strategy, there is a need to reach 300 GW of offshore wind capacity installed by 2050, compared to today's installed wind capacity of around 14.6 GW. And, the Baltic Sea region has an important role to play in achieving this goal.

In September 2020, I was pleased to sign, together with the energy ministers of the eight EU Member States in the Baltic Sea region, a declaration committing themselves to closer cooperation on offshore wind in the Baltic Sea. The declaration aims to scale up offshore wind energy capacity in the region. By cooperating in the region, the countries make the most of the 93 GW potential that the Baltic Sea has to offer. Harvesting the full potential of offshore wind energy would already fulfil a large part of the objectives set out in the offshore strategy of reaching 60 GW by 2030 and to 300 GW by 2050. It illustrates how a significant increase in offshore energy can be most efficiently achieved with a cooperative, regional approach.

There is undoubtedly an economic, as well as an environmental, incentive to improving the sustainability of our energy systems. It is why the European Green Deal is also the EU's growth strategy. This has become more evident in the light of the devastating COVID-19 pandemic.

Member States, including the Baltic region, have put together national and EU recovery and resilience strategies to turn the economy around to make it greener and more digital. Here, I want to highlight the ambition shown by countries along the Baltic Sea on spending on the green transition. For instance, Lithuania intends to spend 37.8% of its EUR 2.2 billion; Latvia is dedicate 37.5% of its EUR 1.8 billion; and, Estonia aims to spend 41.5% of its EUR 969 million on the transition. We are on the right path.

There is no denying that the times are turbulent in the field of energy. The global surge in the price of natural gas is the main driver of the high electricity and gas prices that has affected every member state. Already in October, the Commission proposed a toolbox with a set of measures the Member States can use to alleviate the pressure on the most vulnerable. It is often hard to keep a constructive mind in the hardest of times, but we must not forget that the EU energy system is the most reliable in the world and the design of our electricity market is not the cause of the current surge in electricity prices. This does not

mean it is perfect and in can't be made better, but important to note nevertheless.

To conclude, countries in the Baltic Sea region can greatly benefit from the European Green Deal. We welcome the progress already made. Looking ahead, by accelerating the pace of reforms they can become a textbook example for Europe and beyond. ■

KADRI SIMSON
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European Commission

JANUSZ STEINHOFF

Challenges for the Polish power sector

Expert article • 3148

The turn of the year 2021/2022 for the citizens of Poland was marked by a drastic increase in the prices of natural gas, electricity and heat. The official narration indicates that it is the effect of the EU climate policy. There is no reliable explanation for the statistical citizen of the real reasons, which would unequivocally show that the continuation of energy policy based on coal will only maintain these high prices and, consequently, will also lead to a significant reduction in the competitiveness of the Polish economy and the standard of living of Poles.

Thus, the Polish energy sector is currently facing many challenges, the key one being how to ensure competitive energy production and trade while simultaneously meeting the objectives of the European climate and energy policy. Under these slogans there are specific tasks, i.e. essential reconstruction of production assets which do not meet the technical conditions defined in the EU standards known as BAT or BREW. The challenge is also to implement the state strategy in the field of energy and climate, the real improvement of air quality, reducing the increase in energy prices, filling the gap left by lignite and hard coal, and last but not least how to finance the energy transformation, from which there is no turning back.

In 2020, the European Commission presented a plan to reduce greenhouse gas emissions in the EU by at least 55% of the 1990 level by 2030. Such an ambitious goal will allow the EU to achieve climate neutrality by 2050. The new EU CO2 reduction target of 55% means that this process will have to be accelerated in order to find a viable alternative to coal.

After 2025, when the so-called power market - i.e. public support for coal units - ends, we will have to face the loss of 10GW of power in the national power system. Taking into account economic conditions, investment process implementation time, and environmental issues, in order to supplement the missing capacities, Poland must develop RES, nuclear energy, and temporarily gas-fired power plants, as well as take into account energy imports. It is also necessary to expand the capacity of cross-border transmission networks to ensure continuity of supplies and integration of the competitive European energy market.

Taking into account the fact that last year Poland achieved only 11.5% share of RES in electricity production, the key issue is to select solutions enabling their faster development to a level that guarantees maintaining stability of the power system.

As regards the future of the Polish power sector, it is necessary to point to the assumptions of the new draft National Energy Policy 2040 (PEP2040). It is a proposal for transformation of the system towards low- and zero-emission sources, however, with the preservation of solid fuels and natural gas in the mix as an element guaranteeing stability of electricity supply in the interim period.

Depending on the rate of growth of emission allowance prices, the share of coal in electricity production is proposed to be 37-56% in 2030 and 11-28% in 2040. Considering the fact that currently coal-fired power plants produce over 70% of electricity, this target can be considered realistic. The share of gas, which is to be a bridge fuel in the energy transition process, in the energy mix is planned at 17-33% in 2030. Demand for natural gas and crude oil will be offset by biofuels and alternative fuels.

The share of RES is to reach at least 23% in the final energy consumption divided into no less than: 32% in electricity, 28% in heating and 14% in transport. Extensive investments are planned in offshore wind energy located in the Polish economic zone of the Baltic Sea. It is forecasted that the installed offshore generation capacity will reach 5.9 GW in 2030 and 8-10 GW in 2040. According to the Ministry of Climate, as much as 28 GW of offshore wind energy capacity may be created by 2050, and the level of employment in companies related to the construction and operation of these installations is estimated at around 70 thousand people.

Due to the dynamic growth of RES, including numerous prosumer installations, it will be necessary to expand the transmission and distribution infrastructure, which will allow power to be derived from existing and new sources, including wind, PV and nuclear energy. The first nuclear unit with a capacity of 1-1.6 GW is planned to be commissioned in 2033, with subsequent units to follow every 2-3 years. Six generation units with a total capacity of 6-9 GW are expected to be built by 2043 to strengthen the system's foundation and significantly reduce pollutant emissions. However, taking into account the experience of other countries in recent years, the planned schedule seems unrealistic given the current progress of these projects.

Projects related to the development of industrial energy, energy storage technologies, smart metering, energy management systems, electromobility and alternative fuels, including hydrogen technologies, should also be considered key for the future shape of the Polish power sector.

According to many analytical centers, the scope of necessary transformations in the Polish energy sector is one of the most extensive in the EU. The current state of the Polish energy sector and the EU's challenge to reduce CO2 emissions should make the ruling coalition finally abandon the narrative, according to which deep transformations of the Polish energy sector are unrealistic and unjustified due to a rather archaic understanding of energy security based on solid fuels and social conditions. Among the important decisions, on which further liberalization of the Polish energy sector depends, is the abandonment of regulation of electricity and gas prices for households as well as consistent building of consumer awareness of the effects of a competitive energy market and the resulting benefits.

The long-term success of the transformation of the Polish energy sector depends on political decisions, strategy, financing and appropriate regulations. At the same time, market predictability, legal stability and greater competition are the only chance to reduce its costs. ■

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ARTŪRS TOMS PLEŠS

The Greener the Deal, the Greener our Future

Expert article • 3149

Climate change remains one of the most pressing challenges of our time. Science has been very clear that we must strive to keep the global temperature rise to 1,5 degrees Celsius to avoid the most dangerous impacts of climate change. Although internationally progress was achieved in the context of the Glasgow Climate Pact, much work remains ahead of us to implement the promises we have made in Paris and in Glasgow.

The European Union is steadily moving towards increased climate change mitigation targets for this decade and climate neutrality by 2050, however we must really prove we are serious not only about setting targets, but also about their implementation. In this decade, we need to achieve very rapid reductions of greenhouse gas emissions to truly keep the world within the safe temperature limits. In Latvia we are also ready to do our part.

The European Green Deal and the climate neutrality goal are concepts that have become priority in Europe as well as globally. A European strategy for growth that would entail a green deal for everyone is vital in achieving the goal of climate neutrality by fulfilling green and digital transformation. The transition will need to be just as well, therefore most affected sectors will need to be supported.

Ambitious long-term goals have been already set to limit climate change, increase biodiversity, and move to circular economy; however, swift, and simultaneous societal and economic transformation will be a challenge because all economic sectors will require significant investments and innovation. The development of innovation capable of accelerating economic growth must be one of the priorities of national economies as it is the basis for increasing productivity and value-added products.

In turn, a successful digital transformation, as a prevailing element with improved efficiency and productivity, will significantly contribute to reducing greenhouse gas emissions and increasing carbon sequestration, and will help in moving areas such as transport and industry towards climate neutrality.

At the same time, the European Green Deal aims to dedicate resources to those regions and sectors that are most dependent on fossil fuels or carbon-intensive processes and will be hardest hit by the transition to climate neutrality. Our role is to plan these investments on a territorial basis, therefore close cooperation among all sectors and regions is important.

In 2020, Latvia supported the strengthening of the EU climate neutrality target by including it in the European Climate Law, as well as expressing support for raising the 2030 greenhouse gas emission reduction target to at least 55% compared to 1990, while stressing the need to foresee and provide additional EU financial resources to meet the new targets. The EU's new growth strategy – the European Green Deal – will be very important as the underlining concept of the EU's economic recovery from the pandemic.

The implementation of the goals of the European Green Deal in Latvia will be supported by already adopted documents: Latvia's Strategy to achieve climate neutrality by 2050, the National Energy and Climate Plan for 2021-2030, Latvian National Plan for Adaptation to Climate Change until 2030, Circular Economy Action Plan 2020-2027, River Basin Management Plans up to 2021, Programme of Measures for the Achievement of Good Marine Environmental Status, Air Pollution Reduction Plan 2020-2030. Furthermore, several new documents are under preparation that will support the implementation of the Green Deal objectives in Latvia, and these are: State Waste Management Plan for 2021-2028, Environmental Policy Guidelines 2021-2027.

Simultaneously, important work has been undertaken by the government and different stakeholders to prepare Latvia's recovery and resilience plan that will ensure financing within the next EU multiannual financial framework period to support transition to climate neutrality.

The changes brought about by the reduction of fossil energy use, the much greater impact of the circular economy, the principle of green procurement, and raising public awareness will change people's daily consumption habits, create new jobs, and improve well-being and quality of life.

Considering the current geopolitics, moving towards climate neutrality can also be used as an opportunity to increase the energy independence by reducing dependence on fossil fuel imports and switching to local renewable energy resources.

Furthermore, the proposals within the "Fit for 55" package that were published by the European Commission last year will significantly contribute to increased greenhouse gas emission reduction in this decade, especially because the proposals envisage expanding the EU's emission trading system to buildings and transport sectors and strengthening the existing EU ETS. The proposals will also contribute to broader use of renewables and increased energy efficiency. The implementation of the "Fit for 55" package will speed up the development of low-emission modes of transport and the infrastructure and fuels needed to use them, align tax policies with the objectives of the European Green Deal, implement measures to prevent carbon leakage and introduce instruments to protect and maintain natural carbon sinks.

"Fit for 55" package highlights the European Union's ambitions and planned action in the areas of climate policy, circular economy, and biodiversity conservation, while promoting economic growth and creating jobs that are consistent with Latvia's development priorities. As these proposals require far-reaching policies, this year they will continue be negotiated among the key stakeholders prior to adoption and implementation.

The European Green Deal can be the pathway for our recovery and an opportunity for catalytic change which could generate a more and better opportunities for a future that is greener, more digital, and inclusive. ■

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ERKI SAVISAAR

The European Green Deal and Estonia

Expert article • 3150

The European Green Deal has marked a very important development in the environmental policy both in Europe and in the world. It is for the first time that environmental policy plays such a central role in planning the future of our economy. While reaching the ambitious goals set out in the European Green Deal is difficult and requires careful planning to make the transition positive for everyone in society, we are ready in Estonia as this is not our first large transformation in the past decades. Our digital transformation over the past decades has proven successful and the experience gained from that will surely help us with the green transition as well.

The transition to a green economy will be a major change for our society, however, we have been on this track for a long time already. While we still have a long way to go to get the most out of our environmental policy, we have been quite successful in protecting our forests and biodiversity. In addition, our energy sector has been progressively moving towards renewable energy and we are well on track to reach our 2030 goal of reducing 70% of our greenhouse gas emissions compared to 1990. By 2019, we had already reached a 64% reduction, so we are well on the way. But of course, such progress needs to be achieved in all countries to reach our global goals.

However, several big challenges still remain. While around half of the energy used in heating and cooling and one fifth of electricity used in Estonia comes from renewable sources, we still need to increase our efforts in developing more renewable energy. We see a lot of potential in wind energy, biogas and hydrogen and wish to have energy security in the future – not just in electricity production, but for all fuels.

In addition, we need to focus on finding solutions in areas where suitable ones are still distant. While we are good in figuring out how to improve energy efficiency in buildings and just need to get on it, we still have a way to go in decarbonising the transport sector – especially aviation and maritime transport.

The European Green Deal has helped a lot in addressing these challenges. Firstly, we see that public approval and expectations for environment and climate policy have increased in the last year. This can be seen in the Eurobarometer surveys on climate change as well as the surveys carried out internally.

As public concern has been one of the major deterrents of fast wind energy development, we hope that this shift will also translate into new wind parks coming online in short- and long-term. A recent survey in Estonia showed that 72% of Estonians support offshore wind farms and 62% support them on land. This is good progress, especially since both percentages were around 80% for people under 34 years of age. Clearly, younger people see transition as positive and are more prepared for the measures that need to be taken.

Secondly, the green transition has inspired a lot of innovation from first-movers in the industry and research. Within our start-up economy, we have seen companies like Bolt and Comodule, looking for sustainable transport solutions; Skeleton Technologies developing superconductors to make energy use more efficient; Roofit.solar building solar roofs; Single.Earth creating a market for carbon removal and biodiversity, etc.

The change is also very apparent in larger companies and industries, something that is especially needed in our oil shale sector. Eesti Energia, the world's biggest oil shale energy company has drawn up a long-term action plan to achieve carbon neutrality by 2045. Together with Ragn-Sells, it is also testing valorisation of oil shale ash, a project that has potential to deal with a big environmental problem in Estonia – the by-product of our energy generation.

The two areas where we see a lot of development currently, are nuclear energy and hydrogen. While there is no clear understanding whether nuclear energy is something Estonia wants to pursue, technical discussions on its feasibility are gaining speed. Of course, this has to lead to a thorough societal debate before any actions are to be taken.

As regards hydrogen, we see a lot of interested partners, and the first state funded pilot projects are already well under way – the first hydrogen fuelling stations and taxies are already planned in Tallinn, our capital city. In addition, Skeleton Technologies, Elcogen ja Stargate Hydrogen Solutions will be working on research and development projects in the IPCEI framework.

One of the main concerns regarding green transition for everyone is that we need to improve everyday life as well as the environment. Neither can be sacrificed if we want the transition to be fair and supported. We have worked hard to address these concerns in Ida-Virumaa, the region in which our oil shale industry is concentrated. But the effects of the European Green Deal will be felt everywhere and much still remains to be done.

The European Green Deal offers a lot of new opportunities for everyone who is ready to change, but change always comes at a cost. We are determined to have the opportunities outweigh the costs. ■

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Channelling the competitive advantage by the greening of the economy

Expert article • 3151

What is in common between the mattresses the grandchildren of Queen Elizabeth II of Great Britain sleep on and green deal achievements in Lithuania? How comes that Lithuanian born unicorn is a part of sustainability aims? Why second life is profitable?

There is one answer to all three questions. A future oriented, visionary business model. About a decade ago, Mr. Viktoras Verpetinskis, the head of "Ivo ir ko", implemented principles of circular economy in his company. People who value sustainable production are not indifferent to these provisions - Ivo ir ko produces and exports about 70-100 thousand mattresses a year. Since 2018 Vinted is a billion euro e-commerce platform, which allows all European citizens to sell second hand clothes. The company from Kaunas "IT Max – Refurbas" brings second-hand computers and other electronic equipment to a second life. And almost all of it is sold abroad. While Europe prepares to move to a circular economy, there are already successful companies in this field in Lithuania.

Lithuanian industrialists purposefully move to a circular economy and maintain their competitiveness in an increasingly conscious society. To reorient the country's economy towards a circular economy, it is essential to set the direction and detail the objectives and incentives pursued to ensure private sector investment and close cooperation with science and the public sector. Lithuania is an industrial country with an industrial contribution to GDP of 20%. Industrial products account for over 80 percent. Lithuanian exports of goods, so in order to maintain Lithuania's competitive advantage, it is very important to ensure its proper technological progress. The support of both the Ministry of Economy and Innovation and the Ministry of the Environment is important for business at this stage of industrial transition.

The roadmap for the transition of Lithuanian industry to a circular economy is the first co-creation project in Lithuania. The aim of the project is to envisage concrete actions that will help maintain the competitiveness of the industry, considering the principles of the circular economy. Involving stakeholders in the implementation of the project - representatives of Lithuanian industry, public organizations, and public authorities - aims to ensure a successful and efficient transition of industry to a circular economy.

Lithuania is not only ahead of majority European countries in moving towards circular economy, it is among the few countries in the EU where the "Green Deal" is a part of the official Programme of the Government as one of the three priorities, alongside digitization and education. It envisages that the energy, industry, transport and housing sectors will be restructured from above with a sharp rise of standards, with public funding for the transition.

More than a year ago the world realized that money trying to save a pandemic-stricken economy could either deepen the climate crisis or help overcome it. The European Commission has given a positive assessment to Lithuania's recovery and resilience plan, which will be financed by €2.2 billion in grants. None of the plan's measures will do significant harm to the environment.

38% of the plan's total allocation for reforms and investments support climate objectives. **€242** million for sustainable power generation: developing offshore wind infrastructure, and onshore plants for renewable energy sources (solar and wind power), and creating public and private energy storage facilities. In 2020 the Ministry of Energy and 19 organisations, including the Ministry of Economy and Innovation, the Ministry of Transport and Communications, business associations and large energy companies, have signed an agreement on the establishment of a hydrogen platform in Lithuania. The signatories have agreed to cooperate in the creation and development of hydrogen technologies, which will be crucial for achieving national and European energy and climate targets.

Reforms of the green transformation will make a significant contribution to the country's strategic autonomy and address long-standing security challenges.

€341 million for sustainable mobility: Significantly reducing greenhouse gas emissions by phasing out the most polluting road transport vehicles (private, public and commercial) and by increasing the share of renewable energy sources in the transport sector.

The implementation of this measure will encourage faster changes in the composition of transport modes. Integrated regulatory, communication and investment measures will be implemented that the operation of electric vehicles becomes economically viable and rational. Preconditions for the use of public transport will be created and quality of public transport will be increased

€218 million for accelerating renovation of buildings: supporting the production of modular elements for renovations from organic materials and providing financial support to citizens for actual renovations. This will accelerate the renovation and modernization of apartment buildings by implementing measures to increase energy efficiency, as well as use of renewable energy sources, by reducing energy consumption in buildings and phasing out the use of fossil fuels in them.

Lithuania has political will, the EU provided good part of the money. But most important Lithuania has the ideas what to do. In Scandinavia students can already ride electric minibuses Altas EV Ecoline and Altas EV Cityline, which have been assembled in Lithuania by Elinta Motors, a company, which developed a unique electric engine and overall electric system without any use of scarce metals. Ecology unfolds both through the product itself and through its manufacturing process. Zero emission minibuses will make our cities cleaner and opens the new opportunities to choose environment friendly passenger transport solutions.

In Western part of Lithuania biggest factory in the Northern Europe is being built by VMG group to ensure Europeans could

build sustainable wooden houses. The factory will mainly be run by robots, which will ensure sustainable and innovative materials and wooden parts to be used in assembling high quality wood houses.

In the middle of Lithuania (Panevėžys) Harju Elekter has constructed first engine for driverless vessel, which is tested in Scandinavia.

Many more circular ideas and green projects are in line. For that RRF or other European funds are not the only source. In addition, Lithuania is well on track to attract large scale investments providing the Green Corridor for big investors in advanced manufacturing, IT and other areas also contributing well to Green Deal goals. First agreements are signed after the new legislative package in force since the beginning of 2020. Several new important investments are being negotiated in the area of advanced manufacturing, thus enabling Lithuania to further climb up the value chain, introduce new clean and climate neutral solutions and create new jobs.

Lithuanian society, business, science and state institutions are cooperating towards a Green Deal to make the EU a climate-neutral economy by 2050. Green is competitive. ■

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NIELS FUGLSANG

Energy efficiency can solve three major crises in Europe

Expert article • 3152

As we enter a new year, Europe is facing three major crises. We are in an energy supply crisis resulting in rising energy prices and more households struggling to keep their home warm. We are still struggling with the covid-19 pandemic, which has slowed the European economy. And most importantly, we are facing a global climate crisis which calls for immediate action. Energy efficiency can be part of the solution to all three crises. My goal as the European Parliament's rapporteur on the recast of the Energy Efficiency Directive is to secure that we fully use this potential.

The current energy crisis in Europe is partly due to Europe's dependency of imported gas. An analysis from the European Commission shows that when we increase our energy efficiency in the Union with 1%, the gas import declines by 2.6%. This shows that energy efficiency is the way forward towards energy self-sufficiency in the Union. Further, it is self-evident that a logical way to tackle rising energy prices is to introduce measures that decrease our need of energy. The cheapest energy of all is the energy we do not use.

It is important to note that the energy supply crisis is also a social crisis. Rising energy prices are especially affecting the most vulnerable citizens. According to the latest data, 31 million European citizens are living in energy poverty. It is very likely that this number is much higher now with the rising energy prices. A study made by the Council of Europe Development Bank finds that a 1% increase in energy efficiency leads to a -0.19% decrease in energy poverty. This shows that energy efficiency is an important tool to tackle energy poverty but it also shows the need to ensure that a part of the measures in the Energy Efficiency Directive are addressing energy poverty directly.

Another social problem facing Europe is the recession and unemployment caused by the covid-19 pandemic. It varies a lot from country to country, how well its economy has made it through the pandemic, but it remains certain that the European economy needs a recovery, and preferably a green recovery. According to the International Energy Agency, energy efficiency can create millions of jobs. It demands labour to renovate our buildings, install energy saving solutions and to create and produce new technology. Energy efficiency can be a part of the green recovery of Europe after covid-19.

And the recovery indeed needs to be a green recovery. The world is facing a serious climate crisis that demands us to rethink our economy and our energy use. According to the International Energy Agency, the most efficient way to reach climate neutrality and the targets in the Paris Agreement involves that 44 % of the necessary CO2-reductions should come from energy efficiency. Using less energy and using energy in smarter ways through renovating our buildings and introducing new green technology is a crucial part of solving the climate crisis.

Therefore, an ambitious recast of the EU's Energy Efficiency Directive is highly needed. In July 2021, the European Commission presented its proposal of a recast of the directive as part of the so-called Fit for 55 Package, which contains a number of legislative proposals that aim to make the Union fit for reaching the climate targets of the European Green Deal. Ambitious energy efficiency targets is an important part of that aim. My main goal as the European Parliament's rapporteur on the directive is to secure that the targets in the directive stay ambitious and, very importantly, are binding for the Member States. Only then can we fully exploit the win-win-win potential of energy efficiency, which I have described in this column.

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RASMUS ANDRESEN

Don’t forget the blue over the green

Expert article • 3153

The European Green Deal is a well known European legislative framework. It gives principles and guidance on how to reach climate neutrality and an overall environment friendly approach within the EU legislation and everything which is linked to it such as funding criteria or quotas.

As someone who has lived near the Baltic Sea all my life, ocean protection is very important and dear to me. And I am working on European laws that have a direct impact on seas and oceans.

The conditions of our oceans are dramatic. Although our oceans and seas are of major value, we often abuse them and try to squeeze the last bit out of them - with terrible consequences. We have destroyed many habitats on the seabed and many species have difficulty reproducing. The Baltic Sea is one of the most polluted seas in the world. At the same time, almost half of the EU's population lives less than 50 km from the sea and the ocean is crucial to the European economy. Yet key EU policy instruments are not geared towards protecting the seas.

As a member of the committee on budgets I am working to ensure that EU money flows into the transformation towards a more sustainable economy. We need to spend more money on biodiversity and should stop funding ecologically harming projects, like for example Nordstream 2 or nuclear energy.

Blue New Deal

That is why I am calling for a new deal between the ocean and the people: I made a concrete proposal for a Blue New Deal, that leads to a healthy ocean, allowing future generations to connect with the ocean and enjoy its full potential while protecting marine life. In order to reach this objective we need an engaged civil society to pressure politicians and business people to take leadership.

One major point is of course unsustainable fisheries, eutrophication and aquacultures. We can’t afford to continue with business as usual - we need a stronger protection of marine species and habitats, and a transition to more sustainable, low-impact fishing.

The marine ecosystem in the Baltic Sea has been in a fragile state for decades. Scientists always had a clear message - we need to urgently protect the Baltic Sea and reduce human pressure on it. Despite that, political action has not been ambitious enough. For example, scientific advice was not followed when it came to setting fishing quotas, which led to overfishing.

The climate crisis is a major threat to our ocean primarily due to ocean warming and extreme heat waves, which can result in the collapse of whole marine ecosystems and put some species in serious danger.

The biodiversity crisis threatens marine life in all European seas and in a very worrying way the Baltic sea, due to the combined impacts of anthropogenic activities on land, in the air and at sea, which are exacerbated by climate change. Sea-level rise is posing significant challenges for coastal communities in combination with other human-induced processes such as coastal erosion and flooding. Plastic pollution including abandoned, lost or disposed fishing gears and toxic biochemical flows are major threats to the marine ecosystems and oceanographic processes with significant impacts on present and future generations.

Another issue we have to address in the Baltic Sea is that we need to invest more into research, assessment and removal of military ammunition abandoned in the sea following the end of the First and Second World War.

We already have plenty of detailed and clear scientific research that can guide us and help us in solving these challenges. We also already made policy commitments on the global, European, and national level. So we have a framework in place, but we have to implement it. We need to work together on all levels and we have to be dedicated, coordinated, and consistent to give our oceans the opportunity to recover.

FuelEU Maritime

Last but not least: the shipping sector: In addition to my position in the committee on Budgets, I am responsible for EU Maritime Fuels in the committee on industry and energy. This regulation requires ships to progressively switch to sustainable maritime fuel in order to support green waterborne mobility and transport, which would also have a direct impact on improving the environmental state of our oceans.

Unfortunately, big fights still lie ahead of us. We had hoped for ambitious greenhouse gas reduction targets and effective measures to incentivise the uptake of sustainable fuels like renewable-based e-fuels. But the proposal that is on the table is very disappointing and has been labeled a “climate disaster pathway” by environmentalists.

The proposal for the FuelEU Maritime Regulation actually falls drastically short of delivering a pathway to zero-emissions in the maritime sector by 2050, let alone 2040. It introduces overall greenhouse gas intensity targets for energy used on board, yet while doing so it risks incentivising massive uptake of only marginally greener, yet very cheap and still harmful fuel alternatives, like LNG. It might also drive unsustainable demand for biofuels, which -even when produced sustainably- should better be channeled into otherwise hard to abait sectors, like aviation, where no other green alternatives are available.

The proposal also completely disregards the potential to substantially cut greenhouse gas emissions in the short term by harvesting the operational and energy efficiency solutions available as of today to ship owners (e.g. slow steaming, wind assist, improvement in engine efficiency etc). That alone could achieve about 40% emissions by 2030. This omission of energy efficiency measures is defended with an uncritical trust into market forces and the naive belief that higher fuel prices will be sufficient to incentivise the implementation of energy efficiency measures. Moreover, the obligation to use on-shore power supply or zero-emission technology in ports is unjustifiably delayed to 2030 and plenty of exceptions are foreseen.

We as Greens/EFA want to set an ambitious yet predictable regulatory framework for the swift transition of the maritime sector towards a highly energy efficient and fully renewable based approach. We do not see any room for fossil fuels, nor for the use of unsustainable biofuels or the unsustainable demand for advanced biofuels.

To reach a good environmental status for the Baltic Sea and beyond, a mobilisation across all actors in society and a strong governance including citizens is needed with all socio-economic

activities considered in relation to their impact on the ocean. To achieve this, positive ambitious visions and holistic solutions that are being co-developed with local communities and all relevant stakeholders across scales in a long-term participatory and systemic process will be paramount.

I call for a Blue New Deal “cross check” of all EU legislations congruent with marine and coastal policy, taking into account the complexity and interlinkages between humans and the ocean is strongly recommended. We need a radical shift not greenwashing by weak legislation. That is what we are standing for at the European level and I count on the new German government to fight alongside for clean oceans and a healthy Baltic Sea. ■

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RIHO TERRAS

The Green Deal must be a thought-out transition not a precipitous switch

Expert article • 3154

Europe's future in energy can be viewed through three prisms: economic-competitive challenges, technological challenges, and security of supply challenges. It is important to build the European Union's strategy for an environment friendly energy sector through these domains.

The current aim of the Green Deal is to replace existing energy sources with renewables no matter what. The European Union wants to be at the forefront of tackling climate change, and this absolutely is commendable. However, our eagerness alone will not solve any problems: the EU makes up approximately only 6–10% of the total CO2 emissions in the world. Every other country and major polluter – China, India, even the US – is taking the whole transition 'at their own pace'. Our eagerness might instead create new problems for us.

The economic-competitive aspect is one of the reasons why every major power has its own pace for conducting the green transition. Those who are slower to adopt green energies have an advantage in several industries and production. China is building numerous new coal power stations because they do not have to adhere to any CO2 quota systems and their economy benefits from it. The EU has rushed to the forefront with the Green Deal but on the expense of our competitiveness. Everyone else has taken notice of this.

Should we forfeit and continue as we were? Definitely not. Someone must take the initiative. Our current plans for climate neutrality by 2050, however, are a bridge too far. We are living in an electricity civilisation. Electricity is the input for almost everything: our industries, our communication, our housekeeping, our entertainment. More and more is the same course being set in transportation. Our dependency on electricity is growing. Therefore, we must find means of energy production that could keep up with this rapidly increasing demand, not focus on phasing out existing technologies in favour of green technologies that cannot fill the void left by the switch.

Investments into new technologies is the key

I am a big proponent of new technologies and innovation in general. Prospective technologies must reach further than the exhibition floor, they need proper investments and government backing to achieve their potential and become financially feasible. For example, in Estonia we have several scientists who are enthusiastically developing hydrogen technology, but because of the disinterest of the government and lack of a corresponding strategy the advancements are limited at best. One cannot develop hydrogen powered heavy transportation without the required infrastructure and government support.

My grandmother worked at an oil shale mine in Estonia. I have been surrounded by this resource most of my youth. Nevertheless, I am not opposed to moving away from filling our power station furnaces with oil shale to produce electricity. I welcome it. However, we cannot just snap our fingers and switch to solar and wind power overnight. It must be a transition in the literal sense.

Existing technologies can be replaced when there is a suitable replacement. Denmark and Netherlands might make do with solar energy, but Poland and Lithuania will not; Sweden has the possibility for hydro energy, Estonia has not, etc. This transition cannot be achieved with the current shotgun approach where the Green Deal proposes a 'one size fits all' solution. The EU is a diverse union of nations, and these specificities must be accounted for.

The effects on energy supply and security

Regarding the discussion of climate neutrality, we are not talking about absolutes but proportions. We intend to reach a certain level of 'greenness' but the demand for energy is rising more quickly than green energy can replace it. The current energy crisis in Europe is a prime example of it. Short-sighted preparations for a cold winter and the increased demand for natural gas worldwide has led to high demand, insufficient supply, and obscene energy prices – and I am certain that the prices will not fall but increase further. Expensive electricity is the new normal.

The very prompt switch from fossil fuels to renewables is ravaging the pockets of all European people as green energy is not yet up to the task of replacing current previous technologies. Advancements in energy storage could help to alleviate these problems and make renewables more viable.

One of the biggest mistakes is the voluntary dependence on natural gas. Germany has led the way of tethering themselves by pipelines to natural gas – specifically Russian natural gas. Europe is so dependent on natural gas that there is no quick way of solving this problem and therefore there is no easy fix for the current crisis.

Energy supply and energy security can be guaranteed by a diverse portfolio of energy sources and energy sources that can be regulated according to demand. Solar and wind are not dispatchable energy sources and for natural gas we hinge on others.

Both, the European Union and its member states, need a reliable energy strategy that tackles not just the effects of the energy sector on the climate, but guarantees a strong energy supply to its people. Investments and trust in new technologies and bettering existing ones is paramount to achieve these goals. One does not fill up the previous well before a new one has been dug.

We have to ready ourselves for all kinds of opportunities. ■

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SAARA-SOFIA SIRÉN

European Green Deal and circular economy in Finland

Expert article • 3155

The greatest challenges of our time are climate change, loss of biodiversity and environmental pollution. By harming the climate and the environment, we are only harming ourselves. Nature or the atmosphere do not need people for anything, but people cannot do without a functioning ecosystem. Our wellbeing in the future is linked to meeting climate and environmental challenges.

Climate change, loss of biodiversity and the poor state of water bodies, for example, are global issues that require international cooperation. Countries of the world have variably prepared for these challenges. For example, emission reduction objectives have been set jointly in the UN framework of the Paris Agreement on Climate Change. However, actual efforts are urgently needed to achieve the objectives. This year, a similar global agreement on biodiversity is being sought in Kunming, China. Loss of biodiversity is a challenge at least the size of climate change and, of course, the problems are also strongly linked.

The most important reference group for Finland in responding to global threats is the European Union. EU is strongly committed to the Paris Agreement on Climate Change. The objective is for the EU to have a climate-neutral economy and society by 2050. With this commitment, the EU seeks to show leadership in global climate policy. Finland has been promoting the tightening of objectives in the EU to better meet global challenges.

One of the EU's tools for tackling climate change and environmental problems is the European Green Deal programme. It also seeks to respond to the consequences of the corona crisis. The programme aims to promote the EU's development in a modern, resource-efficient and competitive direction. The key is to differentiate between economic growth and resource use, so-called “decoupling”.

To this day, economic growth has also meant an increase in emissions. That is no longer possible. Fortunately, we already know that it is indeed possible for the economy to grow while reducing greenhouse gas emissions. More information is needed on how economic growth can also be decoupled from over-exploitation of natural resources. Economic growth has long depended on the increasing use of natural resources. This cannot continue.

Climate change and the loss of biodiversity can therefore be solved, but it requires success in decoupling. This means ending the over-exploitation and disposable consumption of natural resources and moving towards a resource-efficient circular economy. The Green Deal promotes these objectives through legislation, reforming governance mechanisms, significantly increasing the availability of “green finance” and making pollution less profitable.

Funding for the European Green Deal programme is one third of the EU's NextGenerationEU recovery plan and seven-year budget. There are plans to invest more than one trillion euros in sustainable objectives. The Green Deal investment programme (Sustainable Europe) directs investment especially to areas where the necessary changes have the greatest impact on people's lives. The idea is to make sure no one is left behind in development. The need for this type of thinking has become stronger during the preparation of the programme, as not all Member States have embraced the aims behind the programme. For Poland, for example, giving up coal seems to be a very distant objective.

It goes without saying that the EU's green policy has also been criticised. Each Member State has its own special characteristics, concerns and perspectives on the actions presented. It is well known that states strive primarily to promote the best possible solutions at their national level and only secondarily those of the common good. In the end, however, common success should be in everyone's interest.

Moving towards a more sustainable lifestyle inevitably means changes in people’s habits. The need for change is unfortunately a working soil for populism. Populist rhetoric has been witnessed across Europe, turning the objectives of sustainable development and circular economy to address people's fears and frustration. The global energy crisis has been strongly linked to EU’s climate actions, although there are several reasons for the rise in electricity prices. Fuel prices, on the other hand, were taken up as a rhetoric weapon even in the Finnish regional elections in January, although this has very little to do with the reform of social and health services.

There is a good basis for social justice and it is clear that some people and regions need more support in change than others. Responsible decision-makers do not leave anyone alone. We need everyone involved in the change. There are, of course, also well-founded justifications for criticism. However, populist, hate-based political rhetoric obscures the intentions of green politics. At the same time, it undermines the unity of the EU, in a situation where, on the contrary, European unity should be strengthened.

As usual, the Green Deal programme, when drawn up, has been balanced with requirements and priorities from different directions. Some see the programme as unrealistically ambitious, others as a positive first step, and from a third’s perspective it is too little too late. The preparation was rightly criticised for the strong impact of lobbying by the fossil-based industry, but in the end, there is a lot of good in the programme generated as a result of compromises.

It is not naive to say that the transition to a resource-efficient circular economy is an opportunity for Finland. Pioneering provides competitive advantage and Finland has a lot of expertise and opportunities for innovations for which a billion-dollar market would be available. There will be demand for sustainable solutions in every corner of the world.

However, leading position in climate and environmental sustainability does not come to Finland automatically. Many other European countries also recognise the commercial potential and want to strengthen their own brand as a home for clean solutions. Sweden, for example, is happy to represent in international meetings with a large ministerial and business delegation, highlighting the strengths

of Swedes in climate and environmental work. The competence and negotiation skills of Finnish civil servants are valued around the world, but in international competition it is not always enough, whether it is to influence resolutions or to promote the sale of commercial innovations by Finnish companies.

In its simplicity, circular economy is a way to make things more sensible. That is, all things. It means changes to some of our habits, but also the opportunities that renewal brings. Finland has every opportunity to be a model country for the circular economy, and the EU is now stepping up its efforts through the Green Deal. We cannot afford to miss those opportunities. ■

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SARI RAUTIO

How can the Green Deal start the renaissance of Baltic Sea Region?

Expert article • 3156

The European Green Deal is an ambitious set of policy initiatives presented by the European commission, with the aim to reach climate neutrality by 2050. The target of climate neutrality is prescribed in the European Climate law and is legally binding. The Green Deal package includes several policy goals initiated by the European Commission and covers a broad scope of measures, some of them completely new and other revision of existing legislation. While climate neutrality by 2050 is the long-term goal, a large part the work must be done already by 2030. The union has defined the target of reducing the emissions of greenhouse gas by at least 55% by 2030, in comparison to the levels of emissions 1990.

The EU Strategy for the Baltic Sea Region has aimed at building trust and fostering cooperation around the Baltic Sea to reach common goals of clean sea, well-connected region and increased prosperity of its inhabitants. The aim is now to turn challenges into opportunities for sustainable growth in BSR. We need the whole ecosystem and all stakeholders to work together towards common objectives. Real impact is based on co-creation and collaboration. This is the way to work also with the Green Deal.

Around the Baltic Sea, there is a strong sentiment towards the flourishing Hanza times. Maybe that is why the trade, economic cooperation, innovation and the acknowledgement of the role of the business in the Region's prosperity is that high. Now, this can only be achieved if the needs of nature are on the basis of all.

The European Committee of the Regions' Baltic Sea Region Intergroup has set a vision: we want it to be the leading innovative and people-centred region. A goal that clearly everyone from around the Baltic Sea could sign for.

What does the European Green Deal mean for the Baltic Sea region? With regards to the inherently broad mission to reduce greenhouse gas emissions, it goes without saying that the Green Deal will have some sort of impact on the vast majority of activities in the region. The measures needed according to the Green Deal will affect the way we produce, invest, move and consume. More explicitly, the Green Deal entails priorities to protect biodiversity and vulnerable ecosystems, reduce pollution on land and in waters, facilitate the transition to a more circular economy, modernize waste management as well as find a way to create a more sustainable fishery sector. The Green Deal also includes objectives to make the blue economy in the EU more sustainable.

Measures that are highly relevant for the time being are, among others, plans on increasing renewable offshore energy sources, such as wind power. In order to boost the sector and reach its full potential, the Commission has underlined the importance of cross-border cooperation between different member states of the Union. This serves as another good example of the importance of close contacts and collaboration between countries in Europe, starting from grassroot initiatives at the local level.

To facilitate a transition to a more sustainable Baltic Sea region it becomes clear that the public sector alone will not be able to carry through the necessary transition. An increasing need for private actor involvement and projects is evident, and the only way forward to make a sustainable change towards a climate neutral society. Many ground-breaking ideas and innovations have derived from the private sector and will continue to do so. The channels between the public and private sector have to be kept open and encouraging. The more visions and ideas that are generated, the stronger the likelihood of finding new, sustainable ways forward.

Clear economic incentives are crucial to mobilize private actors and entrepreneurs to participate. Several EU funds are already available for businesses within the EU, such as Interreg. It is possible and encouraged for member states to utilize the Recovery and Resilience Facility to invest in projects. A new tool is the Interregional Innovation Investments (I3) instrument with total budget 570 million euros. Now there is money – we only have to find the ways to use it wisely, and for common good. An interesting possibility is also to promote the impact investing which is a process of investing in companies, funds, or firms that are dedicated to improving the environment or society while also providing a financial return for investors.

Many success stories of the EUSBSR implementation prove that all ecosystem should be involved right from the beginning, when we create the strategies, and stay involved all along. Various initiatives prove that business involvement is crucial also when it comes to real implementation of Green Deal goals.

The strength of the Baltic Sea region lies in the long history of cooperation and its versatile networks. These will play a key role in delivering the European Green Deal in the areas linked to the Baltic Sea. Now it is time to find new partners, and warm it up with the old ones, and do the Green Deal together – and make it big. ■

The article has been produced in co-operation with Jenny Vuorenlinna, Kuntaliitto Brussels.

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The cost of degradation: a price tag on the Baltic Sea

Expert article • 3157

The Baltic Sea is a major source of income. The figures related to tourism alone are impressive: the sector employs about 160,000 people in the coastal areas. The total recreational benefits of the Baltic Sea are estimated to be around 15 billion euros annually. And tourism is just one example. The total annual value added for the region from freight and passenger transport is about 5 billion, respectively 2.5 billion euros. Considerably lower, but not altogether insignificant, we estimate the value of fish and shellfish landings at roughly 200 million euros per year.

No less important than the direct economic benefits are the marine and coastal ecosystem services that are critical for the functioning of society – think carbon sequestration, climate regulation and purification of water and air, but also cultural services and natural heritage. So far, we have not yet been able to put a price tag on these contributions. But in any event, mere numbers would insufficiently reflect their importance as they are, effectively, invaluable.

Benefitting from the sea, especially when considering the long-term, implies that it is kept in a healthy state. We have come a long way since the pollution peak in the 1980s, but the Baltic Sea is not yet in the condition we would like – and need – it to be. Despite all recent progress, we still fall short of fulfilling the HELCOM vision of "a healthy Baltic Sea environment with diverse biological components functioning in balance, resulting in a good ecological status and supporting a wide range of sustainable economic and social activities."

97 percent of the Baltic Sea is affected in one way or another by eutrophication, the excessive concentration of nutrients that leads to harmful algal blooms, choking marine life and causing the Baltic's infamous "dead zones". Marine litter and pollution from hazardous substances of all types are still a cause for concern, and so are emerging threats such as climate change, new chemicals, pharmaceuticals and underwater noise.

As a consequence, the sea's biodiversity components are heavily disturbed, and all Baltic Sea habitats and species are affected in one way or another by pressures from human activities. For example, the Eastern Baltic cod stock has declined sharply in recent years, impacting other species and the entire food web, likely reflecting large scale changes in the Baltic Sea ecosystem.

When the biological components are not in equilibrium, the entire equation is off-balance too, and the sea can no longer support economic and social activities in a sustainable manner. An unhealthy marine environment comes at a cost – the cost of degradation.

Concerning eutrophication, we estimate that up to 4.4 billion euros are lost every year across all sectors, due to a variety of effects that include reduced water clarity, increases in blue-green algal blooms, damage to underwater meadows, changes to the composition of fish species and oxygen deficiency on the seafloor.

In the Baltic Sea region, tourism and recreation take a hit of up to 2 billion euros annually due to poor environmental conditions, and citizens' welfare would increase by up to 2.6 billion euros annually if the state of the sea's perennial vegetation and fish stocks improved.

So, how do we get our sea and the wellbeing we derive from it back on track?

To further improve the state of the Baltic Sea, HELCOM has recently updated its Baltic Sea Action Plan (BSAP). The 2021 BSAP contains 199 concrete actions and measures addressing biodiversity, eutrophication, hazardous substances, and sea-based activities, such as shipping and fisheries. Implementing the BSAP by 2030 at the latest, as agreed by all Baltic Sea countries and the EU will be the prerequisite for attaining our overall objective of a healthy Baltic Sea.

Furthermore, all human activities that may have an effect on the marine environment, regardless of whether they take place on land or at sea, need to be viewed through the prism of the ecosystem approach and ecosystem-based management. Whatever the activity, it needs to be conducted in such a manner as to not affect the health of the marine environment, thereby guaranteeing the sustainable use of ecosystem goods and services.

Maritime spatial planning (MSP), with its forward-looking analysis of the use of marine space in order to identify optimal locations for sea-based activities, is key to implementing the ecosystem approach. On the one hand, MSP signals areas of high nature value, helping us to steer sea-based activities away from zones where they can cause serious damage or disturbance. On the other hand, and in return, that also means that MSP will be able to help to identify areas where such activities could take place without harm to the marine environment.

We are an integral part of the Baltic Sea's ecosystem and should be allowed to benefit from its resources. But doing so also entails the obligation to maintain our sea in a healthy state and conducting our activities in the most responsible and sustainable manner. To put it bluntly: we should not take a saw to the branch we are sitting on. ■

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ANDREAS GOLDTHAU & NICK SITTER

The EU Green Deal and economic competitiveness

Expert article • 3158

Towards net-zero

The future is green – at least when it comes to the European Union's new growth model. By 2030, the world's second largest economic bloc aims to reduce emissions by 55 percent compared to 1990 levels. By 2050, it is to go carbon neutral, in line with the Paris goal of well-below 2 degrees of global warming.

The EU Green Deal amounts to a historic transition. Never before has a big trading bloc transformed its economic model so deeply and so quickly. The transition from feudalism to industrialized economies took a century and a half, as Europe went from biomass-energy to coal. The transition ahead will move the EU from high-carbon fueled production to low-carbon in less than three decades. This will shift Europe from a growth model built on resource overuse to one aimed at preserving the global ecosystem.

A low-carbon economic model will need to sustain the European welfare. This is essential if it is to maintain the 'social license to operate'. It involves maintaining industrial-scale production and fostering innovation in strategic sectors, so as to fund social policies and deliver jobs. The EU Green Deal is therefore nothing less than a green industrial policy program, aimed at ensuring global economic competitiveness.

Never before has a big trading bloc transformed its economic model so deeply and so quickly.

Economic competitiveness and the level playing field

Although the green economy clearly represents a competitive edge in the long run, there will be short- and medium-term costs. Ambitious climate policies entail higher costs for both industry and consumers, at least during a transition period. How these costs are distributed will be hotly contested. Within the EU, winners can be taxed and losers compensated. However, if dirtier producers outside the EU can be more cost-competitive, companies will face incentives to move production from the EU to countries with lower climate ambitions. This problem is known as carbon leakage.

The danger for the EU is that it gets deindustrialization, but no reduction of greenhouse gas emissions. If the CO2 abated at home simply gets reimported in the shape of manufactured goods produced abroad, the EU Green Deal cannot work. Rather than helping the climate, stringent decarbonization policies may simply lower economic competitiveness and decrease domestic welfare.

The EU solution is to make trade policy conditional: adjusting for carbon content at the border can create a level playing field between goods produced under the EU's green regime and outside it. The Carbon Border Adjustment Mechanism (CBAM) is set to become operational in 2026, and will target goods produced in countries with laxer climate regimes. It is designed as a levy, and will primarily hit energy intensive (high-carbon) goods such as aluminum, steel or fertilizer that are significantly affected by high carbon prices.

Economic competitiveness of EU trading partners

The case for leveling the playing field by adjusting for carbon at the border is strong. Not only is carbon leakage avoided; a CBAM also present an incentive for EU trading partners to raise their own climate ambition (because they, rather than the EU, will then reap the income from carbon pricing). However, for some third countries, it also raises the specter of decreasing economic competitiveness.

As recent research shows, countries that are highly exposed to a CBAM because of the combination of high levels of trade with the EU and the difficulty of decarbonizing their own energy systems, face very high policy risks (Apergi et al. 2021). A case in point is Ukraine, a country looking for stronger ties with the EU but suffering from an outdated high-carbon energy system. Moreover, countries that lag behind may get stuck in negative feedback loops, where lower economic competitiveness decreases their attractiveness for (clean) investment, which further undermines their ability to catch up (Eicke and Goldthau 2021).

Such dynamics will undermine the EU's incentive system and its quest for rules-based, liberal international order. Worse still, they may translate into social tension and outright political instability in affected countries. EU trade policy must therefore be complemented by other policy tools.

The need for Green Deal Diplomacy

The key challenge for the EU lies in balancing the domestic imperative of competitiveness and the danger of negative external spillovers. Part of the answer lies in proper (external) economic impact assessment prior to the implementation of CBAM. Another part is complementing the EU Green Deal with Green Deal Diplomacy. So far, the latter is largely an empty shell. One of its key elements should be to support vulnerable economies in their clean transition, to improve both their economic competitiveness and their ability to benefit from trading with the EU. The EU Green Deal must not stop at the border. It must live up to the imperative of a just transition for all – inside and outside the Union. As a leading economic power, the EU can do its share. The best place to start is in its neighborhood and the Eastern Partnership – through financial support, know-how and technological assistance for clean energy. ■

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Renewable energy communities under the Green Deal: Enablers of a socially just transition?

Expert article • 3159

The European Green Deal (EGD) has been presented as "a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases (GHG) in 2050 and where economic growth is decoupled from resource use". Further, the EGD demands that the transition must be "just and inclusive", putting "people first" and "paying attention to the regions, industries and workers who will face the greatest challenges". In its Climate Law, the EU has formulated an interim target of reducing net GHG emissions by 2030 by at least 55% compared to 1990. In 2021, the Commission launched its 'Fit for 55 package', a set of proposals whose aim is to revise and re-align EU legislation with the new climate goals.

The energy transition is expected to particularly affect carbon-intensive economies and regions. With a view to making the transition socially just, the EU has established the Just Transition Mechanism supporting the most affected regions. The 'Fit for 55 package' proposes further measures to mitigate the social effects of the transition to carbon neutrality including a Social Climate Fund addressing the impacts of a new emissions trading system for road transport and buildings.

Although the concept of Just Transition is deeply rooted in the trade union movement and initially related to jobs, workers and communities mostly affected by environmental and climate policies, it bears also broader connotations. These encompass other groups of society and also include households and consumers in general and addresses inequalities caused by the energy transition across the board.

Energy communities (EC), collective bottom up initiatives of citizens and other local actors who invest in clean energy infrastructures can be considered as potential suitable "vehicles" for a Just Transition in a broader sense. ECs show a variety of organisational models and legal forms, with cooperatives representing the most common form. Besides reducing GHG emissions, ECs offer multiple socio-economic benefits including generation of local profits and jobs, local tax revenues and other financial returns to the communities. Energy sharing may help to reduce individual energy bills and system costs and may also help mitigating energy poverty. Finally, ECs help to promote energy citizenship and democracy enhancing social capital, mutual trust and social cohesion. ECs offer a vast potential to make the energy transition more inclusive and socially just. In the Baltic Sea Region (BSR), Denmark, Germany and Sweden are pioneers with regards to EC, whereas in the three Baltic countries and Poland these communities are still underdeveloped. The reasons are complex and range from socio-cultural and socio-economic factors, lack of political recognition, lack of effective support schemes, to administrative and regulatory barriers, prevailing power asymmetries and powerful incumbents.

The former EU Commission unfolded its vision of an Energy Union "with citizens at its core, where citizens take ownership of the energy transition, benefit from new technologies to reduce their bills, participate actively in the market, and where vulnerable consumers are protected". In 2019, for the first time, ECs were given legal recognition in the EU Clean Energy Package (CEP). Renewable energy communities (RECs) and citizen energy communities (CECs) were introduced as new market actors entitled to engage in a variety of market activities along the energy supply chain. The recast Renewable Energy Directive (RED II) required Member States to put in place an enabling framework to promote and facilitate the development of RECs. Although the transposition deadline expired in June 2021, this process will likely last for the next few years.

In its Communication on the EGD, the new EU Commission committed itself to a "clean energy transition that involves and benefits consumers". However, the EC provided rather patchy information on how ECs should be supported. In a later Communication, the EU Commission pledged "to look into capacity building schemes to implement citizen-driven RECs financed by the EU and self-consumption models enabling higher consumer uptake and faster development of decentralised renewable energy technologies". Taking into account the multiple potential benefits, ECs deserve more attention in the EGD and there should be closer linkages with the CEP. The EGD and derived legislation should pay more attention to the role of ECs as a means to facilitate Just Transition in a broader sense.

The RED II underlines that "the participation in RECs is accessible to all consumers, including those in low-income or vulnerable households". In most countries, this has been neglected so far. Empirical research shows that mainly older, affluent, well educated, male persons participate in ECs whereas women, young people, migrants, or disabled people are underrepresented. The same applies to vulnerable and low-income households. Only few, yet a growing number of ECs declare to pursue the mitigation of energy poverty.

The Horizon 2020 project COME RES aims to advance the development of RECs in nine European countries. The project´s activities involve a number of target regions, where community energy is in its infancy and model regions where ECs are in an advanced stage of development. The consortium of 16 partners examines barriers, potentials, business models, (socially inclusive) good practices and aims to initiate transfers of good practices. To engage with local stakeholders the project has established stakeholder desks in each partner country and organises solution-oriented dialogues and policy roundtables to co-create solutions to overcome existing barriers for RECs. ■

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Pan-European Institute

BALTIC RIM ECONOMIES

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GERLIND WAGNER-VOGEL

How to engage citizens to establish renewable community energy projects

Expert article • 3160

Co2mmunity is a network of organisations which are scattered across eight different countries in the **Baltic Sea Region (BSR)**. Our mission is to facilitate **community energy (CE) project development** as part of a transition to renewable energy sources. To achieve this mission, we create local partnerships for energy project development, provide knowledge, develop tools, and organise stakeholder meetings. Instead of working in isolation, we exchange ideas and experiences while continuously supporting one another. Doing so will help us improve our understanding of CE barriers and enablers, and thus relay the acquired knowledge to policy makers. Therewith, the Co2mmunity project contributes to the European Union's vision of providing Clean Energy for all Europeans.

Energize Co2mmunity is the extension project of the Co2mmunity project, intending to further develop pilot projects and reach more stakeholders in the piloting regions. We try to find solutions to overcome barriers to CE projects and promote the transferable RENCOP model as a solution.

The Co2mmunity project is co-funded under the INTERREG programme by the European Regional Development Fund alongside the project partners' own contributions.

What is Community Energy?

CE projects offer the generation of renewable energy (RE) from local sources such as solar, biomass, hydropower, and geothermal. Projects are developed and implemented through active participation of local communities, in which citizens work together to co-finance, co-develop, and co-operate RE plants. Sustainable energy distribution, such as local heating networks and biogas filling stations have a greater chance of success as CE projects. Furthermore, through active communication, transparent decision-making, and local benefit sharing, CE projects have high social acceptance.

Who Benefits from our Project?

There are currently no comprehensive documents concerning CE in the BSR. Therefore, one of Co2mmunity's objectives is to fill this knowledge gap. From our shared experience, we created a CE knowledge base to help enhance institutional capacities to support local communities. These benefits will not only be felt by municipalities, but also institutions responsible for regional energy planning, political decision-makers, and both energy and citizen's associations that facilitate CE projects.

In the project pilot regions across the BSR, the CE stakeholders benefit from coordination and facilitation through our RENCOP coordinators. The six pilot projects will be instructive examples for the participatory mobilisation process according to RENCOP and for profitable RE on a community level. Ultimately citizens benefit from the outputs and have access to knowledge that allows them to take the energy transition into their own hands.

EU Law on Renewable Energy

As renewable energy technologies have become more accessible, citizens have got more empowered. The **'Clean Energy for all Europeans Package'** together with the recast **Renewable Energy Directive** make it easier for citizens to form energy communities, but also to produce, store, and sell their own renewable energy.

Promoting Community Energy (CE)

1. The recent Green Deal of the European Union includes:

* the claim for clean, affordable, and secure energy, setting out the requirements that future energy systems must meet. These requirements can be fulfilled by enabling and facilitating energy communities to take an assured position in societies and to operate actively in the energy market. Therefore, the new EU legislation on CE should effectively be transposed and then properly and intensively implemented in each EU member state.
* the direct and central focus on building renovation and energy efficiency. CE directly supports relevant activities – engage citizens to lower consumption, deploy more efficient infrastructure, collective decision making, supporting communities at large to initiate buildings renovation projects and focus on fighting energy poverty.

2. The Green Deal does not include concrete detailed measures on how to support the democratisation of the energy system, and to assure and encourage communities as well as local municipalities participating in energy production. There is the need to include a more detailed description about the role and expectations of CE in this, as CE is the prime opportunity for communities to take ownership of a fair share of the decentralised and renewable energy production in the near future.

3. The Clean Energy Package (CEP) clearly acknowledges the big potential of CE since it will secure social acceptance of the Energy Transition. It states that in every member, state the barriers to CE should be mapped and consequently removed with determined political action at all levels. Creating a stable policy framework and eliminating regulatory barriers is the key to seize the potential of CE.

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SIMON BONNEL

Infrastructure for Europe's Green Deal

Expert article • 3161

The EU's domestic gas production is in rapid decline. To meet demand, in the green transition the EU needs reliable, affordable, and sustainable gas supplies. The Nord Stream 2 Pipeline provides modern infrastructure to transport natural gas from Russia to the EU, supporting climate goals, enhancing security of supply, and strengthening the internal market.

Gas – a key bridge energy source

Natural gas will continue to play a central role in Europe's efforts to reduce CO2 emissions and reach the goal of climate neutrality by 2050, especially in the transition from coal to renewable electricity generation, as well reducing oil combustion in the heating and transport. Natural gas also serves as the key raw material to produce climate-neutral hydrogen, when combined with carbon capture.

Coal use in the EU-28 electricity sector accounted for about 694 million tonnes of CO2 in 2018 and generated a total of 666 TWh of electricity. In producing the same amount of electricity with natural gas, the EU could save around 400 million tonnes of CO2, greatly contributing to meeting its targets. If the annual delivery volume of Nord Stream 2 (55 bcm) was to be used to substitute coal in electricity generation, 160 million tonnes of CO2 could be saved annually, reducing EU's total emissions in by 14 per cent.

As the lowest-emission fossil fuel, natural gas also serves as a bridge energy source that supports the adoption of renewable energy. As countries switch from fossil fuel-fired base load plants towards renewable intermittent energy sources such as wind and solar, the need for peaking or load following power plants (e.g. turbines burning natural gas) increases correspondingly.

Large quantities of hydrogen produced without CO2 emissions are needed to establish a market. Production by means of electrolysis and surplus green electricity will not be sufficient in the medium term because there is not enough renewable electricity capacity available. But natural gas can be used to produce hydrogen in large quantities and when in combination with carbon capture, in a climate-neutral and economic manner. Efficient and versatile natural gas pipelines, as well as future-proof import systems such as Nord Stream 2, will be the backbone of Europe's hydrogen production moving forward.

The shortest, most sustainable route from source to market

Nord Stream 2 is a modern, reliable, state of the art pipeline, providing the shortest route from the gas source to end users in the EU. It has a single compressor station that sends the gas from the starting point in Russia, over the 1,234-kilometre offshore route across the Baltic Sea to join the European gas grid in Germany.

The pipeline was subject to national environmental impact assessments and international consultation carried out in all the Baltic Sea countries. Monitored through the construction phases and as a result, it has been built in the most environmentally friendly and sustainable way possible.

Nord Stream 2 AG is committed to complying with the Environmental and Social Performance Standards of the International Finance Corporation. All elements of the project were executed according to the mitigation hierarchy, which means that adverse impacts were anticipated, avoided where possible and if not, mitigated.

When the twin pipeline system is in operation, the impacts associated with natural gas transport and use will be significantly lower than those associated with power generated using other fossil fuel types such as coal and oil.

The greenhouse gas footprint from Nord Stream 2 will also be more than two times lower than that of liquefied natural gas (LNG); due to the liquefaction / regasification process and the long-distance shipping required. The power generation for the liquefaction of LNG, along with the fuel combustion of shipping and regasification, all generate emissions. By contrast, pipeline transportation chains environmentally outperform LNG-based chains and their many additional processing steps.

Offshore pipelines like Nord Stream 2 also perform better than their onshore counterparts. Notwithstanding, the use of land, time to construct and associated environmental impact, they also consume more natural gas along the transport route due to the higher number of intermediate compressor stations. Compared to onshore routes for Russian gas to Europe, the highly efficient Nord Stream 2 offshore route saves up to 61 per cent of transport-related emissions to deliver to the same destination.

To decarbonise Europe, we need a well-functioning internal market that is reliably supplied by safe and modern import infrastructure. The transport of natural gas should be as efficient as possible, with low emissions over the entire supply chain. In this context, modern pipeline systems, such as Nord Stream 2, offer economic and environmental advantages that ultimately contribute to the European Green Deal. ■

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Poland and the European Green Deal

Expert article • 3162

With the acceleration of climate policy in the EU and the concept of the European Green Deal, Poland has found itself in a difficult position. The coal-based production mix, the lack of a strategy for decarbonising the economy, or moderate social expectations regarding climate ambitions never have put Poland in the position of a promoter of such a policy. What is more—the country has consciously blocked it in the past. Nevertheless, following the European Green Deal still seems possible, because Poland has strategic energy problems to solve, which are independent of the policy implemented at the EU level.

The political transformation and the collapse of entire branches of industries resulted in a sharp decrease of Poland's greenhouse gas emissions (GHG) in the late 1980s. However, in 2019 emissions were only 15% (data based on: European Environmental Agency) lower than in 1990, a base year for the EU climate targets. Whereas in the EU-27 GHG emissions dropped by 26%. Moreover, since 2005 (the year adopted for counting targets in the ETS and non-ETS areas), emissions have basically stagnated. In 2019 Poland emitted 378.9 Mt CO2 equivalent, which makes the country the fourth biggest emitter in the EU, after Germany, France and Italy.

The sector responsible for the largest part of Poland's emissions is the power industry—it is as much as a quarter of national emissions. This is due to the predominance of coal in the mix. In 2021 coal accounted for around 75% of electricity production. Heavy reliance on coal is also the reason for the high emissivity of district heating and individual heating. Significant, but above all increasing, are emissions from transport. This sector is already responsible for 15% of national emissions and has more than tripled over the last 30 years. Industry and agriculture each account for around 8% of emissions.

However, it is the excessive dependence on coal in the production of electricity, the largest among the EU countries, that causes the climate policy in Poland to arouse so much resistance. The EU regulatory framework related to the reduction of greenhouse gas emissions (including, in particular, the ETS) targets primarily the electricity sector. The European Green Deal has only strengthened it: in this decade there will be a faster and more steep reduction. It is already visible recently with the record high CO2 prices. Also, the European Commission proposed an extension of the ETS system to transport and buildings. And this is the latter area, that causes contestation by Poland's government.

The difficult discussion about the European Green Deal is causing resistance, because climate policy is being shown to be the cause of the problems of mining, energy, and the entire Polish economy. This is very evident now, when in the political debate the costs of purchasing emission allowances are shown as the main cause of the increase in electricity prices. Meanwhile, the government ignores high fuel prices, little competition on the domestic market or simply costs incurred as a result of long-term neglect and postponement of investment decisions in the energy sector. At the same time, it also omits the record budget revenues from the sale of CO2 emission allowances, which last year amounted to over EUR 5.5 billion. And which should be spent at least half on low-carbon transformation.

Unquestionably, in such circumstances negotiating and implementing the various elements of the European Green Deal will be a difficult task. From the perspective of Warsaw, it is more difficult than for other Member States. It is worth noting, however, that increasing the EU's ambitions is also connected with financing, which Poland can use more than other Member States. For instance, Poland may become the largest beneficiary of the new Just Transition Fund and the newly planned Social Climate Fund. Of course, if the country is going to transform.

To allow the realization of the European Green Deal in Poland, the discussion about the necessary reductions of emissions must be linked to the challenges the country is still facing, regardless of the European Union's climate ambitions. The end of coal is inevitable, Poland must ensure its energy security, and the country requires new investments to rebuild the economy losing its competitive edge with rising energy and labour costs. Last but not least, reducing CO2 emissions is linked to improving air quality, which the government defines as a strategic challenge. Addressing these internal problems may result in a gradual shift towards stringent EU climate and environmental rules and a greater focus on sustainability of the economy. ■

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The European Green Deal from the perspective of the Polish energy sector

Expert article • 3163

The European Union is consistently implementing environmental and climate protection objectives. Climate and energy policy is a key tool for achieving the ambitious priorities set by the European Commission in 2019 for the energy transition. The targets set by the *European Green Deal* aim to ensure climate neutrality by 2050.

As the EU Member State, Poland has accepted the challenges posed by the European Green Deal. This caused much discussion within the country. The main issue in the debate, on the one hand, was the ambitious nature of the European assumptions and, on the other hand, Poland's ability to implement these challenges and the costs involved.

The ideological correctness of the action taken to achieve climate neutrality in the European Union by 2050 cannot be denied. There is no doubt that the direction taken by the European Commission is right towards ensuring sustainable development, protect the climate and look after the welfare of future generations of Europeans.

In the case of Poland, the implementation of climate neutrality appears to be rather complicated. It consists of numerous challenges that should be taken into account from the perspective of the European Green Deal. Selected issues, which seem to be the most difficult to implement, will be discussed below. They are related – in particular – to the specificity of the Polish energy mix.

1) The policy strategy issue. In 2021, the government adopted a strategic document for the energy sector entitled *Energy Policy of Poland until 2040.* This is a relatively unambitious plan in the context of achieving a zero-carbon economy, although it realistically reflects the capabilities of the Polish economy in terms of the energy transition, especially in the context of a slow transition away from fossil fuels. In addition, the Polish strategy lacks time compliance with the European Union strategy. Without an amendment to this document, it is difficult to effectively predict whether there is a chance that the actions carried out by Poland will be more compatible with the time horizon to 2050.

2) The dominance of fossil fuels in the structure of energy generation. The energy balance of Poland is predominantly based on the use of fossil fuels, in particular hard coal (approximately 45.4% in 2020) and lignite (approximately 24.3% in 2020). The importance of the mining sector in Poland results from two premises: firstly, hard coal and lignite resources constitute the basis of national energy security, and secondly, the mining sector in Poland is characterised by a high level of employment. Therefore, the prospect of reducing coal in the Polish energy mix is perceived by those in power as a potential threat to the country's energy security, and it will involve a major restructuring of employment not only in the mining industry itself but also in areas linked to the mining industry. This may mean an increase in unemployment and, consequently, social discontent and further structural problems in mining regions. Such a situation will not be without influence on electoral preferences and will certainly burden those political elites that will be identified with the phasing out of the mining industry in Poland.

3) Low share of renewable energy sources (RES) in the energy mix (approximately 17.7% in 2020). According to the provisions of Directive 2018/2001, the share of RES in gross energy consumption should be 32% in the Member States by 2030. Despite existing support systems for the development of RES, the development of this technology is not dynamic enough in Poland to achieve the assumed targets. According to national estimates, Poland may reach a level of approx. 23% by 2030. Actions taken to support renewable energy include an efficient auction system for most of the currently dominant renewable technologies, green certificates, government support for prosumers and dispersed energy, especially cluster initiatives and energy cooperatives. The main barriers to the development of renewable energy should be mentioned, in particular: limited possibilities of financing investments by entrepreneurs, legal regulations of support, administrative and procedural difficulties, as well as problems with the functioning of transmission networks.

4) Lack of alternative energy sources, mainly nuclear. Although the long-term energy strategy envisages that the first nuclear power plant unit with a capacity of about 1-1.6 GW will be commissioned by 2033, with subsequent units to be commissioned every 2-3 years. A total of 6 units are planned to be built. However, this does not mean that the programme will be implemented. In the past, strategic plans also referred to this type of energy. It was supposed to be available as early as 2024, but construction has not started. The implementation of these measures involves both high economic costs and requires social acceptance, especially in terms of minimising the NIMBY syndrome. Meanwhile, Poland's planned abandonment of hard coal and lignite in the face of insufficient energy production from renewable sources could pose a serious risk to energy security in the future, especially in the context of growing demand for energy.

5) Possible restrictions in access to European funds necessary for the transformation of the Polish economy and environmental protection. Poland needs European funds especially for the transformation of mining regions. The initiation of procedures related to the violation of the rule of law in Poland by the European Commission may constitute an important obstacle resulting in blocking this financial stream.

To sum up, the European Green Deal enjoys social acceptance and understanding of politicians in Poland. Ideologically it is considered to be the right course of action. However, there are some difficulties and structural challenges that may call into question whether its objectives can really be achieved.

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From the perspective of the EU, we can only talk about success when it emerges in 2050 that the Member States have effectively fulfilled their obligations and the goal of climate neutrality has been achieved. It seems important to be consistent in implemented actions and to maintain full mobilisation of all countries over the next 30 years.

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Lithuania – ahead of the European Green Deal

Expert article • 3164

In terms of renewable energy (RE) deployment, the European Union is outpacing most other jurisdictions. With the European Green Deal, the EU is aiming at further speeding up the transition of its economy towards decarbonization. Renewable energy and other carbon-neutral energy sources play an important role in that regard. Fundamentally changing the EU's energy supply system does, however, not come easily or automatically. Lithuania may appear like an unlikely candidate for learning about the energy transition, but historical experience makes the country well prepared for the decarbonization ambitions of the Green Deal. Moreover, Lithuania serves to highlight some of the economic, political, and security challenges the Green Deal will meet during its implementation.

Challenge 1: political decisions

The Green Deal requires high-level decisions regarding Europe's future energy options. Due to its historically difficult energy situation, Lithuania has much experience with the sometimes-difficult trade-off between domestic political sentiments and international commitments. This includes decisions regarding the economic promises and environmental dangers of nuclear power, LNG imports and new electricity interconnectors. Based on this experience, Lithuanian policymakers embraced large-scale deployment of RE sooner and in a more encompassing manner than many other countries in the region. Today, RE has become the country's main strategy in terms of energy policy. In the long run, Lithuania hopes that this policy will provide a basis for achieving both energy security and reaching EU and international climate goals.

Challenge 2: economic dynamics

The case of Lithuania shows that markets can drive the transition. As in most countries, wind and solar power are now cost-competitive in Lithuania, which provides the country with a good basis for a profound energy transition. In September 2019, the country announced the first of three planned annual technology-neutral auctions (each for 700 GWh of renewable generation capacity), offering a 12-year priority to the grid and feed-in premiums. The winner of the first auction, an onshore wind farm, won with a bid of 0 EUR/MWh, which showed that renewable sector development has reached a stage where it can freely compete without state support. The second auction, planned for 2020, was cancelled as per Renewables Law, because Lithuania reached the target of 5 TWh of annual domestic electricity production from renewables at the time. However, while the energy transition is progressing, a slowdown has been noticed, particularly in the area of distributed solar power.

Challenge 3: economic side effects

Despite the positive development of RE, total energy related GHG emissions are rising by 1% a year. According to the IEA, the government needs to review targets and monitor progress closely, otherwise it risks missing the targets for 2030 and 2050. To cope with the slowing progress, the Energy Ministry is offering a one-time compensation for PV installations. Deep energy transitions, do, however, also involve macro-economic costs. In that regard, Lithuania can look back at strong experiences with fundamental changes in the energy supply system. Specifically, it had to deal with the closure of its most important power source, the Ignalina nuclear power plant. Despite changing from a net energy exporter to one of the EU's main net per capita importers, Lithuania was able to maintain economic growth. EU support was an important factor in that regard. Today, Green Deal related discourses in Lithuania circle again around external funding.

Challenge 4: geopolitical fall-out

Facing a distinctly asymmetric and one-sided import dependency on Russia, Lithuania aspired energy independence and managed to strategically reposition itself in the regional energy system. This move anticipates some of the external effects of the European Green Deal. Progress towards decarbonization will, eventually, lead to the reduction of external energy dependence, and hence growing strategic autonomy for the EU. However, the Lithuanian case also highlights some of the EU's deep-rooted limitations. Blocking electricity supply from Belarus created tensions with Latvia and Estonia, while full cooperation is needed on the synchronization of Baltic countries electricity grid with the West and North European power systems. Divisions between EU member countries such as these may jeopardize the achievement of projects of common interest, and thus slow down system integration.

Conclusions

The case of Lithuania is well-suited to highlight some of the political and energy dynamics stemming from the European Green Deal. It shows that energy transition is possible. Political hurdles, (macro-) economic challenges, and geopolitical implications can be controlled, even under difficult circumstances. However, there is a risk that the European Green Deal consolidates splits between member countries.

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Embracing the mentality of sustainability

Expert article • 3165

Latvia's chance to get the best out of the European Green Deal rests on the ability and willingness to embrace the mentality of sustainability where economic growth depends on the principles enshrined in carbon neutrality, circular economy and biotechonomy. Let me shortly elaborate on some of the aspects of the Green Deal in Latvia.

The Green Deal provides framework of opportunities for sustainable and successful development of economy although is perceived and interpreted by many as a threat to national economy and people's welfare. Ambivalent feelings and reactions are exacerbated by currently high energy prices, which do not provide a good context for convincing society to embrace the goals and processes associated with the Green Deal. There are several aspects to this context that are relevant for the implementation of the Green Deal in Latvia. Transport, energy production and consumption are perhaps those sectors of economy, which are primarily identified with the impacts and policies that the Green Deal incurs.

The best energy is the one we do not need to produce. The logic may tell that if the overall level of energy efficiency is low and energy prices are unusually high, one should invest in improving energy efficiency. An intuitive reaction to the situation is to try cutting expenses by requesting measures that would decrease the price of energy through reducing energy or environmental taxes, introducing subsidies to energy consumers and producers. This is yet another example that policy making at times has to be counter-intuitive to ensure that the right goals are pursued. There will be blaming and shaming, but decision-making ought to be based on evidence stemming from research and analysis and should not give in to pressure in favour of easy solutions. In Latvia, there is also a local political context – with general election approaching in October 2022 politicians are tempted to opt for easy solutions that do not go against the current of public opinion.

Increasing energy efficiency in buildings is one of the most challenging tasks, and the biggest part of the burden, albeit not exclusively, is on the shoulders of Riga, where roughly one third of the country's housing stock is situated. The current pace at which buildings are renovated is too slow to be able to meet energy efficiency targets by 2030 set out in the National Energy and Climate Plan, which is criticised by environmental NGOs and researchers for lacking sufficient ambition for RES and energy efficiency targets. Also, making industry energy efficient remains a challenge although energy and environmental management systems are being introduced at an increasing rate. Slowly the awareness that modernisation and energy efficiency are key to competitiveness is sinking in. Perhaps the biggest problem resides in peoples' minds.

If we consider that the focus of the Green Deal is on reducing carbon emissions, then some of the biggest challenges are associated with the transport sector. Transition from conventional fossil fuels to more environmentally friendly transport solutions is nowhere near entering mass market. Limited use of CNG, no biomethane for use in transport, reduced excise tax for natural gas in transport, almost no hydrogen (except for public transport in Riga), only gradually growing number of EVs and slowly expanding EV charging infrastructure are the highlights of energy transition in transport. Although public transport is rather broadly available it is difficult to motivate passengers of private cars to switch to trams, trolleys, buses, and trains. New approaches will have to be searched for to establish a motivating mix of policies representing *hugs, carrots and sticks.* Good thing is – there is plenty of space for improvement.

In energy production challenges are mainly related to the currently significant role of natural gas in the heating sector and in power production. District heating in Riga relies mostly on natural gas. Two combined heat and power plants (CHPs) in Riga are the biggest source of consumption of this expensive energy resource. Riga district heating company has been diversifying fuel for heat production away from natural gas by building wood chip boiler houses, but that seems to be only part of the solution. The gas-fired CHPs constitute significant power production capacities with installed capacity of just under 1 GW (144 MW for CHP-1 and 881 MW for CHP-2). Although natural gas CHPs function according to merit order the overall electricity deficit in the Baltic States means that these CHPs are factored in the production capacities when there is an insufficient supply as other types of production are limited or unavailable. Decisions about deploying and integrating more renewable energy solutions into a smart energy system of tomorrow is going to be at the centre of tasks to be accomplished under the mind-changing umbrella of the Green Deal. ■

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Can Estonia achieve the goals of the EU's Green Deal?

Expert article • 3166

As part of the European Union's (EU) Green Deal – an ambitious goal to become a climate-neutral continent by 2050 – Estonia has committed to reducing net greenhouse gas emissions by 70% by 2030, compared to 1990 levels, and achieving carbon neutrality by 2050. While Estonia's CO2 emission has decreased 64% since 1990, this change is mostly attributed to the restructuring of the economy following the collapse of the Soviet Union.

Today, Estonia's economy is still the most carbon-intensive among OECD members, which is mainly due to the reliance on fossil fuels in domestic energy production. According to a recent study, achieving carbon neutrality in Estonia by 2050 is feasible, if a comprehensive set of cross-sectorial measures is implemented, while the estimated cost of this would amount to a substantial 17.3 billion EUR. Looking at the current domestic debates, Estonia's path towards the 2050 goal remains questionable.

Above all, the issue requires strategic vision and strong political commitment to take unpopular decisions that will influence the lives of many. Throughout the past 30 years, Estonian governments have not demonstrated a convincing track record regarding climate and environmental issues. A long-term plan concerning climate and energy policies has not been a political priority for several reasons, three of which – security considerations, socioeconomic implications, and lack of public demand – will be discussed below.

First, concerns over energy security have led Estonia to increase its energy independence by decoupling from Russian power grid. Estonia has long been producing energy from oil shale, which guarantees sufficient energy supply but, as a fossil fuel, is not a sustainable strategy in light of the Green Deal. Even if the decision to stop using shale oil for energy production will be enforced in the coming years, it will remain an important resource for the chemical industry.

Estonia's progress in adopting renewable energy solutions has been gradual and successive governments' approach mostly passive. The Green Deal has propelled discussions on alternative energy resources, especially regarding renewables, hydrogen and nuclear energy, but without tangible outcomes so far. Concrete steps in this direction will be required; however, as Estonia will continue to prioritise energy security, it cannot follow the example of some EU member states who seek to rely on full-scale energy imports from third countries.

Second, there are compelling socioeconomic implications to the "green" transition. This affects the north-east part of Estonia in particular, which is the most industrialised region, inhabited largely by Russian-speaking minority employed primarily in energy and manufacturing sectors. Significant restructuring of the economy would leave the local communities in a heightened risk of poverty and inequality (a trend already present), and significant compensation packages and alternative employment opportunities would have to be provided. This is one of the key elements in Estonia's recovery and resilience plan, funded from the *NextGenerationEU* initiative.

Socioeconomic concerns have raised alarm among the population and mobilised political parties seeking to extend their voter base. The right-wing populist Estonian Conservative People's Party (EKRE) has been vocally opposed to the Green Deal, denying the anthropogenic causes of climate change and claiming ideological motivations behind the initiative. Given that EKRE is one of the three most popular political parties in Estonia, it is likely that green transition will emerge as one of the main topics ahead of the upcoming parliamentary elections in March 2023.

Third, it is noteworthy that while nature is highly valued by Estonians, climate change is not perceived as a crucial issue by the majority, and substantial discussions have arisen only because of the Green Deal. Estonians are yet to experience serious consequences of climate change and thus find its global effects hard to grasp. Waste management, where the predominant treatment option is still landfilling instead of recycling, is one of the sectors where Estonia is lagging behind in Europe, but public awareness is growing. Recently, environmental NGOs have mobilised over sustainable forest management, claiming that logging volumes should be reduced, while the government sees biomass as a potential renewable energy source, given the high forestation of the country.

In sum, the lack of wider public discussion in the Estonian society on effective and appropriate measures to achieve carbon neutrality, coupled with security, political and socioeconomic implications outlined above, have led successive governments to prefer short-term political gains over uncomfortable decisions regarding climate and energy. Estonia can achieve carbon neutrality if the goals and resources provided through the Green Deal are backed up by local political commitment and strategic vision to change the status quo. ■

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The European Green Deal and EU-Russia relations

Expert article • 3167

The European Union (EU) has launched a Green Deal to promote the energy transition and a climate-friendly economic recovery after the Covid-19 pandemic. The European Green Deal is a comprehensive roadmap for policies that should lead the EU to climate neutrality (zero net greenhouse gas emissions) by the year 2050. For the year 2030, the EU's plan is to reduce emissions by at least 55% (compared to 1990 levels), while simultaneously increasing renewable energy production and energy efficiency.

The decarbonisation of the European economy poses a major challenge to hydrocarbon producers that supply the large European market. This issue is particularly relevant to Russia. The trade of fossil fuels has been a crucial economic and strategic aspect of EU-Russia relations for decades. The EU has had access to competitively priced Russian fossil fuels, whereas Russia has made vast profits by selling its energy in the EU market. In Western Europe and large EU members in particular, this trade tends to be regarded as the cornerstone of EU-Russia economic interdependence.

In the current context of political crisis between Moscow and Brussels, energy trade is one of the few remaining areas of bilateral cooperation – and the most significant one from an economic standpoint. The prospective scaling down of this trade may further alienate the EU and Russia from each other and potentially aggravate political tensions. At the same time, the climate crisis requires prompt action from large polluters such as the EU and Russia in order to avert an environmental catastrophe.

The European Green Deal will have two main challenging consequences for Russia. The first one concerns Russia's energy exports. European demand for Russian fossil fuels will decrease. This will initially affect coal demand, then oil and, after 2030, gas. While Russia is now increasing exports to Asia, Europe remains the largest purchasers of Russian oil, coal and gas. Moreover, Asian countries are also embarking on the energy transition – Korea and Japan aim to achieve climate neutrality by 2050, China by 2060. Hence, Asia's demand for fossil fuels will also decline in the mid- and long-term.

The second main implication of the European Green Deal concerns Russia's energy intensive exports to Europe (metals, chemicals, fertilisers). The EU is planning to introduce a carbon border adjustment mechanism, namely a tax related to the volume of emissions caused by the production of the imported goods. With the tax, the EU aims to prevent carbon leakage, namely the transfer of carbon-intensive production to countries with weaker environmental standards. It also intends to induce other countries to adopt similar standards. The tax will impact on the price of Russia's metallurgical and chemical exports to Europe. The EU's plan to introduce a carbon border tax has aroused criticism in Russia and in other trade partners of the EU, where many see the tax as "green protectionism". Some Russian actors mentioned that the issue could be taken to the World Trade Organisation.

Nonetheless, the European Green Deal could also lead to new forms of cooperation between the EU and Russia. While the huge income from hydrocarbon exports have discouraged ambitious green policies and investments in Russia, official discourses on climate policy are beginning to change in Moscow too. In his state of the nation address of April 2021, President Vladimir Putin mentioned environmental and climate issues as a priority for Russia's development for the first time. In July, he signed a law that mandates companies with significant emission levels to record them; the data will be used to monitor if emission targets are met. If Russia develops domestic carbon pricing, it may be able to collect carbon fees domestically instead of having its exports taxed at the EU's border.

Against this background, Russia and the EU face the task of progressively transforming their energy relationship along more sustainable models. Important areas of potential EU-Russia green cooperation include the development of renewable energy, the trade of rare earths, hydrogen, and improvements in energy efficiency and connectivity.

Russia has huge potential for developing renewable energy. Some European companies have already invested in the Russian renewables sector. For instance, the Italian ENEL is building wind farms in the Murmansk, Stavropol and Azov regions. Renewable energy – for example wind power – can be produced and used locally to satisfy the demand of relatively small urban centers in the vast Russian North and East, which is more cost efficient than connecting them to a centralized power grid over long distances.

Russia is one of the largest producers of rare earths and minerals such as nickel and cobalt, which are essential for renewable energy technologies and are in high demand in the EU. It also has numerous resources that are capable of producing hydrogen, as well as a number of R&D activities in this area. Russia could produce hydrogen from hydrocarbons (for instance grey and blue hydrogen), renewable sources (green hydrogen) and nuclear power (purple hydrogen). Here, the different preferences of the EU and Russia would need to be reconciled – the EU clearly prefers green hydrogen, despite the generally higher cost of producing it now.

There is plenty of room for both the EU and Russia to increase their energy efficiency. As the lack of investments is a key issue in this area, Russia's cooperation with the EU could compensate for the shortage of finance, especially if administrative and bureaucratic barriers are eased. Moreover, Russia and the EU could ensure their connectivity through infrastructure that allows electricity trade. Finally, the harmonization of regulatory aspects, such as green taxonomies, would greatly facilitate green cooperation and investments. ■

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Developing a green industrial policy for the European Green Deal

Expert article • 3168

In 2019, Ursula von der Leyen adopted the European Green Deal as the flagship initiative of her new European Commission. With this initiative, the EU executive arm aims at making Europe the first climate-neutral continent by 2050. To get there, EU Member states committed to cut its greenhouse gas emissions by 55% by 2030 compared to 1990 levels. With the 'Fit for 55' package, the European Commission unveiled in July 2021 a set of legislative proposals to achieve its 2030 climate target.

As the European Green Deal seeks to unleash a major transformation in the European socio-economic structure – such as the ones from fossil fuels to renewables, or from internal combustion engine cars to electric cars – this challenge is often referred to as a revolution against a deadline. As in any major transformation, there will be winners but also losers, particularly in the short-run. A strategy only based on climate targets and instruments, such as raising the price of carbon or banning diesel cars, could miss the target, when firms and citizens fail or even simply reject to adjust. Only a policy creating a broader space for more winners than losers can sensibly face the challenge of such a vast transformation.

The necessity to meet climate and environmental targets, while at the same time ensuring economic and social sustainability requires a transformation that will generate enough benefits to compensate the losers. This brings industrial policy under the spotlight of the European Green Deal.

Today, Europe is characterised by a multitude of green industrial policy initiatives, undertaken at regional, national and EU levels. These initiatives are generally not coordinated. This is a major issue, because significantly different green industrial policies in different EU countries fragment the EU single market and could disrupt the level playing field. A fragmented EU single market for green technologies prevents innovative European cleantech companies from scaling up in the way that their United States and Chinese competitors do on their domestic markets. It is thus vital to develop a solid regulatory framework accompanied by competition policy enforcement, ensuring access to a truly single, competitive EU market with common environmental standards.

Furthermore, European countries and companies would benefit greatly from joint coordinated actions in certain green technologies, so that they can exploit synergies and economies of scale. This can be achieved through European Alliances – already established since 2017 for batteries and since 2020 for clean hydrogen – aimed at fostering cross-European public-private collaboration. These Alliances are a valuable EU green industrial policy tool, and should be expanded, also to involve emerging and innovative industrial stakeholders alongside established industrial players.

To develop a successful green industrial policy, Europe also needs to be braver in innovation because the green revolution needs breakthrough innovation. This requires significant risk-taking by public institutions. To facilitate this, the innovation component of an EU green industrial policy should be viewed as a portfolio, in which certain initiatives will inevitably fail. A portfolio with no failures entails no risks, and a portfolio with no risks is unlikely to provide breakthroughs.

Finally, the reach of EU green industrial policy should extend beyond Europe's borders. Europe produces less than 10% of global greenhouse gas emissions. To really make a difference in terms of climate protection, the European Green Deal has to go global. The EU can leverage its external development policy and turn it into a vehicle of global sustainability. Such an approach would provide a triple benefit. First, it would help meet the EU's climate finance obligations and thus help to achieve the conditional emission-reduction commitments made by most developing countries under the Paris Agreement. Second, it would help EU industry to enter into new, rapidly growing markets. And third, it would help economic development in the EU's partner countries, providing an invaluable foreign policy dividend for the EU.

If it builds on these principles, the EU has a real opportunity to create a workable green industrial policy that will help deliver on the ambitious objectives of the European Green Deal. Doing so is important for the European economy, as much as for the climate. ■

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Green Deal and Finnish agriculture

Expert article • 3169

As a part of the Green Deal on agricultural sector the Farm to Fork Strategy aims to accelerate transition to a sustainable food system, have at least neutral environmental impact, help to mitigate and adapt climate change, reverse the loss of biodiversity, ensure food security, nutrition and public health, making sure that everyone has access to sufficient, safe, nutritious, sustainable food and preserve affordability of food while generating fairer economic returns, fostering competitiveness of the EU supply sector and promoting fair trade.

Finnish agriculture is almost exclusively based on family farms: in 2021, 85% of the farms receiving support were privately owned and 13% were owned by heirs and family companies and corporations. The average age of farmers is rising and is currently 53 years. As the farm population ages, the share of young farmers falls and the older farmers increases.

In 2021, the total number of farms which had applied for agricultural support was a little under 45 000. During the 26 years that Finland has been part of the EU (1995–2021), the number of Finnish farms has fallen by more than 50 000 farms. At the same time the average size of farms receiving agricultural support increased from 23 ha of arable land to 51 ha. The average farm size increases as the number of the smallest farms declines and that of the largest farms goes up. Large farms with more than 100 ha of arable land are the only group where the number of farms is growing. The total cultivated arable area of farms receiving agricultural support was 2.268 million ha, and about 40% of this was leased. In 1995, the share of leased land was 22%. The average size of base parcels is about 2.5 ha.

The changes in the production structure of Finnish agriculture have been characterized by a rapid decline in the number and share of livestock farms and an increase in the share of crop farms. For example, in 2021, around 5 000 farms practiced dairy husbandry as their main activity. In 1995 the number of dairy farms was more than 32 000 farms. Dairy farms, like beef farms, are more evenly distributed across all regions of Finland than the other lines of production. In 2021, the number of farms specializing in pig meat production was about 500 in 2021. The number of poultry farms was 400. At the same time there were about 31 000 crop farms. Forests are an integral part of Finnish farms. The average forest area of farms receiving agricultural support is about 50 ha, but regional variation is considerable.

In EU Finnish agriculture cannot compete on cheap prices so we chose a quality strategy. This meant higher quality standards in both crop and livestock production. This means no heavy metals and average phosphorus level in soil is satisfactory, minor residues of plant protection products in food products, minor leach of nutrient into water bodies, more organic production and very high standards of food hygiene like no salmonella in Finnish food. We believe this choice will be beneficial to us in the Green Deal. We cannot be at the forefront of environmental sustainability while striving for competitiveness within the European single market. It is essential for the continuity of production that agriculture be supported in environmentally sustainable production.

We see this in the country specific recommendations to the members states which the commission made in part of the Green Deal process. For the Finnish agriculture commission was concerned about e.g., the low rate of generation renewal, poor profitability, improving the added value of agricultural production, biodiversity, improving the use of nutrients, climate change mitigation, reducing greenhouse gas emissions and improving resilience but not, for example, the use of antibiotics.

The impact of Green Deal measures for agriculture

Some economic analyses have been carried out already on the impact of the Green Deal on agri-sectors. Kiel University study: Double disaster — Europe's Green Deal Farm to Fork plan would undermine environmental sustainability goals with no significant economic payoff https://www.bio-pop.agrarpol.uni-kiel.de/de/f2f-studie/executive-summary-en. Also, Wageningen University (WUR) carried out an impact assessment that shows that farm income can be seriously affected. https://www.wur.nl/en/newsarticle/Green-Deal-diverse-and-uncertain-farm-net-income-impacts-1.htm

The whole Farm too Fork -project is very sensitive on prices both on input and outputs. What is clear for everybody is that the production costs in EU is increasing and the old tools for market balance in the Common Agriculture Policy (CAP) is not available nor having funds in the EU budget. At the same time, the focus of the CAP is shifting to the externalities of multifunctional agriculture, to the public goods.

New trade policy is to ensure level playing field in single markets

In last few years the EU has been very liberal in trade policy and focused to new openings to global markets. European Food chain has been very successful in export. The Green deal has changed the situation. The traditional way to tackle trade policy has irreversibly change. It is not enough anymore to create new market possibilities. The first two steps the earlier Commission started already by nominating new trade enforcement officer. The focus in this new task is fully implement the trade deals and secondly train European SMEs to use possibilities.

The Green Deal rules for EU farmers have been more demanding that what is required from the third country products due to the cross-compliance demands in the CAP. For this reason, the Commission planned three additional proposals as a part of new trade strategy (https://ec.europa.eu/commission/presscorner/detail/en/ip_21_644) to ensure level playing field in the EU single market. The first two proposal has already been published and we are still waiting for the due diligence package.

- Carbon Border Adjustment Mechanism (CBAM) is built to prevent outsource production outside of the EU, because of lower costs. The product coverage is steel, aluminium, cement, nitrogen and electricity. The challenge for food chain is that there is only nitrogen as a basic product inside, but products where the nitrogen is the main variable cost is not included. Secondly, nitrogen is having also antidumping duties, which are not calculated in the proposed CBAM-duty.
- Deforestation Free labelling is proposed to ensure that no rain forest is cut down because of the food import. The system is not ready at the moment, but it seems to be very bureaucratic and leading to additional certificates and audits in EU production as well.
- Due diligence has same kind demands as the CAP is having in

cross-compliance, but because we do not have the proposal, we do not know what kind of audits the food chain must have to ensure that there is no force-labour, slavery, child-labour or human trafficking.

Programme for the French Presidency of the Council of the European Union includes some new activities call “mirror measures” to ensure that imported products are subject to the standards in force within the EU, whenever this is necessary, to improve the protection of health and the environment, in compliance with WTO rules.

The implementation of existing legislation is an important issue in trade policy. For example, animal welfare legislation has been in place for years and the 12-year transition period is over. Yet many Member States have not implemented the legislation or have granted exemptions to local businesses. In trade negotiations, this means that the EU faces challenges in arguing that the EU is single entity from a trade policy perspective.

If the Farm to Fork equivalent criteria is not possible to require through legislation the DG SANTE has introduced a voluntary “the Code of Conduct” firstly for large multinational companies and on the next face for all the actors on the single markets. ■

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ICT and energy efficiency: the two sides of the equation

Expert article • 3170

The use of ICT shows considerable promise as a means to support energy efficiency in other sectors, including three sectors which are responsible for a substantial portion of Greenhouse Gas emissions worldwide, transport, buildings and energy. On the other hand, ICT can also be a source of emissions. We consider both sides of the equation in this brief article.

In a study conducted by WIK-Consult for Stokab in 2020,[1] the municipal network of the City of Stockholm, we found that fibre infrastructure was being used in Stockholm in a range of innovative ways to reduce pollution and limit green-house-gas emissions.

For example, by introducing Smart Waste Handling, which involves using sensors to identify different types of waste and facilitate their separation, underground transportation and recycling, the City was able to reduce traffic from waste vehicles by 90% with an accompanying reduction in CO2 emissions, noise and pollution. Buses also experienced 25% faster driving times in a trial of dynamic traffic light controls, which gave public transport priority over other more potentially more polluting forms of private transportation. ICT (including video capture and analysis of licence plates) has also played a critical role in the introduction of "congestion charging" and "diesel ban" schemes which have been established in a number of cities, and is central to the introduction of "transport as a service" as well as "connected automotive mobility" which is expected to increase the efficiency of freight transport.

Fibre-connected sensors can also be used to optimise energy use in buildings, by controlling the use of heating, lighting and air conditioning to precisely reflect ambient conditions. Sisab, which is responsible for maintaining Stockholm's schools, was able to save 35% of energy, saving 18,500 tons of CO2 and 4 million Euros per year between 2012 and 2019, through using "smart building" solutions, supported by fibre. Buildings are responsible for around 40% of all energy consumption in the EU as well as 36% of CO2 emissions,[2] so the opportunities for energy (as well as cost) saving could be significant.

Digitalisation also offers significant promise in increasing the efficiency of energy generation and distribution. For example, as discussed in a 2019 study by WIK for the Danish Energy Agency,[3] ICT can be used by grid operators to monitor processes in the grid and boost the efficiency of energy transmission. This is crucial in a system with a high feed-in from intermittent energy sources such as wind and photovoltaic generation and will become increasingly important as demand for electricity increases as a result of the growing use of electric vehicles and heat pumps. Meanwhile, on the demand side, smart meters offer the potential for time or load dependent tariffs and provide consumers with real-time information on their energy consumption, supporting consumers in making energy-efficient choices.

Recognising these contributions, the European Commission highlighted in the 2019 European Green Deal, that the Information and communication technologies (ICT) sector is a key enabler to achieve Europe's sustainability goals in many different sectors. However, the EC also emphasizes that the digital sector itself should be sustainable at its heart,[4] and provides an objective that digital infrastructures should achieve climate neutrality.

Looking at the ICT sector itself, the largest proportion of Greenhouse Gas emissions stems from end-user devices. Trends are towards devices and delivery methods which are more energy intensive. For example, higher energy use (and thereby emissions) is associated with larger screens, while streaming is more energy intensive than the content delivery mechanism, which it is increasingly replacing - traditional broadcasting. However, at the same time, with incentives from legislative and soft law measures including the Ecodesign Directive and voluntary Codes of conduct covering broadband equipment and data centres, the ICT sector is taking steps to improve the energy efficiency of devices and data centres. Electronic communications operators have also been active in improving energy efficiency, with many adopting "net zero" targets between 2030-2040.

The balance between increased demand for energy within the ICT sector and steps towards energy efficiency will ultimately determine whether the ICT sector can maintain its energy consumption within the current footprint. In any event, it stands to play a significant role in supporting the energy as well as digital transformation in a range of other sectors. ■

1 *Godlovitch et al (2020) Neutral Fibre and the European Green Deal.*

2 *See EC (2019). Energy performance of buildings.*

3 *Godlovitch et al (2019) Analysis of the Danish Telecommunication Market in 2030.*

4 *2019 European Green Deal.*

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Perspectives of wind energy extraction in the Baltic Sea in the context of the European Green Deal

Expert article • 3171

In the last decades the climate change effects became obvious and without effective measures for reducing the greenhouse gas emissions the changes can be even more dramatic in the future. The concept of Representative Concentration Pathway (RCP) has been defined in 2014 in the fifth Assessment Report (AR5) elaborated by the Intergovernmental Panel on Climate Change (IPCC). These pathways describe different possible climate scenarios, depending on the volume of greenhouse gases (GHG) emitted in the next years. The RCPs initially defined in AR5 are 2.6, 4.5, 6, and 8.5, being labelled after the radiative forcing values expected in 2100 (2.6, 4.5, 6, and 8.5 W/m2, respectively). In 2021, in the framework of the sixth Assessment Report (AR6), a new concept has been introduced by defining five different Shared Socioeconomic Pathways (SSPs). These SSPs are scenarios related to projected socioeconomic global changes up to 2100, presenting more complex and holistic perspectives of the future climate dynamics in direct relationship with different climate policies.

In this context, the European Green Deal, released publically in December 2019, presents the European strategy for decarbonisation, according to which the European Union is assumed to be climate neutral by 2050. An important step in achieving such ambitious target is represented by a significant enhancement in extracting marine renewable energy and offshore wind, in special. Although the offshore wind industry has increased exponentially in the last decade, the EU target assumed for 2050 is 300GW, being 25 times higher than the current European operating capacity of 12GW (in 2021). Such very ambitious goal involves both wide geographical extension and high technological advance. Europe is the world leader as regards extraction of the offshore wind. The first offshore wind farm (Vindeby) was installed by Denmark in 1991 in the Baltic Sea and it is still operational. Moreover, the Baltic Sea is among the coastal environments where the offshore wind farms have been systematically implemented in the last decades, with 18 operational wind farms.

An analysis of the wind power in the coastal environment of the Baltic Sea, targeting especially the average and extreme wind power conditions and focused on the main locations where wind farms operate, shows the expected trends. This analysis is first related to the historical wind data considering the 30-year period 1976-2005. The results indicate that the locations corresponding to the wind farms: EnBW Baltic 2 (De), Anholt (Dk) and EnBW Baltic 1 (De) have the highest mean wind power, with values greater than 850 W/m2 (even than 1000 W/m2 for EnBW Baltic 2). As a second step, relative to the 30-year time window corresponding to the near future period 2021-2050, projections of the expected wind power have been done considering the two most significant climate scenarios, RCP4.5 and RCP8.5. In the first RCP scenario, an enhancement of the greenhouse gas emissions until 2040 is presumed and a decline afterwards. The second scenario (RCP8.5) assumes that this enhancement will continue during the entire 21st century. The wind data delivered by the Regional Climate Model (Rossby Centre regional atmospheric model, version 4) was analysed and the results indicate a moderate increase of the wind power in the near future (slightly higher for RCP8.5). This is expected to be more significant in the winter, while in the summer a small decrease is noticed. However, the general tendency for the wind power in the Baltic Sea is to increase. Another aspect observed is that, for the locations with high wind power resources, a higher seasonal variability is characteristic than for the locations with lower wind resources, as for example for the Swedish wind farm Lillgrund for which the wind resources appear to have a low variability along the year. A comparison with some other sea environments indicate similar trends of wind power enhancement in the North and the Black Seas, while in the Mediterranean Sea a small decay is expected in the future. On the other hand, both in the North and the Black Seas a significant enhancement of the intensity and frequency of the extreme events is expected with wind speeds often higher than 30 m/s. This is not the case of the Baltic Sea where the impact of the climate change appears to be less dramatic from the point of view of the expectations in terms of extreme events. This is favorable from the point of view of the operationally of the wind farms.

Finally, considering also the expected dynamics of the offshore wind sector, in correlation with the ambitious objectives defined in the framework of the European Green Deal, new coastal areas are going to be considered. From this perspective, it can be concluded that the Baltic Sea remains a very significant environment as regards the extraction of the wind energy. ■

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Baltic offshore wind role in Poland's energy transition

Expert article • 3172

Poland's energy transition policy has been characterized by series of failures for years. Lack of ambitions, lack of political will, even lack of imagination in relation to the security implications of climate change – they all have conditioned a visionless long-term energy and climate policy of the successive governments. One could explain this attitude by acknowledging that there were more urgent energy security challenges, which Polish authorities had to deal with. This was true to some extent. In the framework of EU's energy policy Poland insisted on giving higher priority to security of supply and focused on such issues as improving the gas system interconnectivity and reducing import dependencies on Russian supplier. Regarding climate and energy goals Poland's actions has been rather slow and passive. Of course, for the coal-dependent economy, meeting the CO2 reduction goals and achieving climate neutrality by 2050 requires complete transformation of the energy sector. This is a fundamental challenge.

In this critical decade to address climate insecurity, Poland's government still sends inconsistent signals about its energy and climate policy. It first did not pledge to EU's goal of carbon neutrality by 2050, while a few months later formally endorsed the goal in the 2040 energy policy. During last COP26 in Glasgow Polish government signed declaration on coal-phase out but at the same time declared that the phase out will take place in late 2040s. Deeper analysis of sectoral policies especially regarding renewable energy, including onshore wind farms, photovoltaics or prosumerism can be also confusing. In this context Poland's offshore wind policy seems to be an exceptional case.

Baltic offshore wind power is considered to be one of the most promising renewable energy options for energy transition in Poland. It is a rapidly maturing technology and a scalable industry with huge potential for expansion. Similarly, to the EU's offshore wind strategy, Poland recognizes that the vast untapped wind power potential of Baltic Sea will play an important role in achieving CO2 emission reduction targets by 2030 and climate neutrality by 2050. The offshore wind potential in Poland's Exclusive Economic Zone (EEZ) is estimated at a capacity of 12 GW and net energy production of 43.2 TWh up to 50 TWh by 2050. From the investor's perspective, it is important that in comparison to other Baltic locations, the South Baltic (EEZ of Germany and Poland) proves to be the most attractive in terms of LCOE. Yet, it is also clear that public policy regulations will be crucial to investment decisions and the wider infrastructural shifts, which could lead to the transformative changes in Poland's energy supply chain.

So far, Poland has adopted several acts, which provide a legal basis for the development of support mechanisms dedicated to offshore wind energy. They include Energy Policy up to 2040), Offshore Wind Act from 17 December 2020—the first Polish law on offshore wind energy which came into force on 18 February 2021, finally the Maritime Spatial Plan for Polish Sea Areas adopted on 14 April 2021, which indicates the boundaries of the zones in the Polish Baltic for permits for the construction of wind farms and the use of artificial islands, structures, devices, and laying seabed cables. The designed and applied support measures imply high public intervention. Among others they encompass economic regulation tools, such as Contracts for Difference and auctions, grants and loans, local content provisions. It's been also decided to give the leading role to the biggest Polish energy companies and their Western corporate partners. Thus far the most advanced and the biggest projects belong to three joint ventures: PGE Baltica (PL)/ Ørsted (DK), Polenergia (Pl)/Equinor (NOR), PKN Orlen (PL) /Northland (CAN). Together the offshore wind projects will add up to 5,9 GW of installed capacity to the energy system by 2030.

Today the Baltic Sea is a region of great geostrategic value for energy security. It provides access to oil and gas supplies enabling Poland a wider diversification of suppliers, import routes, and transportation technologies. The critical energy infrastructures such as oil and LNG terminals, storage facilities, refineries, etc., are located in the region. With every new offshore wind installation, the strategic importance of Baltic Sea for both energy transition and energy security of Poland will be increasing even more. The corporative data show that between 2018–2032 energy companies in Poland plan to decommission approximately 11.8 GW. Hard coal and lignite plants will account for approximately 93.6% of these operations. To what extent offshore wind energy can replace fossil capacities is still under discussion. Yet, it is becoming clear that unlike other sectoral policies of Poland, offshore wind sector has received significant government support. Taking into consideration the applied public policy tools, the planned projects in South Baltic, and the potential of scalability, we can expect that offshore wind energy will become central in the process of energy transition in Poland.

The additional important factor of offshore wind power development in Poland will be international cooperation of the Baltic states. Although the degree of offshore projects advancement varies across the region, we can observe how international cooperation becomes a supportive measure in the sector development. As a new source of clean energy, the Baltic offshore wind installations will contribute to the decarbonization of the energy sector and become an important element of critical energy infrastructure in the integrated EU market. ■

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Sea of opportunities – offshore wind energy development potential in Baltic Sea

Expert article • 3173

Offshore wind energy is one of the most promising electricity generation technologies. Interest in exploiting its potential in the Baltic Sea is growing rapidly. The European Union is raising its climate targets for 2030 and is committed to becoming climate-neutral by 2050. In 2020, the European Commission published a new EU strategy on offshore renewable energy as part of the European Green Deal. The strategy aims to push for the necessary changes to have at least 60 GW of offshore wind and at least 1 GW of ocean energy capacity installed by 2030, with the aim of reaching 300 GW, 10 GW and 40 GW of installed capacity respectively by 2050. Offshore wind is seen as a technology that can help the European economy recover from the COVID-19 pandemic. Investment in offshore wind projects can boost sustainable job creation and economic activity, thereby contributing to green recovery and long-term sustainable and inclusive growth.

The EU is already a world leader in offshore wind energy development, but the Baltic Sea potential is still unexploited (over 20 GW of offshore wind installed in European waters, of which around 2 GW are in the Baltic Sea). The Baltic Sea can make a significant contribution to achieving the EU ambitious goals with its enormous potential for offshore wind development estimated at up to 93 GW by 2050. To unlock this potential, decisive action by the individual countries of the Baltic Sea Region (BSR) and cooperation is required to ensure consistent, dynamic development of this technology and the competitiveness of the electricity market in BSR region.

WindEurope predicts that 9 GW of offshore wind energy could be easily deployed in the Baltic Sea by 2030. With intensified regional cooperation and determined, ambitious actions from BSR Governments, this could be as high as 14 GW. Offshore wind energy stimulates the economy - the industry already employs over 60,000 people all around Europe and this number is expected to increase significantly (around 10’000 new jobs annually in ambitious scenario in planning and construction phase and around 29’000 in O&M, indicated in study on Baltic offshore wind energy cooperation under BEMIP).

Nevertheless, we need strong regional cooperation to boost this potential. Working closely together we can achieve more than individually. We need joint initiatives, ambitious goals, and funding so that the opportunity is not missed. Regional cooperation should include marine spatial planning, grid development, funding, technical standards, and the permitting process. Cross-border cooperation becomes even more relevant in the Baltic Sea, where an interconnected market would help to overcome the issue of different power pricing zones with different patterns and technical standards.

Some steps have already been taken and BEMIP is a good example. BEMIP – the Baltic Energy Market Interconnection Plan is a trans-European initiative led by the European Commission and the governments of the eight countries surrounding the Baltic Sea (Denmark, Germany, Estonia, Latvia, Lithuania, Poland, Finland, and Sweden; Norway as an observer). The primary objective of the BEMIP initiative is to achieve an open and integrated regional electricity and gas market between EU countries in the Baltic Sea region. The BEMIP parties are working together to support the European Energy Security Strategy and to support the development of offshore wind energy in the Baltic Sea. Recently BEMIP adopted a new work programme in the Baltic Sea region dedicated to offshore wind. The programme confirms the commitment of BEMIP parties to coordinate on the development of the offshore grid and to cooperate in maritime spatial planning process focusing on offshore wind development.

Today we understand that the transformation of the energy sector towards non-carbon, green and innovative technologies is a necessity to reduce its negative impact on the environment. Given this, offshore wind energy is an opportunity and a chance to all BSR Countries. An opportunity that may bring measurable benefits not only in terms of achieving the EU climate and energy targets, but also from the perspective of a number of socio-economic advantages accompanying the development of this technology. Experience of countries such as Denmark or UK show that electricity generated in offshore wind farms may be cheaper than that generated in conventional power plants, but it can also significantly contribute to economic development. BSR Countries shall define clear climate and energy targets to exploit the added value that the sector brings. ■

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Emissions-free electricity for Baltic sustainability

Expert article • 3174

The burning of fossil fuels for electricity and heat production is the largest single source of global greenhouse gas (GHG) emissions - around 25%. Trying to reduce the emissions we produce more and more energy from renewables each year, but we also continue to burn more. Electricity demand is expected to increase by more than 40% over the next 20 years, meaning the construction of many new power generating facilities, which should be emissions-free.

The sources of electricity with the lowest GHG emissions intensity according to existing researches are wind, hydroelectric, nuclear, and solar photovoltaic (PV).

The Baltic area, mostly is flat and low-lying. Although we have numerous rivers in this area, they do not result in significant hydroelectric potential, the best possible places for large-scale generation are already in use. Small hydropower is an option for the future with potential electricity generation of 200 GWh/year.

Nuclear power plants (NPP) currently are in operation in Sweden, Finland, Germany, and Russia. Lithuanian NPP was closed at the beginning of 2010. The project of the new “Neman” NPP in the Kaliningrad region of Russia was closed in 2014 because of technical and political reasons. Sweden covering about 40% of the country's consumption, Finland - about 30%, Germany - about 12%. “Leningradskaya” NPP in Russia covers around 30% of the total consumption of the North-West part of Russia.

The nuclear industry is a complex technology, which is strongly interconnected with other industries and economic sectors. Existing installations are contributing to energy security and economic stability in the region, decreasing the carbon footprint of the region. The cooperation in the field of nuclear safety and radiation protection in the BSR is fairly strong. The risks are nuclear accidents or terrorist attacks, the difficulties and high costs of nuclear waste management, and the fear that nuclear waste might be used for nuclear weapons production.

Industrial-scale wind energy production has two options - onshore and offshore. In Germany, Denmark, and Sweden the most economically feasible places for onshore installations are already in use and such projects suffer more and more because of new legal and technical restrictions. Future wind production development will be most probably covered by new offshore big-scale installations in the Baltic Sea. Such project nominal capacity starts from 50 MW and requires its connection to a high voltage grid of 110 kV and higher - the backbone of Baltic country's electrical systems.

The history of offshore wind power projects in the Baltic Sea starts in 1995 and shows a gradual increase of individual wind farm installed capacity, longer and longer distances from the shore, and bigger installation depths. These projects are part of Marine Spatial Planning. The main stakeholders are marine transport, fishery, environment, communities, and authorities (including military). Because of the high complexity and size, the period between the getting of a building permit and a grid-connected plant startup is at least five years. One more problem - uncertainty in the support mechanisms and regulatory framework in some countries. Permit processes might take longer and affect the project execution time even more. In the future floating wind turbines could become an economically efficient option.

Solar energy potential in the Baltic area is not the best, but still, this technology looks promising for sustainable future development of the region. The leaders in terms of total installed capacity are Germany, Denmark, and Poland, in terms of capacity per capita - Germany, Denmark, and Sweden. All countries of the region declare optimistic future development plans.

There are utility-scale PV (10 MW and more), commercial/ industrial PV projects as integrated solutions to business buildings and facilities (up to 1-2 MW), and residential PV – individual projects for private households (5-20 kW).

Utility-scale projects require the withdrawal of large areas from agriculture and other activities. Commercial and residential projects are expected to bloom, because of a decrease in PV systems prices and the introduction of government financial and legal supporting measures. The total installed capacity of such projects can triple in the next decade.

Focusing on electricity production, the main challenge for the future is to minimize the use of fossil fuels, such as coal, oil, and gas, and substitute it with clean energy sources. Nuclear power, wind, and solar electricity production look promising for the development of the Baltic Sea region. ■

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Energy efficiency trends and driving factors in the Baltic States

Expert article • 3175

Estonia, Latvia and Lithuania have inherited from their Soviet past comparatively well-developed power, natural gas and district heating systems. Technologies of the energy transformation sectors were suitable for regional cooperation. Major strong points of energy sectors: power capacities satisfactory to meet regional demand, strong interconnections between three countries, diverse energy mix in the region based on contribution from oil shale, nuclear energy, natural gas, oil products and hydro resources complemented with other local energy resources. The major weaknesses: low energy efficiency, high dependence on imports of primary energy resources from Russia and large exports of electricity and oil products to neighbouring regions.

Former inefficient energy consumption was caused by several factors: large losses in the energy transformation sectors, energy-intensive technologies in the industry sector and agriculture, the previous long-term existence of low energy prices, low thermal performance of buildings, old and worn-out cars, etc. Energy consumption in the Baltic States has fallen dramatically since beginning of transition to a market-based economy over the period 1990-2000 due to the decrease of activities in industries and agriculture, implementation of new technologies and structural changes. However, energy efficiency in 2000 was still much lower than in many developed countries. Thus, improvement of energy efficiency was the most important strategic objective in all three countries.

The detailed analysis of economic growth and development of energy sectors demonstrates significant improvement of energy efficiency over the period 2000-2020 – primary energy intensity was decreasing in Estonia and Lithuania on average by 3.5%, and in Latvia by 2.5% per annum. The significant reduction of this indicator in Estonia was caused mostly by threefold reduction of electricity generation in power plants fired by oil shale and corresponding reduction of conversion losses. Similarly, the most important factor of reduced losses in the Lithuanian energy transformation sector was decommissioning of Ignalina nuclear power plant. In 2020, primary energy intensity measured as gross inland energy consumption per unit of GDP was quite similar in all three countries – this indictor was by 5.7% in Lithuania and by 13.6% in Estonia higher than in Latvia.

Based on the Eurostat database, primary energy intensity in Estonia is still about by 2.0 times, in Latvia and Lithuania by 1.7 times higher than the average in the EU-27 because of inefficient energy transformation sectors, existing energy saving potential in economic sectors of the national economies and due to the low level of GDP. In 2020, real GDP per capita at market prices in Estonia was by 1.8 times, in Lithuania by 1.9 times, and in Latvia by 2.2 times lower than the average in EU-27. If GDP is adjusted using estimates of purchasing power parity, indicators of primary energy intensity in all three countries are approaching to the average in the EU-27.

Index decomposition analysis has shown that the strongest driver of energy efficiency is the reduction of final energy intensity, supplemented by the positive effect in own use of energy sector, decreasing losses of energy conversion and distribution as well as reduction of non-energy use. A component of final energy consumption in sectors of the national economies is playing the major role in primary energy balances of the Baltic countries. In 2020, its share in the gross inland energy consumption in Estonia amounted to 62.3%, in Latvia to 88.0%, and Lithuania to 71.0%.

The analysis of final energy intensity trends has shown that changes of this indicator were similar – in 2020, final energy intensity has decreased in Estonia by 39.4%, in Latvia by 36.3%, and in Lithuania by 33.8%, compared with the 2000 level. The major effect underlying this reduction is coming from decreasing energy intensity in the residential sector – in Estonia the share of this sector in total gain was equal to 45.2%, in Latvia to 61.5%, and in Lithuania to 54.7%. The role of modernisation in the industry sector was much lower with 37.4% in Estonia, 8.7% in Latvia and 22.2% in Lithuania. Certain contribution is coming from the increase of energy efficiency in the services sector with 14.6% in Latvia and 15.4% Lithuania, but with 2.7% only in Estonia. Similarly, contribution of the transport sector was also different with 14.6% in Estonia, 13.2% in Latvia, and 2.6% in Lithuania.

Based on the application of the Fisher Ideal Index, the driving forces underlying changes in the final energy intensity were identified in 5 sectors of the national economies. The increase of energy efficiency was the dominant driver of final energy saving accounting for 70.8% in Estonia, 98.2% in Latvia and 100% in Lithuania. The effect of structural changes in economic activities accounted for 29.2% in Estonia and 1.8% in Latvia. ■

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Energy transition under the ESG trend

Expert article • 3176

The ESG (Environmental, Social, and Governance) criteria have been the core of corporate governance. An enterprise does not only aim to make profits but also meet the ESG criteria at the same time. Energy transition is to change the energy structure from the fossil base to the renewable base, which is consistent with ESG. The energy generated from renewable sources is called 'green electricity'. An enterprise fulfilling ESG has to undertake energy transition at the same time, in order to meet the 'net zero 'carbon emission target in 2050.

Fossil fuel use is the primary source of CO2 emission. CO2 emission is the main cause of climate change. Carbon reduction has been a global effort embodied in the 1997 Kyoto Protocol and the 2015 Paris Agreement. Even though the governments can induce carbon reduction via imposing regulatory measures such as carbon taxes and emission permits, without the participation of enterprises and consumers as the major market players, it is very unlikely to realize the carbon reduction targets in the global market economy. The ESG criteria followed by the enterprises hence become a powerful force to realize the carbon reduction.

Under the ESG criteria, the enterprises have to review and report their environmental footprints, including carbon and water, etc. The consumers can choose environmentally friendly products and services by knowing the validated and released environmental footprints of these enterprises. In order to reduce the carbon footprints, an enterprise can take energy-saving measures such as taking energy-saving measures, using energy-efficient equipment, employing green transportation, buying green energy, having green buildings, etc. These actions to reduce carbon footprints also help realize energy transition from the enterprise side.

The production and use of energy accounts for 75% of the European Union (EU)'s greenhouse gas emissions. EU aims to achieve carbon neutrality by 2050 via a 'clean energy transition'. EU has been developing a fully integrated, interconnected, and digitalized energy market. Enhancing energy efficiency is a priority, which can be done by improving the energy performance of buildings and increasing the proportion of renewable energy sources.

APEC (Asia-Pacific Economic Cooperation) aims to reduce its energy intensity by 45% between 2005 and 2035 and also to double the share of renewables in the fuel mix. There are many economies of emerging markets among APEC members. In order to make their economic growth sustainable, the energy transition path is a must for them to walk on.

The ESG requirements are not only enforced by individual enterprises but also by the supply chains. United Nations (UN) has been promoting sustainability in supply chains to create global impacts to achieve sustainable development goals (SDGs). Taiwan Semiconductor Manufacturing Company (TSMC), as the leading semiconductor manufacturer in Taiwan, has joined RE100 to commit itself to 100% renewable energy use by the end of 2050. This commitment is because of the requirements from worldwide supply chain partners as well as the mission of TSMC to realize a beautiful future together.

The COP26 held in 2021 has declared to accelerate energy transition, including deep decarbonization, reduction in coal and other fossil fuels use, clean tech investment, etc. The economies in the world will then have their regulations and actions to respond to these international agreements and movements. All enterprises have to adjust themselves for energy transition to sustain their own competitiveness as well as to co-work in the markets for a better world.

The investors in the world now are expected to engage in socially responsible investment. In addition to financial returns and risks, they have to take into account the ESG costs and benefits of their investment. Many investigations by World Economic Forum (WEF) have shown that the investors are willing to invest in the items fitting ESG criteria and the consumers are willing to pay for products and services provided by these ESG-qualified suppliers.

Since the Covid-19 pandemic breakout in 2020, the relations between the environment and public health have attracted great attention. If the modern economy keeps relying on the heavily polluting production and consumption modes, then human, animal, and plant lives will be seriously threatened by the dirty and harmful global economic operation. Energy transition is part of necessary jobs that the global village should and must immediately undertake.

For enterprises, energy transition is not only an obligation but also a market opportunity in the ESG trend. The investors can take advantage to invest for their own profits and the future of the world. The inventors can take the opportunities to invent for their own achievements and the future of human beings. Energy transition creates a win-win situation for the nature and human society. Energy transition under the ESG trend brings people in the world together to sustainably help each other. ■

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Biomass for heating - opportunities in the Baltic region

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Europe's energy system is undergoing rapid changes with phasing out of fossil-fuel-burning power plants and rapid growth in unregulated renewable electric power from wind and solar. Increased use of biomass and electricity in district heating systems can provide need flexibility in the power system, improve the economic viability for renewable power and reduce the emissions from the heating sector. Feasible value chains and market opportunities for bioenergy are studied in the BalticBiomass4Value project, which is implemented under the framework of the Interreg Baltic Sea Region Programme (https://balticbiomass4value.eu).

Flexibility needs in a changing power sector

Ambitious emission reduction targets within the EU combined with technological development imply a substantial increase in renewable energy production. Energy systems with high percentages of wind and solar power face challenges related to the balance between the production and consumption of electrical power. Wind power has a seasonal profile that is in relatively good seasonal accordance with the consumption of electrical power, but large short-term variations mean that wind power is often in poor accordance with the electrical power consumption during the day and night. Solar power has a 24-hour profile that is in good accordance with the consumption, but solar power production is greatest during the summer in opposition to the consumption. As a result, the coming renewable power system faces major challenges related to 1) fluctuations in wind and solar conditions that give rise to a need for rapid upward and downward adjustment of the remaining production to keep the system in balance, 2) overcapacity in periods with large amounts of wind and/or solar power production and 3) a need for reserve capacity especially on days with high consumption, little wind, a low inflow of water and low solar intensity.

Flexibility options

Increased flexibility can be achieved by increasing the exchange capacity – so that it is possible to export power in surplus periods and import it during periods of deficit. It is also possible to increase the storage capacity – so that surplus power can be stored in batteries, thermal storage systems, and hydropower reservoirs. Increasing the consumer flexibility so that the consumption follows the production to a greater extent is getting larger attention but is a short-term option. Improved interaction between the electrical power and the heating system is another flexibility option so that electricity is used for heating in water-borne systems during surplus periods and biomass is used when there is a deficit of electrical power that also provides improved energy security over time.

Heating and cooling are important

Heating and cooling account for more than half of the energy consumption in the Baltic region. Better insulation, more efficient equipment, and higher outdoor temperatures have reduced the energy shares used for heating and cooling in the last decades. However, changes in the building stock are relatively slow and we observe an increase in the average to-be-heated area of single-family homes om many countries. A large share of the heating and cooling is produced from fossil fuels, decarbonizing of the heating sector is thus a major challenge in the region. Biomass and electricity represent the major renewable options for heating.

Bioenergy opportunities in the Baltic region

The use of biomass, mainly from residuals and side streams in the forest sector, is steadily increasing in the region. The model analyzes show that most of the different production units that use coal and oil shale in the Baltic region become outdated and close in the coming decade. The amount of district heat produced from biomass is increasing with increasing carbon prices. The use of biogas is also increasing, and an increasing share of biogas is used as peak load in district heating plants. The utilization of biomass is highest in the winter season. The fraction of heat production covered by biomasses varies between 10-30% in the summer and 18-24% in the winter. The reason for this is that the need for baseload heating is higher in the winter weeks than in the summer weeks, where also the use of solar collectors increases the need for technologies that have possibilities to ramp the production up and down during a day.

Targeted incentives are needed

Increased costs for emission of carbon from fossil fuels imply increased use of biomass in the Baltic region, especially in district heating, and represents a low-hanging fruit for reduced GHG emissions in many countries. Carbon costs, regulations, incentives, and knowledge are needed for this change. Biofuels for transport will continue to be based on agricultural products in the next decade, but the establishment of second-generation biofuel plants based on woody biomass is likely to gradually influence the biomass market. ■

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Bioenergy as a low carbon energy: Promoting bio-based economy in the Baltic Sea Region

Expert article • 3178

1 Introduction

Security of energy supply, promotion of the bio-economy, nutrient recycling, and innovation are prioritized policy areas in the EU Strategy for the Baltic Sea Region (EUBSR) aiming at conserving the sea, connecting the region, and increasing the economic prosperity of its inhabitants. Bioenergy is an abundant renewable resource in the region, which can be deployed to explore multiple environmental and socio-economic benefits. It can play an essential role in providing energy security, diversifying energy sources, and mitigating climate change in the region. However, if not properly managed, the use of land for energy crops may affect food supply and forest cover, reducing the natural adaptive capacity to climate change impacts. Therefore, the entire supply chains of bioenergy and eco-systems services, interdependencies and trade-offs between ecosystem services and other economic activities should be examined. Understanding the interlinkages between energy transition, ecosystem services, and climate change is necessary for building a resilient economy. How can we harness the full potential of bioenergy while maintaining ecosystem services? What are the potential synergies for bioenergy development in the bioeconomy? What are the challenges for meeting low-carbon development in the region? This article reflects a brief assessment and highlights the need for an integrated systems approach in the region.

2. The role of bioenergy in the Baltic Sea Region

Fossil fuels dominate the primary energy consumption in the Baltic Sea Region. The share of bioenergy in the primary energy supply of Sweden and Finland is quite significant. Sweden, Latvia, Estonia, and Finland do not have fossil reserves, while Estonia has a vast reserve of oil shale. Sweden, Finland, and Sweden have the highest shares of renewable energy, that is, 60%, 44%, and 42%, respectively.[1] Lithuania is also progressing well in terms of energy supply from renewable sources. Meanwhile, Poland has less than 16% renewables in final energy consumption in spite of their huge bioenergy potential.

Bioenergy is a versatile energy source with varying feedstock, conversion technologies and end uses. The supply of biomass can be classified into three broad sectors – forestry, agriculture and waste. The Baltic region has abundant biomass resources which are largely untapped. Bioenergy is one of the leading energy carriers in Sweden and Finland. These two countries have the highest share of forest cover in the region, with more than 65% of the land area being forests. Estonia and Latvia had 54% and 53% of their land covered by forests. Bioenergy can play a key role in achieving Estonia's goal to reach 80% of heat and 50% of electricity from renewables by 2030. Denmark has 15% forest cover but residues from agriculture can be quite significant. In Lithuania, the share of biomass in district heating (DH) has increased from 2% to 68% between 2000 and 2018. Forests cover approximately 34% of Lithuania, and heating with biomass is up to 3 times cheaper than heating with natural gas.

One of the key areas of biomass utilization in the region is the production and trade of wood pellets. Sweden, Latvia and Estonia are among the major pellet producers. Lithuania is relatively small in comparison but exports most of its wood pellets production. The same goes for Latvia, a major producer and exporter of pellets. Denmark is the EU's 2nd largest importer of wood pellets while Latvia is the one of largest exporters of wood pellets globally.

3. The need of integrated assessment: Balancing bioenergy and ecosystems services

The region is one of the largest suppliers of ecosystems services and one of most species abundant in Europe. The increase demand of bioenergy might put pressure on the environment, affecting land use, carbon sequestration, ecological connectivity, and biodiversity. Additionally, bioenergy, agriculture and forestry systems overlap each other when it comes to land use and water resource use, and activities such food and energy production and maintenance of multiple ecosystem services. The focus should be at balancing the renewable sector with the carrying capacity of ecosystem services by employing a geographically explicit engineering model for systems optimization. Integrated planning reduces the risk of economic and environmental losses, keeps the region attractive for living and working, strengthens competitiveness and stimulates future investments. While addressing energy sustainability, solutions should simultaneously support climate strategies, maintaining and/or enhancing ecosystems services, and exploring synergetic opportunities for a low carbon and climate resilient economy in the Baltic Sea Region. A holistic, quantitative, and multiscale approach is necessary in order to avoid the shifting of environmental burdens. Thus, a coherent and integrated approach for the utilization of bioresources is required when dealing with the challenges of climate change, resource efficiency, economic prosperity, and food security.

4. Promoting bio-based economy in the Baltic Sea Region

The bioeconomy concept primarily includes: (a) sustainable production of bioresources with the aim to reduce both anthropogenic climate impacts and the dependency on fossil-based products, and (b) increased added value of biomass materials considering a reduced consumption of natural resources. Thus, it is important to evaluate the bioresources potential, conversion into multiple products (biofuels, food, bio-materials, etc.), nutrient recycling, and synergies for climate mitigation and adaptation strategies. The bioeconomy offers a unique opportunity to address inter-connected societal challenges such as food security, natural resource depletion, and climate change impact, while simultaneously achieving sustainable economic development. The use of bio-waste and bio-based processes can provide starting points for an innovative approach to

1 *EU - Renewable energy statistics.*

substitute fossil-based products. Bioeconomy is one of the key policy areas of the EU Strategy for the Baltic Sea Region (EUBSR) and it is strongly linked with the overall prosperity and green growth of the region. The Baltic Marine Environment Protection Commission, also known as HELCOM, action areas include agriculture and industrial/ municipal releases, among others. Reduction of nutrient release to the sea and nutrient recycling in agriculture and wastewater treatment plants are planned. Diverting solid and liquid waste away from the sea, and using it for biogas and organic fertilizer production can promote significant change. The development of a bioeconomy needs to be considered in its potential to promote the EUBSR, goals set by the HELCOM Baltic Sea Action Plan, and implementation of the Renewables Directive and the Paris Agreement to the climate convention.

Bioenergy is already part of the local economies but great potential still exists which can be explored as part of the EUBSR strategy. Integrated assessment facilitates understanding of bioenergy and bioeconomy developments in the region and enhance the involvement of stakeholders and local communities in transparent decision-making process. Last but not least, the interconnectivity within the region but also beyond – i.e. with the rest of Europe – need to be considered in decision making and planning. ■

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The role of digitalization in the development of bioeconomy businesses

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The Fourth Industrial Revolution is characterized by the rapid development of advanced digital technologies and the globalization of the economy. Today, developments in information technology play a significant role in the economy. New business models and innovative technologies in bioeconomy businesses, especially in agriculture and the food industry, are necessary to ensure that future challenges do not become a global social and political issue.

Bioeconomy businesses can significantly improve their competitiveness by introducing new technologies into their operations. The introduction of more efficient digital systems and other innovative technologies reduces operational time, improves product quality, attracts more consumers, and reaches new markets faster.

The use of innovative digital technologies is transforming the business models of the bioeconomy, generating additional income and value creation opportunities, and is at the heart of the transformation of industrial agriculture into a sustainable bioeconomy. The digitalization of business processes can impact the bioeconomy in several ways: by enabling more efficient cultivation, transport, and processing of biological resources and by better planning of investments for their optimal use. Several core digitalization trends in bioeconomy businesses, shaping new business models in the bioeconomy, are identified.

One of them is *the Internet of Things and the use of sensors*. Collecting information through the Internet of Things (IoT) – by sensors, machines, and drones capable of delivering information in real-time, which is then stored and processed in the cloud – makes it possible to increase the efficiency of bioeconomy businesses, for instance, by reducing labor cost, monitoring and preparing for adverse climatic conditions that interfere with the production process, tracking the spread of pests and diseases in plants and so on. Sensors strategically placed around crop fields, combined with image recognition technology, allow farmers to view their crops from anywhere in the world. Moreover, business forecasting models based on big data and artificial intelligence make it possible to predict outbreaks of pests and diseases, make recommendations on selecting the best plant varieties, and determine the most appropriate timing for placing products on the market. Sensors embedded in the equipment provide real-time information on yields.

The usage of drones is another trend. Drones are used to assess soil quality by creating 3D images for analyzing and planning sowing and planting techniques. Drones are already being used to spray crops in a way that prevents chemicals from reaching groundwater. The latest research has shown that drones can increase the speed of spraying five times compared to technologies.

Research shows that *the introduction of robots* in bioeconomy businesses, especially in agriculture, increases livestock productivity and crop yields. Spraying and hoeing robots can reduce the use of agrochemicals by up to 90%. Companies developing robotics technologies for agriculture are experimenting with lasers and cameras to detect and remove weeds without human intervention, developing transplanting robots that bring a new level of efficiency to traditional methods, and testing automation for fruit picking and nut harvesting.

The use of *artificial intelligence and machine learning* enhances the ability of bioeconomy businesses to run their businesses with the help of smartphone apps. For instance, the use of artificial intelligence in smart cameras installed in livestock barns makes it possible to identify and recognize each animal, determine whether the animal is eating enough or whether it is sick, and display the information on the phone.

Digitalization technologies are opening up new opportunities for the management of bioeconomy businesses at all stages of the agri-food value chain: automation of agricultural processes makes it possible to accurately adjust the quantities of raw materials and inputs used, to reduce the need for manual labor; satellite data and sensors improve the accuracy of monitoring the growth of crops, and the quality of the land or water, all of which reduce costs. Product traceability technologies and digital logistics services can simplify food supply chains while providing reliable information to consumers and boosting the competitiveness of entrepreneurs applying these technologies.

Finally, digital technologies facilitate new trade patterns in agri-food products, connecting sellers and buyers in new markets and enabling authorities to monitor and enforce quality standards and ensure faster and more efficient Border procedures, which are essential for perishable products, etc.

All these technological advances will contribute to achieving the goal of more resilient, productive, and sustainable agricultural and food systems that better meet the needs of consumers. ■

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Climate change for the Baltic Region until 2100

Expert article • 3180

Human-induced changes in climate are increasing in magnitude, affecting all areas of the Globe, with varying magnitude and varying consequences for ecosystems and human society. The Baltic Sea area contains very sensitive ecosystems, where small changes to temperatures, precipitation patterns and sea currents can have major disruptive effects exacerbating already serious environmental stress factors like eutrophication and pollution.

Details of climate change are generally obtained from climate models. Large computer resources are being spent on the production of ensembles, multiple realisations of global computer model simulations in order to translate scenarios of greenhouse gas concentrations into regional changes of many aspects of climate. Ensembles of climate models don't just give better estimates of expected climate, they also provide estimates of the certainty with which we know details.

Global climate models by computational necessity operate with relatively coarse grids, typically several thousand square kilometres per grid square. Local details are therefore not achievable with current global models. To estimate local effects of climate change from global models, regional models are frequently used. These models typically use around 10x10 km or smaller grid squares but only cover a limited area such as Europe and adjacent ocean areas. Sea temperature and sea ice cover and atmospheric conditions on the boundary of the area are provided by a "driving" global model.

In a coordinated effort among climate modelling institutions in Europe, a very large ensemble of atmospheric regional model simulations in comparable set-ups have been produced in the EURO-CORDEX collaboration. More than 120 simulations covering Europe have recently been analysed in a study about climate change in the Baltic area in the Baltic Earth Assessment Report (BEAR), which is being published at the moment[1]. The simulations provide expected changes of temperature, precipitation, wind, solar radiation, and others for the three emission scenarios RCP2.6, RCP4.5, and RCP8.5 assessed by the IPCC. Below, some main results of these studies are summarised.

The new results generally confirm earlier reports, though with further details and better defined margins of error. The current much larger ensemble of scenario simulations allows for a more reliable assessment of future climate change compared to earlier studies. Also, the addition of several emission scenarios enables a better foundation for estimating effects of, e.g., emission reductions.

Major expectations based on earlier studies have generally been confirmed. First and foremost, the area will experience a warming at least as high as the global mean warming. The strength of the warming influencing both atmosphere and the Baltic Sea depends on the emission scenario followed and the period under investigation. For the present scenarios this translates to between 1.5 and 4.3 degrees of mean warming over the Baltic Sea catchment region; more over land, and less over sea.

A major impact of the increasing temperatures is a prolongation of the summer season and a shortening of winter. The geographical location of the Baltic region, in the transition zone between mid-latitude and polar climates, and between maritime conditions in the west and continental conditions in the east, leads to a strong south west-north east variation of expected winter warming; the further north and east, the larger winter warming is expected. In the north-eastern part of the area in winter, the warming approaches twice the average global warming. The general warming leads to more intense heat waves (including marine heat waves) and less intense cold snaps.

Precipitation is expected to increase over the entire area in winter. In summer, there is a somewhat smaller increase in the northern part of the domain. The large ensemble does not show any significant change in the southern part where individual simulations show either increasing or decreasing precipitation. Extreme precipitation increases, particularly in summer, in the entire domain with some simulations showing more than 50% increase in extreme intensity by the end of the century for the high RCP8.5 scenario.

Surface solar irradiation is not projected to change in summer, but the regional climate model simulations show some decrease in winter connected to more extensive cloud cover. There is, however, a large uncertainty related to this, since many of the global driving models show increases.

The amount of snow on the ground in winter is reduced drastically, particularly in the south of the Baltic Sea catchment area, where the relative decrease is close to 80% by the end of the century for RCP8.5. Also, drastic reductions are seen for sea and lake ice cover as well as Scandinavian glacier extent.

Even this large ensemble of simulations does not indicate a significant change in wind speed with the exception of parts of the Baltic Sea that become ice free in the future and consequently are subject to less calm conditions. The wind has a large variability on many time scales, making any climate change signal difficult to discern. Individual simulations show increases or decreases in different parts of the area for different periods.

These expected climate change effects on meteorological quantities are large, and they will add to environmental stress factors already present. It is therefore of the greatest importance to prepare this sensitive region for the coming changes, and at the same time work to reduce effects on society and ecosystems through reductions in greenhouse gas emissions. ■

1 https://esd.copernicus.org/articles/special_issue1088.html

Expert article • 3180

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Indicators of climate change in the Baltic Sea region

Expert article • 3181

Our planet Earth is going through an accelerated process of global warming in the 21st century because of the accumulation of a series of gases in the atmosphere generated by human activity. Natural landscapes are rapidly being replaced by urbanized areas and growing industrial activities. Large conglomerates of urbanized territories become “heat islands,” which affect and change not only the local but also the macroclimate. The Earth's climate is constantly changing. It is characterized by cyclical fluctuations caused by geophysical and astronomical factors. Unfortunately, there is concern about the faster-than-usual warming that began according to all-natural indicator readings at the end of the 20th century.

Climate change indicators help identify how the climate is changing in different areas. Understanding and managing climate change processes is an important task not only at the global level but also at the level of various regions and countries. In 1988 the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC), which now is the United Nations body for assessing the result of science research related to climate change. IPCC provides the world community with the most up-to-date and comprehensive scientific, technical, and socio-economic information about climate change. Scientists and communication specialists have identified global Climate Indicators in a discursive process led by Global Climate Observing System (GCOS) and have been endorsed by WMO. These headline indicators comprise key information for the most relevant domains of climate change: temperature, energy balance, atmospheric composition, ocean, and land water as well as the cryosphere. Nevertheless, a set of subsidiary indicators providing additional information are needed for a more detailed picture of the changes in the respective region. Understanding and managing the climate change processes is an important task not only at the global level but also at the level of various regions and countries. As in other parts of the world, research on climate change is now a major interest in Europe, including the Baltic Sea region. The EU seas are getting warmer and especially the Baltic Sea.

The Baltic Sea is a young semi-enclosed intra-continental shallow sea with a specific environment uniqueness due to its special geographical, climatological, and oceanographic characteristics. Unfortunately, its uniqueness also contributes to its faster increase in eutrophication due to climate change and increasing anthropogenic pressures. The Baltic Sea in Northern Europe is surrounded by nine economically developed countries: Denmark, Germany, Poland, Lithuania, Latvia, Estonia, Russia, Finland, and Sweden. The basin (drainage area) of the Baltic Sea is inhabited by around 85 million people. Regional monitoring and assessment of the Baltic Sea are one of the core tasks for the inter-governmental Helsinki Commission (HELCOM). It is aiming to maintain good ecosystem health, including adaptation and management of climate change, and regional collaboration. Baltic scientists are collaborating to investigate the effects of climate change in the Baltic Sea region. For instance, as Baltic Earth is one of the scientific networks that strive to achieve an improved Earth System understanding of the Baltic Sea region as the basis for science-based management in the face of climatic, environmental, and human impact in the region. The joint HELCOM/ Baltic Earth Expert Network involves more than 110 scientists from around the Baltic Sea. Climate change impacts are evident in the Baltic Sea: air and water temperature rising, sea level increasing, ice extent is decreasing, change heat and water balance, intensification of the extreme storm events, change of atmospheric dynamic, wind and waves regime, rise sea eutrophication. Specific warming „jump” observed in all physical parameters started in the 8-9th decade of the 20th century. Baltic Earth group scientists future scenarios for the Baltic Sea show that by the end of this 21st century, sea surface temperature in the Baltic Sea is expected to increase by between 1.1°C (RCP2.6) and 3,2°C (RCP8.5), and air temperature - by 1.5°C (RCVP 2.6), compared to the period 1970-1999, if the Paris agreement is fulfilled, and 4.5°C in a worst-case scenario (RCP 8.5). All these changes affect the nature of the sea, its ecosystems, and ecosystem services, as well as the human activities depending on the sea.

Is global warming of 1°C significant and noticeable? How much does one degree add to the tremendous changes in the Earth’s ecosystems? For instance, during the last ice age (about 20,000 years ago), the average temperature of the Earth's air was around 10°C. Currently, the temperature of the Earth is close to 15°C. Huge changes await us if, according to pessimistic forecasts, air temperatures rise by more than 2°C degrees in the 21st century.

We cannot change the climate, but we may adapt. Climate change issues are of major importance in the modern world and these problems are to be monitored and examined on the global and national level involving national organizations, business and industry, research institutions, including the different education levels. Developing innovative technology and life-long learning of society improving understanding about climate change and smart innovation integration are the most important changes to accomplish this.

In Lithuania, as in the rest of the world, great attention is paid to climate change. Klaipeda Seaport City is an example of how it can combine the municipal and Klaipeda University efforts to combat climate change and work with stakeholders, IT, economy, and industry sectors. Sustainable Blue economic, "Green" seaport, ambitions joint to Climate-Neutral and Smart Cities Mission, development of the region, Good practices for Sustainable development Coastal areas – is a priority connected with climate change and sustainable innovations. Klaipeda University - a hub of excellence in Smart Urban Coastal Sustainability, through Cooperation, Education, innovation of Blue Economy and Green Course.

Science, like never before, has every opportunity to help bring in researchers from all fields, to innovate, to help the economy develop sustainably, and to implement the principles of the circular economy. The blue and green economy is the guarantor of a common, sustainable future for humanity and nature. *It gives us a new opportunity to adapt to living in harmony and sustainability with nature, and protect our only home yet, the blue planet Earth.* ■

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Behavioral change towards climate neutrality in Baltic States

Expert article • 3182

The ambitions of European Green Deal require significant behavioral change for more sustainable way of life. Data from European Social survey (2016/17, "Climate change") indicate that people in Baltic states and Central Europe exhibit quite low concern with climate change, compared to countries in other parts of Europe. For example, only 16% of Estonians (lowest number in Europe) and 19.5% of Lithuanians are very worried or extremely worried about climate change, compared to 52% in Portugal or 50 % in Spain.

Furthermore, people in Baltic States do not feel high personal responsibility about climate change. As Special Eurobarometer survey on Climate Change from 2021 indicates, only 20% of people in Latvia, 26 % in Estonia and 28% in Lithuania said that they personally are responsible for tackling climate change (when asked to indicate multiple actors that are responsible), compared to highest scores of 57 % in the Netherlands, 56 % in Denmark and Sweden. The level of action to fight climate change at individual level in Baltic states is again among the lowest in Europe (from 42 % in Latvia, 47 % in Estonia and 48 % in Lithuania indicated they have taken any action compared to EU27 average of 64%).

This lack of personal responsibility and low concern creates a gap in the need of rapid transformations at individual level and passive observer role currently specific to a large part of society in Baltic States.

I would like to identify few obstacles towards faster behavioral change at individual level for the climate change action in various sectors based on Lithuanian examples.

– *Policy measures and communication strategies regarding waste are targeted mainly at the recycling rather than the prevention, which is at the top of waste hierarchy.* The share of recycled waste in Lithuania is constantly increasing from 2011. The major shift was with the introduction of deposit refund system in 2016, when refund of plastic bottles reached over 90%. And still, the total amount of waste in Lithuania is increasing. Little effort at the policy level is made towards the reduction of consumption, food waste, quantities of textile waste and other preventive behaviors.
– *Infrastructure development is lagging behind the needs and public expectations.* One of the target areas of Green deal is the radical reduction of fossil-based energy in the transportation system. The law on Alternative Fuels was passed in Lithuania in 2021, setting up the plan to increase the number of electric cars up to 10% of total car park by 2025. At the beginning of 2022, there were 5045 electric cars and 3210 plug-in hybrid cars registered in Lithuania, that is less than 1% of total car park. This means, that in coming three years, there should be a major shift in the individual decisions about the car choice. But if we look at the infrastructure of charging stations, it is poor. For example, on the way from Vilnius to Kaunas (two biggest cities), there are three charging stations. In the biggest seaside resort Palanga, which attracts over 300,000 tourists every year, there are two charging stations for the electric vehicles. And usually charging stations in Lithuania have possibility to charge just one car at once. In addition, often public charging stations are not functioning properly because of lack of maintenance. In big cities there is a struggle for a free spot in the charging station, and those who live in the apartment buildings, do not have the possibility to charge their cars in their living place. Then, if we consider average charging time of 20 minutes, we can assume high resistance at the individual level to the electric cars, as that involves uncertainty and inconvenience. Plans to increase significantly the network of charging stations are there, but they should be implemented faster, that demand would not exceed the supply. The infrastructure of the charging stations should be attractive (for example, to be installed at the existing gas station network to provide additional services of food for the consumers), sufficient (charging spots in the main highways should include the possibilities to charge multiple cars at once) and sustainable (the constant maintenance of the public stations to ensure the smooth functioning).
– *The individual support for greener solutions at individual energy production and electric transport is not sustainable and sufficient.* The ministry of Environment in Lithuania has introduced several incentives to motivate individuals for a transfer to the renewable energy in the households and transportation. One of the incentives, commissioned by the Environmental projects management agency under the Ministry of Environment, is the funding for the installation of solar power plants. The demand is so huge, that, for example, when the application system was opened on 10th of January 2022, every minute there were 2 applications, and in one day total requested amount for support exceeded 7,8 million euros, when the all support for 2022 will be over 4 million. The application system is open for one month, and it is apparent that societal potential to renewable energy use in the households is massive, also triggered by significantly increasing electricity prices, and the support is not sufficient. Another incentive is the support of 5000 euros for new electric cars, and 2000 for older electric cars. Every year there is a certain amount of budget for these incentives, and when the budget ends, the incentives end. Such kind of system is not sustainable, and will not induce needed radical change, as the motivational system should be long term and sustainable, like for example reduction of taxes on environment friendly cars or similar.

In order to achieve climate neutrality by 2050, the right motivational mechanisms should be activated for the significant behavioral change. Sociological surveys indicate, that people in Baltic states have higher concerns about economic, social and geopolitical social problems, than environmental. High potential for the individual sector to faster energy shift is the incentives for the energy prosumer behaviors in

the individual level. Prosumerism, defined by futurist Alvin Toffler, means the system where consumers become producers at the same time. People then become not only end-users, but also active energy citizens, competent in modeling their own impact and the economic revenue from environmentally friendly behavior. Fist, technological/ instrumental shift should happen, then we can expect the intrinsic value shift toward environmental conscious behaviors. ■

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A fossil fuel that supports decarbonisation

Expert article • 3183

The current spike in natural gas prices shifted the EU's climate and energy focus from the long-term issue of decarbonisation to the short-term issue of energy availability for households and enterprises. The crisis highlighted the importance of natural gas within the member states' energy mixes and triggered a variety of solutions, such as increasing the intake of liquified natural gas from the international market or reversing the gas flow to tap into the main European underground storages (which, however, reached exceptionally low levels during 2021). This happened alongside discussions surrounding a list of sustainable energy technologies that support sustainability and qualify for the EU's financial support (so-called taxonomy). Although the definitive decision is, as of the writing of this text, not yet known, natural gas has been included on the Commission's draft list. Indeed, natural gas can support decarbonisation within the EU, even though it is a fossil fuel, and its utilisation is connected to several issues the EU needs to prepare for.

The EU has set 2050 as the deadline for developing a carbon-neutral economy. During the period of almost three decades between now and 2050, the Union (as well as other regions and countries) will be decreasing the amount of fossil fuels in its energy mix, until it reaches a level at which they will produce only a minimal amount of carbon emissions that will be absorbed by the natural environment (so-called carbon sink). As the most polluting and replaceable (in electricity generation) fossil energy source, coal has been removed from the energy mixes of several EU countries, with almost all the other members setting a coal phase-out deadline. Similarly, a lot of effort has been devoted to finding a replacement for oil in transport, where it presents a major challenge. The recent surge in hydrogen-related discussion amplifies the shift towards alternative modes of transportation, heretofore fuelled especially by electric cars. However, in both electricity generation and transport (not only road, but also maritime) natural gas and its various forms are viewed as greener alternatives to more polluting energy sources – not to mention the role natural gas plays in heating and industry.

While there is a lot of discussion on how to (almost) phase out natural gas from the EU's energy mix – necessary in the long-term in order to reach carbon neutrality – natural gas will be needed in the transition period as it can smoothen the transition from fossil fuels to renewable sources of energy. The concept of natural gas as a bridging fuel has received a lot of criticism due to (among others) the possibility of lock-in effect. The idea of a bridging fuel claims that natural gas presents an intermediary step between an energy system based on heavily polluting, finite fossil fuels and renewable sources of energy with a much smaller footprint. Those critical of this perspective claim that there is a risk of sustainable alternatives (i.e., renewables) being locked out by well-established fossil fuels (in this case, natural gas), which, in turn, will be locked-in in the system thanks to existing infrastructure and overall convenience. Therefore, critics oppose investing in the development of fossil fuel infrastructure and support rapid changes of energy systems. Contrary to this, the Commission has shown support for future investments into the natural gas sector by including natural gas into the taxonomy.

The rapid and complex shift of the energy system towards renewables can be accompanied by many negative externalities that can lead to questioning the energy transition itself – as the German case suggests. Moreover, the German energy transition points towards the importance of natural gas as an energy source that can support the inclusion of renewables into existing energy systems by providing solutions to current challenges connected to renewables, such as electricity storage or grid balancing. Natural gas – a fossil fuel – can thus be viewed as the main propellent of the transition towards renewables and decarbonisation.

As the current development on the natural gas market suggests, this process will inevitably create problems in different areas, both domestic and foreign in nature. The main issue outside the EU concerns natural gas supplies from countries that are dependent on revenues from energy export. A lower EU demand will translate into lower revenues, which will be unable to support the social policies these countries use to gain support from their population. This can create geopolitical pressures resulting in supply interruptions and similar issues which have proven to be part of the energy exporters' toolbox in the past. Domestically, the main challenge will be to find a compromise among the member states on natural gas. We can already observe the emergence of coalitions among the member states and, based on past experience (in nuclear energy, for example), we can expect the individual states' positions to strengthen as their energy mixes start to diverge due to decarbonisation. ■

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Geological storage of CO2 in the Baltic States

Expert article • 3184

If greenhouse gas emissions are allowed to continue without implementation of mitigating measures, then changes to the climate will endure on the timescale of centuries with consequent frequent and devastating natural disasters. Alas, the climate change due to growing CO2 emissions is now inevitable, even if tomorrow the humanity moves to a complete carbon neutrality, because the change has already begun and because CO2 has exceptionally long lifetime in the atmosphere. However, if immediate action in this climate crisis follows, then the transition to new conditions may be more gradual and thereby give people more time to adapt to the change.

The Baltic States recognize climate change as topical issue and look for mitigating measures, which include halting anthropogenic emissions and eventually reaching complete carbon neutrality. Strategies to achieve carbon neutrality involve the expansion of renewable energy and phasing out fossil fuel. In this regard, CO2 capture, and consequent storage are one of the most promising approaches without immediate transformation of the industry. In addition, it can be applied not only for industrial decarbonization but also for the green growth of the energy sector.

In general, carbon capture and storage technologies involve separating CO2 from flue gases and capturing it after the combustion of fossil fuels. Among the most common capture methods are the absorption, use of CO2 for microalgae cultivation, membrane separation, adsorption, and cryogenic separation. The captured CO2 is then transported, injected, and stored in geological reservoirs for exceptionally extended periods of time with minimal risks of leakage. However, in order to avoid any impact on climate, CO2 must remain isolated for at least 10 000 years, which therefore requires safe and predictable storage settings. The geological structure of the Baltic States offers such storage conditions with an adequate CO2 storage capacity and dense surrounding sediments, which work as natural insulation to prevent CO2 leakage – in general, these are porous sandstone structures deep underground. One of the most promising geological formations for CO2 storage in the Baltic States and in the entire Baltic Sea region is the Baltic Sedimentary Basin. It contains structures with porous Cambrian terrigenous sediments within the temperature and pressure regime that allows to store CO2 in a supercritical state. Currently, some of such structures are used for natural gas storage, for example, Inčukalns gas storage in Latvia.

The optimum geological conditions that meet the requirements for CO2 storage are in Central and Western Latvia and the Baltic Sea. Even if it is possible to store CO2 in structures in Lithuania, they are too few and have a low overall storage capacity. In addition, in Estonia there are no prospective Cambrian structures for CO2 storage.

Based on the seismological research and evaluation of the reservoir properties, 15 onshore sites can potentially be used for CO2 storage in Latvia, with total estimated storage capacity exceeding 400 Mt CO2. Those are Dobele, Northern Blīdene, Snēpele, Southern Kandava, Degole, Lūku-Dūku, Kalvene, Vērgale, Ēdole, Northern Kuldīga, Viesatu, Aizpute, Usma, Liepāja, and Northern Līgatne. Two additional potential offshore sites are established in the Baltic Sea near the coastline of Latvia: E6 and E7. The capacity of the 15 reported onshore structures could support storage of the national emissions for at least the next 200 years, and the additional offshore structures can increase the CO2 storage lifespan even more. Notably, that scientific observation suggests larger (up to 1 000 Mt CO2) than estimated storage capacity because these structures have not been studied in high detail and no recent data are available about them. However, to prove higher storage capacity, it is crucial to perform new in-depth geophysical and seismological research, and it is expected that the results will indicate much longer lifespan for the CO2 storage. Nevertheless, among the Baltic States, Latvia is the only one with a practical potential for CO2 storage in geological formations. The high CO2 storage potential of the Latvian structures is related to the intense structuring of the Baltic Sedimentary Basin and effective reservoir properties of Cambrian sedimentary rocks. Thus, use of carbon capture and storage in these unique geological structures can support the aims of the Baltic States climate policies to achieve climate neutrality. ■

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Energy citizenship and the low-carbon transition

Expert article • 3185

The production and consumption of energy account for more than 75% of the EU's greenhouse gas emissions. Therefore, decarbonising the EU's energy system is a crucial step to achieve the goal of carbon neutrality by 2050. Recent legislation, most notably the Clean Energy Package, aims to accelerate the transition of the energy sector to renewable energy sources. One of the pillars of the EU's approach to the decarbonisation of the energy sector is consumers' participation. This is due to energy decentralisation, which is shifting the traditional concept of citizens-as-consumers to energy citizenship. Energy citizenship is a term used to indicate that citizens can actively engage, as individuals or larger collectives, in activities that contribute to the promotion of sustainable energy.

The EU legislation encourages consumers' active participation in the energy transition in different ways, including, for example, renewable energy communities and demand response schemes. The former are legal not-for-profit entities that can be established by private persons, municipalities or small and medium-sized enterprises to jointly carry out activities such as energy generation, consumption or storage. The latter is a demand-side management tool that provides an opportunity for consumers to play a role in balancing the electric grid by reducing or shifting their electricity usage during peak times. Demand response programs allow consumers to reduce their energy bills and facilitate the penetration of renewable energy sources.

Although the Clean Energy Package paves the way for increased energy citizenship, through both collective and individual actions, there are still numerous barriers that hinder the EU's goal of promoting citizen participation in the energy transition. Furthermore, although efforts are underway to transpose EU law in the member states' national frameworks and create more favourable conditions for energy citizens, we have not yet come to a clear understanding of the factors that foster energy citizenship.

Focussing on the Baltic Sea Region, countries on the eastern side of the region have been ahead of some of their western counterparts in reaching their renewable energy targets. However, they have very few examples of renewable energy communities. On the other hand, countries such as Denmark and Germany have both very high shares of renewables and active participation of citizens in renewable energy communities. More than policy, socio-cultural factors seem to explain these different outcomes. Countries in the western portion of the Baltic Sea Region have traditionally enjoyed high levels of civic activism and social capital, which are some of the preconditions for energy citizenship. Moreover, they have traditions related to cooperatives, as well as high per capita income. On the contrary, countries in the eastern Baltic Sea Region do not exhibit the same levels of civic activism and social capital. Some scholars believe this deficit is due to the repression of civil society during the Soviet regime.

Therefore, the concept of energy citizenship as collective energy action in energy production, which is predominantly inspired by a Western European vision, does not entirely fit into the cultural milieu of countries on the eastern side of the Baltic Sea Region. However, some of these countries have managed to find their own way to promote energy citizenship by, for example, supporting prosumers (i.e., households and local businesses that produce and consume energy) through state incentives. A case in point is Lithuania, which currently has more than 10,000 prosumers and a total installed capacity of 105.69 MW.

Finland is considered a leading country for demand response. Dynamic electricity price contracts (i.e., the tools that enable price-based demand response) for domestic energy consumers have been available for many years. Nevertheless, energy customers are generally regarded as being uninterested in such contracts due to the small savings that they grant. This is a persistent mischaracterisation of energy consumers who are assumed to be a monolithic block, driven merely by economic interest. In reality, consumers are motivated by a multitude of factors, including emotions and the desire to act sustainably. Until this mischaracterisation is eliminated and the systemic implications of consumers' choices for energy tariffs (e.g., flat vs. dynamic prices) are made clearer to the public, demand response programs will have a limited role in enacting energy citizenship.

To sum up, energy citizenship can contribute to accelerating the transition to a more sustainable energy system. However, we need to be more aware of its many forms (energy communities, prosumerism, consumer choice, etc.), understand the factors that drive and hinder it in different contexts, and above all, further implement national and local policies enabling citizens to take an active role in the low-carbon transition. ■

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Carbon neutral Baltic Sea Region by 2050

Expert article • 3186

Carbon Capture, Use and Geological Storage (CCUS) is one of the important technologies for reaching climate neutrality by 2050 and 2070. CCUS permits to provide energy security in the transitional period to a green economy and full transition to renewable energies. In the longer term, CCUS could provide not only carbon-free energy but also renewable green and carbon-free blue hydrogen and even negative emissions technologies (NET). NET include Bio-CCS (or BECCS) when biofuel is used instead of, or together with fossil fuels, and Direct Air Capture (DAC) with CO2 storage (DACS). The synergy of CCUS with renewable energies (wind, solar and geothermal), biofuel, hydrogen production and DAC are innovative tools, which can lead the world and BSR to a carbon-neutral future.

However, the Baltic Sea Region, which includes 11 countries at the Baltic Sea and around it, has both drivers and serious challenges at the way of reaching Paris climate targets.

Large CO2 emissions produced in the Baltic Sea Region (BSR) is one of the main drivers to implement CCUS. In spite of the general trend in decreasing CO2 emissions in 2020 (partly connected to the global pandemic), the fossil CO2 emissions per capita were higher than the EU average (5.9 t) in seven BSR countries (Russia – 11.6, Estonia – 11.1, Norway, Germany and Poland – 7.7, Finland – 7.3 and Belarus – 6.3 t) and were higher than global average per capita (4.6 t) also in Lithuania – 4.8 t. Only in Denmark, Sweden and Latvia CO2 per capita were lower than the global average (4.4, 4.2 and 3.9 t, correspondingly) (Crippa et al, 2021). According to UNFCCC, global per capita emission levels by 2050 under the well - below 2 °C and 1.5 °C scenarios are at 1.6–2.4 t CO2 eq. and 0.6–1.2 t CO2 eq., respectively. According to the 1.5 °C scenarios the global net anthropogenic CO2 emissions need to decline by 45% from 2010 level by 2030, reaching net zero around 2050. For the 2 °C scenario CO2 emissions need to decrease by 2030 by about 25% from the 2010 level and reach net zero around 2070.

BSR has a large theoretical capacity to store CO2 in the Palaeozoic sedimentary successions of the Baltic Basin (BB). The most prospective areas for CO2 storage within the BB border are several countries such as Sweden, Latvia, Lithuania, Poland and Russia and include large saline aquifers and oil and gas fields.

The main drivers for implementation of CCUS technology in the BSR are (1) a need to decrease the high CO2 emissions; (2) obligations taken under the Paris Climate Agreement and national strategies by 2050; (3) European requirements for low-carbon, green and circular economy; (4) a large potential CO2 storage capacity; (5) London Protocol (LP) Parties in October 2019 adopted a resolution to allow application of an amendment to article 6 of the LP to allow sub-seabed geological formations for CO2 storage projects to be shared across national borders; (6) safe offshore CO2 storage is demonstrated under the North Sea; (7) a well-developed natural gas pipeline system exists that can be reused and combined with the potential CO2 transportation network; (8) good research capacity demonstrated by BSR institutions; (9) CO2 injection experiments have been positively evaluated by oil companies in Lithuania and Russia.

The main barriers for implementation of CCS technology in the BSR are: (1) limitations and bans in the national CCS regulations; (2) not all BSR countries are parties of the LP; (3) amendment to Article 6 of the LP is implemented only by four BSR countries (Estonia, Finland, Norway and Sweden) ; (4) absence of a CO2 storage atlas of the BSR; (5) low public awareness, acceptance of CO2 storage options and limited education options for CCS in most of the BSR countries; (6) relatively high costs of CCS projects; (7) low or absent national support of CCS research and pilot projects; (8) onshore CO2 storage in saline aquifers is not well established in Europe and not permitted in the BSR.

During the last years, there are a number of positive developments in the BSR. Fortum is planning to develop pilot CO2 capture plants in Sweden, Lithuania and Poland. Danish government and industry are planning to update CCS regulations and implement offshore CCS projects, including the Greensand CO2 storage project. Large energy and cement companies in Sweden, Latvia and Estonia are planning to implement CCUS projects by 2030. Green and blue hydrogen production by refinery in Finland and for hydrogen-based iron and steelmaking industry in Sweden, both with CCS, have been already supported by EU Innovation Fund.

Among negative developments is the non-secure energy policy in the Baltic States, including the closing of power plants in Estonia in 2019 and the banning of any CO2 injection in Lithuania since 2020. ■

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Sustainable phosphorus management in the Baltic Sea Region

Expert article • 3187

Phosphorus (P) is a crucial element of the food security system as it is a key nutrient for the growth of all living organisms. Despite efforts in recent decades to make a more rational and sustainable use of it, of all the mineral P used in food production, only 15% is actually consumed by humans. Although there are losses in mining and fertiliser production, the greatest losses are associated with the cultivation of crops and the production of meat and milk.

Along the food value chain, the main phosphorus-rich waste streams are (i) animal manure; (ii) municipal wastewater and sewage sludge; and (iii) food processing. These flows constitute a major loss of money and food production capacity. Furthermore, when discharged into neighbouring ecosystems, the effect of the nutrients can cause environmental problems such as eutrophication of water bodies.

Of the many coastal areas in the world affected by eutrophication, the Baltic Sea belongs to the most impacted. Despite significant reductions in P discharges achieved through the testing of some approaches within the Helsinki Commission (HELCOM), eutrophication in the Baltic Sea still remains the largest coastal water pollution problem.

Decreasing the present value of the P load in the Baltic Sea to meet HELCOM targets is more difficult than in the past. The largest sources of P pollution are mainly diffuse sources, related to agricultural activities and animal production, which are difficult to reduce and trace. On the other hand, localized sources of P (the second category of P pollution sources) are easier to intercept, as they are concentrated and usually monitored. Recovering and reusing the valuable resources contained in these effluents could contribute both to the prevention of eutrophication and to the food security.

Unfortunately, due to a lack of legal and economic factors, nutrients recovery is not yet a common solution. In particular, the uptake of P recovery technologies in some key industrial sectors characterised by nutrients-rich effluents, such as wastewater treatment plants (WWTP), is limited by the lack of in-depth analysis on the potential, benefits and risks of industrial innovation in this field. Without methodologies and tools able to quantify commercial, environmental and social impacts at company level, companies do not have the elements to define an informed strategy on P management.

To fill this gap, the Department of Industrial Engineering of the University of Bologna channelled the knowledge gained in two EU projects - InPhos (2018–2020, EIT Raw Materials) and Prosumer (2020, EIT Climate-KIC) - into the development of an industry-oriented methodology to provide quantitative information needed by each company to explore potential P recovery paths and compare different alternatives. This analytical approach consists of four main steps: (i) Identification of corporate interests and constraints (e.g. legislative limits); (ii) Assessment of P flows within corporate boundaries through the application of an innovative visualisation tool, ViVACETM, developed by the University's Department of Industrial Engineering to assess circular business models; (iii) Cost assessment through the Net Present Value (NPV) method; (iv) Sustainability assessment through industry Key Performance Indicators.

The methodology was applied to an Italian food company that has already installed a large-scale P recovery technology based on struvite precipitation. The application of the ViVACE tool to assess the annual P fluxes in the food processing plant showed that less than 50% of the P contained in the raw materials remains in the final products, while the recovery technology reduces the P concentration in the wastewater by about 80%. According to the NPV method, economic feasibility is not ensured, as the selling price of struvite is not competitive when compared to the cost of primary P.

The identification of the potential for P recovery and re-use at company level (through the proposed methodology) would also facilitate the definition of suitable and tailor-made policies and financial instruments to respond to the needs and specialisation of companies in a specific geographical area, and ensuring the environmental and economic sustainability and thus allowing the dissemination of P recovery at industrial level.

In conclusion, as eutrophication has an impact on environment, economy and human health (the three pillars of sustainability), a regulatory plan supporting the cross-cutting use of fiscal incentives, policies and research activities is therefore needed to incentivise the reduction, recovery and re-use of P. Fortunately, recent European regulations and directives show an increasing focus on nutrient recovery and wastewater treatment plants, while the publication of the STRUBIAS criteria, following the proposals and actions of the European Sustainable Phosphorous Platform's (ESPP), enables the use of precipitated phosphates (such as struvite) as fertilising products in EU. ■

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Smart specialisation supporting circular economy in the Baltic Sea region

Expert article • 3188

The implementation of a circular economy is seen as a possible solution to respond to the sustainability crises. In a circular economy material is used in an effective way in order to save resources. Focus is put on utilizing materials and products through sharing, leasing, reusing, repairing, refurbishing and recycling. Actors from policymakers, businesses and experts to researchers seem to agree that in order to achieve sustainability the future economy has to be circular. In this transition process regions and regional strategies play a central role. The circular economy is promoted through international, national, regional and local strategies. One of the strategic tools that can support the circularity change is smart specialisation.

The smart specialisation concept was launched by the European Commission. It means identifying a region's competitive advantages with the aim of developing targeted strategies for further improving its competitiveness. Smart specialisation strategy (S3) is an ex-ante conditionality for the use of ERDF funding in the regions to ensure that the ERDF investments fit into the overall research and innovation policy and build on the region's existing strengths while aiming to see new possibilities. S3 can also be a way to accelerate the regional discussion towards defining circular economy goals.

In the recent years the sustainability discussion has developed on all fronts. The launch of the United Nations Sustainable Development Goals (SDG) in 2016 has resulted in a new awakening of underlining the importance of sustainability also in other contexts. Also, the concepts of circular economy and smart specialisation have been redefined or rethought in order to highlight the sustainability that, in fact, already had been (or should have been) built in. S3 should be developed to smart specialisation strategies for sustainable and inclusive growth "S4+" to serve better as a pivotal tool towards the new green and digital economy and the SDGs. The key idea of S4+ is to create a strategic approach to mobilise transformative innovation for cross-sectorial solutions and synergies between innovation at all societal levels, while leaving no one behind.

Supported by the Policy Area Innovation of the EU Strategy for the Baltic Sea Region (EUSBSR PA INNO), sub-regions in the Baltic Sea region are actively developing their S3 in line with the EU Green Deal and with increasing focus on interregional cooperation. In general, innovation priorities and actions of the new EUSBSR action plan aim at tackling common BSR challenges by developing shared solutions, and at supporting the development of interregional value chains across the strongest areas in the BSR, such as in circular economy. An EUSBSR example of the cooperation where S3 and circular economy met is the BSR S3 Ecosystem Platform project (2019-2022), financed by the Interreg Baltic Sea Region Programme 2014-2020.

The BSR S3 Ecosystem project has aimed at raising awareness among and influencing regional, national and EU level innovation policy makers and experts of the opportunities and needed capacities related to the development of more strategic interregional cooperation that would be strongly based on the innovation policy priorities of regional smart specialisation. As bioeconomy and circular economy are shared strengths in the BSR, the project conducted a value chain mapping analysis of the circular bioeconomy across the BSR and accomplished a "value chain mapping manual" describing a method for identifying relevant value chains across regions in a selected field. Furthermore, the outcomes were valorised in workshops and innovation camps where innovation policy stakeholders shared experiences and good practices on bottom-up approach to regional innovation policy and smart specialisation.

Recent experiences and results from EUSBSR PA INNO supported S3 projects, such as BSR S3 Ecosystem, provide insights and tools for the regions to develop their S3 for sustainability (S4), with a strong focus on inclusive sustainability and green transition. Furthermore, they offer valuable tools and guidance for the effective and coordinated utilisation of EU 2021-2027 opportunities in the BSR regions, including the new EU instrument for interregional innovation investments (I3) and coordinated utilisation of mainstream ERDF programmes.

When aiming towards a sustainable future in BSR regions, it is essential to look for synergies and innovative ways both on strategy level and in practice. In order to achieve successful and sustainable regional and macro-regional circular economy development and cooperation, the systemic and holistic perspectives of circular economy need to be fully understood. Active engaging of stakeholders to ensure a bottom-up contribution to and joint regional understanding on the possibilities for systemic change is crucial. Authorities in charge of regional development play a key role in this process. ■

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The important role of stakeholder collaboration in local energy transitions

Expert article • 3189

In Europe, the energy sector is the main source of emissions with the building sector as the largest single energy consumer [1]. The sector accounts for ca. 40% of total energy consumption and 36% of the EUs GHG emissions [2]. In Europe, 75% of the building stock has been found to be energy inefficient; renovating the building stock could reduce the total EU energy consumption by 5-6%, which represents 5% of all EU CO2 emissions [3]. In addition, the European Commission estimates that energy efficiency measures could stimulate the economy, generating around 9% of Europe`s GDP, and creating 18 million jobs. Especially SMEs could highly benefit from such measures as their contribution is more than 70% of added value in the building sector [3]. But the renovation numbers show an average of only 1% of existing building renovated in EU countries instead of the needed 3% [3]. This progress is inadequate to reach the GHG emission reduction targets and to reduce dependency on fossil fuels for electricity and heating.

Approach and background

Stakeholder collaboration plays an essential role for local energy transitions and could trigger the needed energy efficiency activities and unlock unused potential. Results and good practices from almost four years of stakeholder collaboration practice in local energy transitions from the Interreg Baltic Sea Region project AREA 21 and its successor AREA 21 + action demonstrate this. AREA 21 developed and tested innovative forms of stakeholder collaboration between public and private actors in seven urban areas in six countries: Germany, Estonia, Finland, Poland, Russia, and Sweden (2017-2020). Key to unlocking energy efficiency potentials was the establishment of the Energy Improvement District (EID) Concept [4]. Within this EID framework, public and private key stakeholders were identified and activated, and defined the overall aims for the urban district [4]. They co-developed a strategy and an action plan defining how to reach the goals including specific measures and activities, e.g. the replacement of oil heating in private homes, awareness for energy use and savings, replacement of old heat pumps, visualisation of energy use etc. In AREA 21 + action (2020-2021), selected activities from the action plans were implemented and lessons drawn in order to institutionalise the energy efficiency work and cooperation of the stakeholders. Information on specific cases is available at the project website [5].

Stakeholder collaboration and results

Stakeholder collaboration can be understood as ‘various actors working together to the ends of a common goal’. Stakeholder collaboration is generally seen as beneficial for the included actors. In addition, it builds trust and ownership and allows for long-term cooperation of actors. On the other hand, it requires additional resources (e.g. time, organization, finances) and can lead to unexpected results [6]. Stakeholder collaboration in AREA 21 resulted in the aforementioned co-development of strategies and action plans, with a total of 134 actions. 176 homeowners, energy utilities and energy agencies, public property owners, hospital and university staff, students, academia, politicians and public authorities from six countries were involved in the co-development of local strategies and action plans. Several actions will be implemented together with the stakeholders involved in their development. As the EID concept is fully transferrable, spill-over effects or adaptations can already be observed. In Finland, the City of Tampere and local energy authorities dedicated public funding for energy counselling to homeowners and building associations. Two reports (i.e. “Oil heating report” and “Smart energy advice report”) have been published that help stakeholders, especially the City of Tampere, to roll-out counselling services to other neighbourhoods. Both reports stress the effectiveness of counselling for motivating home owners to act. In addition, it gives the city needed information to support energy transition. A national campaign is under development using the experiences of ICT tool-based assessment and counselling from the EID Tampere. In the St. Petersburg EID, findings have been directly integrated in students’ course curricula, and in a new master programme in energy management at the Polytechnic St. Petersburg. In addition, a bonus / payback system for student is under development where energy savings can be used for campus services (e.g. dorm laundry, printing etc.). Students are directly involved in the development and can actively steer their energy bill leading to more awareness. In Kohtla-Järve counselling on energy efficiency is of special importance due to several local challenges (i.e. low value of property and economic situation of home owners). The pilot built trust among local stakeholders and raised awareness, providing independent and reliable information through round tables and study tours. ■

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Environmental characteristics of economic dynamics in the Northwestern Federal District of Russia

Expert article • 3190

The global trend toward sustainable development involves reducing the environmental load in all countries through the use of new, less environmentally intensive technologies. The Baltic region countries are making significant efforts to reduce environmental pollution and have already achieved some success in combating climate change. Russia adjoins the Baltic region countries with the territory of its North-Western Federal District (NWFD), therefore, close attention was paid to it when assessing the environmental consequences of economic dynamics for the period 2015-2020.

The NWFD includes 11 subjects of the Russian Federation: the Republic of Karelia, the Komi Republic, the Arkhangelsk Region, the Nenets Autonomous Area, the Vologda Region, the Kaliningrad Region, the Leningrad Region, the Murmansk Region, the Novgorod Region, the Pskov Region and St. Petersburg city. Its total area is 1,687 thousand square kilometers, the population is about 14 million people, and the population density is about 8.3 people per 1 square kilometer.

The gross regional product (GRP) in the NWFD in constant prices increased by 2.7%: from 7205 billion rubles in 2015 to 7403 billion rubles in 2020[1]. Economic growth was observed in most subjects of the NWFD, except for the Republic of Karelia (-0.9%), the Komi Republic (-8.8%), the Nenets Autonomous Area (-0.7%) and the Vologda Region (-0.7%). In general, the positive economic dynamics in the NWFD was accompanied by various environmental effects in the condition of the air, water resources and waste generation.

Atmospheric air: There have been no cities with high atmospheric air pollution in the NWFD in recent years. The total volume of pollutant emissions in 2020 was 2080.2 thousand tons, which is 40.6% lower than in 2015. At the same time, emissions from stationary sources decreased by 23.0%, and emissions from mobile sources (road and rail transport) fell by 68.2%. It should be noted that the KOVID-19 pandemic contributed to the reduction of this type of environmental load: emissions from mobile sources decreased from 1,422.2 thousand tons in 2018 to 451.1 thousand tons in 2019 and 432.5 thousand tons in 2020. Accordingly, the environmental intensity in terms of atmospheric air pollution fell by 42.2%: from 0.49 to 0.28 tons per million rubles of GRP. Decrease of ecological load and ecological intensity was observed in all subjects of NWFD of Russia. Thus, the environmental dynamics with regard to atmospheric air in the NWFD can be characterized as "green".

Water resources: In 2020, 584.5 million cubic meters of fresh water were withdrawn from natural water reservoirs, which is 7.0% higher than in 2015. About 80% of water was used for production needs. At the same time, the volume of recycled and consistent water increased by 11.4%: from 827.6 to 921.9 million cubic meters, indicating an increase in the circularity of the NWFD economy with relation to water use. Ecological load in the form of discharge of polluted sewage decreased by 14,9 %: from 2637,0 to 2245,3 million cubic meters. Environmental intensity fell from 0.04 to 0.03 million cubic meters per 100 million rubles of GRP. Thus, the environmental dynamics in the NWFD with reference to water resources in general can be characterized as "green". The exception is the Republic of Komi, where the economic reduction was combined with the growth of environmental load and ecological intensity. Here the discharge of polluted wastewater increased from 117.0 to 171.1 million cubic meters. At the same time it increased from 0.2 to 0.4 million cubic meters per 100 million rubles of GRP. Therefore, the economic dynamics in the Komi Republic is characterized as a "black recession".

Waste: In 2020, the total volume of waste generation in the whole NWFD was 150189 million tons, which is 30.3% higher than in 2015. The growth of the environmental load, exceeding the growth of the gross product has caused an increase in environmental intensity. In 2015 there were 6.1 tons of wastes per 100 million rubles of GRP, and in 2020 - already 7.7 tons. About 50% of waste is disposed of and about 40% is stored. Less than 15 % of waste is utilized and neutralized. In general, the economic dynamics in relation to waste in NWFD is characterized as "black". The exceptions are the Novgorod Region, where there was a "green" economic dynamics due to a threefold reduction in waste generation, and the Arkhangelsk Region due to a twofold reduction in waste generation. The main reason for this positive environmental trend was the deterioration of the economic situation. The volume of production in the mining sector in the Arkhangelsk Region and in the manufacturing industry in the Novgorod Region decreased sharply due to the difficult epidemiological situation.

Thus, the environmental conditions in NWFD of Russia are characterized by positive changes with regard to the protection of atmospheric air and water use and negative - with regard to waste generation. The urgency of the waste management problem requires the Russian government to create institutional conditions conducive to the creation of a waste recycling industry and encouraging the widespread use of best practices in this area. ■

1 *Due to the lack of official statistical data on the GRP volume index in the Russian regions for 2020, the GDP volume index for 2020 was used in the calculations.*

Expert article • 3190

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High mountains in the Baltic Sea Basin – „water towers" of the region

Expert article • 3191

Scandinavian Mountains and Tatra Mountains are the only regions representing the high mountain environment in the Baltic Sea drainage basin. In spite of dissimilarities in abiotic and biotic components of natural environment of these two mountain ranges, the high mountain landscape – common in both regions – makes them spectacular and exceptional. These mountain ranges rise above the upper forest limit and above Pleistocene snow line, and have a glacial origin, and features, which do not exist in other mountains i.e. glacial cirques, steep rocky crests and walls, cirque lakes, glaciated rocky knobs etc. Presence of glaciers proclaims the Scandinavian Mountains as a very unique and spectacular region in North and Central Europe. In spite of relatively favorable climatic conditions there are no glaciers in the Tatra Mountains due to lack of suitable orographic conditions (too steep mountain slopes). However firn and snow patches are able to survive in cold and moderately cold climatic belts.

Despite a small contribution of high mountains in the Baltic Sea drainage basin (areas over 1000 m a.s.l. represent merely 0.6%), they play a key role in provisioning water to their surrounding landscapes due to the highest precipitation exceeding 2 th mm per year (the Baltic Sea region as a whole has an average annual precipitation of 400 mm). They are vital headwaters of the major rivers in the Baltic Sea region (i.a. Torne, Kalix, Lule, Ume, Indal, Ljungan, Dal, Klarälven, Vah, Dunajec) therefore they can be called natural "water towers" of the region. Mountains are also rich repositories of biodiversity, they provide of ecosystem goods on which downstream communities rely, they contribute to the wellbeing of many people. They are, in general, the basis for the survival of almost the whole Baltic region. Moreover, mountains represent the most fragile environment on Earth, they are particularly vulnerable to any kind external changes.

The Scandinavian Mountains and the Tatra Mountains are facing enormous pressure from various anthropogenic impacts and drivers in global, regional and local scales. Hydropower sites, mining, wind power, deforestation, road building, tourism, recreation, skiing, surface water and groundwater intakes, influence mountains' environment, including water. Moreover climate change is one of several processes affecting water resources. Changes in the river catchment which is a system of interrelated geographical components induce changes in the hydrological system and rainfall-runoff relations are disturbed. One may observe ongoing intensification of the water cycle, with increasing rates of evapotranspiration and water vapour concentration in the atmosphere.

In the anthropocene age, in particular in a few last decades, many problems in water resources in high mountains resulted from interactions between water and human water demand and use. There are numerous conflicts between different groups: from one side exploiting natural resources in high mountains and from the other side – involved in their protection. Internal inconsistencies, unclear and indecisive statements and the lack of conformability in documents concerning nature resources management and protection are main reasons of bad solutions or faults in the interpretation of limits of human activity in natural environment of high mountains.

It is necessary to take the appropriate activities in management of water resources including an integrated approach in local, regional, trans-regional, and global scales. Efficient natural protection of mountainous areas should continue in order to safeguard water and biodiversity, a very threatened planetary resources. Such measures should be designed so that mountains visitors can continue to enjoy nature and wildlife, although within limits set by the sensitivity of each area. For this purpose the long term concerns need to be given larger importance than the short term. There is a need for a "problem-oriented" research involving experts from different disciplines and incorporating relevant knowledge instead of "discipline-oriented " research. It might enable solving environmental problems. Pro-ecological education and behaviour of local communities are also very important.

Realising the importance of high mountains as environment of crucial significance for water resources, the Institute of Geography and Spatial Management of the Jagiellonian University in Cracow, the Baltic University Programme in Uppsala and the Tatra National Park in Zakopane developed the Tatra Hydrological Workshop on *Sustainable water resources management in high mountains in the Baltic Sea Region* (10-13 June 2019) dedicated to students as well as young scientists. The aim of the workshop was to get a relevant knowledge about monitoring and sampling techniques for analyzing hydrological processes, and organizing a monitoring network to control the influence of human activities on the quantity and quality of water resources in high mountain catchments. The number of over 30 participants from Europe, Asia and Africa took part in the workshop. All activities and introductory lectures were provided by specialists, i.a. Lars Ryden (Uppsala Univ.), Ladislav Holko (SAS), Marek Kot (TPN), Miroslaw Żelazny (UJ). The book "Sustainable water resources management in high mountains in the Baltic Sea Region" was published. A full version of the book is available https://denali.geo.uj.edu.pl/publikacje.php?id=000244&lang=1 ■

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The European Green Deal and five myths related to natural gas

Expert article • 3192

The European Green Deal will have a major impact on the future energy consumption of the European Union (EU) and the EU's energy imports until 2050. However, a report predicts that natural gas will maintain its share in the EU's energy mix until 2030 (a link to a report dealing with the geopolitical impact of the European Green Deal). As several myths exist related to natural gas and the role of natural gas in European geopolitics, I will try to dispel five of them.

Myth 1. Russia is in dire need of revenue from natural gas exports

According to the Russian Ministry of Finance, oil and natural gas accounted for less than 30 % of the Russian Federation's budget revenues in 2020. However, oil is a more important source of income for the Russian State than natural gas. According to the Central Bank of Russia, the country received nearly $120 billion in exports of crude oil and petroleum products in 2020, while export revenues from natural gas – including liquefied natural gas (LNG) – were just $30 billion. The majority of Russia's natural gas export revenues come from the EU, which accounted for almost three-quarters of Russia's gas exports in 2020 (a link to Russia's economic relations with super powers). When assessing Russia's dependence on natural gas export revenues, it should not be forgotten that the country's reserve funds are currently worth nearly $200 billion. In addition, the country's foreign exchange reserves are worth more than $600 billion. In other words, Russia would not freeze even if natural gas export revenues were not received from Europe for several years. However, Central Eastern Europe, whose energy supply relies too much on Russian natural gas, would freeze almost immediately if the supply cut were to happen in the wintertime.

Myth 2. As Germany is shutting down its remaining nuclear power plants, it urgently needs the Nord Stream 2 gas pipeline

Germany plans to shut down its remaining nuclear power plants this year, which used to account for 5 % of Germany's primary energy consumption. If Germany were to decide to make up for the energy shortage caused by the decommissioning of nuclear power with natural gas alone (an unlikely scenario), it would have to buy approximately 15 billion cubic metres (bcm) more natural gas than at present. Currently, Germany produces 5 bcm of gas and imports the rest from abroad: almost 15 bcm from the Netherlands, 30 bcm from Norway and about 55 bcm from Russia. Germany will have to increase its natural gas imports from Russia as the Netherlands closes the EU's largest natural gas field this year, imports from Norway cannot increase significantly and Germany has not so far built LNG import terminals on its soil. Although Germany will have to increase its natural gas imports from Russia, Ukraine's current pipeline capacity would have allowed Germany to transport additional gas from Russia without the construction of the Nord Stream 2 pipeline. Nord Stream 2 is a geopolitical route choice, justified by the fact that direct access to Germany is a less risky option for Germany than transporting natural gas from Russia to Germany via Ukraine or Belarus. However, a lower risk for Germany means a higher risk for Ukraine and Belarus. As Russia has also built a gas pipeline (TurkStream) across the Black Sea, bypassing Ukraine, some experts have been warning for years that Russia's foreign policy towards Ukraine and Belarus could become more aggressive (a link to a report of 2009).

Myth 3. Ukraine is no longer dependent on Russian natural gas

Until a couple of years ago, the Ukrainian state gas company Naftogaz charged its Russian counterpart Gazprom $3 billion a year for the transit of natural gas through Ukraine. Naftogaz will soon lose these revenues. The loss of these revenues not only affects Naftogaz but also the Ukrainian state as Naftogaz paid more than $5 billion into Ukraine's state budget, meaning the company covered more than a tenth of all Ukrainian budget revenue in 2020. In addition to these gas transit revenues, it should be noted that Ukraine still consumes Russian natural gas, although it has not imported it directly from Russia since November 2015. The explanation for such a strange situation is that Ukraine mainly imports its natural gas from Slovakia and Hungary, who in turn import virtually all of their natural gas from Russia. Natural gas satisfies a third of Ukraine's primary energy consumption. Ukraine itself produces two-thirds of the gas it consumes, and a third truly originates from Russia, though Ukraine does not import directly gas from Russia. Russian natural gas thus covers a tenth of Ukraine's total energy consumption. In other words, Ukraine is still dependent on Russian natural gas, even though it no longer buys gas directly from Russia.

Myth 4. With the help of LNG, the EU will no longer need to impart natural gas from Russia

The EU consumes almost 400 bcm of natural gas a year, of which the EU itself produces only a tenth. In other words, EU countries must import 90 % of the natural gas they consume from outside the EU. Four-fifths of these natural gas imports come via pipelines and the remaining one-fifth is transported by ship as LNG. The share of LNG could be even higher as the average utilisation rate of LNG terminals in the EU is only 50 %. However, even if the utilisation rate of existing LNG terminals were to increase to 100 % (in practice, this is not possible), the LNG volumes would remain lower than the volume of the natural gas supplies from Russia to the EU. It should be borne in mind that Russia supplied half of the EU's natural gas imports in 2020, and its share will increase towards the end of this decade. In this context, it should not be forgotten that in 2020, Russia was the EU's third largest supplier of LNG after the United States and Qatar. In other words, LNG will help the EU to reduce its dependence on Russian natural gas, but it will by no means eliminate the EU's dependence on Russian gas altogether.

Myth 5. The US wants to stop the Nord Stream 2 pipeline to increase its gas export revenues

It is obvious that the USA wants to increase its LNG supplies to the EU, and for some North American LNG exporters, the European market is strategically important. However, money is hardly the main motive for the US to slow down the opening of the Nord Stream 2 pipeline. As far as I am concerned, the USA wants its LNG supplies to help European NATO countries dampen Russia's energy policy influence rather than generate additional revenues. Here, it should be noted that LNG accounts for only one percent of US export earnings from the EU. In other words, even if the USA multiplied its LNG exports to the EU, LNG exports to Europe would not be a money-making machine for the US.

More detailed information on natural gas and its role in the Baltic Sea region can be found in Palgrave Macmillan's book *The Future of Energy Consumption, Security and Natural Gas: LNG in the Baltic Sea Region* (a link to the book). In June, the National Baltic Sea Forum of Finland will continue to address this issue (a link to the forum). ■

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BRE REVIEW BALTIC RIM ECONOMIES

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