NOVELTIES IN POWER INDUSTRY

CLIMATE NEUTRAL RENEWABLE ENERGY TECHNOLOGIES

VALDIS KAMPARS

As the population and their living standards grow, global energy demand also continues to grow. Although the annual demand for energy growth seems less dramatic, at only 1–2%, it is undoubtedly dramatic in the long period and will lead to irreversible climate change. The US Energy Information Agency (EIA) forecasts (Fig. 1) suggest that this increase could reach 50% over the next 30 years, and only OECD countries with significantly lower growth could expect to provide it with renewables.

The increase in energy consumption contributes to economic growth and, unfortunately, to greenhouse gas (GHG) emissions. This means that without fantastically successful technical solutions, GHG emissions will increase significantly, and the goal set in 2015 by the UN climate conference in Paris, to limit global warming below two degrees of Celsius compared to pre-industrial level, will not be achievable. Without effective solutions, catastrophic global warming of up to 2.7 degrees is expected by 2030. Of course, GHGs are not just CO_2, but CO_2 emissions are so vast that scientists and society are currently focusing on essential reducing of these emissions. Increase in CO_2 emissions is clearly linked to the increase in energy consumption.

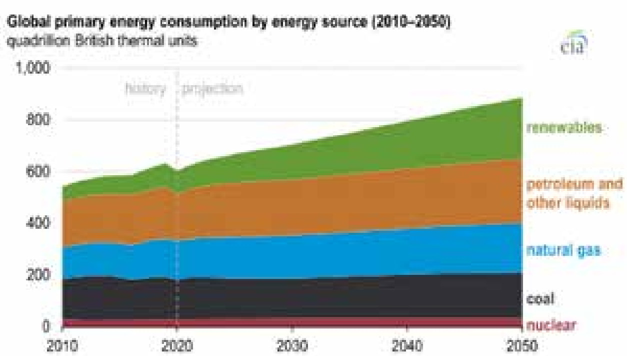


Fig. 1
EIA global energy consumption forecasts

The main directions in the search for technical solutions to reduce CO_2 emissions seem to have been outlined, and there is good understanding that complete elimination of fossil carbon from the economy is not possible. What we can do is:
1) rational and economical use of energy;
2) increasing the share of renewable energy, ensuring practically all the increase in demand for at least OECD countries with renewable resources;
3) capture and conversion of CO_2 into useful products by forming artificial carbon cycles. The latter is not possible without hydrogen and can also be included in the hydrogen energy sector.

The EU emits around 10% of GHG emissions, but it has undoubtedly become a global leader in more rational use of energy and replacement of fossil fuels with renewables. The EU has agreed to reduce GHG emissions by at least 20% by 2020 compared to 1990 levels, while improving energy efficiency by 20% and increasing the share of renewable energy to 20%. A large body of legislation has been approved at EU level, including the emissions trading scheme, renewable energy sources, transport energy, energy-efficient buildings and products, car emission standards and fluorinated hydrocarbons emissions. In the framework of the Treaty of Paris, the European Commission also presented in November 2018 a strategy for a climate-neutral economy until 2050, ensuring a cost-effective path towards achieving the agreed zero emissions target in the Paris Agreement, increase the number of companies reorganising their operations with the aim of achieving climate neutral or net zero emissions. There are promising projects and promising commitments,

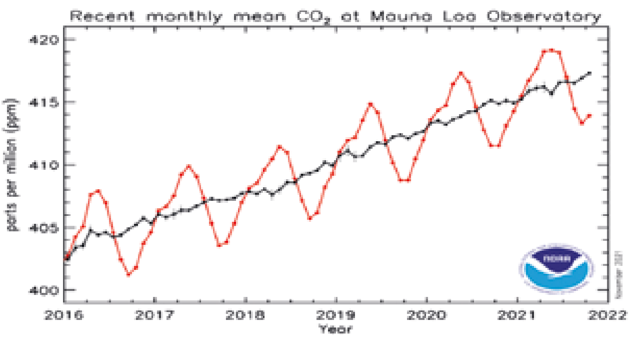


Fig. 2
Measurements of CO_2 concentrations in the atmosphere at the Mauna Loa Observatory

but there is no change in the rate of increase in CO_2 concentrations in the atmosphere (Fig. 2). The situation is dramatic and forces all countries and organisations to address these extremely important challenges in search for new technological solutions of climate neutral economy.

Riga Technical University (RTU) is an active developer of energy policy and new technological solutions for the implementation of this policy. At least three RTU Research Platforms have a direct connection to the problem: Energy and Environment, Transport and Materials, Processes and Technologies. The Institute of Applied Chemistry has also been involved in the development of new technologies of climate neutral economy. One of the scientific groups, consisting of V. Kampars, K. Lazdoviča, Z. Ābelniece, I. Māliņa, L. Laipniece, R. Kampare, A. Stanke, A. Gaile, and I. Astrauskas, is occupied with five different problems:

- Improvement of the biodiesel production process;
- Production of biodiesel from residues (use of non-food raw materials for fuel production);
- Possibilities of using pyrolysis and catalytic pyrolysis processes for bio-oil production;
- Development of catalysts for the production of hydrocarbons from synthesis gas;
- Development of catalysts for the conversion of captured CO_2 into methanol.

The first two topics are related to real production processes in Latvia and focus on the development of existing production companies in accordance with the new requirements. We have here two companies operating: SIA Bio-venta (the largest manufacturer in the Baltic States) and GVF BIO. Currently, the industrial synthesis of biodiesel in the world takes place in the presence of homogeneous basic catalysts, the use of which has several drawbacks, including high requirements for the purity of the feedstock and insufficient quality of biodiesel and glycerol, which requires additional purification. The low-value by-product glycerol is also a problem.

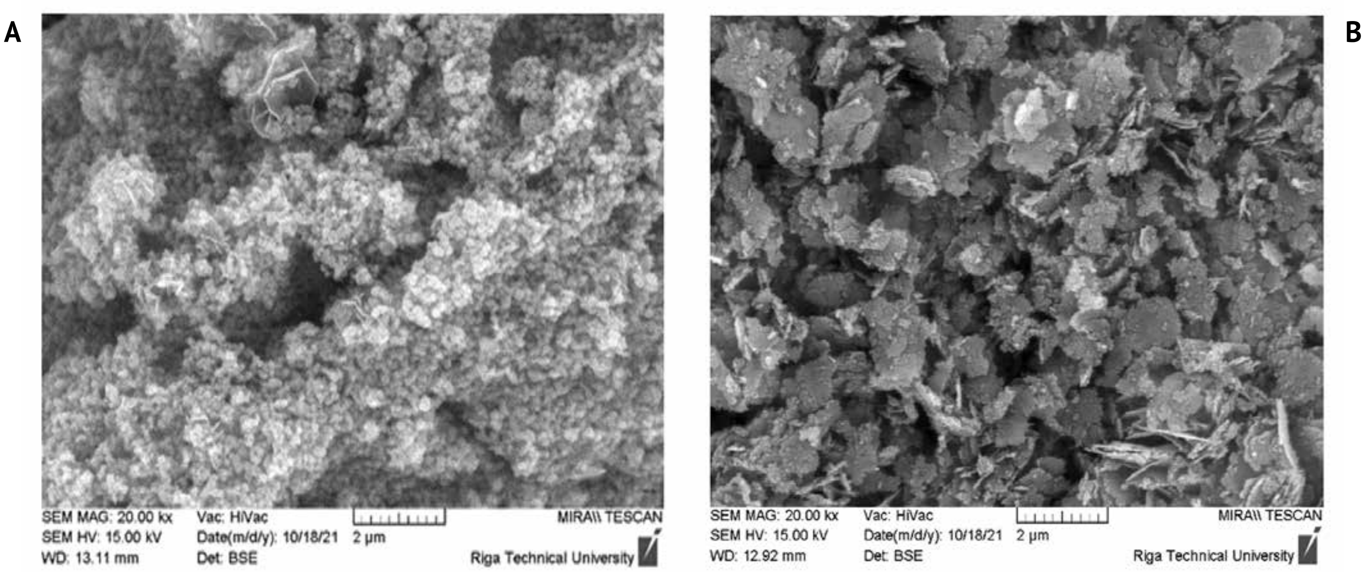


Fig. 3
Scanning electron microscope image of active (A) and inactive (B) MgO catalyst

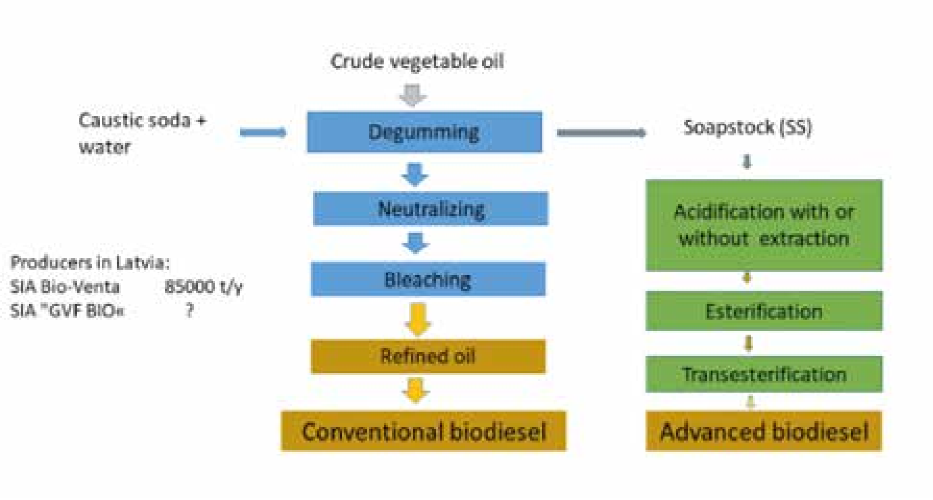


Fig. 4
Soapstock generation and conversion to advanced biodiesel

These shortcomings could be addressed by the use of heterogeneous basic catalysts, but the development of low temperature and atmospheric active heterogeneous catalysts has so far not been successful. In this section, our chosen research direction is magnesium oxide catalysts (Latvian Council of Science project lzp-2020 / 2-0194). MgO catalysts are inexpensive and widely studied for various practical applications, however, their activity varies from insignificant to quite high depending on the raw material and manufacturing technology, therefore published works provide contradictory information. By studying different raw material and catalyst synthesis methods, not only new regularities were obtained (Fig. 3), but also magnesium oxide catalysts, which in one stage were able to provide biodiesel synthesis with standard quality, excluding the need to implement the purification stage. Further research will show whether these catalysts can be developed to the level of industrial catalysts.

The production of biodiesel from vegetable oil production residues has been developed by the LIAA project KC-PI-2020/28. According to RED II renewable fuel production from raw materials useful for food production must be gradually reduced and replaced by biofuels produced from residues or waste that cannot be used for food production. Such a raw material, called “soapstock”, is produced in the process of refining of vegetable oil (Fig. 4). It is a cheap, low-quality raw material, the processing of which up to biodiesel requires the extraction of the necessary useful parts, and then converting this via several chemical processes. Experimentally testing the pathways with minimal and complete soapstock hydrolysis, we come to the conclusion that preservation of fatty acid glycerides allows to obtain the final product with a higher yield, and we have developed 3-stage and 4-stage processes for obtaining biodiesel from soapstock. The development process managed to reduce the duration and energy consumption of each stage, as well as make them more environmentally friendly.

In the industrial realisation of the developed process, we hope for an active connection between SIA Bio-venta and GVF BIO, so that the technology can be further realised not only in Latvia, but also in countries with higher production of vegetable oil and soapstock.

In the medium and rapid pyrolysis processes, bio-oil is obtained from biomass, and is considered to be a promising raw material for the production of liquid fuels. In practice, it is very difficult to use bio-oil because it is corrosive, unstable, and difficult to recycle to hydrocarbon fuels. Catalytic pyrolysis is being extensively studied to bring the bio-oil properties more in line with the intended refining processes. We have also sought to find catalysts that reduce the oxygen content of bio-oil from biomass and make it more suitable for known refining technologies.

The last two directions of research are devoted to the parts of complex technologies, the implementation of which is of great general interest. The production of hydrocarbons from synthesis gas on an industrial scale is realised from fossil raw materials – coal and natural gas. Of the renewable raw materials, the highest results have been achieved from wood processing residues. Although the technology itself, which includes gasification and Fischer–Tropsch synthesis, is universal and applicable to any carbonaceous material, including municipal and food waste, its practical implementation poses problems. The process has two sensitive positions – synthesis gas purification–conditioning and the need for a robust but active and selective catalyst. We worked on the last problem within the framework of the "Energy" project VPP-EMAER-2018 / 3-0004. We have developed new promoted Fe catalysts as robust to the H_2/CO ratio. By varying the conditions, an opportunity was sought to synthesise hydrocarbons at a temperature of 240–300°C and a pressure of 20–30 bar. The synthesised catalysts are sufficiently active and provided the synthesis of hydrocarbons with carbon chain compatibility for the production of gasoline, aviation fuel and diesel fuel (Fig. 5).

The latter line of research belongs to the net zero emission technologies and considers a completely different possibility, assuming that CO_2 emissions are inevitable. Emission occurs in the natural carbon cycle and additionally is caused by human activities. The reserves of the natural cycle for balancing opposite processes are not large and are in fact exhausted. It is necessary to create artificial cycles (anthropogenic cycles) that would reduce the concentration of CO_2 in the atmosphere, similar to photosynthesis. It would be logical to start artificial cycling with carbon capture and storage (CCS) from large emitting plants. Such studies for the capture and storage of CO_2 have been carried out for many years and are no longer considered rational and targeted for various reasons. CO_2 capture and recovery (CCU) is required. The CCU is already an anthropogenic cycle, the practical realisation of which is growing rapidly, with the development of hydrogen synthesis by the water electrolysis process (realisation of hydrogen energy process without the use of hydrogen as fuel).

Unfortunately, the reaction of CO_2 with hydrogen do not proceed like to Fisher–Tropsch reaction and the existing industrial catalysts are not suitable for the process. New catalysts are needed for industrial conversion of CO_2 into useful products. Our group, like many other groups around the world, is involved in the development of catalysts for the conversion of CO_2 to methanol. Methanol is used as a C1 feedstock for the synthesis of industrial organic matter and fuels. The main methanol derivatives are acetic acid, formaldehyde, methyl methacrylate, methyl tert-butyl ether (MTBE), dimethyl ether (DME), and olefins. Important end products such as adhesives, paints, LCD screens, sealants, foams, lubricants, plastics, hardboard, and plywood are produced from methanol, acetic acid, and formaldehyde. Methanol is a highly combustible, biodegradable fuel. The environmental and economic benefits of methanol make it an attractive alternative fuel for vehicles and boats, cooking and heating homes. The possibility of supplying methanol with existing infrastructure for fuel transport and distribution is the basis of the so-called "methanol economy". To carry out studies in this line, equipment with an automatic Microactivity EFFI reactor has been used (Fig. 6). The experimental results showed that our synthesised Cu catalysts are able to provide CO_2

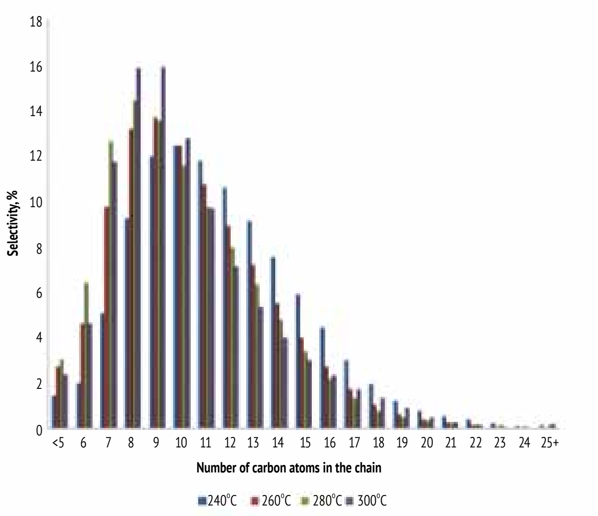


Fig. 5
Composition of hydrocarbon compounds synthesised in the presence of K/Fe catalyst

Fig. 6
Investigation of catalysts for CO2 conversion.

conversion to methanol with good selectivity and yield. Methanol was condensed in the reactor receiver and separated from the reactor as a methanol-water mixture. The aim of further research is to increase the activity and selectivity of catalysts for the CO_2 conversion to methanol and participate in a pilot project on CO_2 conversion with our catalysts.

We hope to develop the most promising research directions with the help of talented students, creating both new knowledge and products with practical application.

ABOUT THE AUTHOR

Professor, *Dr. habil. chem.* **Valdis Kampars**, full member of the Latvian Academy of Sciences, passed away on 23 February 2022. He studied chemistry at Rīga Polytechnical Institute (now Riga Technical University, RTU) and all his working life was associated with RTU: he was the head of the Department of Chemistry and established the Institute of Applied Chemistry; he was the Dean of the Faculty of Materials Science and Applied Chemistry, a lecturer and creator of new study programmes. V. Kampars dedicated the last ten years of his research to green thinking, which was related to biofuel raw materials and their development technologies. The professor has published 105 Scopus indexed scientific articles. Valdis Kampars has received important awards: the Paul Walden Medal awarded by RTU (1994), the RTU Scientist of the Year Award (2009), the Gustavs Vanags Award awarded by the Latvian Academy of Sciences (2011), and the Order of the Three Stars (2019), the World Intellectual Property Organization (WIPO) Inventor Medal (2020).

PEATLANDS AND PEAT – MARSH MANAGEMENT: MYTHS AND SOLUTIONS

ULDIS AMERIKS, IGORS GRAURS

Historically swamps and marshes have been characterised in scholarly works and popular science publications as ecosystems with certain negative features. Thus, swamps are portrayed in our folklore as scary places with a negative aura. In recent years, this image has changed, undoubtedly influenced by the ravages of the pandemic, with marshes becoming a recognisable element on Instagram. Thanks to the presence of marked footpaths through swamps they have become places worthy of respect and awe. In addition to this popular image of swamps, formerly discussion of the commercial exploitation of peat bogs was a taboo, and, in like manner, must take myths into account.

The origin of tales and myths about swamps in Latvia very likely is related to popular observation of the progressive advance that, in fact, flows from the geographical location of the country in a moderate climate zone, one characterised by elements of a maritime climate, i.e. a narrow range of low average temperatures, increased precipitation, and unstable weather conditions. It is also safe to say that the formation of swamps and peatlands in Latvia is due to a combination of natural physical features and climate conditions.

Peatlands are distributed very unevenly throughout Europe, with more found in the northern Europe than in the southern part. Peatlands largely reflect the local range of precipitation and temperature, i.e. few peatlands are found in regions where summer temperatures are high and the climate is dry [1].

In Europe historically there has always been competition between amelioration of wetlands and nature conservancy, the former promoting agriculture and forestry, and development of an urban environment, with many major metropolitan areas in Europe built on swampy land, whose well-being has come about following drainage and reclamation of swamps. Until very recently, formation of swampland was considered to be a nuisance, to be solved by installing drainage systems; however, the newest guidelines of the European Union (EU) redefine the concepts of land reclamation and peatlands.

Thus, for example, the Reclamation Law in force in Latvia [2] defines land amelioration as land improvement, reducing the adverse effects of climatic conditions and ensuring long-term use of natural resources; we find, on the other hand, in the new EU regulatory technical guidelines on carbon farming [3], a completely new definition of what is peatland: i.e. any land that contains peat (e.g., lawns, moors, grasslands) within the histic horizon. The latter is defined as a surface layer of soil that, when not exposed to drainage, consists of poorly aerated organic material saturated with water (without drainage) for 30 days or longer.

At the same time, such definitions, which are politically correct and are dogmatic revisions of previous ones, conform to a "contemporary" adoption of paradigms, sustain new clichés of green thinking, and provide the basis for creating new myths.

This notwithstanding it must be noted that the peat industry was established at the same time as the Republic of Latvia and is one of the traditional sectors of the economy, alongside agriculture and forestry. It has existed and developed independently of external or internal influence. It plays a major role, especially regarding the impact on professional horticulture in the world and related industries, ones where Latvia has become a leading player. Given that over the past thirty years the use of peat practically has been abandoned in energy production, pre-conditions were created for modernisation of peat production, resulting in high added value products, such as peat moss substrates that are recognised and used as substrates by professional and amateur gardeners around the world.

CONDITIONS FOR EXTRACTION OF PEAT

The total area of peat bogs is estimated at approximately 643 thousand ha, i.e. around 9.8% of the size of the country – 208 400 ha in Vidzeme, 117 600 ha in Kurzeme, 95 800 ha in Zemgale, and 221 500 ha in Latgale [4]. Of these, only a part can be exploited to extract peat in commercially viable quantities. Industrial processes require peat to be accessible over a certain extraction of a certain minimum area and volume of peat contained therein. The industrial operations require an area of at least 100 ha with a mean layer thickness of 2.5 m containing approximately 175 kg of dry peat per cubic metre [5]. The total area of swamps in Latvia that may be thus exploited was around 350 thousand ha in Latvia.

Peat may be recovered providing the bog is not sited within a protected area and it has been shown that it contains an industrially attractive peat stock. On the other hand, the plan for peat extraction must comply with the territorial plans of local government together with an environmental impact assessment. An essential condition is a geological survey carried out by engaging specialists who determine the extent of the peat deposit, characteristics, quality, extent, etc. This information makes it possible to draw conclusions and decide on whether extraction of peat is economically justified.

Once a licence has been granted for the extraction from of subterranean layers a plan may be developed for a peat extraction project, preparation can begin of the peat extraction site area selecting the appropriate technology, establishing drainage systems for the extraction site, providing access pathways to storage areas for extracted peat, as well as fire protection infrastructure.

MANAGEMENT OF BOGS – SUSTAINABLE USE OF A NATURAL RESOURCE

Issues related to management of peat bogs after their utilisation have evolved over the past ten years, since in most cases, peat extraction was begun in the past century. We define wetland management to comprise responsible use of the land, the swamps themselves regarding efficient recovery of a natural resource, duly minimising environmental impact during the peat extraction process, and later – through remediation measures monitoring managing the recovery of swampy areas. This includes taking responsibility for the management of wetlands in terms of resource efficiency, as well as to swamp after use with environmental compensatory measures. As a proprietor SIA "Laflora", considers wetland management to be a distinct economic process. The potential for this kind of land use serves to raise natural resources with attendant socio-economic benefits. Efficient exploitation of a natural resource to the benefit of proprietors and society as a whole has to be defined in terms of specific aspects of the bioeconomy, the circular economy, and climate change.

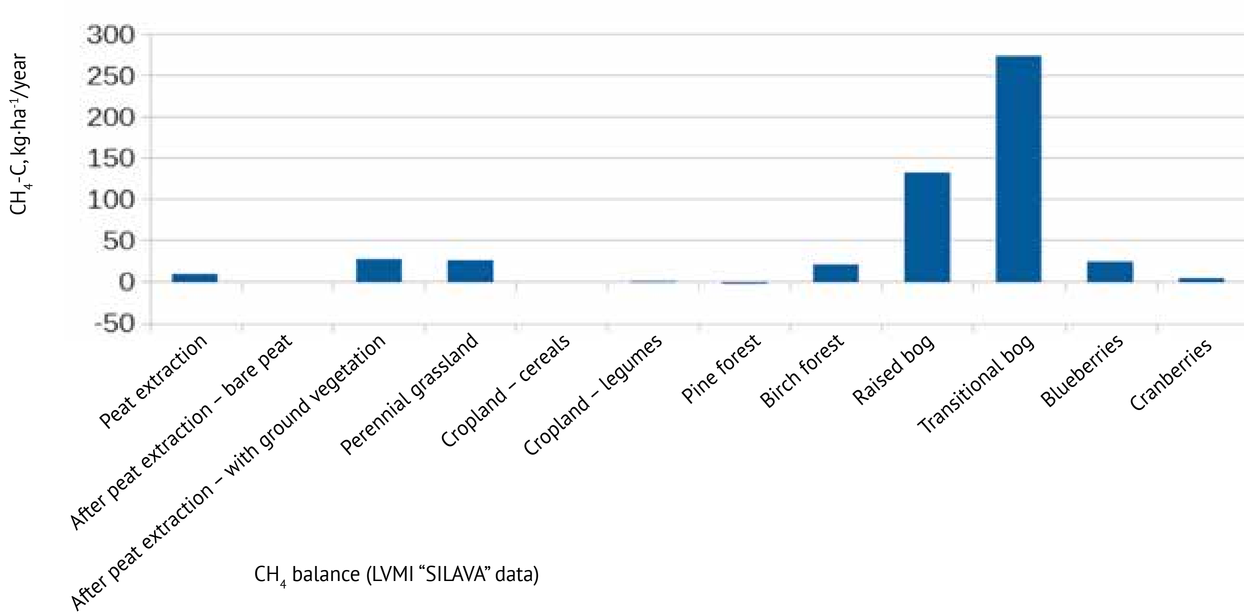
MARSHES IN TERMS OF CARBON STORAGE

Peat has formed and accumulated because of incomplete decomposition of plant biomass under conditions of increased humidity and oxygen starvation. Swamps sequester large amounts of atmospheric carbon dioxide via organic materials. Peat ecosystems contain approximately 30% of the global terrestrial carbon (C) inventory. Hence, they are one of the main components of the world's C cycle. It is estimated that the rate of carbon accumulation in the Northern Hemisphere has averaged 23 ± 2 g C m/year over the last 11 700 years and atmospheric C bound up in peat has reduced global temperatures by approximately 1.5 to 2°C.

Through photosynthesis, ombrotrophic bog plants remove C in the form of absorbing carbon dioxide (CO_2) and thus separate C as a by-product of growing vegetation. C sequestration in bogs results from fluctuations in the production of biomass on the one hand, and the degree of decomposition of organic material on the other hand.

In the study on the build-up of the carbon in Teiči Marsh, a raised bog located within Teiči Nature Reserve. The bog covers some 14 000 ha, and the quantity of stored carbon is estimated to increase by 24 336 t C (89 313.12 t CO_2e) per year; the bog has accumulated over the past 180 years some 4.380 480 t C (4380.48 Kt or 0.00438 Gt) equal to approximately 0.016076 Gt CO_2e or 0.034129 ppm of the increase over this period of time of CO_2 in the atmosphere [6].

Methane is far more consequential in the increasing the greenhouse effect, at a rate that is 20 times greater than that for carbon dioxide, which latter has thus far been seen as a major factor in global warming. The peat bogs of Western Siberia, for example, contain 70 billion tons of methane.



CH_4 balance (LVMI "SILAVA" data)

SHARE OF PEAT CO2 EMISSIONS IN HORTICULTURE*			
	CO2 emissions from peat		
	Co2/t	Co2/t	Share %
Energy supply	1.280.000.000	5.200.000	0,41
Industrial processing	849.000.000	5.200.000	0,61
Transport	931.000.000	5.200.000	0,56
Commercial	575.000.000	5.200.000	0,90
Agriculture	511.000.000	5.200.000	1,02
Waste	138.000.000	5.200.000	3,77
International aviation	148.000.000	5.200.000	3,51
International shipping	147.000.000	5.200.000	3,54
	4.579.000.000	5.200.000	0,11

European Environment Agency data for 2016

Emissions due to peat use versus those from other sources – 2016 CO_2 emissions in Europe

PEAT – A SLOWLY RENEWABLE RESOURCE

Currently peat is described in documents as a fossil resource [7], notwithstanding that it has been shown to be a slowly renewable resource (under favourable conditions at up to 4 mm per year).
It is noteworthy that studies have shown an increase in the quantity of peat, both in unscathed areas of bogs as in those areas where a small system of drainage ditches have been dug excavation of ditch systems has occurred.
Digging by hand of the first drainage ditches in Teiči swamp (1920–1930), did not visibly impact the hydrological regime. Under the circumstances, impact would be measured at 179 ± 14 g C m/year. From 1960 to 1999, installation of a drainage system involved the use of motor automated equipment that affected the hydrology of the marsh, resulting in a decrease in the rate of carbon accumulation, i.e. a decrease in the rate of peat accumulation, which led to reduction to 159 ± 48 g C m/year [8]. However, it is clear that there has been an increase in peat production to a rate of 4 mm/year in both the unscathed part and that affected by peat recovery.

REDUCED RATE OF HARVESTING – A HUGE CONTRIBUTION

Peat is an integral part of the circular economy, one from which no waste is generated in horticulture, as it is to be used repeatedly in the production processes and is returned to the soil at the end of the growing cycle.
Approximately 25.1 million m^3 of peat is produced annually in Europe for use in horticulture and the food industry, equivalent to 5.2 million tonnes of CO_2 emissions. Peat is shipped from Latvia mainly to other countries in Europe, the Middle and Far East and China, and it is used by around 750 million people annually, corresponding to CO_2 emissions of 6.9 kg CO_2 per capita per year. By comparison, the equivalent in terms of fuel consumption is 2–3 litres per year.
In addition, 6000 tree seedlings may be grown using just one cubic metre of peat, which are capable of replanting 3 ha of forest, which latter would fix some 1110 tonnes of CO_2 in a 50-year perspective. A significant reduction in GHG emissions corresponding to 4.3 million tonnes of CO_2 equivalent per year would occur were the entire area used for agriculture (158 000 ha) to be afforested.

PEATLANDS AND THEIR PEAT CONTENT ARE A NATURAL RESOURCE THAT IS USED TO MEET HUMAN NEEDS

Unfortunately, many myths persist today about what happens to a swamp, when peat extraction ends, or that they are threatened with extinction. Statistical data may be erroneous, but figures do not lie already, a significant number of marshes are inscribed in the list of identified nature areas afforded strict protection, ensuring that biodiversity is safeguarded. For example, the number of marshes in the category of protected habitats, "untouched raised swamps", or active marshes in which peat formation is taking place, occupy in total ~266 200 ha or 41.7% of the wetland of Latvia. Approximately 27%, or ~83 000 ha of these are offered additional protection being designated as Specially Protected Nature Territories. By comparison, extraction of peat in Latvia takes place over ~27 000 ha, or approximately 3% of the total area of peat bogs.

ON THE WAY TO CLIMATE NEUTRALITY

The European Commission has set a target for 30 years for the economy in Europe to become climate neutrality within 30 years.
For the peat producer, this means assessing the balance between generation of emissions and their mitigation as part of the peat harvesting process. Hence the added value of products includes a measure of the producer's responsibility for meeting global challenges such as climate change, preservation of and increasing natural resources, social well-being, and peace and quiet. Specifically, SIA "Laflora" produces peat that is a biomass product in the absence of which healthy food from plants cannot be imagined. The marketable peat product derives from raw material that has contributed to removal of climate-warming gases. Plants laid down as peat in bogs remove these gases from the atmosphere. It is possible to achieve the above

By its very nature the industrial park at Kaigu Peat bog will be in line with the growth strategy of the European Union, the European Green Course, whereby the generation of renewable energy is aligned with its smart and practical consumption, in growing food in greenhouses, by restoration of areas affected by mining in peat bogs, thereby providing a path for business, regions, and the country to achieve green transformation

A view of the infrastructure of a green industrial zone proposed at Kaigu Peat bog – energy-intensive industrial plants set alongside remediated areas, whose output, thanks to a renewable energy source, will be climate neutral and form a part of a circular economy

objectives already in the peat harvesting process itself. This can be done effectively by exploiting areas where both resource extraction and product use occur, which includes replanting, augmented by alternative energy generation on site by setting up a wind park in the area where biomass is harvested. Areas affected by resource harvesting shall be remediated though planting soft fruit producing bushes and other vegetation appropriate for the local environment, and stands of trees, thus ensuring removal of emissions from the atmosphere. The presence of bees and bumble bees, which are compatible with this industrial ecosystem, will attest to the high degree of purity and also will enhance the productivity of agricultural crops. Wind energy shall partially meet production plant energy needs and will partially compensate for emissions released during the mining process. It is planned to develop a green industrial zone, one based on wind energy, as a renewable energy oasis, as an area for business making use of infrastructure with regional significance. This zone would be developed by attracting energy-efficient companies allowing them to develop new products, ones in line with the new climate reality, creating new, sustainable jobs, at the same time as producing alternative energy carriers, such as renewable hydrogen from wind energy. This will significantly improve the share of renewable energy and alternative energy generation in the energy mix Latvia, contributing to reaching by 2030 target laid out in the National Energy and Climate Plan (50% share of RES in the final consumption of electricity).
The goals as listed and the preamble may set our agenda politically, but what is obvious cannot be denied: in order to achieve climate neutrality, or in other words, if the aim is to achieve it, then the role of swamps and peat in its realisation cannot be doubted.
Peat – the natural wealth of Latvia – must be used wisely in terms of its long-term mining, generating products with high added value, ensuring the well-being of the people, and the future growth of the country. Use of peat in Latvia can be sustainable and is justified by a rise in natural capital in the marsh sector; dispelling myths, it is climate-neutral, when conceptually viewed broadly, both in the context of the country and the entire world.

A BASIS FOR SUSTAINABLE RESOURCE USE: SYNERGY OF SCIENCE, PRODUCTION, AND ENVIRONMENTAL CONSIDERATIONS

The mining and economic exploitation of peat clearly has both benefits and risks. Depending on which side of the "front" one is on, we usually tend to rely on arguments that are in favour of our position, and the discussion is concluded not in favour of those whose arguments are right, but by the side with a stronger political lobby, with more financial resources available. Competent and constructive cooperation between entrepreneurs, scientists, and politicians is needed maximally to avoid such outcomes including decision-making. Only cooperation at all levels can guarantee the situation where the right decision will be taken, based on professional expertise and in the long-term interests of our country.
Among its various activities, the LAS Science Foundation set itself the task of identifying the most pressing problems, the successful resolution of which would have a positive impact on the development of our country. In addition, it would become a collaborative platform, one bringing together specialists from different sectors and disciplines, thus enabling making professional and well-informed decisions touching important Latvian economic spheres. It would also attract the relevant specialists who could deal with issues arising.
The Board of the LAS Science Foundation (SF) organised a discussion on 26 November 2021, to evaluate the Kaigu Peat bog Wind Park Project, as an excellent example in the search for and delivery of optimal and sustainable solutions. Many Latvian experts and energy leaders participated. In general, the potential of the project and its possibility is becoming a kind of trial land reclamation project, which may not only be an example of good practice, but also serve as a kind of practical laboratory where novel solutions may be found under real business conditions, and which would answer many obscure questions.
As one of its activities, the SF has set itself the task of identifying the most pressing problems, the successful resolution of which could have a positive impact on the development of our country, as well

as becoming a collaborative platform that can bring together specialists from different sectors and spheres and enable them to take the most professional and informed decisions in important economic spheres for Latvia and attract them to deal with the needs.

A. Vanags, representing the Latvian Wind Energy Association, remarked during this discussion: "Excessive reliance on renewable energy resources can lead to a reduction in their profitability due to overcapacity under certain operating regimes producing energy that cannot be sold due to certain constraints and low demand. At the same time, any "surplus" of energy can be eliminated by using existing opportunities or creating new ones for energy storage within the Baltic energy system. The development of high-capacity RES in this system would lead to a significant reduction in atmospheric emissions; however, it is necessary to seek additional solutions replacing fossil energy producing plants in order to achieve zero emission."

It is our belief that, during implementation of the Kaigu Peat bog Wind Park Project, we might receive answers to many vague questions, and find realistic solutions for the development and future stabilisation of the Baltic energy system. Given that it is difficult to predict future energy prices, this is becoming more and more acute, and any solution that strengthens Latvian energy independence is particularly important.

Translated by **Eduards Bruno Deksnis**

REFERENCES

1. Tanneberger F., Tegetmeyer C., Busse, S., et al. The peatland map of Europe. *Mires and Peat*, 2017, Vol. 19, 22. http://mires-and-peat.net/pages/volumes/map19/map1922.php

2. Meliorācijas likums in its current form is accessible at: https://likumi.lv/ta/id/203996-melioracijas-likums; translation into English is not fully inclusive of all amendments.

3. European Commission, Directorate-General for Climate Action, Radley G., Keenleyside C., Frelih-Larsen A., et al. Operationalising an EU carbon farming initiative: executive summary. Publications Office, 2021. https://op.europa.eu/en/publication-detail/-/publication/10acfd66-a740-11eb-9585-0 1aa75ed71a1/language-en

4. *Latviešu konversācijas vārdnī*ca, 1933–1935, 18672.

5. *Latvian Economic Review* 1936, 5.

6. Stivrinsa N., Liiv M., Ozola I., Reitalu T. Carbon accumulation rate in a raised bog in Latvia, NE Europe, in relation to climate warming. *Estonian Journal of Earth Sciences*, 2018, Vol. 67, No. 4, pp. 247–258. https://doi.org/10.3176/earth.2018.20 247 . https://kirj.ee/public/Estonian_ Journal_of_Earth_Sciences/ 2018/issue_4/earth-2018-4-247-258.pdf

7. Net Zero by 2050 A Roadmap for the Global Energy Sector// https://iea.blob.core.windows.net/ assets/imports/ events/35/IPCC

8. Stivrinsa N., Liiv M., Ozola I., Reitalu T. Carbon accumulation rate in a raised bog in Latvia, NE Europe, in relation to climate warming. *Estonian Journal of Earth Sciences,* 2018, Vol. 67, No. 4, pp. 247–258. https://doi.org/10.3176/earth.2018.20 247. https://kirj.ee/public/Estonian_ Journal_of_Earth_Sciences/ 2018/issue_4/earth-2018-4-247-258.pdf?fbclid=IwAR0f1G41NID7g0xiTaz02pzeLjk59DKZrysOqiC7MrrCrnBSOaNobA6JmV8

Uldis Ameriks, Chairman of the Board of SIA "Laflora", insists that the company's products are part of Latvia's wealth, thanks to which our country is recognised worldwide: "We not only process and package this natural resource, but connect the material and spiritual components into the final product – it is a unique substance in which there is continuous birth and growth – seed once planted grows as a flower, or healthy vegetables, or even as an entire forest – this product exists as part of an endless cycle."

ABOUT THE AUTHORS

Uldis Ameriks is a hydraulic engineer, Chairman of the Board of SIA "Laflora".
Dr. phil., Mg. oec. **Igors Graurs** has been active in science and higher education for the past ten years. He is currently an assistant professor and researcher at RISEBA University and the Chairman of the Board of the LAS Science Foundation. He has also been a visiting researcher at Riga Technical University for the last three years. In previous years, he has held senior positions in the Riga City Council, as well as in private business. He has held leading positions in four commercial banks, managed an investment company, and was the communications director of the bus manufacturing company AS "Amoplant" for five years.