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SMART METERS IN SERBIA – WHERE WE STAND TODAY AND WHAT COMES NEXT

AKIRA IMAMURA

Ambassador of Japan to Serbia

The Future Is Green – Japan's Climate Goals

Pure energy

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Dear readers,

We have officially said goodbye to the cold days and finally stepped into the season of vacations, sunny beaches, and refreshing drinks. As temperatures continue to rise, the topics we bring you in the new issue of the Energy Portal Magazine are equally hot – current, inspiring, and informative.

The focus of this edition is an interview with the Ambassador of Japan to Serbia, Akira Imamura, who revealed how Japan, as a global leader in decarbonization, positions itself in the modern energy landscape – as well as how this Land of the Rising Sun is helping Serbia on its path to achieving climate goals.

There is also an exclusive conversation with Rade Mrdak, advisor to the Minister of Mining and Energy for renewable energy sources, who sheds light on the importance of past RES auctions, as well as government projects bringing new, green energy into our system.

You will also learn how Sarajevo is defining its climate ambitions, what plans the Serbian electricity exchange SEEPEX has, and what specific changes are brought by the recently adopted rulebook on pellets.

Inspired by the sun, we explored the potential of agrisolar facilities, which can transform the region. We presented the current solar capacity in Serbia and highlighted the plans of the Electric Power Industry of Serbia regarding the further development of solar power plants under its ownership.

Whether you've already packed your bags or plan to spend your summer break in the comfort of your home, we are sure that this issue of the Magazine will not only inform you but also inspire you to become an active participant in the energy transition that is shaping our future.

Nevena Đukić

Nevena Đukić,
editor-in-chief

Photograph: courtesy of Nevena Đukić

IN THIS ISSUE...

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THE FUTURE IS GREEN – JAPAN'S CLIMATE GOALS

In light of increasingly urgent global challenges – from climate change and the preservation of natural resources to the ongoing energy transition – Japan stands out as a country that successfully balances technological progress, economic stability, and sustainable development.

With this in mind, we spoke with His Excellency, the Ambassador of Japan to Serbia, Mr Akira Imamura, about the strategic directions of Japan's climate and energy policies, the concrete measures being taken to achieve carbon neutrality, and the potential for cooperation between Japan and Serbia in the fields of circular economy, environmental protection, renewable energy, and the development of the electric vehicle market.

In this interview, we also explore how Japanese initiatives contribute to the improvement of local communities throughout Serbia and the strengthening of the friendship between our two nations.

Q: Japan has outlined ambitious climate objectives, aiming to achieve carbon neutrality by 2050 and to reduce greenhouse gas emissions by 46 percent by 2030 compared to 2013 levels. Could you please elaborate on the specific measures being taken to meet these targets?

A: While aiming at achieving net-zero emissions by 2050, Japan intends to achieve a stable energy supply and economic growth simultaneously. This requires significant acceleration towards structural changes in the energy and industrial sectors, as well as undertaking bold investments in innovation. We are shifting to decarbonized power sources such as renewable energy and nuclear power, which will help increase energy self-sufficiency, at the same time promoting thorough energy savings. To finance the Green Transformation (GX), the public and private sectors

Photograph: Pixabay/Thomas Ulrich

are expected to invest a total of more than 150 trillion yen (approximately 920 billion euros) over the next 10 years. As a first step, the government is issuing Climate Transition Bonds to raise 20 trillion yen (approximately 120 billion euros) for investments in areas such as promoting a hydrogen society, decarbonizing manufacturing industries, developing next-generation storage batteries, and establishing domestic supply networks for renewable energy. Going forward, we will introduce a "growth-oriented carbon pricing framework" to increase the added value of GX-related products and businesses.

Q: What are the key policies and initiatives Japan has implemented to preserve its natural resources—such as forests, water bodies, and biodiversity? In your view, how might these practices be adapted and applied within the Serbian context, particularly for the protection of vulnerable ecosystems?

A: The world is currently facing three crises: climate change, biodiversity loss, and pollution. Modern civilization is unsustainable, and transformation is inevitable. The goal we should aim for is a "circular symbiotic society" built through efforts to simultaneously achieve a nature-positive (halting and reversing nature loss), net-zero, and circular economy. An example of such an initiative, which may apply to Serbia, is ecosystem-based disaster risk reduction (eco-DRR). This concept involves utilizing ecosystems as buffers to protect people's lives and reduce disaster risks. In Japan, more than half of the forest is protected to prevent disasters such as landslides and floods. They also contribute to mitigating climate change, biodiversity conservation, and recreational services. Based on this experience, the Japan International Cooperation Agency (JICA) is supporting the promotion of eco-DRR in many countries, including those in the Western Balkans.

Q: Japan is often cited as a model for successfully balancing economic growth, energy security, and decarbonization goals. What elements of Japan's approach do you believe could be meaningfully transferred to Serbia's path toward sustainable development?

A: One of the things I consider important for Serbia's sustainable development is the transition to a circular economy. It contributes to solving social issues related to climate change, biodiversity loss, and environmental pollution by minimizing resource consumption and reducing waste generation. It should be designed in a way that strengthens industrial competitiveness, economic security, and the well-being of people. One example is plastic recycling. Japan has been implementing measures since 2022

AMBASSADOR AKIRA IMAMURA, born on April 6, 1960, is a seasoned Japanese diplomat with decades of experience in international relations. He graduated from the University of Tokyo in 1984 with a degree in International Relations and completed a certificate program at the Harriman Institute in 1987. He joined Japan's Ministry of Foreign Affairs in 1984 and has since held key positions both in Japan and abroad. His roles have included Director of divisions focused on Russia and Europe, as well as senior posts in embassies in Russia, the UK, Australia, and Canada. He also served as Deputy Secretary-General at the Board of Audit of Japan. From 2020 to 2023, he was Ambassador to Georgia. Since July 2023, he has served as Ambassador to the Republic of Serbia, and since August 2023, he has concurrently served as non-resident Ambassador to Montenegro.

Photographs: (middle left) Pixabay/Kohji Asakawa; (middle below) Pixabay/Sasin Tipchai; (Imamura) courtesy of Akira Imamura

under the "Law on the Promotion of Resource Circulation of Plastics" to promote efforts toward plastic resource circulation across all stages of the product lifecycle—from design to waste disposal—in accordance with the 3R (reduce, reuse, recycle) + Renewable principles, involving all relevant stakeholders. Concrete results have been achieved in many areas, including the food industry, which has successfully reduced the amount of plastic used in packaging.

Q: The Embassy of Japan in Serbia has been actively engaged in impactful donor initiatives, including support for public utility companies such as "Drugi oktobar" in Vršac and assistance to the Vojvodina Food Bank. How would you assess the significance of these humanitarian contributions in strengthening bilateral relations? Are there any new projects planned for the near future?

A: They are small-scale projects called GGP (Grant Assistance for Grassroots Human Security Projects). Human security is a concept that encourages sustainable, individual self-reliance and social development through protection and empowerment. It focuses on every human being and aims to protect people from the wide-ranging and serious threats to their lives, livelihoods, and dignity, enabling them to reach their full potential. Based on this concept, GGP has been of great significance, especially in rural areas of Serbia, as it is directly linked to improving people's lives in areas such as the environment, disaster prevention, education, health, and social welfare. The two projects you mentioned are related to environmental protection and the circular economy, which we discussed earlier. GGP has also contributed to the capacity building of local governments, schools, hospitals, NGOs, and other organizations by directly providing them with necessary equipment and facilities. As a result, GGP projects have become a symbol of friendship between the local people in Serbia and Japan. The Embassy receives applications for GGP from municipalities throughout Serbia every year, and we implement approximately 10 projects annually. This month, I plan to attend GGP handover ceremonies in Plandište and Zrenjanin and look forward to meeting with the local people there.

Q: How do you evaluate the current level of Japanese investment in Serbia's energy sector? Which specific areas offer the most promise for further cooperation, and what would you identify as the key steps toward deepening bilateral engagement in the field of energy policy?

A: Cooperation between Japan and Serbia in the energy sector is focused on areas related to climate change and environmental pollution. Perhaps the most advanced project is the Energy from Waste project in Vinča. This is a Japan-French joint project to clean contaminated water from household waste in Belgrade that has been dumped in the landfill for many years, and to supply citizens with electricity and heat by using methane from the waste and heat generated from its incineration. Another example would be the installation of a flue gas desulfurization facility at the Nikola Tesla Thermal Power Plant in Obrenovac. This JICA-financed project has significantly improved air pollution, helped Serbia meet EU environmental standards, and is crucial in facilitating Serbia's green transition from coal to renewable energy. Last but not least, the Serbian government has requested that JICA finance the construction of the Bistrica Pumped Storage Hydropower Plant, which is currently undergoing feasibility studies. This type of hydropower plant plays a crucial role in mitigating the fluctuations of renewable energy sources, ensuring a stable power supply. They use surplus

Photograph: Pixabay/Jacqueline Macou

electricity to pump water to higher elevations and then drop the water to generate electricity when needed. Through this mechanism, they act like "natural storage batteries." If realized, this project will significantly facilitate the development of renewable energy sources in Serbia.

Q: In 2024, hybrid electric vehicles accounted for over 60 percent of new passenger car registrations in Japan, while interest in fully electric vehicles has seen a slight decline. In your opinion, what factors contribute to the popularity of hybrid cars in Japan, and is there a strategic roadmap in place to further promote the adoption of EV technology?

A: To achieve carbon neutrality in the automotive sector, Japan has adopted a "multi-pathway strategy" that does not limit itself to specific technology but rather offers a variety of options, including EVs, hybrids (HVs), hydrogen/FCVs (fuel cell vehicles), and others. In 2024, HVs accounted for the largest share of new vehicle sales in Japan, accounting for 55 percent, while EVs accounted for only 1.4 percent. The popularity of HVs can be attributed to their high fuel efficiency and environmental performance, while they do not have the same restrictions on recharging infrastructure as EVs. At the same time, Japan has set a goal for all sales of new passenger vehicles to be electrified vehicles, including EVs, FCVs, and HVs by 2035. The government is therefore offering subsidies to buyers of EVs and other clean energy vehicles, and by 2030, it aims to install 300,000 fast chargers, including 30,000 for public use. In addition, the government will invest approximately 210 billion euros over the next 10 years to promote the adoption of electrified vehicles, including EVs, and the development of new technologies.

Photograph: Pixabay/Thomas Ulrich

Q: How might Japanese companies contribute to the development of Serbia's electric vehicle market—whether through investments, local manufacturing, or technology transfer?

A: The most promising area is likely to be investment by Japanese companies in the manufacturing of parts for EVs. As you know, Nidec is already manufacturing EV motors in Novi Sad. In April of this year, JFE Shoji began producing motor cores in Inđija, which will be supplied to Nidec. This means that an EV supply chain between Japanese companies is beginning to take shape in Serbia. In this way, I believe Japanese companies can contribute to establishing the EV supply chain in Serbia, which should align with the agreement reached last July between Serbia and the EU to support Serbia in building a high-standard EV value chain. Many Japanese companies that have decided to invest in Serbia highly value Serbia's talented workforce, and it is reasonable to expect that Japan's EV component manufacturing technology will be duly transferred.

Q: What role does the Embassy of Japan play in facilitating the transfer of Japanese expertise, technology, and best practices in the areas of renewable energy and energy efficiency, especially in the context of Serbia's ongoing energy transition?

A: One way of transferring Japanese expertise to Serbia is to participate in one of the technical assistance programs provided by JICA. JICA offers various training courses held in Japan for developing countries in the areas of renewable energy and energy savings. They cover Japan's government policy as well as the presentation of Japanese technology in these areas. Another way to transfer expertise in these areas is to introduce Japan's energy-efficient equipment or renewable power generation systems to your company. For example, it could be a biomass cogeneration system, a high-efficiency boiler, or an electric heating furnace. If your company would like to contact a Japanese company for this purpose, the Embassy can put you in touch with JETRO (Japan External Trade Organization), which can provide further assistance.

Interview by Milena Maglovski

SERBIA ON A MISSION TO DECARBONIZE ENERGY SECTOR

Despite facing numerous challenges, Serbia remains committed to decarbonizing its energy sector, as demonstrated by amendments to the Energy Law and significant investments in renewable energy sources. We spoke with Rade Mrdak, Advisor to the Minister of Mining and Energy for Renewable Energy Sources, about the significant steps Serbia has taken in its energy transition and its plans for the future.

Photograph: Unsplash/Waldemar

We are currently working on major projects, including 1,000 MW of self-balancing solar power plants with a 200 MW battery storage system, as well as the Morava and Kolubara solar plants, which have a combined capacity of 120 MW

Rade Mrdak
Advisor to the Minister of Mining and Energy for Renewable Energy Sources

Q: Amendments to the Energy Law were adopted recently, but the public is still not fully informed about the details. What are the most important new provisions, and how will they affect citizens and the economy?

A: The amendments to the Energy Law represent a significant step towards modernizing our energy sector and aligning it with European regulations. Firstly, the decades-long ban on building nuclear power plants has been lifted, opening the possibility for nuclear energy to be reconsidered as a legitimate and stable source, particularly important in the decarbonization process. Furthermore, key European regulations related to electricity market integration have been transposed into national law. This sets the conditions for linking our market with neighboring and broader European markets, which means greater competition, more secure supply, and better conditions for end-users.

It is also important to highlight the introduction of European mechanisms for crisis cooperation, such as rules on risk preparedness and emergency coordination. In times of energy instability, such regional coordination means we will not be isolated but part of a wider energy security system. The law also recognizes new roles for consumers. The concept of the active customer and citizen energy communities has been introduced, encouraging more active public participation in the energy transition. Additionally, for the first time, the law defines the concept of energy poverty and introduces protection mechanisms for vulnerable groups, giving it an important social dimension.

Finally, the law introduces a legislative framework for the use of hydrogen and recognizes the potential of biomethane as a key factor in decarbonizing the gas sector. All these changes contribute to a just and sustainable energy transition while ensuring a secure and reliable supply for citizens and businesses.

Q: At the Kopaonik Business Forum, you announced that Serbia plans to reach 3.5 GW of capacity from renewable energy sources by 2030. What are the main steps and strategies outlined to achieve this goal?

A: Serbia is already well on its way to achieving this goal, with the key strategies being:

Private investment through auctions – through the auction system, we plan to activate at least 1,300 MW of new capacity. The first two auctions have already secured 1,200 MW, which is significantly more than the planned 850 MW for those two rounds. This approach ensures competitiveness and encourages new private investments in the renewable energy sector.

EPS as a key player – Elektroprivreda Srbije (EPS) has a central role in greening the energy sector. We are currently working on major projects, including 1,000 MW of self-balancing solar power plants with a 200 MW battery storage system, as well as the Morava and Kolubara solar plants, which have a combined capacity of 120 MW. The first wind and solar capacities are also nearing completion, such as the Kostolac wind farm (66 MW) and the Petka solar plant (10 MW).

Citizen and business capacity – we also count on installations by individuals and businesses. Currently, we have approximately 95 MW of private production, and we estimate that this could increase to at least 300 MW by 2030. By combining these factors, along with potential commercial projects and a third auction round, we believe we will achieve the goal of 3.5 GW from renewable sources by 2030.

Q: The second round of renewable energy auctions has been successfully completed. What is your assessment of the results, and when can we expect the third round of auctions? Also, are higher quotas planned compared to previous ones?

Photograph: Nenad Kostić

A: The second round of renewable energy auctions was very successful. A total of 645 MW was awarded across 10 new power plants, significantly exceeding the previous quotas. It is imperative to note that this round saw the successful implementation of a mixed auction model for the first time, where not only the price but also the investor's readiness to offer capacity to the guaranteed supplier for public supply needs was taken into account. This approach ensured that all electricity supported through these auctions remains on the domestic market, further strengthening Serbia's energy security.

The bids were highly competitive, with prices ranging from 53.59 to 68.25 euros/MWh for wind farms and from 50.9 to 58 euros/MWh for solar power plants, indicating strong interest and market seriousness. We also managed to attract investors not only from Serbia but also from countries such as China, Spain, and France, which further confirms that Serbia has laid the foundations for a long-term and sustainable energy transition.

The third auction round has not yet been officially announced, but we can expect it to proceed in line with our energy transition targets. As for quotas, we are guided solely by the three-year incentive plan, which will determine future auction quotas.

Q: With increasing renewable capacity, there is a growing risk of the cannibalization phenomenon, where surpluses of green energy lead to falling prices. How does Serbia plan to respond to this threat and protect market stability and investment?

A: Serbia is not yet seriously affected by market cannibalization, but early signs of this phenomenon are already emerging, particularly during weekends and days with a high number of sunshine hours when system demand is low. At such times, there is a surplus of electricity from solar power plants and a short-term drop in prices, which could impact the sustainability of investments in renewables.

The most effective way to mitigate the effect of cannibalization at this stage is by increasing the flexibility of the power system, primarily through the development of storage capacities. Serbia has already recognized this need and, through recent amendments to the Law on the Use of Renewable Energy Sources (ZKOIE), has introduced an obligation for investors who do not wish to wait for grid connection to provide storage capacities equivalent to 10 percent of their plant's installed capacity. This encourages the development of infrastructure that supports system balancing.

Furthermore, the construction of large pumped-storage hydroelectric plants is planned, primarily the Bistrica RHPP, with a capacity of around 650 MW, which will be a key facility for balancing production from large new RES capacities and ensuring energy stability.

Alongside this, we are developing a project for a large solar park with a capacity of 1 GW and 200 MW of battery storage. These investments will enable Serbia to use surplus solar energy during critical hours after sunset, when demand spikes, directly alleviating the effects of cannibalization.

Of course, storage is not the only solution. Flexible consumption, meaning increased consumer involvement in system balancing, can also help mitigate this effect. Work is already underway on this, and further efforts will continue through the development of active consumers and aggregators, who will play a key role in adapting consumption to market conditions.

Q: At recent press conferences, you noted that the Energy Development Strategy for the first time explicitly recognizes the importance of hydrogen. The Energy Law amendments also foresee the adoption of a special program for its development and use. What is the outlook for hydrogen in Serbia, and what are the Ministry's next steps?

A: The Energy Development Strategy to 2040, with projections to 2050, for the first time explicitly recognizes hydrogen as an important part of Serbia's future energy system. The document outlines the key development directions, and the next step is to draft a dedicated program for the development and use of hydrogen, which will

Photograph: Unsplash/Raphael Cruz

Currently, the hydrogen market in Serbia remains small and is in its early stages of development. It is mainly produced by companies like NIS and Messer for their own use, primarily from fossil sources. Technologies for producing, storing, and distributing hydrogen, mostly green hydrogen, remain very expensive, limiting their wider application.

That is why the current focus is on creating regulations that will enable pilot projects and commercial development when conditions are right, as well as encouraging the domestic scientific community and innovation sector to engage in developing

elaborate on the strategic goals, propose concrete measures, and set out an implementation timeline.

The Ministry of Mining and Energy has already taken significant steps in this direction. Technical assistance has been activated through the EU's IPA program, and the process is underway to obtain European Commission approval for comprehensive regulatory support. This support will enable the preparation of all necessary regulations, standards, and planning documents required to integrate hydrogen into Serbia's energy and industrial systems.

technologies that could secure Serbia a place in this value chain.

In the long term, Serbia sees hydrogen as an important tool for decarbonizing industry and transport, as well as for balancing a system with a high share of renewables. However, this is a process that requires a clear vision, gradual development, and international cooperation- and that is precisely the path we are taking.

Q: Besides solar and wind, which are currently the dominant topics, what are the Ministry's plans regarding other renewable sources such as geothermal energy or biomass? How does Serbia plan to diversify its energy mix in the coming period?

A: Biomass for heating, especially wood biomass, remains the most prevalent renewable energy source in Serbia and accounts for more than half of total RES consumption in the country. It is mainly used in households for individual heating, but it is increasingly recognized in district heating systems.

In this context, the Ministry, together with international partners, particularly with support from KfW Bank, has already implemented projects to convert heating plants from fossil fuels to biomass in several municipalities, such as Priboj, Mali Zvornik, Novi Pazar, Majdanpek, and others. These projects have significantly reduced harmful gas emissions and improved energy efficiency in local communities. Additionally, the Ministry has adopted a Rulebook on technical and other requirements for solid fuels from wood biomass placed on the Serbian market, which is an important step in consumer protection. Standardizing the quality of pellets, briquettes, and firewood enables households to know what they are purchasing, get more energy per unit of volume, and achieve significant savings during the heating season.

Regarding biogas and biomethane, the Ministry is working on establishing a regulatory framework for developing the renewable gas market. The focus is on introducing certification, defining sustainability, and creating conditions for injecting biomethane into the existing gas grid. These sources will be significant in rural and agricultural regions.

The goal is for Serbia to develop a diverse and more resilient energy mix by the end of the decade, incorporating a wider range of RES technologies, with biomass, as a locally available and cost-effective resource, playing an essential role.

Interview by Milena Maglovski

Photograph: Unsplash/Anton Dmitriev

EPS STRONGER AND GREENER – SOLAR MEGAWATTS FROM KOSTOLAC

The Kostolac region has long been renowned for its mines and thermal power plants, and it was here that coal production in Serbia first commenced in 1870. It has been a birthplace of ideas and the realization of projects that have strengthened Serbia's power sector. Even now, Kostolac is at the forefront of new projects that will contribute to increasing the share of renewable energy sources, giving this symbolically mining- and thermal-based area a key role in decarbonizing and greening electricity production.

In addition to the well-known thermal power plants with a capacity of almost 1,300 megawatts, this year the energy strength of the Electric Power Industry of Serbia (EPS) will increase by another 76 megawatts of green energy. The solar power plant Petka has been completed — the first EPS solar plant in Kostolac. Its significance is further enhanced by the fact that it was built on the external landfill of the Ćirikovac open-pit mine. In this way, an old mining dump site is being repurposed to generate new energy.

"The solar power plant and wind park projects in Kostolac are just the beginning of our decarbonization process. With investments that increase the share of renewables, EPS demonstrates its commitment to achieving decarbonization and carbon neutrality," said Dušan Živković, General Director of EPS.

The Petka solar power plant spans approximately 15 hectares, boasting an installed capacity of 9.75 megawatts and a projected annual production of 13.7 gigawatt-hours. The investment is valued at around 1.4 billion dinars and is financed with EPS's own funds.

This first photovoltaic plant in Kostolac generates electricity by converting unaccumulated solar radiation into direct current through

Photographs: Elektroprivreda Srbije

semiconductor-based (PV) solar modules. A total of 18,720 photovoltaic modules were installed at an angle of 25 degrees, each with a power rating of 580 W and an efficiency of 21 percent. The solar plant is equipped with 98 inverters — 97 rated at 100 kW and one at 50 kW. Additionally, the Petka solar plant features 10 transformer stations and one switchgear facility, from which the electricity is transferred to the Požarevac substation. As this is a pilot project and a relatively small plant (about ten megawatts), the panels are mounted on fixed supports.

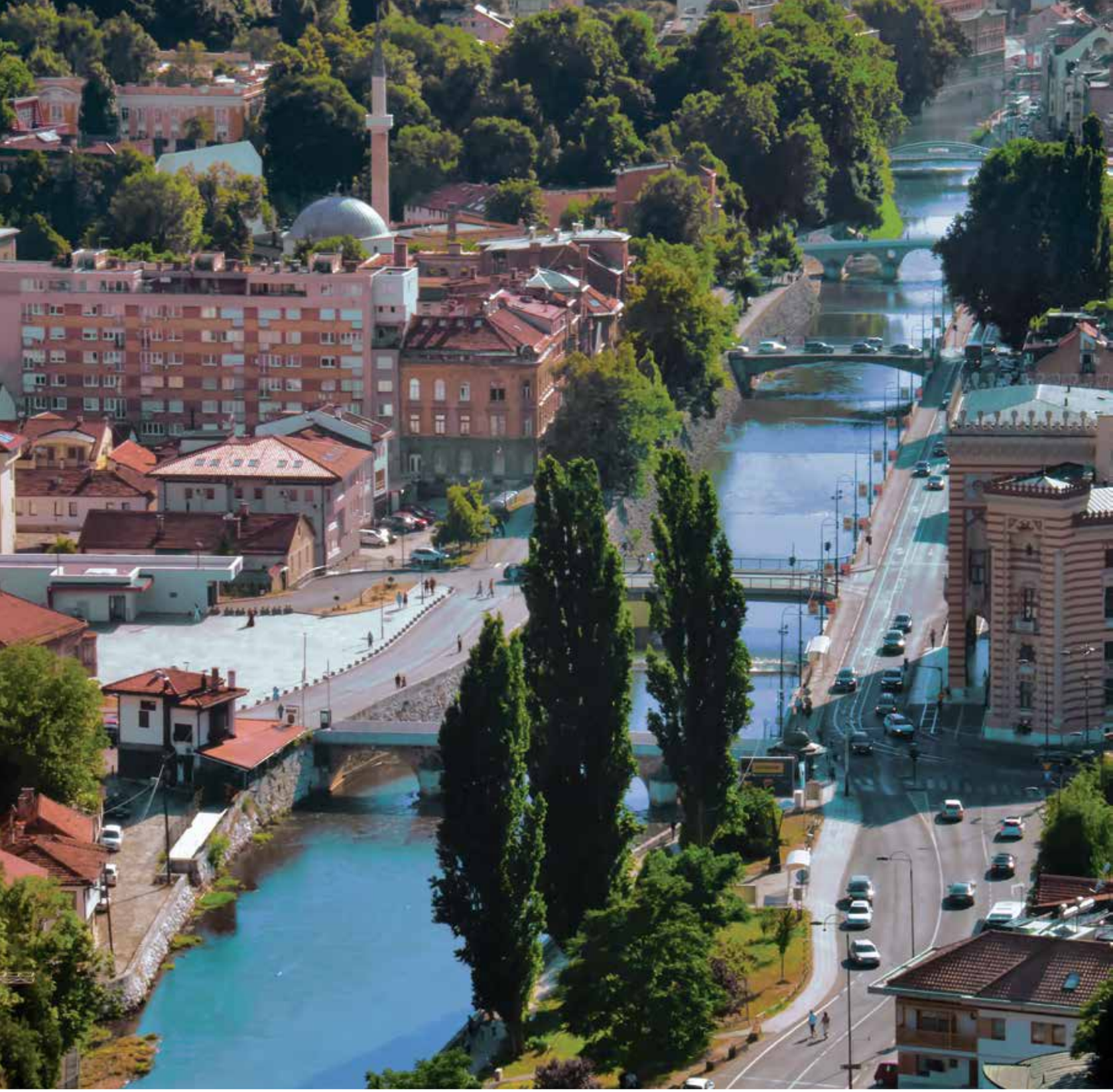
The investment is economically viable. The payback period for the invested funds is estimated at 12 years, while the operational life of the plant is 25 years. After that, only the panels need to be replaced, while the existing structures, roads, and infrastructure — which constitute a significant portion of the total investment — remain intact. Replacing the panels effectively revitalizes the plant for another 25 years of operation. The construction of the Petka plant was carried out by a consortium led by GAT from Novi Sad. Other members of the group include the Novi Sad-based Mio Company and two Hungarian firms — BSD Invest Europe Zrt from Budapest and Levi-Solar Kft. from the town of Zakanjsek.

The Petka solar plant is joined by another renewable energy (RES) facility nearby — EPS's first wind park, Kostolac, with a capacity of 66 megawatts. All 20 wind turbines have been installed, and construction of the substation, switchgear, and internal cable network is underway, enabling wind energy production to commence by the end of this year. This facility, too, is being built on reclaimed overburden dumps, confirming EPS's commitment to utilizing all available resources. The project covers four locations: Drmno, Petka, Ćirikovac, and Klenovnik. The planned annual production of the Kostolac wind park is 187 million kilowatt-hours — enough to supply about 30,000 households with green electricity.

The project is financed with a loan from the German development bank, KfW, worth 110 million euros, and EPS has also been granted an additional 30 million euros in non-repayable funds from the European Union through the Western Balkans Investment Framework (WBIF). Project consultants are Fichtner GmbH & Co. and Energoprojekt Entel AD. At the same time, procurement of the wind turbines, towers, substations, and switchgear is being handled by a consortium of Siemens Gamesa Renewable Energy A/S from Denmark and Siemens Gamesa Renewable Energy from Belgrade.

First photovoltaic plant in Kostolac generates electricity by converting unaccumulated solar radiation into direct current through semiconductor-based (PV) solar modules

Prepared by Milena Maglovski



SARAJEVO – AN EXAMPLE OF SUSTAINABLE URBAN DEVELOPMENT

Photograph: Unsplash/Miguel Alcantara

One of the main priorities of the Sarajevo city authorities is the development of the so-called City Climate Contract, which will be submitted to the European Union. The aim of this document is for the functional urban area of Sarajevo – encompassing the City of Sarajevo, the Sarajevo Canton, and the City of East Sarajevo – to obtain the Net Zero Label.

This label confirms the local authorities' commitment to climate policy and opens up the opportunity to use funds from European Union sources, which is crucial for implementing green projects.

We spoke with Mayor Predrag Puharić about the specific steps Sarajevo is taking in the fight against climate change, how citizens are getting involved in these processes, and how the quality of life in the city is improving.

Q: What measures is the City of Sarajevo taking to reduce air pollution?

A: Although this area does not fall directly under the jurisdiction of the City of Sarajevo, reducing air pollution is one of our key priorities. When we asked citizens a few years ago what the biggest issues in Sarajevo were, they cited air pollution, public transport, and corruption. In response to the public's concerns, we have taken it upon ourselves to contribute to solving this pressing problem. We address this issue through the activities of the City Department for Sustainable Development, which enables us to implement various measures and participate in projects and initiatives focused on this issue.

Through the Smart City initiative, in cooperation with UNDP BiH, we have implemented innovative ideas proposed by citizens. Across various projects and initiatives, we aim to increase green areas and urban vegetation by planting trees, creating urban gardens, and introducing other innovative methods and concepts. A significant step in this area is the joint application by the City of Sarajevo, the City of East Sarajevo, and the Sarajevo Canton to join the EU Mission of 100 climate-neutral cities. The functional urban area of Sarajevo, as we named this comprehensive region, has become part of the Mission and is one of only three cities from the Balkans to be accepted. We are currently developing an Action and Investment Plan, which will form part of the so-called City Climate Contract, and are preparing the First Citizens' Climate Assembly/Forum in Sarajevo on this topic.

Q: What are the plans to reduce the number of cars in the city centre?

A: Through the implementation of the Sustainable Urban Mobility Plan, the City of Sarajevo is working on activities that aim to reduce the use of cars and promote alternative, sustainable forms of urban mobility. We support the efforts and fantastic results of the Sarajevo Canton Ministry of Transport in improving public transport, which is crucial for reducing the number of cars in the city.

Through the implementation of the Sustainable Urban Mobility Plan, the City of Sarajevo is working on activities that aim to reduce the use of cars

Predrag Puharić
Mayor of Sarajevo

We are developing and expanding cycling infrastructure and promoting cycling in general. Every year, we actively mark European Mobility Week through a range of activities, including subsidies for citizens to purchase bicycles and organizing Bike2Work days to encourage employees in institutions, organizations, and companies to cycle to work.

We are actively working on establishing supporting infrastructure, including the installation of so-called Mobility Islands at two locations. These features include electric vehicle chargers, anti-theft bicycle stands, smart benches, and scooter parking. We are also systematically installing bicycle parking at schools and universities to encourage both students and staff to cycle. Following European and global trends, we support the introduction of new systems, such as electric bicycle rental services, which will offer citizens another form of sustainable mobility and reduce reliance on cars.

Q: How would you assess the waste collection and recycling system?

A: The recycling segment is still significantly behind modern European standards. Aware of this, the City of Sarajevo is making efforts through

Photograph: City of Sarajevo

numerous initiatives to improve both infrastructure and public awareness. To this end, the City works closely with the cantonal public utility company, Rad, and the electronic waste management operator, ZEOS Eco-System, implementing joint actions and pilot projects for sorting, recycling, and education.

One example is the Re-Use Day, which offered citizens a chance to learn, exchange, and donate reusable items. A Cool Bazaar was also held, where children and young people could exchange and sell their used belongings. By involving children and youth, we aim to educate and raise awareness from an early age, thereby promoting a circular economy.

Q: Does the city have a strategy for protecting existing green areas and developing new ones?

A: The City of Sarajevo is firmly committed to the protection and expansion of green areas, which is a key element in combating climate change and improving the quality of urban life. Through the City Department for Sustainable Development, we are developing various initiatives and projects that combine spatial planning, ecological innovation, and active citizen involvement.

In addition to protecting existing parks, forests, and natural areas, the City of Sarajevo is implementing innovative greening and urban regeneration models through projects such as Commit2Green, Bauhaus Bites, Bauhaus4Med, and BiodiverCity. These projects include the development of so-called food forests where edible plants are planted for community use, the installation of insect hotels to support biodiversity and pollinators, and the creation of urban gardens in residential areas and schoolyards.

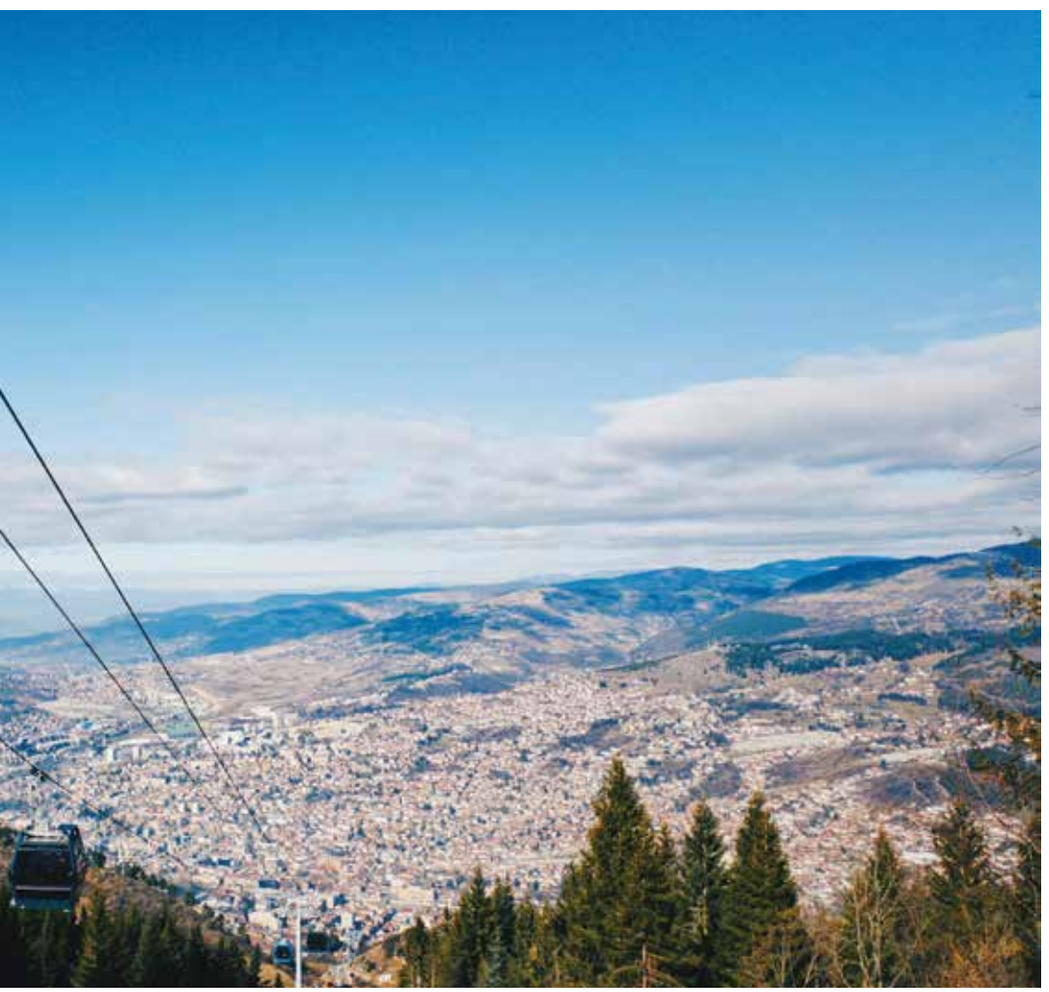
Q: What are the next steps in Sarajevo's participation in the Mission of 100 Climate-Neutral and Smart Cities by 2030?

A: Our participation represents a turning point in our approach to climate

Photograph: Unsplash/Markus Winkler

and urban policy. This mission involves not just political commitment but also concrete and measurable steps towards achieving climate neutrality. One of the most important ongoing processes is the Citizens' Forum/Citizens' Assembly on Climate Change, which involves 70 randomly selected residents of Sarajevo. They meet over three weekends to discuss key topics – air pollution, greening, heating and cooling, mobility, and climate change – with the support of experts and facilitators. At the end of the process, citizens will produce a set of recommendations that will be directly incorporated into the so-called City Climate Contract. In parallel with this deliberative process, a team of experts, in cooperation with relevant institutions, the private sector, academia, and international partners, is working on the Action and Investment Plan, which forms the technical and operational components of the Climate Contract. These documents will precisely define the projects, measures, and financial models needed to achieve climate neutrality.

One of the most important ongoing processes is the Citizens' Forum/Citizens' Assembly on Climate Change



Photograph: Unsplash/Sead Džambegović

The City Climate Contract will be submitted to the European Union in June 2025. It is expected that the functional urban area of Sarajevo, including the City of Sarajevo, Sarajevo Canton, and the City of East Sarajevo, will then be awarded the so-called Net Zero Label. This will provide us with access to EU funding and significantly enhance the prospects for implementing the investments outlined in the Action and Investment Plan, which are crucial to achieving climate neutrality by 2030.

Q: Is Sarajevo planning to invest in renewable energy for public buildings such as schools, hospitals, and sports centers?

A: The City of Sarajevo is strategically planning to increase energy efficiency and the use of renewable energy sources in public buildings, especially in education, healthcare, and sports sectors. A notable example of this is the collaboration between the City of Sarajevo and the Slovak government, which resulted in the installation of a sustainable heating system utilizing infrared panels at Saburina Primary School. This system offers high energy efficiency with minimal emissions, while also providing stable and healthy heating for students and staff.

Additionally, as part of its energy renovation measures, the City funded the replacement of the façade and windows at a secondary school in Drvenija, which will significantly reduce the school's energy consumption and its overall carbon footprint. Similar activities are planned for other public facilities, particularly primary and secondary schools, preschools, health centers, and sports venues. It is essential to emphasize that the City does not rely solely on its budget but actively utilizes available EU funds and other international sources of financing.

Interview by Jasna Dragojević

SMART METERS IN SERBIA – WHERE WE STAND TODAY AND WHAT COMES NEXT

An electricity meter is a device that measures electrical energy, recording the amount of energy (in kWh) delivered over a specific period. A meter does not measure current, nor, as with gas, the physical volume of consumed fuel passing through the installation.

The modern generation of so-called smart meters, which began to be widely installed from 2010 onward, has become the foundation of the digital transformation of the electricity distribution network. Unlike older electromechanical clocks, the new meters combine a digital metering unit, a real-time clock and calendar, a processor and memory for local data storage, and a two-way communication modem. Thanks to their connection with control centers (AMM/MDM systems), these devices exchange millions of grid status records and energy consumption in real-time, and also enable remote control, tariff plan changes, and quicker fault detection.

Photographs: Elektrodistribucija Srbije

Serbia on the Map of Meter Digitalization Development

The first smart meter pilot projects in Serbia were launched between 2003 and 2008 to explore possible technical solutions. A turning point came in 2010 when Elektroprivreda Srbije (Serbian power company – EPS) adopted a national specification for smart meters. Due to the then-high cost of equipment, priority was given to industrial consumers, as just two percent of metering points accounted for as much as 40 percent of the country's total electricity consumption. Therefore, replacing those meters brought the fastest benefits to the economy, especially since industry is its backbone.

For households, replacement began in 2018. The Belgrade district of Bežanija received around 35,000 digital meters, while Niš and Zlatibor were equipped with 16,500 devices each.

A major expansion followed thanks to a €110 million donation from the European Union, during which a total of 523,000 meters were replaced over three years in Belgrade and Novi Sad.

Today, smart meters are installed at about 600,000 metering points, which represents approximately 16 percent of the total of roughly 3.8 million meters in Serbia. Elektrodistribucija Srbije (EDS) continues to procure equipment from its own funds through regular public tenders and has introduced a rule that every new connection request must subsequently be equipped with a device that supports two-way communication. In this way, infrastructure is gradually being built to enable the complete digital transformation of the national electricity grid.

In Serbia, most consumers still think of their electricity bill in terms of dinars, rather than in terms of actual consumption in kilowatt-hours (kWh)

In Serbia, most consumers still think of their electricity bill in terms of dinars, rather than in terms of actual consumption in kilowatt-hours (kWh). Traditional meters do not facilitate quick checks or precise analysis of consumption. To estimate the energy consumption of a specific appliance, people typically refer to its power rating and operating time. Heaters are the largest consumers, so a 2-kW water heater running for half an hour consumes approximately 1 kWh of energy. A smart meter, however, allows accurate and almost daily insight into consumption without the need for estimates.

Smart Meters in Serbia – Where We are Today and What Comes Next

At a workshop in Novi Sad, organized by Elektrodistribucija Srbije at its local branch office, we were introduced to the advantages of smart meters in more detail, as well as EDS's future plans.

Thanks to daily remote readings and automatic data archiving at midnight on the first day of each month, smart meters enable billing to be issued almost immediately after the billing period ends. Data is stored for eighteen months, providing both the user and the distributor with a solid basis for quick checks or possible complaints.

The precise electronics measure energy with an accuracy class of ±0.5 percent, compared to ±2 percent in most of the older meters. Thus, with the new generation, metering errors are reduced, and the resulting difference directly ensures fairer and more accurate billing for everyone.

Smart meters enable consumption to be recorded monthly, daily, hourly, or even at 15-minute intervals

According to estimates presented at the EDS workshop, if all meters in the country were replaced, considering they are old mechanisms that wear out, slow down, and make errors to the distributor's detriment, total distribution losses, currently over 10 percent, could be reduced by around two percent. This translates into tens of millions of euros annually that would no longer be spent on covering lost energy but could instead be used for modernizing the network.

Additionally, data from smart meters allows technical and commercial losses to be pinpointed almost in real time. If a substation shows an unexplained shortfall, teams can be dispatched to the specific location instead of inspecting kilometers of lines blindly.

Smart meters enable consumption to be recorded monthly, daily, hourly, or even at 15-minute intervals. This volume of data paves the way for a new portfolio of tariffs: from seasonal, weekend, or holiday discounts to fully dynamic tariffs that change hourly. These tariffs can be pre-programmed and scheduled to come into effect on

a specific date. Complex tariff schemes become easier to implement. An integrated set of sensors monitors the meter and detects any magnetic interference, unauthorized opening, or similar tampering attempts. Every anomaly is logged and sent to the central system.

Moreover, smart meters are a key link in developing an energy network that supports prosumers, virtual power plants, energy storage, electric vehicle chargers, and a faster transition to green energy.

What's Next for Serbia

Two major projects are upcoming that will accelerate the replacement of hundreds of thousands more devices.

EDS Smart Metering Project Phase 1A – With a €40 million loan from the European Bank for Reconstruction and Development (EBRD), 200,000 meters will be replaced in Niš, Kraljevo, and Čačak, with a nine-month implementation deadline. Once completed, Niš will be on the brink of full smart meter coverage.

EDS Smart Metering Project Phase 1B – the second program, worth €80 million from a European Investment Bank (EIB) loan – plans to replace an additional 400,000 devices. Work is expected to begin next year.

If both projects proceed according to EDS's plans, by the end of 2026, more than 1.2 million smart meters will be in operation, covering roughly one-third of all metering points in the country.

An essential parallel development that EDS has been working on for several months is the launch of a web portal and mobile app for accessing metering data, which will allow users direct, daily insight into their own consumption.

Serbia in the European Mirror

On the European map, Serbia remains among the countries with 10–20 percent smart meter coverage. At the other end are Scandinavia and Italy, which are already entering a second cycle, replacing the first generation of smart meters with new ones. Germany is only now starting an accelerated rollout after years of delay, having sought a business model to justify the investment, as its existing network showed no obvious losses. The main reason for the slow pace in some countries was pragmatic – they waited for the old meters to reach the end of their service life, and where devices still functioned properly, there was no economic incentive for early replacement.

In the long term, the strategic goal of the Republic of Serbia aligns with EU directives, aiming to have at least 80 percent of households equipped with a smart meter by 2030. Elektrodistribucija Srbije clearly sees this goal as having both business and economic merit for all parties involved.

Prepared by Milica Vučković

A MARKET DRIVING THE TRANSITION: SEEPEX AT THE HEART OF A NEW ENERGY ERA

Photographs: SEEPEX

In the year when the Serbian Power Exchange – SEEPEX marks its tenth anniversary, we spoke with Miloš Mladenović, the CEO of this key energy company, about its development, role in the domestic and regional market, as well as the challenges that the energy transition poses for all stakeholders.

From its founding to the present day, SEEPEX has evolved from an innovative idea into a key point on the European energy map, becoming synonymous with market efficiency, transparency, and sustainability. In an interview with Energetski Portal, Mr Mladenović reveals what it takes to build market infrastructure in a dynamic energy environment, what Serbia and the region stand to gain from integration into the ADEX group, and how SEEPEX contributes to strengthening the role of renewable sources and the security of the electricity system.

Q: This year, SEEPEX marks its tenth anniversary. What were the early days of developing an organised electricity market in Serbia like, and where does SEEPEX stand today among European exchanges?

A: As the CEO of SEEPEX, I can proudly say that our development, from our founding in 2015 and the launch of the day-ahead market in February 2016 to where we are today, is the result of commitment, innovation, and a clear vision for creating a stable, efficient, and integrated spot electricity market – not only in Serbia but beyond. Thanks to this, SEEPEX has, in just a few years, established itself as a relevant trading platform, not just nationally but also regionally, with a fully developed spot market framework implemented in line with best European practices. (To recall, in cooperation with EEX, the Serbian futures product was launched in 2019 and is listed directly on the EEX financial derivatives platform.) Today, SEEPEX includes 44 participants from 17 European countries, and trading volume is expected to reach around 5.8 TWh this year on the day-ahead market.

It's important to note that these exceptional business results were achieved under so-called isolated operation – a unique case in the region, where all other exchanges (including those in the EU) only began achieving such business and financial outcomes after implementing market coupling projects, which significantly boosted liquidity.

Moreover, the integration of SEEPEX (one of the initiators of the so-called Blue Sky project that led to the creation of ADEX) into the ADEX Group is a major step toward further regional and European integration of Serbia's electricity market. Alongside SEEPEX, the ADEX Group includes HUPX (the Hungarian power exchange) and BSP (the Slovenian power exchange), establishing a unified platform that enables greater liquidity, efficiency, and market transparency. Through the synergy of its members' and owners' resources, ADEX – with its clearly defined vision of connecting fragmented markets into a single European market – provides a strong foundation for further improving market conditions, as well as a robust and reliable balance between supply and demand in the spot market.

One could say that SEEPEX, together with its partners in the ADEX Group, continues to push boundaries and deliver the highest European standards in exchange market infrastructure. At the same time, it has in many ways realised its original idea of creating a unified regional exchange.

Miloš Mladenović
CEO of SEEPEX

Q: What benefits has SEEPEX gained from joining the ADEX Group, and what do market participants gain?

A: The first tangible results of the planned synergy within the ADEX Group were achieved just a few months after integration, with the launch of Serbia's intraday market at the end of July 2023. This was followed by the successful transformation of the Slovenian power exchange BSP's business model, aligning its clearing function and day-ahead trading platform with that of SEEPEX.

SEEPEX quickly established itself as a relevant trading platform nationally and regionally, with a fully implemented spot market framework aligned with best European practice, involving 44 participants from 17 European countries

With the planned introduction of a unified membership process and pricing structure, along with harmonised market rules, all participants in the ADEX spot markets will benefit from a so-called one-stop shop solution. This includes harmonised operational and clearing infrastructure, collateral netting and cross-margining, a single procedure, and reduced costs for accessing the spot markets. As the first concrete step in this direction, ADEX will soon implement a unified entry fee, coming into effect mid-month. In practice, this means that all existing participants already trading on one of the three exchanges within the ADEX Group, as well as all new members, will be able to trade on the other exchanges within the group without paying an additional entry fee. This benefit marks the first step in improving service to market participants. Going forward, we will continue strengthening synergies and further harmonising processes within the ADEX Group to equalise business conditions across all markets and enable more efficient and competitive trading.

The complex market framework has been successfully assembled and is ready to meet the challenges of the green transition

Q: How important is SEEPEX for the development of renewable energy in Serbia?

A: SEEPEX plays a highly visible and crucial role in this context, particularly in providing a robust and relevant reference price used for long-term financial contracts. This is vital for implementing ongoing government support schemes, industrial and corporate PPAs, and for ensuring a sufficiently liquid day-ahead market capable of absorbing all generated green energy without significantly impacting price levels.

Additionally, the establishment of the intraday spot market has been legally recognised as one of the key prerequisites for the effective integration of renewable electricity sources. It also supports the successful implementation of the new auction-based incentive scheme for long-term power purchase agreements (commonly referred to as Contracts for Difference). Moreover, it plays an important role in reducing balancing costs, both for renewable energy producers and the power system as a whole.

As for SEEPEX's capacity, with the latest improvements, we can confidently say that the complex market framework has been successfully assembled and is ready to meet the challenges of the green transition. This in turn supports planned actions by state institutions aimed at achieving the ambitious targets of the Integrated National Energy and Climate Plan. Furthermore, by advancing the market model – including involving consumption as an active market participant and introducing new market segments such as flexibility

markets and peer-to-peer trading – we aim to accelerate the democratisation of the economy. In the context of the electricity market, this means further application of the marginal pricing concept in energy exchanges, voluntary participation of market players, "democratic" formation of reference prices, decentralisation of energy systems, and the introduction of distributed energy resources. Implicitly, it also means empowering individuals and energy communities to have greater influence over the fair allocation, distribution, and management of economic resources.

Q: What is the answer to the increasingly complex demands of the energy transition? How does the exchange contribute to system security and more efficient balancing, especially in light of the growing presence of solar power plants and wind farms?

A: The energy transition presents numerous and highly complex challenges to all market participants and stakeholders – and electricity exchanges are no exception. In the case of SEEPEX, these challenges are multifaceted: from the constant need to improve technical infrastructure and adapt to rapidly changing legislation, to adequately responding to the growing demands of market participants. The proposal for a new market design, which after lengthy discussions among all stakeholders took shape in mid-2023, was undoubtedly prompted by the recent energy crisis and exceptionally high prices. However, at its core, it represents a response to growing challenges and identified flaws – and in some cases, even economic irrationalities – of the very sharp green transition that the global society and economy have been undergoing for some time.

The energy transition presents many complex challenges for all market participants and stakeholders, including electricity exchanges

In simple terms, the proposed measures can be summarised under two key goals: greater price stability over the long term, both for consumers and suppliers, and more efficient integration of renewable energy sources into the system, primarily through the implementation of decentralised flexible solutions such as controllable consumption and energy storage systems.

Regarding the issue of system balancing, which has recently become a high priority, it is important to highlight its interdisciplinary nature. It spans both the realm of physics and natural laws, and the market-financial framework in which these processes take place. It can confidently be said that the issue is not solely technical, concerning the balance of generation and load within the grid – as it is often oversimplified – but rather lies in the compatibility between society's use of energy and the behaviour of the sources, i.e., the energy system that supplies that energy.

These two sides of the system have co-evolved throughout history to reach their current state. Attempts to change only the generation side to accommodate greater intermittency from renewables, while keeping consumption fundamentally unchanged, have not only failed to deliver results but have also provided solutions to a misunderstood problem.

Because of this, the task – not only for exchanges as market facilitators, but also for engineers and energy policymakers – is not merely to incorporate renewable sources into the current electricity system, but to design and establish a concept that is both sustainable and capable of meeting basic human needs.

Interview by Milena Maglovski

SIEMENS INNOVATION DAY 2025: TECHNOLOGIES SHAPING A SUSTAINABLE ENERGY FUTURE

Siemens, a company renowned for its technological progress and innovation over nearly two centuries, remains committed to sustainable development. In 2024 alone, Siemens employees submitted over 5,300 new inventions, and the company now holds more than 41,000 patents worldwide. These figures not only reflect Siemens' technological strength but also its strategy of placing innovation at the service of the community and society as a whole.

Celebrating innovations that contribute to the energy transition, Siemens Innovation Day 2025 was ceremonially held in Pančevo on May 14, bringing together leading experts in the fields of smart infrastructure, renewable energy sources, and sustainable development.

In the opening remarks, the audience was addressed by Jovana Vukotić, Director of Corporate Communications and Government Relations at Siemens Serbia, and Srdan Srdanović, Director of the Smart Infrastructure Division at the same company, both emphasized the importance of innovation and sustainability for the future of the energy sector.

Photographs: Siemens

The event also welcomed Vladimir Milanović, Board Member of the Renewable Energy Sources Association of Serbia and CEO of Masdar Taaleri Generation, as well as Luka Adžić, Head of the Košava Wind Farm at MK Fintel Wind AD, who highlighted the importance of cross-sector cooperation in the development of renewable energy sources in Serbia.

In his address, Srdanović emphasized the importance of investing in smart energy management systems, particularly in light of the challenges related to power grid stability.

"The world is changing rapidly, and technologies are developing at an incredible pace. To ensure a stable and sustainable future, we must follow these changes and lead them. Our goal is to achieve net-zero CO_2 emissions by 2030, use only renewable electricity at all our facilities, and transition our entire fleet to electric," said Srdanović.

He further emphasized the role of the circular economy in Siemens' operations, particularly through the DEGREE program, which covers six key areas: decarbonization, ethics, governance, resource efficiency, equity, and employability.

The company is also actively collaborating with universities to expand knowledge and awareness about sustainable technologies through education for employees and young professionals.

"We want to be a driver of positive change and, together with the community, change the world for the better," company representatives affirmed.

Danijela Isailović, Director of the Renewable Energy Sources Association of Serbia, expressed satisfaction that the Association had supported the event as a partner and had the opportunity to become acquainted with Siemens' innovations.

"Serbia is currently at a crucial turning point in terms of energy transition. We have a new National Strategy and a National Energy and Climate Plan, and the challenge ahead is their effective implementation. Siemens, as a leader in technological solutions for wind and solar energy, plays a crucial role in this process. Every new technology accelerates decarbonization, increases efficiency, and opens the path to a sustainable energy future," said Isailović.

Siemens is setting standards for responsible and sustainable development

Innovation Showcase and Field Demonstration

Following the opening remarks, participants attended presentations that provided more detailed introductions to the latest Siemens technologies, enabling higher energy efficiency, advancing digital transformation in energy systems, and the more efficient integration of renewable energy sources into existing grids. The event concluded with a field visit to the Košava Wind Farm, which has a capacity of 69 MW and utilizes Siemens equipment and technology. This wind farm stands as a successful example of collaboration between industry, investors, and technological leaders in the renewable energy sector.

Siemens Innovation Day 2025 once again demonstrated that a sustainable future is not just a vision but a tangible goal — one that can be pursued through knowledge, partnership, and continuous innovation. In an era of climate change, energy insecurity, and rapid digitalization, Siemens is setting standards for responsible and sustainable development — not only for Serbia but for the world.

Prepared by Milena Maglovski

THE ROAD FROM TWO TO SEVEN TERAWATTS OF SOLAR ENERGY – CHALLENGES AND PROSPECTS UNTIL 2030

Solar energy has been recording encouraging results for many years, but 2024 marked a new milestone, confirming that the sun is now the fastest-growing source of renewable energy globally. One of the most impressive indicators of this growth is the fact that since 1954, when the first silicon solar cell was commercialized, it took almost seven decades for the world to reach the first terawatt (TW) of installed solar capacity, which happened in 2022. However, it took only two years to reach the second terawatt – by 2024, the global capacity had exceeded two TW.

Compared to the previous year, 2024 saw a growth of more than 30 percent, and solar energy accounted for as much as 81 percent of the newly installed renewable energy capacity. This source of energy recorded three times more growth than wind energy, which ranked second. Specifically, around 600 gigawatts

Photograph: Pixabay/Samuel Faber

(GW) of new solar capacity were installed globally in 2024, with 70 percent of that growth coming from the Asia-Pacific region. At the individual market level, China maintained its leading position with 329 GW of newly installed capacity.

The year 2024 will be remembered as another turning point in the advancement of solar energy. This renewable source not only broke records in installed capacity but also confirmed its position as the fastest-growing form of renewable electricity for the twentieth consecutive year.

However, while solar energy is achieving historic success globally, forecasts for the coming years carry a note of caution. Changes in regulatory frameworks, geopolitical tensions, and slowing demand indicate a shift from the expansion phase to one of stabilization and adjustment. China's success is further underlined by the fact that the country installed capacities more than six times greater than those added by the United States, which ranked second. Moreover, China's result surpasses the combined total of all other countries in the top ten for installed capacity, which includes India, Brazil, Germany, Turkey, Spain, Italy, Japan, and France. Thus, China contributed as much as 55 percent of the total global growth in solar capacities in 2024.

Compared to the previous year, 2024 saw a growth of more than 30 percent, and solar energy accounted for as much as 81 percent of the newly installed renewable energy capacity

These figures are part of the new SolarPower Europe report – Global Market Outlook for Solar Power 2025–2029. The analysis in the report showed that such growth in solar energy was further driven by rapid technological advancements and declining costs of solar modules. Below are the key data and forecasts from this report, which relate to the further development of solar energy worldwide until 2029, along with preliminary estimates for 2030.

2025 will be a pivotal year for the further development of the solar industry globally

Forecasts for 2025: Slowing Growth

Although estimates indicate that solar energy development will continue to grow, it is expected that this growth will slow down by 2025. The market shows that, after a period of intense expansion, stabilization is coming. One reason is the easing of the energy crisis and energy price surges, which in previous years led to a significant acceleration of investments in solar energy. Furthermore, the world faces numerous challenges, including trade tensions, regulatory uncertainty, and a slowing global economy.

Considering the above, SolarPower Europe created three possible scenarios for 2025. The most likely scenario, the medium one, shows a 10 percent growth. This would result in an increase from 597 GW of installed capacity in 2024 to 655 GW in 2025.

According to the medium scenario, this year is expected to bring stabilization due to declining demand and easing trade tensions. The pessimistic scenario forecasts an 8 percent drop compared to the previous year, which would mean 548 GW of new installations. This result would be influenced by trade conflicts, price increases, and political instability in major markets such as the United States, China, and the European Union. If the optimistic scenario materializes, there will be a 30 percent growth compared to 2024, with new installations reaching 774 GW. This scenario envisions stable, low prices for solar modules, accompanied by a slight increase in installation rates across all market segments, with China playing a particularly significant role. Namely, China is experiencing a decline in solar equipment exports, but if it redirects that equipment to increase domestic capacity, it could significantly contribute to the global number of new solar installations. As the largest manufacturer of solar equipment, China plays a crucial role in the future development of the global solar market.

It is concluded that 2025 will be a pivotal year for the further development of the solar industry globally. On one hand, the sector continues to benefit from low costs, flexibility, and constantly falling technology prices. On the other hand, it

Photographs: (left) Unsplash/Ricardo Gomez Angel; (bottom) Unsplash/Biel Morro

Recommendations from the Global Solar Council

In its report, SolarPower Europe highlights eight key recommendations for strengthening and accelerating the development of solar energy, offered by the Global Solar Council:

- Increase the flexibility and capacity of the power grid
- Fill investment gaps and secure cheaper financing for solar projects
- Encourage solar projects with energy storage and interregional connectivity
- Strengthen global solar equipment supply chains
- Introduce ESG sustainability standards in the solar sector
- Develop a skilled workforce and support a just energy transition
- Establish stable policies and targets for solar capacity in climate NDC plans
- Continue innovation and support for different types of solar installations

faces increasing external pressures — from renewed support for fossil fuels, through macroeconomic challenges, to geopolitical uncertainties.

Period 2026–2029: A Pause and Return to Growth

Global growth of solar energy is expected to continue in the coming years, albeit with a significant slowdown in 2026, when a one percent increase is anticipated. The primary reason cited is China's transition from fixed tariffs to market-based pricing, which is expected to bring uncertainty and likely result in delays in project implementation.

A similar situation is expected in the United States, which will further affect the global market. Recovery from the slowdown is expected to begin in 2027, when the growth rate is expected to return to double digits. By 2029, global annual installations could reach 930 GW, and total capacity could exceed six TW. However, all of this will depend on favorable policy, improved infrastructure conditions, further technological advancement, and an increased need for energy security. SolarPower Europe has also created three scenarios for this period. According to the medium scenario, a stable annual growth rate of 10 to 14 percent in solar energy is expected. In the optimistic case, growth would range between 11 and 13 percent, while the pessimistic scenario predicts significantly slower progress, only three to eight percent annually, due to potential political and market challenges.

Forecasts for 2030: A Year of High Expectations

At the 2023 United Nations Climate Change Conference (COP28), more than 130 countries, including all G7 members, reached an agreement to triple the global capacity of renewable energy sources by 2030. The goal is to reach 11 TW, with solar energy playing a very significant role.

Therefore, this decade is expected to have a strong finish. According to the medium scenario provided by SolarPower Europe, global solar capacity is expected to exceed 7.1 TW by 2030, representing around 65 percent of the capacity needed to achieve the goal agreed upon at COP28. To reach this target, an average of 809 GW of solar capacity needs to be added annually from 2025 to 2030. Although this is an ambitious goal, as noted in the report, data show that previous forecasts underestimated the growth of the solar industry, opening up additional possibilities for success.

Although solar energy faces a period of adjustment and challenges in the coming years, its importance in the global energy transition will not diminish. On the contrary, solar capacities will remain one of the key pillars in reducing dependence on fossil fuels and achieving climate goals.

Prepared by Katarina Vuinac

Photograph: Unsplash/Anders

GREENCLEANS AS A RESPONSE TO THE ENVIRONMENTAL CHALLENGES OF OIL REGENERATION

The GreenCleanS project, funded under the Green Program of Cooperation between Science and Industry of the Science Fund of the Republic of Serbia, is being implemented by the Institute of Electrical Engineering Nikola Tesla Joint Stock Company, Belgrade, as the lead institution, in partnership with the Faculty of Technology and Metallurgy and the Institute of Chemistry, Technology and Metallurgy of the University of Belgrade.

Within the GreenCleanS project, an innovative low-temperature technology has been developed for removing elemental sulfur from mineral transformer oils. The presence of elemental sulfur in mineral oil, even at very low concentrations, leads to the formation of conductive deposits of silver (I) sulfide on the silver contacts of the tap selector of the load tap changer, especially at low operating temperatures. This results in the formation of electrically conductive paths, which can ultimately lead to failures of power equipment.

The motivation for developing this innovative technology stems from the need to abandon the risky practice of oil regeneration using reactivated adsorbents, which cause multiple adverse effects. One of them is the generation of dioxin and furan emissions, substances that are extremely toxic to human health and the environment. In addition to the environmental and health hazards associated with oil regeneration, one must also not overlook the technical risks that technologies using reactivating adsorbents carry. Namely, to remove dibenzyl disulfide, these technologies generate elemental sulfur as a byproduct, thus creating a new and escalating problem.

The development of the GreenCleanS technology involved several successive phases, beginning with laboratory oil treatment, followed by the optimization of process parameters in a pilot plant (TRL 4), and culminating in a final demonstration of the new technology under real-world conditions at the Kolubara A Thermal Power Plant site. This was achieved through the treatment of 3 tons of corrosive oil using a mobile unit developed by the Nikola Tesla Institute (INT), resulting in a higher level of technological readiness — TRL 7.

The newly developed patented GreenCleanS technology, combined with previously patented procedures by the Nikola Tesla Institute for the removal of polychlorinated biphenyls (PCBs) and corrosive compounds (DBDS), forms the 3PINT — a unique multifunctional technology.

The INT technology enables PCB decontamination, desulfurization, and re-refining of oil, while also helping to prevent transformer failures caused by the presence of corrosive sulfur.

By implementing the GreenCleanS technology, following regulatory requirements, and the principles of the circular economy, the service life of transformers is extended. The chemical conversion process developed within this technology complies with the principles of Best Environmental Practice (BEP). The competitive advantage of the GreenCleanS technology lies in its significantly lower carbon and overall environmental footprint compared to the competing practice of replacing corrosive oils.

The integration of GreenCleanS technology into standard maintenance procedures for power equipment contributes to the green and sustainable production, distribution, and delivery of electricity.

Institute of Electrical Engineering Nikola Tesla

Event Announcement:

SEE ENERGY 2025: Energy Transition Today

October 28–29, 2025 | Master Center, Novi Sad

Amid global energy challenges, the SEE ENERGY 2025 conference brings together key players in the energy transition from across the region and Europe. Held under the slogan **“Challenges, Solutions, and Future Trends for a Sustainable Future,”** the event focuses on c**oncrete mechanisms for improving energy efficiency, investing in renewable energy sources, and applying cutting-edge technologies.**

In Focus: Sustainability through concrete solutions, knowledge, experience, and new business opportunities.

Here’s a refined version of your paragraph in a polished and professional tone:
Amid global energy challenges, the SEE ENERGY 2025 conference convenes key stakeholders in the energy transition from across the region and Europe. Under the slogan “Challenges, Solutions, and Future Trends for a Sustainable Future,” the event highlights practical mechanisms for enhancing energy efficiency, investing in renewable energy sources, and implementing advanced technologies.

Over the course of the two-day program, we will showcase best practices from Serbia and across Europe – from the use of **biomass and insights from Swiss experts on implementing efficient energy systems, to circular economy models, ESCO financing, and waste management.**
The agenda will also highlight the latest advancements in heat pump applications, battery storage solutions, and the prospects of nuclear energy.
With numerous panel discussions, interactive workshops, and networking opportunities, SEE ENERGY 2025 is where ideas evolve into sustainable solutions and challenges transform into opportunities for growth and innovation.

Source: National Association for Biomass SERBIO

www events-serbio.rs

Source: National Association for Biomass SERBIO

B2B Platform: Direct business connections with potential partners, investors, and decision-makers from the energy sector.
Networking Opportunities: Industry leaders, representatives of local governments, and financial institutions.
Real-World Case Studies: Insights from companies successfully implementing modern technologies and financing models.
Interactive Workshops: Sessions offering practical knowledge and tools for real-world business application.
Timely Topics: The latest trends – from circular economy and waste management to battery systems and nuclear energy.
Access to Solutions and Funding: Learn about available ESCO financing models, subsidies, and EU funds for green projects.

"SEE ENERGY 2025 is not just a conference – it’s a regional B2B platform for connection, learning, and investment in the energy future."

Video
SEE ENERGY 2024

KNOWLEDGE EXCHANGE FOR A GREEN FUTURE: RENEWABLE ENERGY DAYS 2025 IN SPLIT

Around the world, individuals, companies, and governments are making efforts to develop knowledge and skills in areas that shape modern life, including energy and technology, environmental protection, and sustainable development. Actual progress happens when that knowledge is shared and exchanged, shaping common goals. Conferences, therefore, hold exceptional value – they are places where different perspectives, challenges, and solutions meet.

Split, a city on the Adriatic coast that captivates tourists with its blend of history and Mediterranean charm, opened its doors this May to one such opportunity – the Renewable Energy Days 2025. Over a three-day program, more than 400 participants from 19 countries exchanged knowledge and experience on energy transition.

The event was officially opened with a speech by Maja Pokrovac, Director of the Renewable Energy Sources of Croatia Association (OIEH), who emphasized the importance of energy as a key pillar of the economy. As she pointed out, Croatia no longer has an excuse not to utilize its own energy resources. She also highlighted serious infrastructure challenges – the country's power grid is over 40 years old and, as she noted, not ready to meet the demands of the green transition.

Giles Dickson, CEO of WindEurope, praised Croatia's progress in utilizing wind energy. However, he warned that further development of renewables is impossible without new grids to support them. Since no country currently has adequate plans for this, the European Union is preparing a new support package.

On the other hand, Dražen Jakšić, Director of the Energy Institute

Photographs: Renewable Energy Sources of Croatia Association

Krešimir Šimleša, Head of the Grid Connection Department at the Croatian Transmission System Operator (HOPS), presented the current status and noted that, as of May 1 this year, 4,725 MW from renewables had been connected to the transmission grid.

During other panels, participants discussed connection costs, virtual power plants, and how projects can even be connected to already overloaded grids. There was also discussion about system security, especially in the context of the recent blackout in Spain. It was emphasized that such events are often the result of a series of unfortunate and rare circumstances and are not solely the fault of renewable sources.

Christof Litsch, Senior Energy Market Analyst at SolarPower Europe, – from hardware solutions and software tools to strategic planning and investment approaches. Mario Valčić, Director of Siemens Smart Infrastructure, particularly emphasized the importance of advanced software tools that enable communication between power plants and the transmission system operator, as well as fast and efficient monetization of electricity production for investors.

On the final day of the conference, it was highlighted that the energy future begins in communities. Experts also emphasized the importance of cogeneration plants based on biomass and biogas, which, although less visible than solar and wind power plants, play a key role in grid stability and the local circular use of raw materials.

Hrvoje Požar, pointed out that despite the progress made, Croatia still lags behind the EU average. The country currently produces 44 percent of its energy needs, while the rest is imported, and projections for 2050 do not indicate full independence. He stressed that to achieve these goals, procedures must be simplified, a stable legal framework established, and greater security and predictability offered to investors. Panel participants agreed that slow and unpredictable administration is the biggest obstacle to investing in renewables.

presented the latest data and forecasts related to the development of the battery storage market in Europe. Last year was a record year for battery installations, with 21.9 GWh of capacity added across Europe, representing a third of the total installed to date. While EU energy policies strongly support renewables, targets for energy storage are still lacking. Therefore, as he pointed out, the adoption of a European Action Plan for Energy Storage is essential.

One of the discussions focused on innovations shaping the future of energy plants and battery systems

During the panel on environmental protection, participants pointed out the importance of sensitivity maps, which finally became available after years of waiting. These maps facilitate risk assessment and decision-making, but experts warn that some of the data come from outdated sources, making field research still essential for reliable nature protection.

Through the discussions at the Renewable Energy Days 2025, experts confirmed that the green transition is an inevitable path toward energy and strategic security.

Prepared by Katarina Vuinac

SUSTAINABILITY AS A STRATEGIC PRIORITY

In an era where sustainable business practices have become imperative, ProCredit Bank stands out as an institution that not only follows modern standards but also sets them. We spoke with Nemanja Tomić, member of the Executive Board of ProCredit Bank, about how the bank integrates environmental protection principles into its operations.

Q: ProCredit Bank has been applying sustainability principles for over a decade. How would you define your current environmental protection strategy?

A: Our approach is systematic, comprehensive, and deeply integrated into every aspect of our business. Since 2011, we have been implementing the Group Environmental Management Policy. Since 2016, we have been the first financial institution in Serbia to be certified in accordance with the international ISO 14001:2015 standard. Through our internal Environmental Management System (EMS), we monitor and set concrete targets for resource consumption, waste management, and greenhouse gas emissions. We believe that sustainability cannot be a separate process; it must be integrated into every business decision.

Q: What are the most important results achieved through the implementation of the EMS?

A: We have achieved significant reductions in resource consumption, but perhaps more importantly, we have seen a shift in awareness, both

Photographs: ProCrtedit Bank

among our employees and clients. We have adapted our work processes to sustainable practices. We have digitalized services to reduce the need for paper documentation, and we systematically evaluate every procurement according to sustainability criteria. Additionally, we transitioned our vehicle fleet to low-emission models and installed over 40 free electric charging stations throughout Serbia to encourage citizens to make environmentally responsible choices. We also regularly measure CO2 emissions and other environmental impacts, which enables us to continually improve our practices.

Q: One of the pillars of your strategy is managing credit risks from an environmental perspective. What does that specifically entail?

A: As a financial institution, we are aware that our responsibility extends beyond our internal environmental impact. That's why we apply the Environmental and Social Risk Management Standard in all lending processes. We have a clearly defined Exclusion List – we do not finance businesses that harm the environment or society. Every client is evaluated from both an environmental and social risk perspective.

Q: ProCredit Bank is also known for the strong development of its green portfolio. How has this segment evolved?

A: Green financing is the third pillar of our strategy. In 2024 alone, we disbursed around 36 million euros in green loans, and the green portfolio currently accounts for about 15 percent of our total portfolio. Our medium-term goal is to increase that share to 20 percent. We finance energy efficiency projects, renewable energy sources, and other green initiatives that help our clients reduce costs and improve business quality. It's also important to note that we are simultaneously raising awareness through educational events, workshops, and participation in expert conferences.

Since 2016, we have been the first financial institution in Serbia to be certified in accordance with the international ISO 14001:2015 standard

Nemanja Tomić

member of the Executive Board of ProCredit Bank

Q: What are the following major sustainability initiatives you plan to implement?

A: Our goal is to align with the global net-zero strategy. This requires additional investments in renewable energy sources, infrastructure improvements, and further strengthening of our internal culture of responsibility. We are also updating our procurement procedures to ensure that sustainability becomes one of the main criteria in selecting partners.

Q: Finally, how important is it for the financial sector to lead in sustainable practices?

A: The role of the financial sector is extremely important because it directs capital. If we choose to support sustainable projects, avoid financing risky industries, and educate clients on the benefits of energy-efficient solutions. We are not only contributing to the development of banking but also to the broader development of society. For ProCredit Bank, sustainability is not a trend – it is a strategic commitment that guides us toward a future with a greater balance between economy, nature, and community.

Interview by Milena Maglovski

THE HOUSEHOLD OF THE FUTURE – A FARM AS AN ENERGY PRODUCER

In the serene region near the town of Ub, there is a company that has nurtured a tradition and dedication to agriculture for generations – Stočar LSB d.o.o.

The family story has been passed down for generations, culminating in the formal establishment of the company in 1991, deeply rooted in the land and traditions of the Leontijević family.

Today, the estate cultivates as much as 1,400 hectares of arable land, of which 1,000 hectares are under corn and 400 under wheat – all dedicated to feeding livestock exclusively with crops grown on their fields. This closed-loop production system, from field to table, is the foundation of the trust consumers place in their products.

The grains are stored in silos with a capacity of 30,000 tons, while bulky feed is stored directly on the farms. Within the silo complex, there is a mixing facility for preparing complete feed mixtures for cattle.

At the heart of this story are two farms – Farm Orašac, with a capacity of 2,000 head of cattle, and Farm Radobić, which currently accommodates 1,000 head but is undergoing reconstruction that will increase its capacity by an additional 500 head.

However, the company's self-sustainability is also reflected in its electricity production. At the Radobić farm, a 1 MW biogas plant is in its final phase of construction. It will be powered by organic waste from farms and silos.

The company MT-KOMEX, specialized in building solar power plants and experienced in energy infrastructure, has had a long-standing collaboration with the Stočar LSB, starting with the installation of two rooftop solar power plants. The

Photographs: Stočar LSB d. o. o.

first plant, with a capacity of 40 kW, is registered as a prosumer, meaning that part of the electricity is used on-site, while the surplus is fed into the grid. This power plant currently meets approximately 80 percent of the facility's energy needs. The second power plant, with a capacity of 350 kW, is also installed on the company's rooftops.

Following the successful implementation of these projects and the high-quality technical support, the company once again turned to MT-KOMEX to carry out energy connection works for the biogas plant under construction at the Radobić farm, which will have an installed capacity of 1 MW.

During the final construction phase of the biogas plant, MT-KOMEX completed the following key electrical infrastructure works. Two transformer substations were built: the first is intended for supplying the farm's and plant's internal energy needs. It contains the main distribution switchgear for the entire complex, which will be transferred to Elektrodistribucija's ownership upon completion of the connection. The second substation, with an installed capacity of 1,600 kVA, is designed as a grid connection point for the biogas power plant. It includes complete low-voltage equipment and a medium-voltage switchgear manufactured by Schneider Electric. This substation also houses a step-up transformer, which raises the voltage from low (the output of the cogeneration unit) to medium (10 kV), ensuring the necessary conditions for grid connection.

This solution by MT-KOMEX enables efficient use and grid integration of electricity produced from biogas, closing the energy loop and further enhancing the sustainability of the entire Stočar LSB system.

The biogas plant generally operates based on anaerobic digestion, the most widely used technology for producing biogas from organic waste in livestock systems. In closed digesters – large, hermetically sealed tanks – organic matter such as liquid and solid manure and plant residues from silos decomposes naturally in the absence of oxygen. This process takes several weeks, during which microorganisms break down the matter and produce biogas, a mixture primarily composed of methane (CH_4) and carbon dioxide (CO_2). Methane is then used as fuel in a cogeneration unit (CHP – combined heat and power), which generates electricity for sale or internal use, while the heat can be used for heating buildings or maintaining the temperature in the fermenter. At the same time, a digestate is produced, a stabilized, odor-free residue used as a high-value organic fertilizer rich in nitrogen, phosphorus, and potassium, which the company Stočar LSB will further use for its own needs. In this way, the company achieves energy independence, responsibly manages waste, reduces gas emissions, and closes the circular production loop.

The grains are stored in silos with a capacity of 30,000 tons, while bulky feed is stored directly on the farms

In the next phase, in cooperation with MT-KOMEX engineers, the construction of a 9.9 MW ground-mounted solar power plant is planned. This plant will be fully dedicated to producing electricity for the grid with commercial deliveries.

As the company proudly states, their motto is: "We produce healthy food and green energy."

Prepared by Milica Vučković

HOW THE IMPLEMENTATION OF CBAM WILL AFFECT THE ECONOMY OF BOSNIA AND HERZEGOVINA

To achieve climate goals, not only are good intentions needed, but also concrete mechanisms that will translate them into practice, even at customs checkpoints. This is precisely what CBAM (Carbon Border Adjustment Mechanism) aims to accomplish: a mechanism that regulates carbon emissions in international trade. It is a policy that would allow European Union countries to charge a tax or fee on imported products that are produced with high carbon emissions.

The transitional period for its implementation began on October 1, 2023, and will last until December 31, 2025, meaning its definitive application will start next year. CBAM is intended to encourage less developed countries, including Bosnia and Herzegovina, to strengthen their climate regulations, introduce stricter emission reduction targets, and invest in renewable energy infrastructure.

We asked Pero Ćorić, President of the Chamber of Commerce of the Republic of Srpska, how the implementation of CBAM will affect exporters from Bosnia and Herzegovina, particularly businesses oriented toward the EU market.

Q: How will the introduction of CBAM affect the economy of Bosnia and Herzegovina?

A: The EU is increasingly focused on combating climate change, while in other countries outside the EU, less rigorous environmental and climate regulations are generally in effect. Precisely for these reasons, there is a significant risk of so-called carbon leakage, whereby companies based in the EU might relocate their production facilities that emit significantly more CO_2 to other countries to take advantage of more favorable conditions. In such cases, goods produced outside the EU may end up on the EU market, resulting in higher CO_2 emissions during their production. This would merely shift the emissions outside the EU to other countries. It is essential to note that this new EU customs policy will impose an additional burden on our economy. According to preliminary expert estimates, exported goods could become nearly 20 percent more expensive unless

Photograph: Chamber of Commerce of the Republic of Srpska

businesses improve their production processes and increase their energy efficiency.

Q: Which industries will be most affected by the implementation of CBAM?
A: To provide legal certainty and business stability to entities in other countries, CBAM will be introduced gradually and, in the beginning, will apply only to goods at high risk of carbon leakage. Therefore, the industries producing the following goods will be most affected: iron, steel, cement, fertilizers, aluminum, hydrogen, and electricity generation. We believe that in the Republic of Srpska, electricity production will be most affected, and this impact will spill over, placing additional pressure on producers in the metal processing sector, which, of course, relies heavily on electricity.

Q: How will CBAM affect the competitiveness of domestic production, particularly in energy-intensive industries with high CO_2 emissions?
A: To redirect CBAM-related payments back into our country and use them to increase energy efficiency, it is necessary to adopt legislation aligned with European legislation — the EU ETS, i.e., the green certificate trading system. If such legislation is not adopted, the competitiveness of the domestic industry on the European market — where we export approximately 70 percent of our production — will likely decline significantly. Likewise, the impact of this mechanism on the energy sector is enormous — Srpska exports electricity, and its price will depend on the share of renewable energy sources in the total electricity price. Currently, this share is quite unfavorable, with about 60 percent of electricity coming from fossil fuels.

Q: How are local entrepreneurs preparing for this mechanism?
A: Businesses are being intensively informed by the Chamber of Commerce of the Republic of Srpska (CCRS), which has quickly responded in cooperation with other institutions and partners by organizing many seminars and training sessions on CBAM, as well as on CBAM reports that must be submitted to partner companies in the EU. Also, CCRS regularly informs companies about all webinars conducted by the European Commission's Customs Authority regarding CBAM.

We emphasize that the Chamber of Commerce of the Republic of Srpska has translated the CBAM guidelines and forms into our language for our companies, covering more than 400 pages. Given the significance of CBAM for business operations, the Chamber will continue to monitor all developments and keep companies informed, as some lack sufficient capacity to follow news in this field adequately. We will also be available to all entrepreneurs focusing on CBAM. Through seminars, a team of people has been trained at the Chamber to provide adequate training in this area.

Q: What is the Chamber of Commerce's position on the legislation that should be aligned with EU CBAM regulations?
A: Based on information we collected in meetings with representatives of the European Commission, we believe it is necessary to adopt domestic legislation aligned with European legislation — the EU ETS, i.e., the green certificate trading system. This would redirect CBAM-related payments to our country and use them to increase energy efficiency, thereby also improving the competitiveness of our economy.

Of course, much needs to be done to align this legislation with domestic laws, and experts also suggest the gradual introduction of the green certificate trading system.

CCRS calls on all relevant institutions to adopt legal solutions as soon as possible, so that by the beginning of 2026, when CBAM enters into force, we have adopted regulations that enable CO_2-related funds to be used for the development of green energy production in Bosnia and Herzegovina.

Interview by Jasna Dragojević

PERO ĆORIĆ, President of the Chamber of Commerce of the Republic of Srpska, was born in the village of Lađevci near Čelinac. He graduated from the Faculty of Mechanical Engineering in Banja Luka, earning the title of graduate engineer. He has been employed at the Chamber of Commerce of RS since 2003, initially as secretary of branch associations, then as director of the Sector for Branch Associations, and since 2019, he has been the Director of the Chamber of Commerce of RS. For many years, he has been active in the work of the bodies and structures of the Foreign Trade Chamber of Bosnia and Herzegovina, and he is also one of the founders of the Association of Innovators of the Republic of Srpska. Through the work of the Chamber's bodies and structures, he actively participates in connecting the academic community and the RS economy. At the Assembly session of the Chamber of Commerce of RS held in June 2021, he was elected President of the Chamber of Commerce of the Republic of Srpska.

Photograph: Aleksandar Arsenović

HYDROPOWER FROM NORWAY CRUCIAL FOR ALL OF EUROPE

Norway generates approximately 90 percent of its electricity from hydropower, positioning it among the most sustainable and energy-independent countries in Europe. Thanks to this model, the country plays a key role in Europe's fight against climate change.

The importance of Norway for the rest of the continent was the focus of the HydroConnect research project, conducted by the Fraunhofer Institute for Energy Economics and Energy System Technology (IEE).

Norway is connected to the Netherlands, Denmark, Germany, and the United Kingdom via subsea cables, enabling it to leverage its flexible hydropower system.

Philipp Hertel, senior scientist at Fraunhofer IEE, explains that reliance on renewable energy sources increases the need for flexibility and energy storage within the power system — an area where Norway excels.

"Norwegian hydropower can respond rapidly to fluctuations in demand by exporting large amounts of electricity when wind and solar output in Europe is low, and importing electricity when there is surplus generation and prices are low. This ability to balance supply and demand makes Norway a key player in building a climate-neutral, interconnected European energy market," said Hertel.

The analysis encompassed greenhouse gas emissions across Europe, electricity prices in Norway and other countries, as well as the environmental impacts of Norwegian reservoirs and river systems. Several scenarios were considered, including a sudden increase in electricity demand in Norway, the development of more offshore wind farms, the establishment of offshore energy hubs, and changes in the prices of energy carriers such as hydrogen.

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SLOVENIA ISSUES TEN-YEAR SUSTAINABILITY-LINKED BOND, RAISES ONE BILLION EUROS

Slovenia has recently issued a ten-year sustainability-linked bond (SLB) on international capital markets in the amount of 1 billion EUR, with a coupon rate of 3.125 percent and a maturity date of July 2, 2035. This is the first issuance of such bonds in Slovenia and in this part of the world, issued under the Republic of Slovenia's Sustainability-Linked Bond Framework (the Framework). The bond thus carries a fixed coupon interest rate with a possible mechanism for adjusting the final coupon, depending on the achievement of the targets set out in the Framework. The key indicator is the total annual greenhouse gas emissions, as reported on the Slovenian Ministry of Finance's website.

Sustainability Target 1.1: a reduction of total greenhouse gas emissions by 35 percent by 2030 compared to the baseline level from 2005.

Sustainability Target 1.2: a reduction of total greenhouse gas emissions by 45 percent by 2030 compared to the baseline level from 2005.

Therefore, if Sustainability Target 1.1 is not achieved and Slovenia does not reduce its total annual greenhouse gas emissions by at least 35 percent compared to the 2005 level, the interest rate will increase by 50 basis points nine years after the settlement date, which will be July 2, 2025. Conversely, if Sustainability Target 1.2 is achieved, and emissions fall by more than 45 percent, the interest rate will decrease by 50 basis points.

Overall, the new bond applies an increase/decrease mechanism, whereby the final coupon payment is linked to Slovenia's climate goal. According to the bond terms, the interest rate increases by 50 basis points if Slovenia does not achieve the lower reduction threshold of 35 percent, while it decreases by 50 basis points if the upper reduction threshold of 45 percent is achieved.

As for the geographical distribution of investors, 23 percent of the bonds were purchased by investors from the United Kingdom and Ireland, 20 percent from Belgium, the Netherlands, and Luxembourg, and 15 percent from Germany, Austria, and Switzerland. This is followed by Southern Europe, with 12 percent; Slovenia, with 11 percent; the Nordic countries, with 9 percent; and France, with 5 percent. In comparison, 2 percent of the allocation was purchased by investors from Central and Eastern Europe.

Although a recent weakness in the SLB market was noted, demand for the bond was evident, with the offer exceeding demand by more than six times.

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Photographs: (left) Unsplash/Kees Streefkerk; (right) Unsplash/Arnaud Steckle

GREEN PACKAGING IN QUESTION – GLASS BOTTLES FULL OF MICROPLASTICS

Beverages in glass bottles contain more microplastic particles than those in plastic bottles, cartons, or cans, according to a study by the French food safety laboratory Anses.

Their study aimed to determine the level of microplastic contamination in various beverages, including water, soft drinks, iced tea, wine, and beer, as well as to examine the influence of packaging on this contamination.

For most of the beverages analyzed, the level of microplastics was found to be higher in glass bottles than in other types of packaging. In the case of water, the microplastic level was relatively low, regardless of packaging, with an average of 4.5 particles per liter in glass bottles and 1.6 particles in plastic bottles and cartons. Wine also contained little microplastic.

According to the report, an average of 100 microplastic particles per liter were found in glass bottles of cola, lemonade, iced tea, and beer, while the number in plastic bottles and cans was 5 to 50 times lower.

"We expected the opposite result when comparing microplastic levels in different beverages sold in France," said Iseline Chaib, a PhD student from the Food Safety Unit.

Scientists suspect that these plastic particles originate from the paint used on metal bottle caps. The microplastic found in the beverages had the same color and composition as the paint on the caps. Another clue was the presence of microscopic scratches on the paint, likely caused by friction between caps during storage before use.

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GREECE INTENDS TO DEVELOP NUCLEAR ENERGY

At the conference titled "Energy Transition Summit: Eastern Mediterranean and Southeast Europe," Prime Minister Kyriakos Mitsotakis stated that Greece "needs to be ready to join the nuclear alliance" and reminded the audience that his government decided in 2019 to phase out coal rapidly.

In an extensive interview published on the official government website, he discussed the country's energy future.

"Only five percent of our electricity production now comes from coal, and it is mainly used as a reserve. We have recorded a significant increase in the share of renewables – now it's over 50 percent, and those are our capacities," he emphasized at the conference.

Mitsotakis mentioned that the country is leaning toward solar sources and highlighted the significant potential of offshore wind energy.

He also stated that Greece is transforming into an energy hub and could become a supplier of energy security for countries as far as Ukraine.

Regarding joining the nuclear alliance, Mitsotakis acknowledged that the statement may shock many since Greece lacks experience, but emphasized that the world cannot achieve carbon neutrality without nuclear energy.

"I have repeatedly pointed out at the European Council that Europe needs to take strategic positions in clean technology areas where it still has significant comparative advantages. I believe that nuclear energy must be one of those areas," he said.

As for other energy sources, hydrogen is an option for Greece; however, the country is more focused on energy storage, particularly pumped storage systems, due to its geographical advantages.

"We have a major pumped storage project in Amfilochia, western Greece, which is financed by the Recovery and Resilience Fund and is progressing well. We have dams and hope there will be more rain to fill them to the maximum. This is an area I would place more focus on," he stated.

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Photographs: (left) Unsplash/Nicolas Horn; (right) Unsplash/Dole777

TAXING FARMERS BECAUSE THEIR COWS EMIT GASES – A REAL SOLUTION TO CLIMATE CHANGE?

Have you ever thought someone could be taxed because a cow emits gases? It sounds like a joke, but this is a topic being seriously debated in one European country.

When I decided to focus my education on environmental studies, I didn't fully understand the breadth of the field. Initially, ecology referred to reducing pollution, greening spaces, and caring for animals. However, after enrolling in university and starting to work in the field, my understanding of ecology quickly broadened. It was challenging to connect all the information and grasp how deeply ecology permeates all aspects of social life.

After several years of daily study, I began to uncover various, sometimes unexpected, facets of this topic. One of the latest issues I encountered truly intrigued me, and I'd like to share it with you.

In university, we discussed how greenhouse gases influence climate change, particularly methane, a far more potent pollutant than carbon dioxide. I was surprised to learn that livestock farms, particularly those with cows, are major sources of these emissions. In addition to the water and land required for food production, which releases stored carbon, the animals themselves produce methane during digestion, which they emit through, to put it plainly, flatulence.

Yes, exactly – the manure and gases released by livestock are now the subject of one of the most unusual environmental measures I've come across. It's a "fart tax" introduced by a country known for its innovation and environmental awareness – Denmark.

When I first heard about the methane tax on Danish farms, I must admit I laughed. However, as I started to research the topic, I realized this measure is far more serious and complex than it initially appears. That's why I wanted to investigate what lies behind this policy and why a country like Denmark chose to take this step.

How Can a "Fart Tax" Affect an Entire Country?

This policy is formally known as a "flatulence tax" or Fart Tax and targets greenhouse gas emissions from cows, sheep, and pigs. Denmark has decided that, starting in 2030, farmers will pay a tax of 300 Danish kroner (about 43 USD) for emissions produced by their animals, calculated based on methane's climate impact as if it were carbon dioxide. By 2035, the tax will increase to 750 kroner (about 106 USD).

What particularly caught my attention was the potential for farmers to receive a 60% tax refund. They can qualify for this refund by implementing measures to reduce methane emissions. My first thought was – how? Will the animals eat a diet that reduces gas production? As I dug deeper, I found out I was partially right. This reduction can be achieved by modifying the animals' diet, utilizing specific feed additives, and employing technology that converts manure into biogas, among other methods.

This raises the question: why did Denmark choose to implement such a policy specifically for the agricultural sector? The data I found shows that agriculture occupies around 65 percent of the country's land, and Danish farms have five times as many pigs and cows as people. This makes agriculture potentially the biggest climate polluter in Denmark.

Divided Opinions

Although this measure may seem beneficial at first glance, it has sparked a wide range of reactions. Some believe it's politically motivated, claiming that farmers are an easy target for taxation, while larger polluters, such as those in transportation and heating, are avoided due to their political unpopularity. Although farmers pay the tax, it's believed that the costs will ultimately be passed on to consumers through higher food prices. Others are concerned about the growing state control over production and the market, and they question the accuracy of emission calculations from farms.

I don't know how effective this measure will be, what the real motives behind it are, or how valid the divided opinions may be. Still, the methane tax in Denmark raises an important issue – how can we truly reduce emissions in all sectors, including those often overlooked?

Katarina Vuinac

Photograph: Unsplash/Patrick Baum

HEATWAVES DRIVE UP ELECTRICITY PRICES IN EUROPE – SOLAR POWER SOFTENS THE BLOW

Heatwaves brought record temperatures to Europe in June and July 2025, with some areas exceeding 40 °C, posing serious challenges for the electricity system due to a sudden spike in power consumption.

The biggest contributor to the surge in demand was the increased use of air conditioning – during the hottest days, electricity consumption rose by up to 14 percent. At the same time, thermal power plants experienced outages, further straining the grid and leading to a significant increase in electricity prices. In some countries, prices even tripled, surpassing 400 euros per megawatt-hour during evening hours, according to EMBER.

Compared to June 24, average daily electricity prices during the heatwave rose by 15 percent in Spain, 106 percent in Poland, 108 percent in France, and as much as 175 percent in Germany.

Heatwaves also caused power lines to overheat, which in Italy led to failures and further hindered cooling at thermal power plants. As a result, many facilities had to reduce capacity, and some were forced to shut down entirely. In France and Switzerland, nuclear power production was also reduced due to elevated air and water temperatures, which hampered reactor cooling. In France, 17 out of 18 nuclear plants faced operational restrictions.

Heatwaves and Solar Energy

Despite the challenges, June 2025 was the most productive month in EU history in terms of solar energy generation, with 45 TWh produced, 22 percent more than in the same month the previous year.

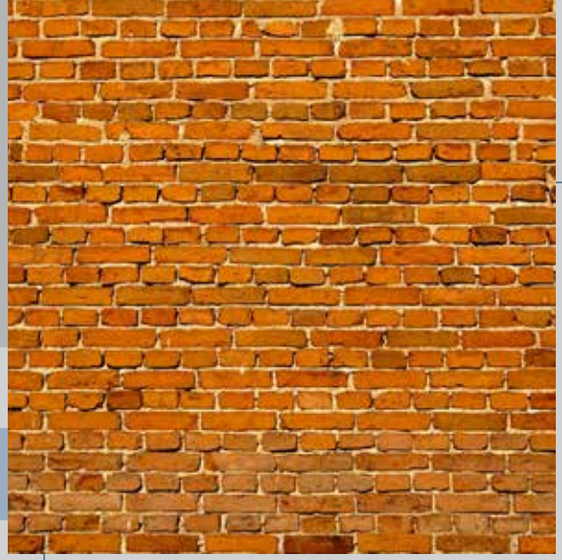
In Germany, at the peak of the heatwave, solar energy was generating up to 50 GW, covering nearly 40 percent of the country's total electricity consumption.

Although solar power significantly contributes to supply during the day and helps ease pressure on the grid, the problem arises in the evening when production drops but demand remains high, pushing prices upward. That's why key solutions include the development of battery storage, more flexible consumption, and dynamic pricing, enabling excess solar energy to be utilized even after sunset.

Heatwaves, which are expected to become more frequent, clearly show that without smart grid management and investments in renewables, along with storage capabilities and better interconnections, there can be no stable supply or energy security in the face of climate extremes.

Energy Portal

Photograph: Pixabay/Tom



STUDY IN SOUTH ASIA: HOW SEEMINGLY SIMPLE CHANGES IN BRICK KILNS DELIVERED MAJOR RESULTS

Bangladesh is among the most polluted countries in the world. A significant portion of this pollution stems from its industrial sector—especially textile, leather, and construction industries—as well as the wastewater they generate and the dense, unregulated traffic. The traditional brick-making industry has been a vital part of the South Asian economy for decades, particularly in Bangladesh.

This very industry, which provides livelihoods for a large number of people, is one of the largest contributors to air pollution and greenhouse gas emissions, including carbon dioxide (CO_2) and fine particulate matter (PM 2.5). Brick production, which largely relies on coal combustion, has particularly harmful health effects in countries with weak regulatory systems and limited technical capacities.

Against this backdrop, researchers from the Boston University School of Public Health, in collaboration with partners from Stanford University, in Bangladesh, Greentech Knowledge Solutions, and the University of Dhaka, conducted one of the most comprehensive studies to date to examine whether and how the brick industry can become more efficient and cleaner without relying on enforcement or legal regulations.

The study involved 276 brick kilns across Bangladesh between 2022 and 2023. The intervention included providing education, technical assistance, and practical advice to kiln owners on implementing simple operational changes, such as improved brick stacking methods, switching to biomass as fuel, and reducing heat loss in the kilns.

The results were encouraging: 65 percent of kiln owners adopted the recommended changes, resulting in a 23 percent reduction in energy use, a nearly 20 percent decrease in CO_2 and PM 2.5 emissions, as well as improved brick quality and savings on coal consumption. One year later, researchers found that the improved practices were still in place and had even expanded further due to their effectiveness.

Energy Portal

RECORD-BREAKING BARRIER REMOVAL IN EUROPE 2024 – 2,900 KM OF RIVERS RESTORED TO NATURAL FLOW

Dam Removal Europe, an initiative and network dedicated to removing old or non-functional dams across Europe, announced that a new record was achieved in 2024 with 542 river barriers removed. As highlighted, this reflects growing support and understanding among communities and governments.

Removals took place in 23 countries, with Bosnia and Herzegovina, Croatia, the Czech Republic, and Turkey removing their first river barriers. Among the top-performing countries, Finland stands out with at least 138 removals, followed by France, Spain, and Sweden.

More than 2,900 kilometers of rivers were reconnected. In Italy, five barriers were removed along an 11-kilometer stretch of the river, restoring its natural flow for the first time in decades. In Croatia, 16 kilometers of rivers were reconnected, which also strengthened climate resilience, water and food security, and halted biodiversity loss, according to WWF Adria.

There are over 1.2 million obstacles in European rivers — such as dams, barriers, and culverts — that interrupt their natural flow. Many of these structures are outdated and have a negative impact on the free movement of water, sediments, nutrients, and aquatic species. This fragmentation weakens the resilience of river ecosystems and reduces their natural functions, significantly contributing to biodiversity loss. A particularly alarming trend is the drastic decline in migratory freshwater fish populations, which have decreased by about 75 percent since 1970 in Europe.

In addition to the record-setting barrier removal, the past year was also marked by the implementation of the EU Nature Restoration Law, which sets a goal of restoring at least 25,000 kilometers of rivers to free-flowing conditions. Barrier removal plays a key role in the global Freshwater Challenge, which aims to restore 300,000 kilometers of degraded rivers by 2030.

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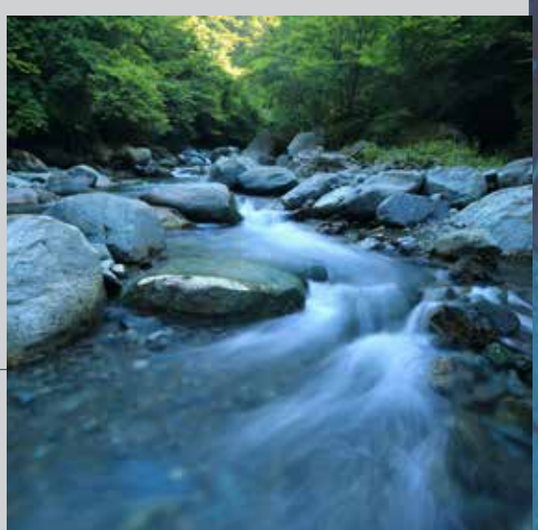


Photographs: (left) Unsplash/Namroud Gorguis; (right) Unsplash/Kazuend

TUZLA AND SEMBERIJA DEMAND A BAN ON LITHIUM MINING ON MAJEVICA

Residents of Lopare, Bijeljina, and Tuzla, along with environmental activists and organizations, strongly oppose the opening of a lithium mine on Mount Majevica. The City Council of Tuzla has recently discussed the harmful effects of this project on the city, while Bijeljina is preparing for a major protest rally on Sunday, similar to the one already held in Lopare.

The environmental association Eko-put from Bijeljina, the citizens' association Guardians of Majevica from Lopare, the mayor and city administration of Bijeljina, and the head and municipal administration of Lopare have called on residents of the municipalities of Semberija, Posavina, Majevica, and the wider region to attend a public rally that will be held in Bijeljina, at King Peter I Karađorđević Square, on April 6 at 6 p.m.

"Due to the submission of a request for the granting of a concession to open a mine in Lopare on February 14, 2025, to the Ministry of Energy and Mining, and the public offering that amounts to a sellout of our land, water, and air — news we only learn about through the media — we once again want to publicly state our united stance: we do not want a lithium mine or the extraction of other critical mineral resources on Majevica," the announcement says.

The Harmfulness of the Project

The main reasons for opposition are that the potential mine site is located in close proximity to populated areas. The rivers Gnjica and Janja flow through the area under exploration and are part of the Sava and Drina river basins. Any potential pollution of these waterways caused by mining activities would pose a serious and unforeseeable threat to nature, the environment, public health, and downstream biodiversity.

The technology required for lithium extraction — particularly the use of sulfuric acid — poses significant risks to public health, the environment, and nature.

A nature park

Majevica should be placed on the list of protected areas to obtain the status of a nature park.

"Through a civic initiative, we requested that a decision be made to impose a moratorium on the granting of concessions for geological exploration and for the exploitation of mineral resources, ores, and other materials in the area of Mount Majevica, until the process of declaring it a protected area in accordance with the Nature Protection Act of Republika Srpska is completed, and until the adoption of the Concession Policy Document in accordance with the Concessions Act of RS," said Snežana Jagodić Vujić, president of the Eko-put association, for the Energy Portal.

She added that they supplemented the documentation last week at the request of the National Assembly of Republika Srpska (NSRS) and that they expect this issue to be placed on the agenda soon.

The authorities in Tuzla have expressed concern over the concession process for a lithium mine on Majevica, which, as they stated, is in the final phase of contract signing with the company Arcore AG, as well as over the agreement signed between Republika Srpska and Hungary regarding the mining of rare metals on March 3, 2025.

The City Council demands an urgent review of the potential environmental impacts of these projects on the City of Tuzla and the wider region, and is calling on the Government of the Federation of Bosnia and Herzegovina and the Council of Ministers of Bosnia and Herzegovina to urgently initiate an environmental impact assessment procedure, including analysis of potential underground and surface water pollution.

"Tuzla is just two kilometers away from the area in question, and some standards for such projects require a minimum distance of 40 kilometers from populated areas. In Europe, there is not a single active lithium mine located near a populated area. Majevica does not only concern Tuzla, Bijeljina, and Lopare — it concerns everyone, because all water sources would be at risk," said Mirnes Ajanović, a city councilor in Tuzla, who, together with Omer Berbić, initiated the discussion of the agenda item titled Environmental Threat from Majevica: The City of Tuzla Demands Urgent Measures to Protect the Environment and Citizens from Lithium Exploitation.

Jasna Dragojević

Photograph: Unsplash/Shane Mclendon

Japan

Investment in Japan's green transition is expected to exceed **€920 billion**.

ProCredit Bank

ProCredit Bank has so far installed **40 free electric vehicle** chargers across Serbia.

Ministry of Mining and Energy

Plans are underway to build a self-balancing solar power plant with a capacity of **1,000 MW** and a 200 MW battery storage system.

The Electric Power Industry of Serbia (EPS) will have **76 MW of new green energy** by the end of 2025.

MT-KOMEX D.O.O.
ENERGY SOLUTIONS

MT-KOMEX company has constructed two transformer stations to meet the needs of the biogas plant operated by "Stočar LSB d.o.o." as well as **two solar power plants with a total capacity of 390 kW**.

City of Sarajevo

The functional urban area of Sarajevo has been accepted into the EU's **'100 Climate-Neutral Cities'** mission.

charge&GO

Charge&GO has commissioned a **120 kW DC charger** equipped with an advanced dynamic load management system.

SEEPEX

PART OF ADEX GROUP

SEEPEX – the national and regional electricity trading platform – is expected to reach a volume of approximately **5.8 TWh** in the day-ahead market by 2025.

Ceefor

The CEEFOR company has obtained **ISO certifications** 9001:2015, 14001:2015, and 45001:2018.

SIEMENS

Siemens currently holds over **41,000 patents** worldwide.

AGROSOLARS – AN OPPORTUNITY FOR DUAL DEVELOPMENT IN BOSNIA AND HERZEGOVINA

Agrosolars are an innovative solution that combines the production of renewable energy with agriculture, allowing for dual land use. In Bosnia and Herzegovina (BiH), where significant underutilized agricultural resources and high solar potential exist, agrosolar projects offer an opportunity for the sustainable development of rural areas, increased energy independence, and support for local communities. We spoke with Miroslav Nikolić, Head of Development for Renewable Energy Sources and Energy Efficiency at the Electricity Utility (Elektroprivreda) of the Croatian Community of Herzeg-Bosnia, about the importance of

Photograph: Unsplash/Harisankar

Miroslav Nikolić

Head of Development for Renewable Energy Sources and Energy Efficiency at the Electricity Utility (Elektroprivreda) of the Croatian Community of Herzeg-Bosnia

agrosolar projects and the necessary measures to increase their popularity in Bosnia and Herzegovina.

Q: What are the main advantages of installing solar panels above arable land?

A: The most significant benefit of agrosolars is the protection of crops from adverse weather conditions. Due to increasingly pronounced climate change and more frequent extreme weather events, agrosolar systems could become the future of agricultural land in vulnerable areas, including our region. Therefore, agrosolar projects should be primarily viewed as an agrotechnical measure to protect agricultural production.

Various studies show that prolonged droughts and other climate disruptions cause immense damage and losses in agriculture. Furthermore, studies indicate that crop yields are decreasing due to climate change. This is why it is essential to achieve synergy between agricultural production and electricity generation.

By combining solar installations with agricultural production, it is possible to protect crops from excessive solar radiation and stormy weather. Agrosolars create a modified microclimate beneath the modules, alter air temperature, and, through partial shading, prevent crops from overheating or burning. Additionally, these solar installations affect relative air humidity and wind speed, reducing wind gusts and soil drying, which also lowers the need for irrigation.

When it comes to protection from stormy weather, this primarily refers to protection from hail. It is evident that hail events and the resulting damage are becoming more frequent and severe, prompting research into protection methods using agrosolars.

Q: What were the conclusions of the recent agrosolar-focused conference in Mostar?

A: At the recently held conference titled Agrosolars – Obstacles and Opportunities for Implementation in Bosnia and Herzegovina, all participants agreed on the necessity of taking concrete steps toward the implementation of agrosolars in Bosnia and Herzegovina. The conference conclusions proposed specific actions.

Firstly, it is essential to align all strategic documents of Bosnia and Herzegovina and its entities with the European Union's legal framework and to incorporate the agrosolar concept within them. Furthermore, in collaboration with all relevant stakeholders, it is necessary to define an appropriate legal and regulatory

Photograph: courtesy of Miroslav Nikolić

framework that creates a stimulating environment and enables the implementation of agrosolar projects. Furthermore, it is crucial to develop studies assessing the agrosolar potential in Bosnia and Herzegovina and to launch suitable pilot projects that would validate the study findings in practice.

Q: What is the actual potential of Bosnia and Herzegovina for developing agrosolar systems?

A: There are no reliable answers to this question. The studies and pilot projects mentioned previously are expected to provide more dependable information about the real potential of agrosolars in Bosnia and Herzegovina, as well as identify the areas where their implementation would be most suitable and the crops best suited for cultivation with agrosolars.

According to available data, serious analyses of agrosolar potential have only been conducted in the Republic of Croatia, where the development of a supportive legal and regulatory framework has also begun. It has been demonstrated that there are significant opportunities for the application of agrosolar technologies.

Since the conditions for implementing agrosolars in countries across the region are quite similar (sunlight, climate, soil, etc.), it can be assumed that the potential for agrosolar development is also similar in Bosnia and Herzegovina, taking into account the size of available agricultural land and the regions in which this land is located.

It should be noted that agrosolars must be designed in a way that allows for the integration of agricultural activity with electricity production, increasing the total production potential. Southern, warmer, and drier areas are certainly more suitable. Still, on the other hand, the maximum grid capacities in these areas have

Agrosolars must be designed in a way that allows for the integration of agricultural activity with electricity production, increasing the total production potential

Photograph: Unsplash/Philipp

often already been reached due to the expansion of solar installations.

Q: What is the level of interest among local farmers and investors in participating in agrosolar projects, and what could further motivate them, in your opinion?

A: There is no reliable information or research that provides a definitive answer to this question. However, judging by the number of people who attended the aforementioned conference, it could be said that there is interest in agrosolar projects. I believe the concept of agrosolars is still largely unfamiliar to the general public, including farmers and professionals. Therefore, a communication strategy should be developed to provide all stakeholders, particularly farmers, with objective information about the potential benefits and limitations of applying agrosolars.

Q: What is the current legal status of agrosolars in Bosnia and Herzegovina?

A: There is no appropriate legal framework for agrosolars in Bosnia and Herzegovina. In fact, the term agrosolars is not even mentioned in the current legislation. It is true that, when looking solely at the energy sector, solar energy can be interpreted under the definition of an active customer, or a prosumer (a producer-consumer). However, there are regulatory barriers related to the use of agricultural land and similar issues.

As I mentioned, aligning with European practices requires introducing the concept of agrosolars into strategic documents and then into regulations. Although there is no internationally agreed-upon definition of agrosolar, the term generally refers to the simultaneous production of agricultural products and electricity from renewable sources (such as solar panels) on a single plot of land, with a requirement for synergy between these two activities. Agricultural production is assumed to be the primary activity, while electricity generation is a secondary and supplementary activity. Therefore, without agricultural production, there are no agrosolars, which means that solar installations on agricultural buildings do not qualify as agrosolars.

Q: How can the misuse of the agrosolar concept be prevented? How can we ensure that agrosolar models are not exploited as a loophole to circumvent the ban on building solar power plants on agricultural land?

A: Thank you for that question, as it is undoubtedly one of the biggest challenges in applying agrosolars. Legislation must include provisions stating that land used for agrosolar systems must also be used concurrently for crop cultivation. Electricity production must be conditional on the continuous agricultural use of the land, without a significant reduction in agricultural activity. In this regard, a precise and encouraging legal framework should be created, along with standards and best practices for agrosolar projects, including technical guidelines for their design, construction, and operation.

The area of agrosolars should be legally regulated in a systematic and sophisticated manner to ensure that all necessary measures are taken to prevent adverse impacts on soil and crops, and to avoid any ambiguities or misuse, especially the covert conversion of land use.

Q: Which crops are most suitable for cultivation beneath solar panels?

A: Not all crops are suitable for agrosolar development, as some crops are negatively affected by shading. The most appropriate agricultural sectors for agrosolar application include viticulture, fruit growing, cultivation of aromatic and medicinal herbs, and even livestock farming. The effects of agrosolars on various types of vegetables, cereals, industrial and fodder crops are not yet fully understood and should be further investigated.

Pilot projects also indicate that agrosolar systems may have greater potential in warmer and drier seasons and areas, where more favorable effects on crop cultivation can be expected.

Interview by Milena Maglovski

Photograph: Unsplash/David Kohler

A SCHOOL PROJECT THAT TURNS WASTE PET PACKAGING INTO 3D PRINTING FILAMENT

A truly conscious relationship toward nature preservation is developed through upbringing, education, and the active involvement of children in ecological initiatives. At the Technical School in Pirot, Professor Bojan Ćirić, in the role of mentor, led a team of motivated and talented students in a research and innovation project that combines ecology, engineering, and modern technologies. When a school becomes a place where teachers not only pass on knowledge but also encourage responsible action and leave space for independent exploration and creation, ideas like RePET3D are born – a team that connects knowledge, sustainability, and innovation into a concrete solution for the problem of plastic waste.

Each student contributes to the project in accordance with their interests and abilities, says Professor Ćirić, adding that he and his colleague, Bojan Blagojević, as mentors, strive to support the students through expert

Photographs: RePET3D

guidance, encouragement of creativity, a research spirit, and independent problem-solving. Their goal is not only to teach them skills but also to empower them to become responsible and socially engaged young individuals.

"RePET3D is an example of how a school can be a place where ideas are born that have a real, tangible impact on the community," says Professor Ćirić.

The RePET3D Project

At the center of the project is a device conceived and developed by the mentors in collaboration with the students, which enables the mechanical processing of used PET bottles – precisely cutting them into strips, thermomechanically treating them, and converting them into standardized filament that can be used in commercial 3D printers. During the development process, students were involved in all stages – from research and mechanism design to prototype

creation, testing, and device refinement. That process gave them valuable experience in solving real-world problems through teamwork, creative thinking, and the application of knowledge from physics, engineering, IT, and ecology.

The solution they developed has broad application – it is used both as an educational tool and a practical means for reducing plastic waste. Regarding its educational purpose, the professor highlights that the device is planned to be used in both regular and project-based instruction, as a tool through which students can practically learn about recycling processes, technical drawing, mechanics, and working with 3D printers. The device also allows them to independently produce filament and use it to create various models, thus encouraging creativity, practical skills, and an exploratory approach to learning. Practically speaking, the system operates as a mini-recycling plant within the school, enabling students to contribute to environmental preservation actively.

"Our goal with this project is to show how education can be a driving force for concrete and sustainable solutions to modern problems," says Professor Ćirić.

During the implementation of the RePET3D project, students faced numerous challenges that required persistence, teamwork, and creative problem-solving. The greatest challenge was developing a functional device for converting PET bottles into filament, which involved solving technical issues such as material selection, temperature control, determining the optimal cutting speed, and ensuring the mechanical stability of the device. In addition to technical obstacles, organizing teamwork played a crucial role, involving task allocation, idea coordination, and mutual collaboration. Through experimentation, error analysis, and mentor support, students developed not only technical skills but also communication, tolerance, and a sense of responsibility.

According to the professor, projects like RePET3D have great potential to influence the development of ecological awareness among students and the community. Through active involvement, students didn't just learn about recycling – direct participation in the process changed the way they perceive waste: not as a problem, but as a resource that can be used in creative and useful ways. The project also encouraged the broader community to participate by donating packaging, showing interest in the results, and spreading awareness about recycling and reuse.

Recognition at the Second STE(A)M Challenge

After successfully completing the first phase of the project and winning recognition at the Second STE(A)M Challenge* – an educational and competitive program – the RePET3D team continues with further development, focusing on technical improvements of the device, increasing efficiency and stability, and introducing automatic regulation of the PET-to-filament conversion process.

The recognition was awarded within a challenge that is part of the UNDP project "Building Key Computer Science Competencies – Towards the Workforce of the Future", supported by the Ministry of Education, the Petlja Foundation, and the Government of Serbia. It brought strong motivation and affirmation of the value of their work.

For the students, the experience provided confidence and proved that, even as high school students, they are capable of developing applicable and innovative solutions. For the mentors, it was a significant acknowledgment, as it confirmed the value of project-based and team learning in education and showed how much students can achieve when allowed to think freely, experiment, and develop their ideas.

Prepared by Katarina Vuinac

* The STE(A)M Challenge is an educational and competitive program that combines various fields of learning to encourage creativity, problem-solving, and teamwork among children and youth.

COLLAPSE OF ENERGY GRIDS AND THEIR RESILIENCE IN THE 21ST CENTURY

Electricity grids are the backbone of energy systems, from which complex and interconnected lines branch out, enabling even the most remote places in the country to access electricity. In the first half of 2025, the world witnessed three major collapses of national electricity systems, leaving millions of people without power, water, communication, and in the dark. Chile, Spain, and Portugal experienced incidents that highlighted the potential and current weaknesses of new energy mixes combined with traditional infrastructure.

Chile – the Land of the Sun in the Darkness

On 25 February 2025, Chile experienced one of the most serious energy incidents in its recent history. In the afternoon hours, a sudden and widespread collapse of the power grid occurred, leaving over 90 percent of the

Photograph: Pixabay

country without electricity within a short time, including the capital city, Santiago.

According to preliminary analyses currently available to the public, an unplanned outage occurred in one region along a high-voltage transmission line connecting the north to the central system. Unexpected activation of protective systems, still under investigation, due to certain circumstances, led to their shutdown, which then triggered a cascading effect of destabilization.

At the time of the blackout, most of the country's electricity was coming from renewable sources – not an uncommon situation in Chile. Among other sources, Chile has a large number of solar power plants that produce and supply significant amounts of electricity on a daily basis. Moreover, the northern part of the country, including the Atacama Desert – the world's driest desert – is particularly abundant in solar capacity, which is enhanced by the number of sunny days, geography, and open space.

Renewable energy sources – such as solar power plants and wind farms that depend on weather conditions – are often located in regions with favorable conditions for production, generating large amounts of energy even at considerable distances from main consumption centers. The transmission grid has limited capacity, so if a fault or imbalance occurs on a key line, the surplus electricity cannot be easily rerouted. There are insufficient alternative routes or energy storage systems, so the surplus is discarded, and the grid becomes unstable.

Due to the heavy reliance on decentralized production from renewables, without adequate stabilization infrastructure, systems are often unable to overcome immediate issues. When the north and south were left without their main connection, an imbalance arose between the electricity surplus in the north and the deficit in the center, where consumption is higher due to the population size.

During the hours-long power outage, life in the country was seriously disrupted. In the capital, Santiago,

Photograph: Unsplash/Hector Espinoza

which was particularly affected, traffic collapsed as traffic lights stopped working, and the metro system, which transports over two million people daily, was forced to carry out an emergency evacuation of passengers. People were trapped in lifts, while hospitals continued to operate under challenging conditions thanks to backup generators.

The government soon declared a state of emergency and imposed a curfew to prevent potential unrest and ensure emergency services could function. At the same time, the banking sector came to a halt as electronic transaction systems went down.

By the morning of the following day, 26 February, electricity had been gradually restored to around 90 percent of households, according to reports from the National Electric System Coordinator (Coordinador Eléctrico Nacional).

For many years, Chile has operated under a liberalized and privatized energy model, where various companies manage electricity production, transmission, and distribution, while the main public institution plays a role of oversight and technical coordination but does not have operational control over the infrastructure. Critics argue that this model has led to the lack of a unified crisis centre and proper coordination, highlighting the need for a stronger state role in network oversight and greater investment in infrastructure to balance and protect the system from cascading failures.

Energy Collapse of the Iberian Peninsula

The next major energy collapse occurred roughly two months later, on the European continent, on 28 April this year, around 12:30 local time, when the electricity systems of Spain and Portugal suffered a total shutdown.

It all began with a series of frequency fluctuations in southwestern Spain. The most critical fluctuation triggered protective mechanisms in France, which cut the interconnection with the Spanish system. This severed a key flow of electricity between the peninsula and the rest of Europe, leaving the region energy-isolated. Although preliminary findings have identified several events that led to the blackout, including frequency and voltage fluctuations and a sharp drop in production, the exact cause of all changes and components awaits official clarification.

Without support from the continental grid, the Spanish and Portuguese systems had to rely solely on their own resources. As the grid began to lose balance, power plants were automatically shut down, and the grid soon collapsed entirely.

Initial data from the Spanish grid operator pointed to unusually low-frequency oscillations between the Iberian Peninsula and the main European network just before the blackout, according to the WindEurope association.

At the time of the incident, renewable sources accounted for a significant share of electricity production in Spain, also a typical scenario

Photograph: Pixabay/Thomas G.

for this region, prompting public discourse around the challenges renewables may pose during moments of technical instability.

Solar power plants are connected to the grid via inverters, which are designed to automatically shut down the plant if they detect unstable grid conditions, such as a frequency falling below a permitted threshold or excessively high voltage. In this case, the inverters may have detected certain instabilities and immediately shut down the solar systems—a standard safety mechanism designed to protect both the grid and the equipment. This resulted in the loss of a significant portion of the electricity being produced at the time.

Under ideal conditions, the loss of solar energy is compensated by battery storage systems or flexible power plants such as gas or hydroelectric stations. However, Spain did not have sufficient capacity to make up for the drop in real time.

Once the solar power plants shut down, the load was automatically transferred to other sources. Nuclear reactors have strict safety protocols, which means that when they detect such deviations in grid parameters, they shut down to prevent risk. The grid continued to lose balance, and eventually, the entire system collapsed.

Some expert circles believe that in situations where there are frequency deviations, a generation mix with a large share of renewables can accelerate system destabilization, as these sources do not provide inertia—the ability of the grid to naturally resist rapid changes in frequency—as conventional power plants with rotating generators do. Nevertheless, this only highlights the need to adapt the grid to the new technological demands of the modern energy transition.

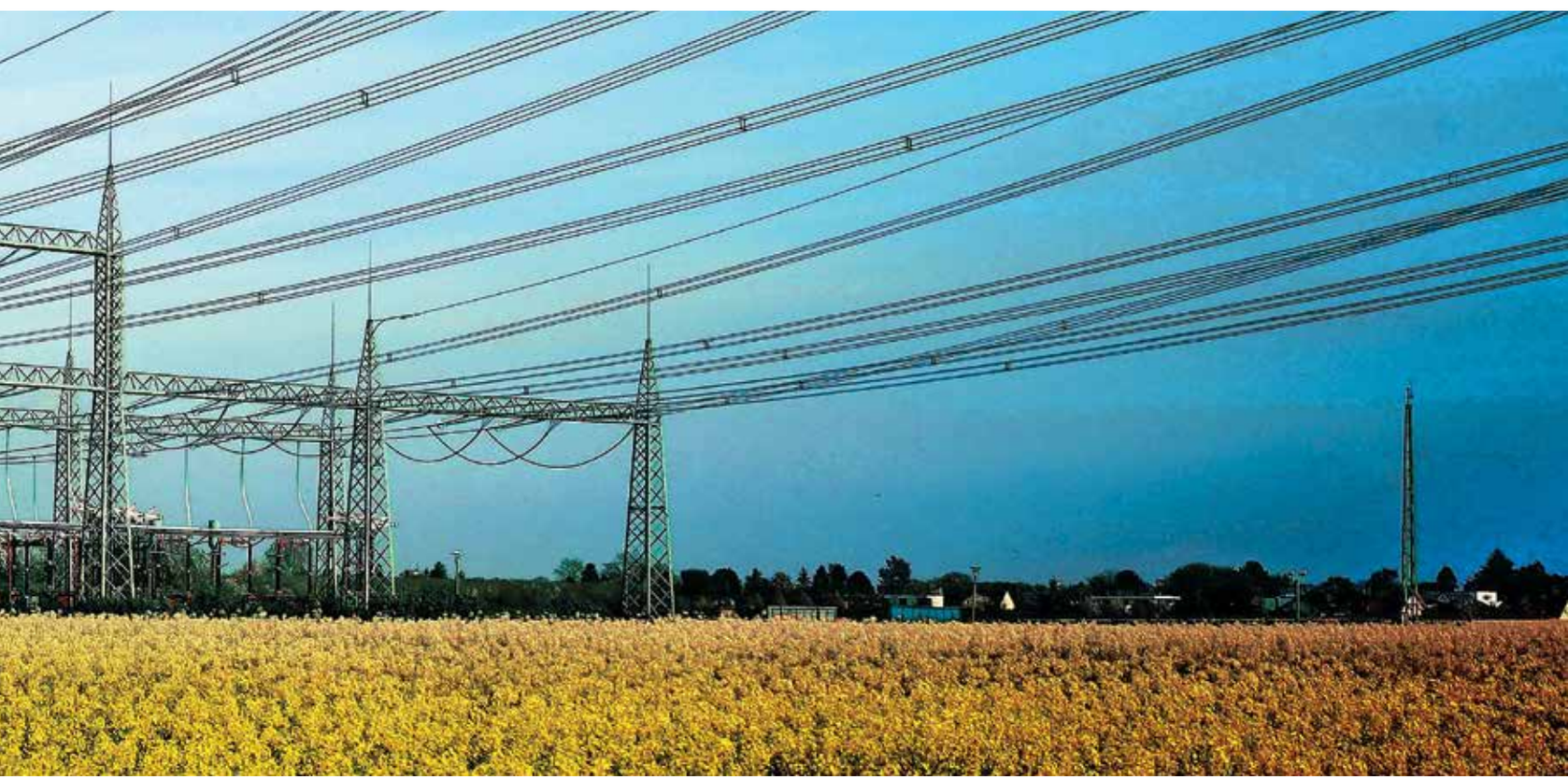
As in the previous case, metro systems in Madrid, Barcelona, Lisbon, and Porto came to a halt, leaving passengers stranded. Hundreds of trains, including high-speed lines between major cities, had to be stopped. Traffic was in chaos due to inactive traffic lights, and operations at the main airports were suspended. Hospitals switched to generators, while water, internet, and digital services were unavailable across the country. The police were mobilized to maintain order and ensure emergency assistance.

Still, by the next morning, more than 99 percent of the system had been stabilized. However, the damage—economic, social, and infrastructural—had already been done.

Conclusion

Although providing an official and comprehensive explanation will take time, it is clear that stability in the 21st century must be built in parallel with capacity, through the use of battery storage, flexible sources, and regional coordination. The energy transition must be accompanied by the development of stable and resilient domestic infrastructure to avoid falling behind the expansion of renewable energy sources.

Prepared by Milica Vučković

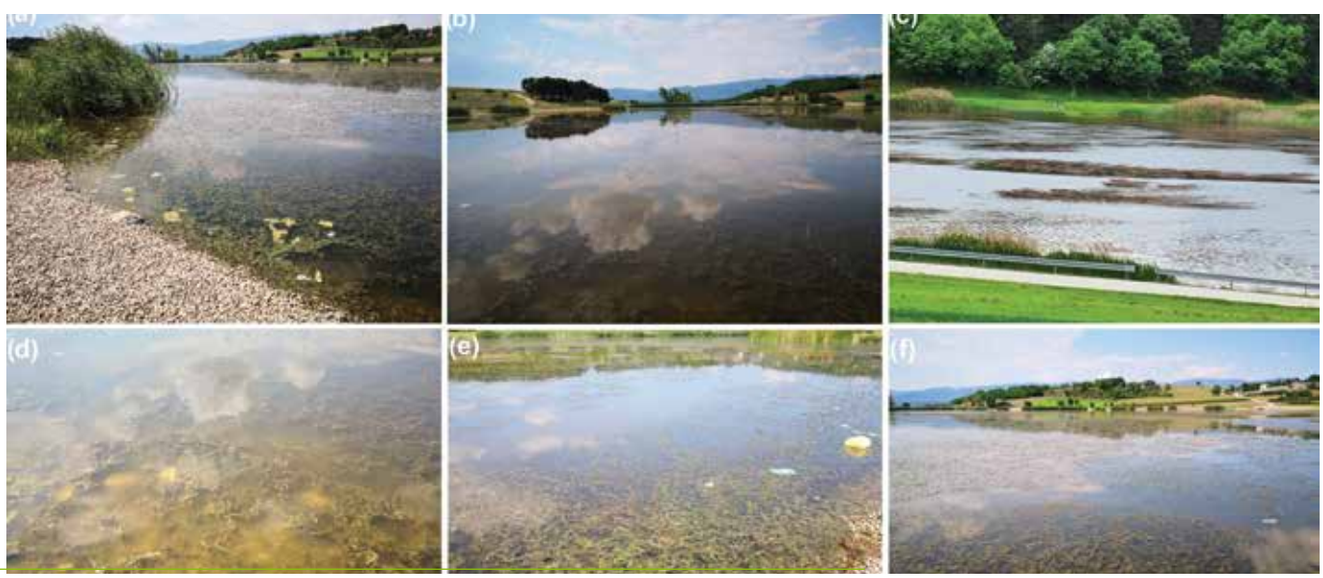


WATER PURIFICATION USING ACTIVATED CARBON DERIVED FROM BIOWASTE

The Vinča Institute of Nuclear Sciences is the largest institute of national importance for the Republic of Serbia, operating under the University of Belgrade. It conducts multidisciplinary research with a particular focus on environmental protection. A healthy and safe environment is one of the fundamental prerequisites for human survival and the well-being of the living world. However, with economic progress comes the generation of large amounts of waste and its inadequate disposal, along with the emission of harmful gases and the greenhouse effect, which has led to climate change and the pollution of water, air, and soil.

Our multidisciplinary team within the Laboratory for Materials, which comprises PhDs in fields such as physical chemistry, technology, environmental protection, chemistry, biology, and mining, has been engaged for many years in solving problems across various disciplines. Members of our team have extensive experience in obtaining ecological, inexpensive, and readily available materials from different raw sources (biomass, mineral raw materials, etc.), as well as from waste (industrial, biowaste, etc.), with the aim of removing various pollutants (organic and inorganic) from the environment. All research is focused on finding the usable value of biowaste and waste generated in industrial production, while also educating and raising the ecological awareness of the population. This has been achieved through numerous completed projects, financed by various domestic and international sources.

I would particularly emphasize the discovery of the usable value of food and green waste from parks and picnic areas, which is usually disposed of in landfills, along with addressing the global ecological problem of



Photographs and illustrations: courtesy of Marija Stojmenović

cyanobacteria and cyanotoxins appearing in water bodies (Figure 1). These studies represent a major challenge today, not only in Serbia and Europe but also globally. The greatest danger associated with cyanobacteria is the release of potentially carcinogenic cyanotoxins, which, at specific concentrations, can be lethal to plant and animal life, and in humans, can cause serious health problems as they quickly travel through the food chain. Through the development of an entirely new technology based on inexpensive and environmentally friendly activated carbon materials derived from food waste and green waste from parks and picnic areas, it has become possible to purify water contaminated with cyanobacteria and cyanotoxins by replacing expensive commercial carbons.

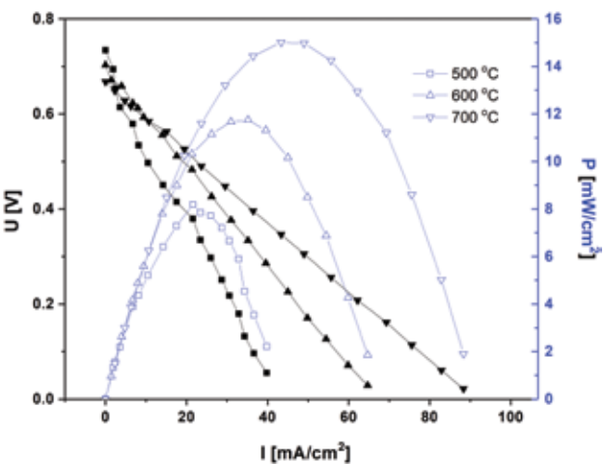
In addition to the above, I would like to point out that within our group, research has been conducted on the development of a new high-temperature ceramic adhesive incorporating waste sludge from wastewater treatment plants, intended for use as a sealing material in intermediate-temperature solid oxide fuel cells (IT–SOFC fuel cells). Solid oxide fuel cells represent the third generation of fuel cells for clean energy production and are the subject of research by many scientists worldwide. In recent years, modern society's increasing tendency towards green technologies, which address concerns about growing fossil fuel consumption, has been on the rise. The adoption of so-called waste-to-wealth concepts in industry is becoming a primary focus of future scientific research. Accordingly, within our research, various tests were conducted on the innovative ceramic adhesive with added waste sludge, which confirmed environmental compatibility, good hermetic sealing, and stable operating voltages in the intermediate-temperature range of the cells, indicating potential applicability in IT–SOFC technology (Figure 2).

I would also highlight that our multidisciplinary team was the first to present the results of the successful application of various waste sludges and enamels from industrial wastewater treatment plants in the construction industry. The properties of cement paste, mortar, and concrete showed that waste enamels (from powder enamel plants) can be used as a substitute for cement in the production of mortar and concrete. In contrast, waste sludges (from plants for applying varnishes and paints) can be successfully used as a replacement for stone filler or other powdered mineral additives in the production of self-compacting concrete (SCC concrete). The achieved results indicate that waste sludges and enamels, although considered hazardous waste, can be used as safe and useful raw materials in the construction industry, while respecting all principles of the green economy and preservation of natural resources (Figure 3).

The benefits of the presented research are numerous – from health and environmental to economic, making these technologies unique and innovative, capable of effectively addressing current environmental problems not only in Serbia and Europe but also worldwide.

Marija Stojmenović, PhD, Scientific Advisor

Marija Stojmenović, PhD
Scientific Advisor at Vinča Institute of Nuclear Sciences



A FAMILY MISSION IN THE SERVICE OF SUSTAINABILITY

In a time when environmental issues are increasingly in the spotlight, one family team from Serbia decided to combine their values, knowledge, and unity into a unique business model that promotes the circular economy through play.

Their handmade board games, crafted from natural and recycled materials, are not just products but also messages. Messages about how the circular economy can be communicated through simple yet deeply thoughtful tools that connect generations, encourage creativity, and bring people back together around the same table.

Vladimir Ilić, who is in charge of sales and client communication in the family brand Wood Play, says that the idea originated from a personal family experience – memories of games his father made when he was a child. Today, those memories have been transformed into a sustainable product that brings people of all ages together, with applications ranging from family events to educational programs and even corporate settings.

"My father has always been passionate about making things from wood. While we were growing up, he made all kinds of items for my sister and me – chairs, toys, various wooden objects – and that's when he sparked our love for working with wood," says Vladimir.

A Business Model Based on Circularity and Togetherness

At the heart of the model lies a team-based division of labor within the family, encompassing brand de-

Photograph: Wood Play

al production, working mainly with plywood and panels made from recycled Tetra Pak materials.

Thanks to this structure, the family has developed a flexible, sustainable, and scalable product suited for various markets.

Their games are rented out for corporate team-building events, Family Day gatherings, Fun Room spaces, and fairs. Delivery is organized directly, accompanied by personalized presentations, and the games come with QR codes linking to instructions, which makes the usage process as simple as possible.

In addition to offering a new form of entertainment for all age groups, the Wood Play brand also has an environmental component. Vladimir explains that all surplus material is either reused or recycled, while every stage, from prototype to final

velopment, design, production, testing, and logistics. Vladimir's wife, Jelena, and sister, Jovana, handle visual identity and communication, while their mother, Gordana, manages accounting. The two Milošes – Vladimir's father and brother-in-law – are responsible for the actu-

product, is designed according to the principles of zero waste.

"We collect all Tetra Pak waste and send it for recycling, where the material is ground down and given a new life. We use recycled boards to create educational games. At fairs and charity events, we raise awareness by setting up bins for collecting used cans, juice boxes, and cartons, then hold lectures on recycling and send all collected materials to recycling factories," our interviewee explains.

Play as a Tool for Education and Raising Awareness

The most popular games – such as CenterShoot, Fishing, and Wembley – are designed to promote interaction, precision, and team spirit. Their strength lies in their universality – they are suitable for children, adults, educators, and even HR departments seeking innovative ways to enhance team dynamics.

In developing new games, the family employs a testing method in real-life conditions, progressing from initial cardboard prototypes to final versions crafted from durable and recycled materials. Every game must meet essential criteria: it must be fun, simple, inclusive, and educational.

Plans for a Broader Social and Environmental Mission

In the next stages of development, this family plans to equip eco-parks where children will learn about recycling, circular economy, and sustainable behavior through play. Moreover, the first digital detox park was already opened on June 1st in Divci, Divčibare, at the Sports Airport. In parallel, Vladimir says they are also developing a line of home toys, created with the same principles: functionality, durability, eco-friendly materials, and family interaction.

This initiative demonstrates that sustainable models are not exclusive to large systems – they can emerge from a single family, a single memory, or a single game. And for that very reason, they hold the power to inspire change, step by step, game by game.

Prepared by Milena Maglovski

Photographs: (top) Wood Play; (middle) Nenad Blagojević

THE POWER OF WIND AND SUN: WHAT THE NEW ERA OF ENERGY BRINGS TO SERBIA

Climate change is increasingly shaping the course of economic and social development, which is why every society aiming for long-term stability and prosperity must place the energy transition at the heart of its policies. Recognizing the green transition as a strategic imperative, Serbia has initiated significant processes to modernize its energy sector, with a particular focus on renewable energy sources.

We spoke with Danijela Isailović, Director of the Renewable Energy Association of Serbia (OIE Serbia), about the current capacities of wind and solar power plants, the legislative framework, the challenges accompanying project implementation, and the outlook for the renewable energy sector by the end of the decade. The association has become one of the key players in Serbia's energy transformation.

Q: What are the current installed capacities of solar and wind power in Serbia, and how much have they grown in recent years?

A: In the past few years, Serbia has significantly improved its renewable energy capacities, with a particular focus on solar and wind power plants (WPPs). We currently have 607 MW of wind power connected to the grid, with an announcement that EPS will soon connect a 66 MW wind farm in Kostolac. WPP Crni Vrh and WPP Čibuk 2 are under construction and expected to be completed within the next year. With these two wind farms, we are approaching the capacity of 1 GW of installed power. We are also waiting for the other auction-winning projects to demonstrate investor seriousness and begin construction. Regarding solar power plants, unfortunately, there is still no precise public registry. However, according to our calculations, the capacity of solar plants connected to the electricity distribution system has long exceeded 100 MW, while prosumers currently account for approximately 97 MW. This indicates that we have surpassed 200 MW of installed solar capacity.

Q: Do you believe Serbia has adopted adequate regulations for adding new renewable energy capacities? Are we on the right path regarding the energy transition?

A: Since 2021, Serbia has introduced significant regulatory changes that have opened the door to investment and accelerated the energy transition, especially in the RES sector. By adopting a set of laws, including the Law on the Use of Renewable Energy Sources, the foundations have been laid for modernizing the electricity sector, enabling easier development of new renewable energy capacities. The law has undergone some revisions to make it functional. The same

Photograph: Unsplash/Karsten Wurth

applies to the Energy Law, whose amendments were adopted at the end of last year, and we are still awaiting the adoption of related bylaws.

A very important document for us is the three-year auction plan, which determines the organization of auctions and the announcement of capacity quotas. Two rounds of auctions have been held so far, and we hope that the final round will be announced by the end of the year, resulting in another 300 MW of wind and 100 MW of solar. We also hope the government will recognize the need for a new three-year auction plan. Auctions have proven to be a winning formula for everyone – the state and EPS receive low-cost green electricity, and investors gain secure 15-year purchase agreements, making their projects bankable. In July 2024, the Integrated National Energy and Climate Plan (INECP) was adopted, which foresees an increase in the share of renewable energy in final energy consumption. The goal is for Serbia to reach at least 45 percent renewable energy in total production by 2030. This plan, along with the adopted energy strategy, clearly demonstrates a commitment to energy transition aligned with EU standards and international agreements. In summary, in terms of regulation, we are in an excellent position – we have positive legal frameworks that undoubtedly support and accelerate the energy transition.

Q: What are currently the biggest challenges investors face when building solar power plants, and what specific problems affect the development of wind farms in Serbia?

A: The renewable energy sector, particularly wind power investors in Serbia, faces issues with inconsistent implementation of the Law on Planning and Construction, as well as changes in the rules of the game during project development, when it's challenging to withdraw after investing several years, millions of euros, and multi-million bank guarantees. It is common for public authorities to change their requirements during project development. Also, due to a lack of communication with other government bodies and a failure to consider the bigger picture, including strategic energy documents, decisions are made that hinder project implementation and, consequently, the achievement of national RES goals. This is the biggest issue.

As for specific problems, the main challenges involve grid connection, as both the transmission and distribution networks are overloaded with requests. Some investors face delays from local governments in adopting spatial plans; others struggle to resolve property rights issues; and still others encounter environmental protection challenges, among other challenges. Each project has its own specific problem, and serious investors are prepared to face risks and invest additional effort in solving them, of course, within legal frameworks.

Q: What are your projections for total renewable energy capacities in Serbia by the end of the decade? Is it realistic to expect the targets set in strategic documents and EU directives to be achieved?

A: Serbia has set ambitious targets regarding renewable energy capacities by 2030. According to strategic documents, the goal is for RES to make up 45 percent of total electricity consumption. Considering this, according to the Energy Agency's 2023 report, we have reached a share of 38.1 percent. The 2030 target of 45 percent is therefore not unrealistic, especially when we consider that, if constructed, the auction-winning projects will contribute more than 1.5 GW of new wind and solar capacity.

We also expect EPS to construct six 1 GW solar power plants, as well as numerous other projects. However, the construction of the Bistrica Pumped-Storage Hydro Plant is strategically important, along with greater investments in the grid and battery storage systems to enable the integration of RES into the electricity system.

Danijela Isailović
Director of the Renewable Energy Association of Serbia

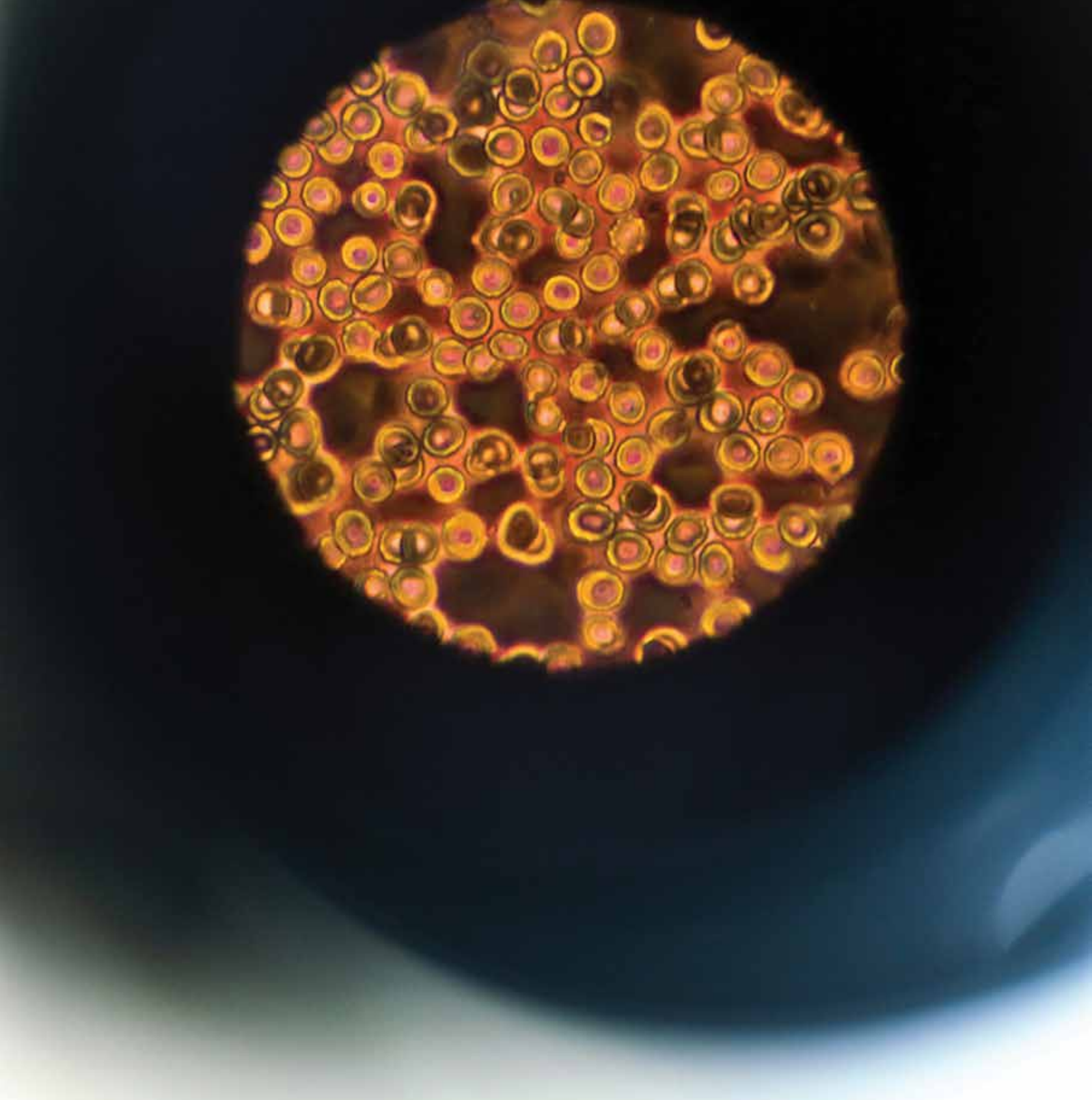
Q: How would you assess the cooperation between state institutions, investors, and the civil sector in the energy transition process? In your opinion, what could further accelerate the development of the RES sector in Serbia?

A: The cooperation is generally constructive, mostly two-way, and mutually beneficial. Of course, there are government institutions that are more open to dialogue and collaboration, and others that take a more conservative approach. Patience, good intentions, equal treatment of all market participants, and transparency are key factors for successful cooperation.

As an association, we actively participate in public consultations on all strategic documents in the energy sector, proposing amendments and improvements that benefit all stakeholders. It's encouraging that civil society is becoming more involved in this topic. To accelerate the development of the RES sector – both in Serbia and globally – the key lies in improving the electricity grid and in the state's readiness to support the development of green energy.

Interview by Milena Maglovski

Photograph: courtesy of Danijela Isailović



MUSHROOM-BASED BATTERIES – A STORY OF APPLYING NATURE'S CYCLE IN TECHNOLOGY

Photograph: Unsplash/Thisisengineering

The development of batteries marked a turning point in technological advancement, enabling numerous benefits without which life today would be almost unimaginable. In the past, batteries were used only for simple devices, such as remote controls; however, their application expanded quickly. Today, batteries not only power our electronic devices but have become an essential element in the development of ecological transport, from scooters and bicycles to cars and airplanes. However, their widespread use also brings challenges related to sustainability and environmental impact.

That's why researchers are seeking more sustainable solutions, and one such approach comes from Switzerland. At the Empa laboratory, scientists are developing 'living' batteries that use microorganisms from the fungi kingdom as the basis for generating electricity. What makes them even more environmentally friendly is their ability to decompose naturally after completing their function.

How Mushroom-Based Batteries Work

Traditional batteries generate energy through chemical reactions, whereas these biodegradable batteries rely on the metabolic processes of fungi. Essentially, the idea is based on what fungi do in nature, like many other microorganisms – they convert nutrients into energy.

Researchers at the Empa laboratory used two types of fungi to produce their batteries – yeast and white-rot fungi – and both proved to be highly effective. To better understand this, it's essential to note that every battery consists of a cathode and an anode, the components through which electrons flow in and out. In this context, yeast is placed on the anode side because, during its metabolism. At the same time, it consumes sugars, just as it does when making bread or beer, and it releases electrons, which then travel through an external circuit and generate electricity. What's essential is for that current not to disappear, but to keep circulating. That's exactly the role of the white rot fungus, which is located on the other side – the cathode. This fungus has the ability to capture electrons, thereby closing the electrical circuit and allowing the current to circulate continuously.

Unlike conventional batteries, which require metals like lithium, often toxic to the environment and difficult to recycle, mushroom-based batteries are completely non-toxic and biodegradable. When their lifespan ends, these batteries do not become hazardous waste – on the contrary, they decompose naturally and can even be beneficial to the soil. Fungi, after all, have the ability to break down organic materials such as cellulose and convert them into nutrients for the soil.

3D Printing

What makes these batteries additionally innovative is the use of 3D printing in their development. This technology enables researchers to design the battery in a manner that provides fungi with easier access to nutrients and makes the structure adaptable to specific conditions. For instance, the batteries can contain specific nutrients that enable fungi to survive in dry environments, if they are to be used in areas with limited water access.

It is also important to note that the materials used to produce the battery are entirely biodegradable, since the 3D printing is done using cellulose-based material – a natural substance derived from plants. This enables the battery to fully decompose in nature after use, leaving no harmful residue.

Although such batteries are not yet powerful enough to operate larger electronic devices, the amount of energy they produce is sufficient, for example, to power sensors used in agriculture and environmental research, and for several days at that. Researchers continue to work on improving this solution, aiming to increase both power and durability.

A technology that doesn't harm nature but instead contributes to it does more than bring innovation – it changes our perception of what progress and success truly mean. Nature once again reminds us that it already holds everything we need. All that is required from humans is to learn from it and act in accordance with its laws. When the natural cycle is properly applied in technology, we obtain solutions that are sustainable and circular, without leaving an unwanted environmental footprint.

Prepared by Katarina Vuinac

At the Empa laboratory, scientists are developing 'living' batteries that use microorganisms from the fungi kingdom as the basis for generating electricity

Photograph: Unsplash/Timothy Dykes

TWO AND A HALF DECADES OF FIGHTING FOR A CLEAN FUTURE

The fight against climate change is one of the most pressing global challenges today, and the transition to clean energy sources is a crucial step toward a sustainable future. Guided by these principles, numerous organizations around the world are dedicated to environmental protection, among them the Center for Environment from Banja Luka, which for a quarter of a century has been actively promoting an ecologically responsible way of life and advocating for a healthier and more sustainable Bosnia and Herzegovina. Their work is focused on concrete change – through active cooperation with local communities, experts, and partner organizations, they combat harmful projects by advocating for policies that protect both nature and people.

They are also present in the field of renewable energy sources (RES), where they have long been working on projects that encourage institutions to adopt and implement necessary regulations, allowing citizens to participate in clean energy production using solar panels to generate electricity for their households.

In addition, they advocate for initiatives that would enable the formation of renewable energy communities — models in which citizens can invest jointly and benefit from renewable energy sources. Dragan Ostić, Assistant for Energy and Climate, highlights for the Energy Portal Magazine that the Center monitors laws and policies to ensure the transition is fair and sustainable for all. He points out that there are numerous challenges in BiH, from institutions that obstruct processes to a lack of knowledge about available opportunities.

"The biggest challenge is the inertia and sluggishness of the system, from vague laws and slow procedures to the continued favoring of outdated energy models based on coal. Currently, it often happens that citizens want to install solar panels but face a mountain of paperwork and poorly coordinated institutions. In addition, misinformation and insufficient knowledge about the possibilities of RES hinder faster progress", says Ostić.

The complex state apparatus of BiH is reflected in all spheres of society and also slows down the transition to clean energy sources.

Photograph: CEEFOR

The complex state apparatus of BiH is reflected in all spheres of society, and also slows down the transition to clean energy sources

Dragan Ostić

Assistant for Energy and Climate at the Center for Environment from Banja Luka

However, institutions in both entities are increasingly recognizing the importance of the energy transition, though this is still not followed by decisive action. According to our interviewee, in the Republic of Srpska, processes are often centralized but lack transparency, whereas in the Federation of BiH, there are more actors involved, which slows down decision-making.

"Regulations differ between the entities, which further complicates the situation. BiH has great potential — with many sunny days and possibilities for wind energy — but also room for improvement in energy efficiency. All in all, we have the potential, but we lack precise coordination and concrete steps toward real transition", he says.

Ostić notes that the energy transition is most hindered by outdated energy policies, slow administrative processes, a lack of political will, and the influence of interest groups seeking to preserve the existing model. Additionally, we lack a concrete national energy strategy, which makes it challenging to secure funding from European sources. All this contributes to the fact that, unfortunately, we are still among the countries most dependent on coal.

We also asked the Center for Environment what could accelerate the energy transition in BiH.

"A faster transition is possible if procedures are simplified, opportunities are opened for citizens and local communities, and easier access to financing is enabled. Also, it is very important that institutions establish a stable and transparent legal framework. In addition, educating citizens and supporting local initiatives can make a big difference", Ostić explained.

The message that the Center has been sending for years is that the green transition should not be seen as a cost, but as an investment in the future. For Bosnia and Herzegovina to become a clean energy country, authorities must show determination, create space for citizens and local communities, and make it clear that the coal era is behind us. Our interviewee emphasizes that there is less and less time for delay and that the transition must be fair, sustainable, and focused on the well-being of all citizens.

Prepared by Jasna Dragojević

CEEFOR CONFIRMS COMMITMENT TO QUALITY THROUGH ISO CERTIFICATION

Today, the success of a business is not measured solely by profit. Companies have a broader social and environmental impact, and are therefore expected to go beyond simply meeting fundamental business objectives. Their activities must be based on high standards of quality, safety, and sustainability to contribute to society and environmental preservation. ISO certifications represent internationally recognized standards that help companies achieve the expected standards. More precisely, they help reduce risks, improve product and service quality, all while adhering to the highest international norms.

The CEEFOR company is proud to announce that it has obtained ISO 9001:2015, 14001:2015, and 45001:2018 certificates, thus

Photograph: CEEFOR

confirming its commitment to quality, sustainability, and safe working policies in all the design and consulting services it provides in the fields of renewable energy, energy efficiency, and environmental protection. With over a decade of experience, CEEFOR has established a high business standard of operations, now officially recognized by the TMS certification body.

Miloš Saleta, Head of the Technical Administration Department and Lead Designer at CEEFOR, explained that the TMS certification body will regularly monitor the implementation of procedures and conduct annual audits, with a complete recertification scheduled at the end of the third year.

"ISO certifications confirm that we operate in line with best practices, but also oblige us to remain on that path. This allows us to provide services of the highest quality, aligned with the latest international standards," said Saleta.

ISO 9001, 14001, and 45001

As the fundamental and best-known international standard for quality management, ISO 9001:2015 sets high requirements for organizations of all sizes and sectors. This standard defines the guidelines for a quality management system, and by implementing it, companies can significantly improve business efficiency, increase customer satisfaction and trust simultaneously, and achieve sustainable growth and long-term success. By obtaining this certification, CEEFOR has confirmed that it implements processes ensuring high-quality services at all stages of its operations.

Environmental responsibility has become a key component of modern business, especially for companies like CEEFOR, which specializes in renewable energy and energy-efficient solutions. For their projects to have a truly sustainable and positive impact, every aspect of operations must align with the highest environmental standards. The ISO 14001:2015 certificate confirms that CEEFOR implements environmentally friendly practices throughout all phases of its projects, ensuring minimal environmental impact.

ISO 45001:2018 is a standard related to occupational health and safety management. This standard is designed for companies seeking to establish a safe working environment for their employees and minimize the risk of accidents and injuries.

International Organization for Standardization

The International Organization for Standardization (ISO) is an independent and non-governmental organization founded in 1947, which gathers more than 165 member countries. By definition, ISO standards represent a set of internationally recognized guidelines and best practices across a wide range of fields, specifically designed for companies.

By applying these standards, organizations can significantly increase the trust of their clients and partners, creating new business opportunities in the international markets, where these certifications are increasingly seen as a prerequisite for cooperation. Additionally, companies with ISO certificates reduce the risk of legal non-compliance, as these standards help to comply with legal regulations in different countries. This simplifies regulatory compliance and reduces the risk of fines and other legal issues. Adhering to ISO standards also strengthens a company's reputation, positioning it as a responsible and ethical organization.

By obtaining the ISO certification, CEEFOR has confirmed that its commitment to quality, sustainability, and safety will form the foundation of its future development and success.

Prepared by Katarina Vuinac

A GLOBAL STANDARD FOR THE ENVIRONMENTAL RESPONSIBILITY OF THE COCOA INDUSTRY

Over the past year, the International Cocoa Organization (ICCO) hosted the 5th World Cocoa Conference, at which the Brussels Declaration was adopted—a document that lays the foundation for a more sustainable, transparent, and equitable future in the production and supply of this commodity. The conference was attended by leading chocolate producers, government representatives, and activists to establish a new direction for the global industry. Precisely in the context of this new path that the cocoa industry is taking, a response has recently arrived, as the World Cocoa Foundation (WCF) introduced the GHG Accounting Standard Methodology on February 6, 2025. This methodology brings a clearer framework for monitoring, reporting, and reducing greenhouse gas emissions throughout the entire cocoa industry value chain.

Photograph: Unsplash/Pablo Merchan

Where Cocoa is Grown

Cocoa thrives in areas near the equator, where high temperatures, abundant rainfall, and humid conditions dominate. Although originally from Latin America, today it is mostly cultivated in West Africa. According to ICCO data, the African continent has provided an average of around 70 percent of total global production in recent years. Côte d'Ivoire has contributed the most, accounting for just under 40 percent of the global output, followed by Ghana, Nigeria, and Cameroon, which together contribute hundreds of thousands of tons. In Latin America — the original home of cocoa — the leading producers are Ecuador, Brazil, and Peru, while in Asia, Indonesia is the leading producer.

Cocoa thrives in areas near the equator, where high temperatures, abundant rainfall, and humid conditions dominate

Photograph: Unsplash/Monika Guzikowska

Most raw cocoa comes from small family farms, whose work is often hampered by unfavorable climate conditions, natural disasters, and unstable prices. These small producers form the foundation and starting point of a chain that usually culminates in chocolate production. In addition to economic challenges, cocoa production also has environmental consequences, resulting from land management practices, fertilizer use, and the clearing of increasingly large forest areas to create space for new plantations. For this reason, the Brussels Declaration emphasized the need for reforestation and the development of agroforestry practices as a response to sustainability challenges.

Precise Tools for Measuring and Managing Emissions

Calculating environmental footprint and measuring carbon emissions in the cocoa industry has been inconsistent, unclear, and often unreliable to date, which has significantly hindered the implementation of shared sustainability standards, particularly due to the complex value chain that encompasses small family farms, numerous intermediaries, and ultimately large producers and factories.

The new method brings a range of concrete benefits for the entire industry, from producers to consumers. By introducing a unified standard, companies receive precise tools for measuring and managing carbon dioxide emissions across every segment of production, with a special focus on so-called Scope 3 emissions, which are the most challenging to identify and will be addressed further. The goal is to achieve more transparent reporting, aligned with the requirements of international frameworks, such as the GHG Protocol and the Science-Based Targets initiative (SBTi), which is particularly important for alignment with increasingly stringent European Union legislation.

The Greenhouse Gas Protocol (GHG Protocol) is the most widely accepted system for classifying and reporting emissions. It distinguishes three categories of emissions: direct emissions occurring within the company itself (Scope 1), emissions from electricity consumption (Scope 2), and the aforementioned Scope 3 emissions, which include all other indirect emissions, such as those from supply chains, transportation, and agriculture. The latter, Scope 3 emissions, are the most difficult to track but also the most important for the cocoa industry, as a large portion of emissions occurs on farms and in intermediary stages of production.

The standard is also aligned with the Science-Based Targets initiative (SBTi), which encourages companies to set emission reduction targets in line with global efforts to limit planetary warming to 1.5°C.

Consumers, at the end of the chain, can potentially expect greater transparency, with chocolate product packaging soon possibly displaying labels on carbon footprint, origin of raw materials, and levels of sustainability. As a result, the development of new products with a lower environmental impact is anticipated, along with potential price adjustments due to the additional costs associated with sustainable production.

As much as cocoa and chocolate are beloved products around the world, global production also carries bitter consequences, which is why it remains on the agenda of international sustainability initiatives.

Prepared by Milica Vučković

YUGOHRANA – SHARING EMPATHY AND SURPLUS FROM THE PLATE

Food waste has always sparked debate within human communities. While some had the privilege of surplus, often discarded without much thought, others strove through solidarity and sharing to ensure everyone could at least have a bite.

Today, however, food surplus has grown beyond a moral issue — it has become a severe environmental burden. Wasted food contributes to environmental pollution, squanders resources, and deepens inequality.

That is precisely why the YugoHrana platform was launched earlier this year — an innovative initiative that ensures food, instead of ending up as waste, finds its purpose and reaches those who need it most. The idea came from Tuzla, from Maid Huremović, who emphasizes that this innovative platform is a bridge between food that some would discard and people who can gratefully make use of it.

"I grew up with the warmth of the kitchen and the aroma of homemade meals that are not thrown away, but creatively transformed into something new. I drew inspiration from everyday scenes — half-empty bakery shelves, leftover food at the end of the day, and at the same time, the needs of people living modestly. YugoHrana is my way of connecting two realities that should never have been separated," Huremović says.

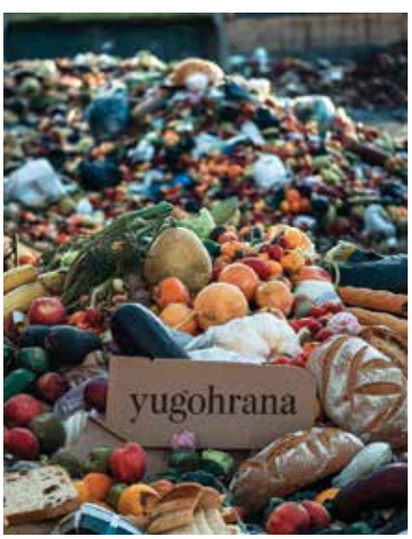
The platform is designed so that its partners (bakeries, restaurants, stores) report food surpluses that would otherwise be thrown away at the end of the day, while users can

Photographs: YugoHrana

An Ecological and Moral Issue

In a world that produces enough food for all eight billion people, it is paradoxical that around 2.5 billion tons of food are wasted annually, more than one-third of total production. Every day, approximately one billion meals are discarded in households worldwide.

At the same time, about 733 million people — nearly one in ten globally — face hunger. This mismatch between surplus and scarcity is not only morally unacceptable but also carries severe environmental consequences. Food waste is responsible for 8 to 10 percent of global greenhouse gas emissions.



reserve these meals via the app or website for symbolic prices and pick them up on site.

Although it's still in its early stages, YugoHrana quickly captured people's hearts, sparked widespread interest, and raised awareness.

"Now, not only do users recognize us, but also hospitality professionals, the media, and members of the community who want to be part of the change. The main goal of the platform is to prevent food waste and help that food find a new purpose — and along with it, people develop new habits," says the platform's founder, adding that this way, everyone benefits: food is saved, costs are reduced, and waste is eliminated.

The plan is for YugoHrana, as its name suggests, to soon take on a regional character and expand throughout the former Yugoslavia. Behind this ambitious plan lies nostalgia for better times, but also faith in the sense of connectedness, sharing, and empathy that characterizes the people of this region.

Our interviewee points out that people recognize the significance of this platform, and they are regularly meeting with potential partners across the region. Still, he admits that every beginning is difficult, but they are ready to face numerous challenges.

"What matters to us is that people are engaged in the process and understand the importance of change — a change we genuinely need. And that proves that the Balkans are ready to embrace change. Right now, we don't measure success by numbers but by the depth of interest we receive — and it grows every day," says Huremović.

When it comes to changing citizens' awareness about food waste, Huremović believes that this change begins quietly, in every home. In the way we store leftovers, in the glance we give a full plate, and in the decision we make about what to do with that last piece of bread.

The main goal of the platform is to prevent food waste and help that food find a new purpose — and with it, people develop a new habit

The founder of YugoHrana emphasizes that through education, positive examples, and concrete platforms like this one, we can shape habits. At the end of the interview for Energy Portal Magazine, Huremović called on restaurants, bakeries, shops, and food producers to join them in their mission to reduce food waste and build sustainable communities — because, as he says, "every town, every village has surplus it can share — and its people who will value it."

Prepared by Jasna Dragojević

NUCLEAR ENERGY – RISK OR PILLAR OF ENERGY STABILITY?

Countries striving for energy stability and achieving carbon neutrality are increasingly discussing nuclear energy as a possible source of a sustainable and stable electricity supply.

Nuclear energy can complement an energy mix comprising renewable sources by taking the lead in electricity production during periods of unfavorable weather and hydrological conditions, when solar, wind, and hydroelectric plants are unable to generate sufficient power.

However, the world has not yet fully recovered from past nuclear disasters, which raises the question: should we give this energy source another chance? Stefan Aleksić, editor-in-chief of the Nuclear Perspective Portal, addresses this question. He compares the fear of nuclear energy to the fear of flying, although statistically safe, it is perceived emotionally as dangerous.

"The available data shows that nuclear energy is one of the safest

Photograph: Unsplash/Nicolas Hippert

forms of energy. And it's not hard to see why: during operation, a nuclear power plant produces no carbon emissions, the nuclear industry has advanced significantly since the first reactors, and it currently boasts an almost unmatched safety record," Aleksić explains.

When it comes to countries leading the return to nuclear energy, it is notable that these are mostly Asian countries, with China at the forefront. Our interlocutor highlights that growing economies drive an increasing energy demand, and Asian countries are more frequently and seriously considering nuclear plants and reactors.

"These countries are seriously developing technologies aimed at reducing the cost of building nuclear installations, with figures being mentioned as low as six billion dollars for two reactor units. That is very competitive compared to reactor costs in the West," says Aleksić.

He cites the energy density of nuclear fuel as a key advantage of nuclear power. According to him, a remarkably small quantity of material produces vast amounts of energy – something no other source, not even fossil fuels, can offer. He also notes additional advantages: a minimal land area required for construction, low electricity production costs once the plant is operational, and the potential for years of energy independence due to the rare need to refuel.

In Aleksić's view, nuclear energy is not just an energy issue, but also a societal one.

"While it is true that every technology is primarily shaped by the political and economic context in which it arises and develops, some technologies have the capacity to influence those structures in a positive way. In my opinion, nuclear energy is one of them. To build a nuclear power plant in our country, we would need to develop educational institutions, regulatory bodies, and a culture of safety. Together, these represent steps towards a better society," Aleksić says.

In 2024, Serbia lifted its decades-long moratorium on the construction of nuclear power plants, opening the door to new investments and cooperation with international companies. Aleksić believes lifting the moratorium was the right move, though he argues it should not have been done through the adoption of a new energy law, but rather through the work of relevant institutions. Only once these institutions are actively involved, he says, will public trust in the industry be restored.

Regarding potential locations for Serbia's first nuclear plant, Aleksić is cautious: "That must be decided by independent experts. As journalists and civil society, we should be creating the conditions for those institutions to function and constantly reminding everyone how vital they are."

Although modern technologies offer a high level of safety, with multilayered protection systems and automatic safety mechanisms, Aleksić underlines that the greatest guarantee of safety is an independent and competent regulatory framework.

In conclusion, Aleksić leaves a thought-provoking message: nuclear energy is not perfect, but it is necessary. If we want a stable and clean energy mix, we cannot ignore it. And if we do choose to pursue it, we must do so seriously, responsibly, and in an institutional manner.

At a time when the world is facing the pressures of climate change, increasingly unstable markets, and the limitations of renewable sources, nuclear energy is emerging as a cornerstone of energy stability. Whether we as a society have the capacity to wisely and responsibly integrate it into our energy mix remains the question ahead of us.

Prepared by Milena Maglovski

The world has not yet fully recovered from past nuclear disasters, which raises the question: should we give this energy source another chance?

Photograph: Unsplash/Hal Gatewood

SUSTAINABLE ENERGY IN PRACTICE

FIRST ADVANCED EV SYSTEM IN SERBIA

The companies Charge&GO and Schneider Electric have implemented the first dynamic load management project on an electric charger at the OMV Lapovo South location. With this new collaboration, both companies once again confirm their leading position in the e-mobility market and their commitment to introducing sustainable solutions, as this project represents a model for the future of charging infrastructure, where smart resource management is combined with environmental responsibility.

After conducting a detailed energy consumption analysis on-site and making necessary preparations, Charge&GO successfully commissioned a 120 kW DC charger at the beginning of May, featuring the advanced EcoStruxure EV Charging Expert with Dynamic Modes, designed for dynamic load management – LMS (Load Management

Photographs: Charge&GO

System). The manufacturer of both the charger and the LMS device is the renowned company Schneider Electric. The system was implemented at one of the busiest petrol stations, OMV Lapovo South, located on the E-75 highway, in the direction of Niš.

Benefits of LMS Applications

The innovative LMS device monitors real-time electricity consumption across the entire petrol station, including all consumers connected to the main distribution board (MDB). Current measuring transformers installed in the MDB measure the total consumption of the facility. Based on this information, the EcoStruxure EV Charging Expert device continuously analyzes the energy situation and accordingly manages the maximum available power that can be allocated to the vehicle charger.

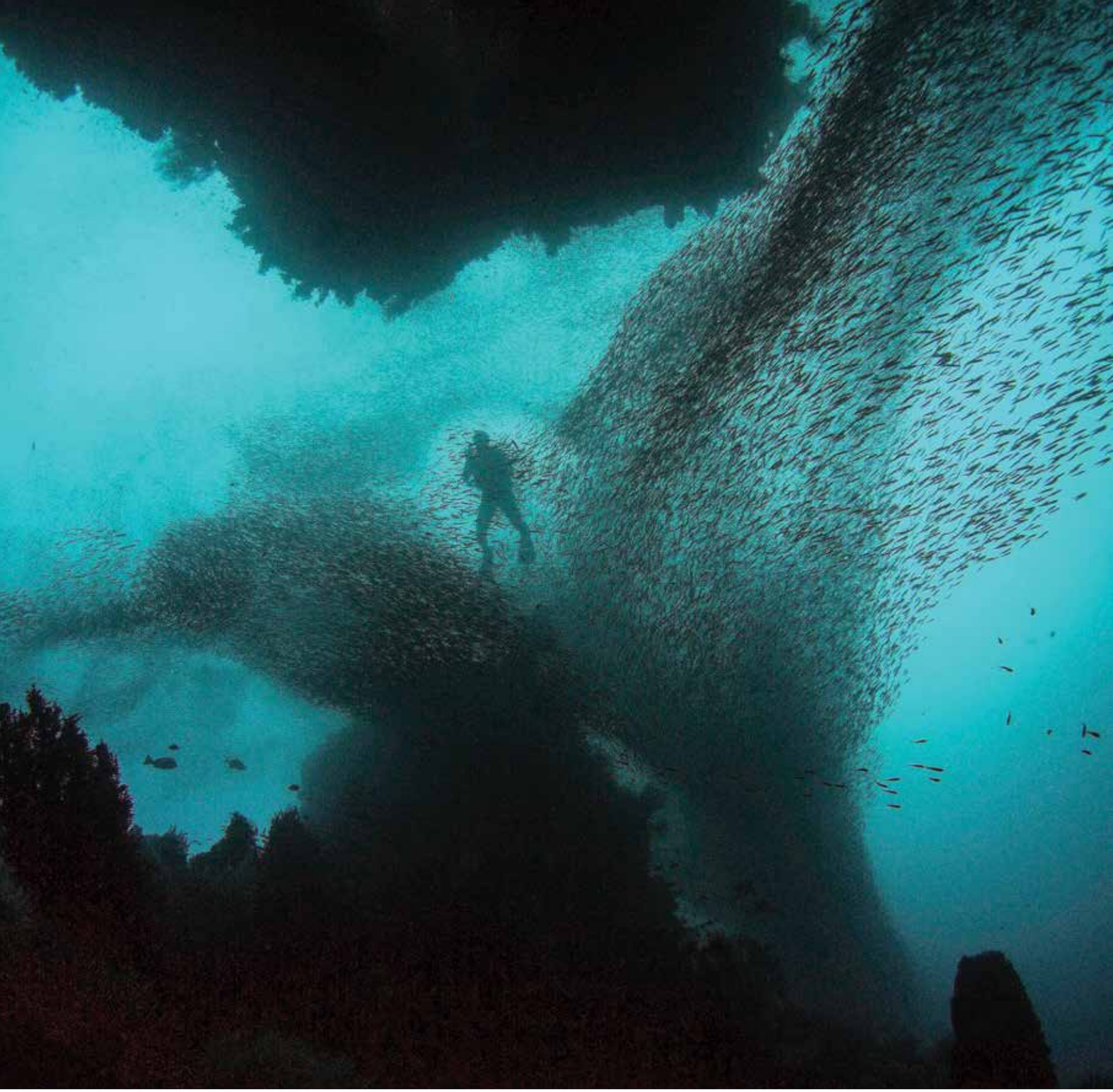
The key advantage of this system is that the charger becomes a secondary consumer; energy is primarily allocated to basic consumers such as refrigerators, air conditioners, ventilation systems, and other equipment, while only the surplus energy is used for charging electric vehicles. This approach ensures the stability of the facility's power system, without exceeding the contracted power capacity.

Additionally, the petrol station is partially powered by solar panels installed on the roof of the facility, which further enhances both efficiency and environmental sustainability of the system. During the day, the energy generated by the solar power plant is used to meet the station's needs and charge vehicles, thereby reducing energy consumption from the distribution network and contributing to a reduction in CO_2 emissions.

This project is the first of its kind in Serbia to enable dynamic energy management and the smart allocation of available power to an electric vehicle charger, allowing for the optimal utilization of limited energy resources. This is particularly significant today, given the growing limitations and increasing pressure on the national electrical grid.

Finally, it is essential to highlight that this solution is ideal for any facility with variable energy demand, especially those that generate their own electricity through solar panels, as it enables maximum use of available energy and minimizes environmental impact. Such facilities include petrol stations, shopping malls, hotels, logistics centers, and office buildings. The system is modular and scalable, making it easily adaptable to different user needs and facility capacities.

Ana Spasojević



THE SOUNDSCAPE OF THE SEA: THE LISTENING TO ITS DEPTH

Photograph: Unsplash/Thisisengineering

The underwater world is constantly alive with sound. The deeper you go, the more light fades, while sound continues its journey through water as vibrations, remaining a reliable guide. In such an environment, acoustics becomes a tool for understanding life beneath the surface. By carefully studying underwater sounds, scientists can track the presence and movements of marine species, as well as the impact of human activity on ecosystems. In the deep, dark, and remote realms of the oceans and seas, vibrations that travel through water – sound – become a vital form of communication. Marine species use it, in tune with their life rhythms, for communication, orientation, and hunting.

A hydrophone is a device that detects sound waves and is used to record and monitor underwater noise. Thanks to these underwater microphones, it is possible, for example, to trace the seasonal migration routes of some marine species. However, this tool also enables us to assess the impact of humans on marine habitats, and one of the current topics in this area is the development of wind farms.

Although wind turbines may appear silent from land as they produce clean, renewable energy, the situation underwater is more complex, as turbines emit low-frequency sounds that travel extensively through the water. One method of detecting their impact is by placing hydrophones near wind farms to analyze changes in the underwater soundscape before, during, and after construction. Based on the collected data, scientists can then determine whether marine species are altering their behavior, ceasing communication, or abandoning the area altogether. Experts believe that each location must be assessed individually, in line with its specific conditions.

During wind farm construction, significant work is carried out on the seabed, from drilling to piling, which causes considerable acoustic stress to marine species. Once construction is complete and the turbine is installed and put into operation, noise in the form of vibrations continues at a lower intensity for as long as the turbine remains active, on average, for more than two decades.

Sound waves travel faster and farther in water than in air, and fish detect them using, for instance, their inner ear or lateral line, which enables them to sense predators, prey, or other fish. Vibrations caused by construction or other human activity can potentially overlap with the natural signals animals use for survival. According to some analyses, although there is still insufficient data for firm conclusions, wind farms may also have a positive effect by limiting other human activities such as fishing.

In any case, research into the impacts requires specialized equipment that is difficult to obtain, and fieldwork is complex, demanding logistical and technical support that many scientific institutions lack. In such a challenging context, reliable tools become invaluable.

Despite the challenges, there are teams working on developing monitoring instruments. Loggerhead Instruments, a US-based company specializing in advanced acoustic devices, has created a series of acoustic recorders that enable long-term recording and analysis of underwater sounds. The company's products are used in oceans, lakes, and rivers worldwide to acoustically track and study aquatic life, from marine mammal behavior, migration, and communication, to their reactions to noise and the impact of industrial activity, ship traffic, and the study of underwater soundscapes. These devices operate autonomously and without constant supervision, allowing research in remote marine locations without disturbing the natural environment.

One concrete example, featured on the company's website, comes from the Pfleger Institute of Environmental Research (PIER) in the United States, where scientists have used Loggerhead equipment for many years to study the white seabass – a species native not to our region, but to the western coasts of the US and Mexico. During spring and early summer, they discovered through recorded sounds that these fish produce specific vocalizations, just after sunset, and during spawning periods. Thanks to this, researchers were able to determine exactly when and where the fish were spawning without capturing or disturbing them, which is vital for conservation efforts.

Prepared by Milica Vučković

By carefully studying underwater sounds, scientists can track the presence and movements of marine species, as well as the impact of human activity on ecosystems

Photograph: Unsplash/Timothy Dykes

THE WHISPER OF TREES – HOW TO RECOGNIZE SIGNS OF DECLINING HEALTH

As we sit in the shade of a large tree with a lush canopy and gaze up at it, the tree appears as a symbol of strength and longevity, firmly attached to the ground by its deep roots. Yet, behind this seemingly peaceful scene lies a daily struggle for survival. Due to climate change and improper care, maintaining healthy greenery is becoming increasingly complex. That is why we need to understand how to properly care for them and recognize the signs that indicate the need for help, as discussed with Professor Milka Glavendekić, PhD, a full professor at the University of Belgrade, Faculty of Forestry, Department of Landscape Architecture and Horticulture.

Regarding the health condition of trees, our interviewee states that it is determined through expert visual inspections. When there is suspicion of damage not visible to the naked eye, special devices such as a resistograph and ultrasonic tomograph are used. Over the past 15 years, pheromones — aromatic substances that insects use to communicate with one another — have been utilized for the early detection of insects that threaten tree health in elements of green infrastructure and forests. Tree health greatly depends on its age, but also on climate change, which creates conditions for the emergence of new and invasive pests. In older trees, rot and attacks by xylophagous insects are common, and without timely remediation, they can threaten vitality, stability, and shorten the tree's lifespan. Trees in newly established green areas are susceptible to solar radiation, which damages the bark, weakens the tree, and facilitates the growth of rot fungi and secondary insects, causing permanent damage.

Photograph: Unsplash/Marko Lengyel

Deciduous trees with thin bark, such as maple, ash, and linden, are also sensitive to solar radiation, while conifers, especially pines, are exposed to bark beetle attacks and pathogenic fungi. Over the past decade, new pests have emerged that target pines, cypresses, false cypresses, thujas, junipers, and other coniferous species. Climate change, such as prolonged dry periods or heavy rainfall, further threatens greenery. Therefore, it is essential to assess soil conditions before planting and seedlings have been transplanted and nurtured in nurseries for over 20 years and then planted in green infrastructure elements, annual inspections are required for the next five to six years. Seedlings after transplanting may carry hidden diseases or pests that are not immediately visible; the first symptoms appear only after two to four years. This is the most critical period for the application of integrated protection measures, as trees over 20 years of age are increasingly being planted and may carry quarantined, unqualified workers. Other problems include labor shortages, inadequate investment, and other challenges.

Milka Glavendekić, PhD
Full Professor at the University of Belgrade, Faculty of Forestry, Department of Landscape Architecture and Horticulture

Climate change, such as prolonged dry periods or heavy rainfall, further threatens greenery

In most cities and settlements, Public Utility Companies (PUCs) are responsible for the care and health of green areas. They are the first line of defense for early symptom detection and taking appropriate protective measures, and when needed, they seek expert assistance from authorized institutions or private companies. In cities without experts, problems are more complex to detect and are usually discovered too late. As our interviewee points out, citizens also play a crucial role, which is why training programs are conducted to recognize symptoms of certain harmful organisms. Early reporting training was held at the Faculty of Forestry, at the International Horticulture Fair, and in PUCs involved in the care and protection of green infrastructure elements, as well as at the Chamber of Engineers and its branches throughout Serbia. Therefore, it is essential to enhance cooperation among professionals, institutions, and citizens to preserve the greenery that makes cities healthier places to live.

Prepared by Katarina Vuinac

design suitable drainage and irrigation systems. Maintaining existing green areas implies regular care, fertilization, and protection, especially in the first years of tree growth. Additionally, monitoring new, climate-resilient cultivars necessitates ongoing professional development for landscape architects.

For trees younger than 30 years that show no visible symptoms of damage, expert inspections every five years are sufficient. For trees older than 60 years with visible damage symptoms, inspections should be conducted at least once a year. If harmful organisms as "stowaways". Expert inspections should be performed by professionals with at least a master's or doctoral degree.

In cities where maintenance measures are regularly implemented and damaged trees are removed, damage is significantly reduced. A good example of such practice is the city of Pančevo, particularly through tree care in the Narodna bašta park. The lack of or poor implementation of green space maintenance measures is often the result of insufficient knowledge of ornamental plants, a lack of continuous education, and the employment of

Photographs: (left) Unsplash/Mihail Ilchov; (Glavendekić) courtesy of Milka Glavendekić

WHEN LOCAL WASTE BECOMES A RESOURCE

Plastic is one of the greatest environmental challenges of our time – it decomposes slowly, often ends up in rivers, lakes, and forests, and harms not only plant and animal life but also human health.

Solving this issue involves reducing plastic use, improving recycling

Photographs: 3D Soba Company

systems, and switching to sustainable alternatives. However, plastic does not have to be waste – with creative ideas and smart technologies, it can be given a new life and a useful function. The Eko-Daska project from Montenegro is a brilliant example of this, as it showcases an innovative way of transforming plastic waste into useful items.

By integrating 3D technology, recycling, and social responsibility into a single process, the creative team at 3D Soba Company produces sustainable outdoor furniture from recycled plastic.

"Eko-Daska was born out of a desire to give plastic a second chance: instead of ending up in nature or landfills, it becomes a lasting, useful product. We make benches, tables, bins, and other elements from plastic waste collected and recycled in Montenegro. The project's goal is to show that sustainable production is possible even without large systems, and that local waste can become a local resource," says Aleksandar Mašić from the company.

He emphasizes that the story of "3D soba" stemmed from a personal passion for technology and creation, as well as a market need for affordable, fast, and precise production solutions. They started in a garage with a single printer, and today they are recognized even outside their country.

"Today, we offer 3D printing services, sell 3D printers and filaments, run modelling courses, and develop our own products – with the Eko-Daska project being the most significant," says Mašić.

The production process for the Eko-Daska was developed in-house and gradually refined. It is specifically designed for recycling local plastic waste and utilizes mechanical processing without the use of chemical additives. The materials used are HDPE and PP plastic, which undergo several stages of transformation to produce a stable, durable, and technically usable product.

The daily production capacity is around 60 meters of planks, with the potential to scale up to 120 meters depending on workload and shift organization. To date, they have delivered several hundred finished products, including benches, tables, chairs, bins, fences, and other elements. The Eko-Daska material itself can be used as a raw material for all types of outdoor furniture.

Unlike wooden products, these do not rot, do not absorb moisture, require no maintenance, last for years, and are significantly more affordable.

"There is great interest in these products, especially from municipalities and schools, which have so far had to replace wooden furniture frequently. Our products offer a long-term solution, with ecological and social benefits," Mašić explains.

Regarding raw material supply, he states that they have no difficulties, as there is more than enough local waste available. They have recycled several dozen tons of plastic so far, and source materials in cooperation with Deponija Podgorica and the Lovanja recycling yard.

"People often ask if they can bring us plastic waste themselves. Although we've allowed that on a few occasions, we're not yet systematically open to individual collection, but we plan to develop this in the future," says Mašić.

He adds that they have not received support from the government, international donors, or funds so far, and that their biggest challenge is balancing production with market recognition. He believes their success has come solely from dedication, quality, and a strong will to create something useful.

Although they currently sell only in Montenegro, there is interest from Bosnia and Herzegovina and Croatia. Customers find them through their website, social media, and word of mouth.

Looking ahead, they aim to expand their capacity, increase staffing, involve more cities and institutions, and develop new products and lines. Speaking to Energy Portal Magazine, they underline that each of their products demonstrates how a circular economy can work in practice and teaches anyone who sees them about the importance of environmental protection and the value of recycling.

Prepared by Jasna Dragojević

THE WORLD AQUATICS CHAMPIONSHIPS AS A MODEL OF SUSTAINABILITY

Ecology has become present in almost all areas of our society, no longer representing just a personal choice but also a social responsibility. The organization of various events, especially large and international ones, increasingly includes ecological aspects as an essential part of planning and execution. World-class sports competitions offer a unique opportunity to support sustainable solutions, thanks to their high attendance and accompanying audience. In this way, they simultaneously raise awareness about environmental protection while creating a positive image of themselves as socially responsible events.

The World Aquatics Championships in Singapore in 2025 will offer far more than thrilling competitions and spectacular performances – it is set to establish new standards.

Medals Made from Recycled Aluminum

One of the projects that has drawn significant attention is Trash to Treasure, which, for the first time at an event of this kind, introduces medals made from recycled aluminum cans. Around 100,000 aluminum cans will need to be collected to produce the 5,000 recycled medals that will be awarded to the top competitors. According to international media,

Photograph: Pixabay/Ronald Plett

approximately 20 cans will be used to make each medal.

What makes this project even more interesting is the involvement of schoolchildren in its realization, with the aim of raising awareness among young people. Pupils from preschools, primary, and secondary schools are participating in the collection of cans through the School Recycling League program.

Innovative Digital Technologies

Advanced digital technologies will also be deployed to monitor the environmental impact of the event in real-time. As the official sustainability partner, MVGX Tech Pte Ltd will use digital tools to track energy consumption, greenhouse gas emissions, and other factors. Monitoring will cover a wide range of aspects, from the venue itself to transport and accommodation for participants and visitors.

For the first time at an event of this kind, introduces medals made from recycled aluminum cans

A Decarbonization Rating System has been introduced to encourage responsible behavior and reward the most successful among suppliers and sponsors.

Spectators will not be left out of the project either. On the contrary, MVGX is developing innovative tools, such as a Carbon Diary, which will enable visitors to track and offset their carbon footprint through the official event app.

There will also be activities designed to encourage environmentally responsible behavior in a fun and competitive way.

Sustainability after the Championships

Special attention has been given to supporting local communities. Fifty thousand biodegradable pencils containing seeds will be distributed to children in local areas, which can be planted after use. In addition to the children, suppliers and sponsors will also have the opportunity to gain new knowledge about sustainability. In this regard, MVGX has launched a training program to provide essential information and tools for adopting environmentally friendly practices. This will help establish sustainable standards not only at this championship but also at future events.

This effort will be further supported by the creation of a dedicated guide for organizing future competitions. All data collected during the World Championships will be shared with international sports federations to serve as a model for environmentally responsible planning of future sporting events.

The World Aquatics Championships 2025 will set a benchmark not only for sports competitions but also for all large-scale social events. It will demonstrate the level of responsibility that gatherings of such scale require – and just how much can be achieved through a comprehensive approach that includes every individual in sustainable change. Protecting the environment does not have to be a burden – with good organization, knowledge, and a touch of creativity, we can create events that inspire, educate, and preserve our planet.

Prepared by Katarina Vuinac

Photographs: (middle) Unsplash/Meriç Dağlı; (bottom) Unsplash/Adam Cai


STIHL

NEW RULES SHAPE THE PELLET MARKET IN SERBIA

Clear rules have recently been established in the domestic wood biomass market, bringing more order, safety, and transparency. The quality of firewood, wood pellets, and wood briquettes is, for the first time, covered by unified rules that standardize the key characteristics of these fuels.

The Regulation on technical and other requirements for solid fuels from wood biomass placed on the market of the Republic of Serbia has been published in The Republic of Serbia's Official Gazette, which precisely defines physical-chemical parameters, sampling methods, and mandatory laboratory control.

When it comes to pellets and briquettes, an additional quality control measure has been introduced in the shape of reports issued by designated bodies and a mandatory declaration of conformity provided by producers and importers.

We discussed the implementation and potential effects of the new regulation with two interviewees representing complementary perspectives: Igor Milekić, a representative of the pellet industry and Commercial Director of Sparrow d.o.o., and Professor Branko Glavonjić, PhD, full professor at the Faculty of Forestry, University of Belgrade, and one of the main authors of this regulation.

The Importance of the Regulation from a Producer's Perspective

According to Milekić, the idea of drafting the regulation originated back in 2017, when major producers, in cooperation with Professor Branko Glavonjić, raised concerns over drastic inconsistencies in the quality of domestic pellets. The initiative was revived last year, partly due to the dramatic drop in production and sales after 2023, with strong logistical support provided by the Serbian Chamber of Commerce.

Milekić adds that similar regulations already exist within the EU, under the auspices of international organizations such as ENplus, which brings together, registers, certifies, and monitors pellet producers and traders worldwide. Twelve out of approximately 90 domestic pellet producers in Serbia are currently affiliated with this organization.

"This regulation, with its technical requirements, is harmonized with the standards set by ENplus, and it also establishes a market quality control procedure that is significantly stricter, taking into account the presence of unfair competition and critically poor-quality structures in the domestic market," Milekić explains.

Under the new rules, every pellet producer or importer must now prove compliance of their finished product with twenty-one clearly defined parameters twice a year. Accredited domestic laboratories, upon request, visit factories, take samples, and complete analyses within a few days. If the results meet the prescribed ranges, a quality declaration is issued and attached to each individual bag,

Photographs: (on previous page) Unsplash/Kasia

valid for six months until the next inspection. The cost of a single analysis is estimated to be several hundred euros, not a significant burden in relation to overall production costs.

The State of the Domestic Market – Challenges and Outlook

In terms of market impact and competitiveness among domestic producers, pellet manufacturers already holding an ENplus certificate, including Sparrow d.o.o. – will not face increased pressure, but will instead benefit from a level playing field without discrimination. Producers who have not previously conducted regular inspections will need to establish a minimum process, which will, in turn, raise standards and likely improve their market position. Once they meet the requirements of the Regulation, Serbian factories will be practically ready to apply for an ENplus license, opening the door to exports to the EU and neighboring regions, where this label has long been the gold standard.

Following dynamic growth between 2016 and 2022, the Serbian market has experienced a significant decline in demand. Its peak came in 2021 and 2022, when estimated demand reached approximately 500,000 tons of wood pellets, placing Serbia among the top 10 wood pellet markets in Europe.

"At that time, the largest market was Italy, with around 3.2 million tons, followed by France and Germany with two million tons each, and Austria and Switzerland with one million tons each. Due to its market size, Serbia also attracted imported pellets, especially during the 2022 energy crisis. Between 2018 and 2022, annual imports were around 80,000 tons of wood pellets," says Milekić.

However, 2023 marked a sharp turnaround. A second consecutive

Photographs: (top) courtesy of Igor Milekić; (bottom) Pixabay/Willfried Wende

mild winter, combined with an unfavorable price ratio of pellets compared to wood, gas, and electricity, led to a drop in demand in Serbia and across Europe. The estimate for 2024 is only about 300,000 tons of domestic consumption (a 40 per cent decrease compared to 2022), while the European average fell by more than 60 per cent. The difference in the degree of decline was partly due to measures taken in 2022, when a working group (comprising producers, Professor Glavonjić, the Ministry of Mining and Energy, and the Serbian Chamber of Commerce) capped the retail price at 38 RSD/kg, thus retaining a portion of customers.

The main innovation is that only pellets of A1 and A2 quality classes are now permitted on the market – class B is no longer allowed

As Milekić further explains, there is sufficient raw material, with Srbijašume remaining the main supplier, but the key challenge is now market placement. The forthcoming implementation of the Regulation opens the possibility for domestic factories to enter foreign markets more easily with standardized quality, fill their capacities, and benefit from economies of scale. This is crucial, as current retail prices are below average, and only higher volumes and export channels can ensure price and quality competitiveness. The Regulation could become a key tool for sector recovery, price stabilization, and the long-term development of domestic bioenergy, precisely what the pellet industry needs after several turbulent years.

Key Innovations from the Perspective of Professor Branko Glavonjić

As Professor Glavonjić explains, the Regulation was introduced with several main objectives – primarily to establish a unified, mandatory quality control system for wood fuels on the Serbian market. This simultaneously protects end consumers from poor-quality pellets or briquettes and removes unfair advantages from companies that have so far avoided laboratory testing, thereby ensuring equal business conditions for all producers and importers. Accordingly, the most significant innovation regarding firewood is the requirement for sellers to issue a declaration of conformity at the point of sale, ensuring that the firewood's parameters comply with the requirements outlined in the Regulation. In this way, sellers are obliged to deliver the quantity and quality of firewood that the customers have paid for.

Regarding wood pellets, the main innovation is that only pellets of A1 and A2 quality classes are now permitted on the market – class B is no longer allowed. Therefore, only the highest-quality wood pellets will be available on the Serbian market in the future.

Another important change concerns the obligation for producers to carry out semi-annual quality control

Photograph: Pixabay/Moses

of their pellets, covering 21 parameters divided into three groups:

- Physical characteristics of wood pellets (dimensions, bulk density, mechanical durability, fine particle content, presence of additives)
- Chemical characteristics of wood pellets (ash content, ash melting behavior, nitrogen, sulfur and chlorine content, presence of heavy metals)
- Energy characteristics of wood pellets (moisture content, net calorific value)

To qualify for A1 class quality, every parameter must meet the prescribed values for that class. If even one parameter fails to comply, the pellet is classified as A2 quality.

"Based on the completed inspection and the report issued by a designated domestic laboratory, producers must place a declaration of conformity on each individual package (every plastic bag) of wood pellets. The Regulation stipulates the procedure domestic laboratories must follow in the quality control process of wood pellets, as well as the contents of the reports they issue to producers. The most important change in this procedure is that sample collection for quality testing must be carried out directly at the production site, not based on samples provided by the producer, as was previously the case with some manufacturers," explains Professor Glavonjić.

When it comes to imported pellets, the Regulation sets out three options. The first is that the foreign producer hires an accredited domestic laboratory to collect samples and issue a quality control report. Based on this report, the producer issues a declaration of conformity, allowing the pellet to enter the Serbian market. The second option is that if the producer does not do so, the importer must, after customs clearance, engage a domestic laboratory to inspect each batch of pellets; based on this report, the importer applies the conformity declaration to each package. The third option allows for the recognition of reports from foreign laboratories, provided all requirements of the Serbian Regulation are met and there is a mutual recognition agreement in place with the domestic laboratory. The list of accredited laboratories is published on the website of the Ministry of Mining and Energy.

Positive Effects of the Regulation

The implementation of the new Regulation, which begins on 19 July, is expected to have positive effects for consumers and other market participants for several reasons. The introduction of a unified quality control system for wood pellets and briquettes will apply equally to all market participants.

"The obligation to meet standards and undergo quality control should eliminate the presence of poor-quality wood pellets and briquettes, which will increase consumer confidence in these wood fuels. Buyers will have clearer information about the quality of the fuel they are purchasing, which means fewer issues related to combustion, ash, and equipment damage," says Professor Glavonjić.

The Regulation will also contribute to environmental protection, as it defines limit values that wood pellets and briquettes must meet concerning emissions of certain gases during combustion. Producers whose fuels fail to meet these requirements will not receive a positive quality control report from designated laboratories and, therefore, will not be allowed to place such fuels on the market until they reach the required quality.

In conclusion, the new Regulation on technical and other requirements for solid fuels from woody biomass represents an important step toward regulating the domestic market and raising the quality of pellets and briquettes in Serbia. It is expected that the Regulation will support the sector's recovery, strengthen the competitiveness of domestic producers, and increase confidence in wood bioenergy as a sustainable heating solution.

The Regulation will also contribute to environmental protection, as it defines limit values that wood pellets and briquettes must meet concerning emissions of certain gases during combustion

Prepared by Milica Vučković

Prof. Branko Glavonjić, PhD

Full Professor at the Faculty of Forestry, University of Belgrade

Photograph: courtesy of Branko Glavonjić

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