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Waste as a Resource – The Path to Sustainable Energy in Serbia

Michelle Cameron
Ambassador of Canada to Serbia

Towards Sustainable Development and Environmental Protection

Circular economy

HUMAN HEALTH IS DIRECTLY DEPENDENT ON THE HEALTH OF NATURE

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Exactly a year ago, we launched the Energy Portal of Bosnia and Herzegovina with a clear goal – to be your first and proper address for information on renewable energy sources, energy efficiency, e-mobility, climate change, green investments, and all key topics in the energy world.

Over the past 12 months, we have explored, informed ourselves, and raised awareness about sustainable projects that shape our future. Your support has shown us that we are on the right track – thank you for your trust, suggestions, criticism, and praise!

We are celebrating this anniversary with a promise to continue supporting you in the world of energy transition by providing accurate, relevant, and timely information. Therefore, we invite you to continue following us and sharing the topics you want us to explore.

Be part of our mission – because only together can we build a sustainable future!

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WORD OF THE EDITOR

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Dear readers,

The circular economy is increasingly taking center stage in discussions about resource conservation, environmental protection, and enhancing the quality of life for both current and future generations. Rather than following a linear model of consumption and disposal, circular approaches provide solutions that extend the lifespan of products, minimize waste, and maximize resource utilization – which is vital for a sustainable future.

That's why, in this issue, we bring you inspiring stories and analyses that highlight how the circular economy can shape a better world. We spoke with the Ambassador of Canada to Serbia, Michelle Cameron, who revealed how this country is facing climate challenges and what valuable lessons we can apply to our environment. Additionally, we discussed with the Head of the Center for Circular Economy at the Chamber of Commerce and Industry of Serbia how this model can boost the domestic economy and align it with European standards.

Furthermore, we investigated how Užice successfully reduced the concentration of PM particles in the air, how Montenegro integrates circular economy principles into its legislation and the potential for its development in Bosnia and Herzegovina.

You will learn from renowned experts how waste in Serbia can be used to generate electricity and how wastewater treatment and hydrogen production can go hand in hand. We also bring you a new section, Eco-Innovations, which presents the most interesting ecological innovations that change how we approach waste, paving the way for a more sustainable future.

In the much-loved People and Challenges section, we will introduce inspiring stories of individuals who have turned waste into something admirable. These stories will remind us that creativity and dedication can bring about great change.

We believe that this issue will provide you with valuable insights and inspiration to contribute to the transition to a more sustainable way of life.

Nevena Đukić
editor-in-chief

Photograph: courtesy of Nevena Đukić

IN THIS ISSUE...

Countries in the region are making significant strides in implementing a circular economy (CE), which is vital for reducing dependence on primary resources, boosting competitiveness, and protecting the environment.

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TOWARDS SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL PROTECTION

Known for its natural beauty, wealth of resources, and high standard of living, Canada, the second-largest country in the world, spans territories that encompass diverse ecosystems, from imposing mountains to vast forests and lakes. The country is a leader in innovation, education, and sustainable development, playing a key role in global issues, from the economy to environmental protection. Given its wealth of natural resources, Canada has set high standards for nature conservation while supporting progress in industry and technology, as explained by Michelle Cameron, the Ambassador of Canada to Serbia.

Canada is the second-largest country in the world and the only one with access to three oceans

Q: Canada ranks highly on the Environmental Performance Index (EPI). What are the key factors contributing to this position? How do you plan to improve your position on this global index?

A: That's correct. Canada's high EPI rating reflects our strong commitment to environmental sustainability and proactive approach to overall natural resource management. The score is a direct result of Canada's consistently strong emphasis on protecting biodiversity and natural habitats and improving air and water quality. We have robust environmental policies and laws supporting sustainable development, ensuring that generations can benefit from Canada's abundant natural resources.

While we are proud of our collective efforts, we are even more proud of our nature. Canada has the 2nd largest territory in the world and is the

Photograph: Embassy of Canada

only country with access to 3 oceans. Additionally, more than 60 percent of the world's lakes are found within the country, giving Canada 7 percent of the world's renewable fresh water. Our extensive boreal forests cover 60 percent of the country's land area, which plays a crucial role in carbon storage, air and water purification, and climate regulation. We take our stewardship responsibilities seriously.

Canada could not achieve such a high ranking in the EPI without the commitment of our citizens and elected governments at all levels. This support has led to the establishment of national air quality standards to limit the concentration of harmful pollutants. These standards, coupled with concrete progress in transitioning to cleaner energy, have led to a significant reduction in air pollution across the country. We also have an extensive network of monitoring stations that measure air quality across the country. Combined with strict standards and policies, it gives us fresh air and places Canada first in the EPI Air Quality Index. Canadian citizens are also behind the country's sustainable forest management strategy, which includes strict laws and science-based practices, such as requiring approved forest management plans for forestry operations on public land and establishing protected areas to conserve critical habitats. In marine management, Canada employs an integrated ocean management approach, creating a network of Marine Protected Areas (MPAs) to conserve marine biodiversity and habitats, coordinated by the Federal Marine Protected Areas Strategy to protect important fish and marine mammal habitats, endangered species, and areas of high biological productivity. This ensures a sustainable industry for those working in this sector.

Like any country, there is room for improvement and readjustment of existing practices, policies, and laws to address environmental protection. Climate change poses a significant threat to the world, including Canada, impacting both our forests and agricultural sector. The increasing frequency and intensity of wildfires, exacerbated by climate change, have led to record-breaking destruction, with 2023 witnessing the most catastrophic wildfire season ever. These fires are becoming larger and more frequent than ever before, posing serious risks to the environment and public health. Similarly, climate change impacts the agricultural sector through unpredictable temperatures, shifting precipitation patterns, and more frequent extreme weather events. These lead to less food production through decreased crop yields and crop failures. These climate-induced changes underscore the urgent need for comprehensive environmental protection strategies to mitigate and adapt to climate change impacts.

MICHELLE CAMERON currently serves as the Ambassador to the Republic of Serbia, Montenegro, and North Macedonia. She has extensive experience in international diplomacy. She began her career as Ambassador to the Lebanese Republic, with responsibilities for Syria, and served as Advisor and Consul in Afghanistan. She was also the Second Secretary in Turkey. In addition, she participated in long-term humanitarian missions in Mali, Iraq, Haiti, and Costa Rica. Recipient of numerous awards throughout her diplomatic career, the broad experience in various fields underscores her commitment to public service and international cooperation.

Through science-based discussions between Canada's citizens and governments, we will continue to advance in protecting our environment.

Q: You are significantly investing in energy transition and reducing dependence on fossil fuels. What are the main strategies and initiatives your country is implementing to accelerate the shift to sustainable energy sources?

A: Over the past five years, Canada has made significant strides in its energy transition through a combination of laws, action plans, and successful initiatives. The federal government has implemented several

Photographs: (bottom) Shutterstock; (Cameron) courtesy of Michelle Cameron

key policies, including the Canadian Net-Zero Emissions Accountability Act, which legally binds Canada to achieve net-zero greenhouse gas emissions by 2050. Additionally, the Clean Fuel Standard aims to reduce the carbon intensity of fuels used in transportation, industry, and buildings. These laws are complemented by action plans such as the Pan-Canadian Framework on Clean Growth and Climate Change, which outlines measures to reduce emissions, invest in clean technology, and build resilience to climate impacts.

Canada's efforts have yielded notable successes. The country has seen a significant increase in renewable energy capacity, particularly wind and solar power. Investments in clean technology and infrastructure have also grown, supported by initiatives like the Canada Infrastructure Bank's Growth Plan, which allocates funds for clean energy projects. Moreover, the phase-out of coal-fired electricity by 2030 is on track, with several provinces already making substantial progress. These achievements underscore Canada's commitment to a sustainable energy future and its role as a leader in the global energy transition.

Q: What are the most important renewable energy sources in Canada? How are you preparing for a future where renewables will become the primary energy source? What are the biggest challenges you face in this area?

A: Canada has made significant progress in expanding its renewable energy sources over the past several years. Canada has an installed renewable energy capacity of 106 gigawatts, making it one of the leading countries in this sector. Hydroelectric power remains the dominant source, accounting for 62 percent of the country's electricity generation. Wind and solar power have also seen substantial growth, with wind capacity increasing by approximately 20 percent and solar capacity by around 30 percent since 2018. In addition to hydro, wind, and solar, Canada continues to leverage its nuclear power capabilities, which contribute about 13 percent to the national electricity mix. Our commitment to clean energy is further demonstrated by Canada's status as the world's third-largest producer of hydroelectricity and the second-largest producer and exporter of uranium. These efforts have positioned Canada as a global leader in renewable energy, with a clean electricity mix that is among the highest in the world.

This data makes us proud, but it's not to say that there are no challenges ahead of us in reaching a Net-Zero economy by 2050. As per recent research done by the Renewable Energy Association Canada (CanREA), Canada will need to deploy 3800 MW of wind and 1600MW of solar energy annually for the next 25 years to reach the planned reduction of fossil fuel use and hit the net-zero target. This will require strong policies, funding resources, and community support to provide sustainability and environmental protection. As per this report, Canada's energy transition plan includes five key tasks: decarbonizing electricity production by 2035, modernizing electricity markets and regulatory structures for cost-effective grid decarbonization and expansion, building new wind, solar, and energy storage to ensure cost-effective procurement of decarbonized electricity, rethinking infrastructure investments to minimize costs for new transmission and distribution, and using decarbonized electricity to reduce greenhouse gas emissions in transportation, buildings, and industry sectors.

Canada has also focused on improving energy efficiency and reducing emissions in the construction and agriculture sectors

Q: Canada is a leader in implementing the Green New Deal and similar initiatives that integrate renewable energy, carbon emissions reduction, and economic revitalization. How do these initiatives work in practice, and what results do you expect in the coming years?

A: The Pact for a Green New Deal (PGND) in Canada, launched in May 2019 by a grassroots coalition of civil society groups, aimed to address environmental degradation, climate change, poverty, and energy insecurity through coordinated state policy. With over 150 town hall meetings, participants called for 100 percent renewable energy, phasing out oil sands, a 50 percent reduction in emissions by 2030, creating 1 million green jobs, and reconciliation with Indigenous Peoples. The Canadian green transition is significant globally due to its high-energy production and use. It involves reorienting government expenditure to spur innovation while addressing social and political challenges like energy democracy, Indigenous leadership, gender equity, and energy poverty.

Canada's Green New Deal (PGND) is fully aligned with the government's Federal Sustainable Development Strategy (FSDS) in its overarching goals of addressing climate change and promoting sustainable development. Both initiatives aim to reduce greenhouse gas emissions, transition to renewable energy, and ensure social and economic justice.

The 2022 to 2026 Federal Sustainable Development Strategy (FSDS) consolidates sustainable development goals, targets, milestones, and implementation strategies from 101 federal organizations, providing a comprehensive view of Canada's priorities. Developed under a strengthened Federal Sustainable Development Act, it aligns with the UN's 17 Sustainable Development Goals and balances environmental, social, and economic dimensions. The FSDS includes 50 targets, 114 milestones, and 162 implementation strategies, focusing on net-zero emissions, biodiversity conservation, reconciliation with Indigenous communities, gender equality, and economic growth. It emphasizes transparency and accountability, with progress reports and public consultations shaping its evolution.

Q: What are Canada's main policies to protect its ecological values, particularly in biodiversity conservation and ecological balance?

A: By far, the most important strategy for preserving our nature is Canada's 2030 Nature Strategy. Nature is integral to Canada's identity and daily life, but the world's biodiversity is declining at an unprecedented rate, threatening essential services like clean air, water, and food security. Indigenous Peoples, the original stewards of Canada's lands, face threats to their constitutionally protected rights and traditional ways of life due to biodiversity loss. Canadas 2030 Nature Strategy outlines how the country will implement these goals. This strategy builds on existing initiatives but recognizes the need for transformative change through a whole-of-government and whole-of-society approach, emphasizing partnership, collaboration, and innovative solutions.

The 2030 Strategy envisions a future where nature is thriving and enriching lives, guided by six pillars: upholding Indigenous rights, ensuring policy coherence, supporting a resilient economy, empowering community action, using the best available science and knowledge, and applying holistic approaches. The strategy addresses all 23 The Kunming-Montreal Global Biodiversity Framework targets, with the federal government leading by example through significant investments in conservation and climate

Photographs: Shutterstock

solutions. However, success requires provincial, territorial, Indigenous, and private-sector leadership. Achieving a nature-positive Canada will enhance well-being, economic prosperity, and quality of life for current and future generations.

Q: How does Canada approach waste management, recycling, and plastic waste waste on the environment?

A: In Canada, plastic production is a USD 35 billion industry employing close to 100,000 people in nearly 2,000 businesses that make and recycle plastic products. Yet every year, Canadians throw away over 3 million tons of plastic waste from our homes and businesses. Almost half of that is packaging. The rest comes from sectors like construction, textiles, agriculture, automotive and electronics. Implementation of the Strategy involves developing regulations, setting targets, and promoting sustainable practices, such as eliminating single-use plastics in government operations and increasing plastic recycling and recovery. The strategy emphasizes innovation, public engagement, and international cooperation to achieve its goals.

In Canada, approximately 97 percent of the waste requiring final disposal is sent to landfills, and 3 percent is incinerated. Provincial and territorial authorities establish waste reduction policies and programs and approve and monitor waste management facilities and operations, including incinerators, landfills, and composting facilities. Municipalities are responsible for collecting, recycling, composting, and disposing household waste. Final waste treatment options such as landfilling and incineration have environmental impacts, including the release of pollutants into the air and water.

Canada adopted the Towards Zero Plastic Waste Strategy in 2018, aimed at eliminating plastic waste and pollution through a comprehensive, collaborative approach involving federal, provincial, and territorial governments, industry, and civil society. The Strategy builds on the Ocean Plastics Charter and includes the Canada-wide Action Plan on Zero Plastic Waste, which outlines actions to improve plastic circularity and reduce pollution.

Q: Electromobility is becoming a key trend in the fight against climate change. How is Canada developing infrastructure for electric vehicles, and how could this sector contribute to reducing greenhouse gas emissions?

A: In 2023 alone, more than 320,000 new EVs were registered across Canada. Canadians are transferring to EVs in an attempt to reduce their energy expenses, which results in GHG emissions as well. The Government of Canada remains committed to supporting this transition by ensuring that all new passenger vehicles sold in Canada are zero-emissioned by 2035. However, this massive transition needs to be supported with appropriate infrastructure, especially in a country with 2nd largest territory, such as Canada.

Since 2016, Canada has invested over USD 1 billion to make electric vehicles (EVs) more affordable and chargers more accessible. Budget 2019 and the 2020 Fall Economic The statement allocated USD 280 million to the Zero Emission Vehicle Infrastructure Program (ZEVIP) for deploying 33,500 EV chargers and 10 hydrogen refueling stations. Budget 2022 added USD 400 million to ZEVIP and extended it to 2027, alongside USD 500 million from Canada's Infrastructure Bank for large-scale charging and refueling infrastructure. By 2029, Canada aims to deploy 84,500 chargers and 45 hydrogen stations.

Q: What are Canada's main strategies for mitigating the effects of climate change? How are you preparing for future climate challenges, especially in agriculture and infrastructure?

A: In March 2022, the Government of Canada released the 2030 Emissions Reduction Plan (2030 ERP), a comprehensive roadmap to achieve a 40 percent reduction in emissions below 2005 levels by 2030 and net-zero emissions by 2050. The

Photograph: Shutterstock

plan, developed with input from over 30,000 Canadians and various stakeholders, includes strategies such as carbon pricing, clean fuels, and methane reduction. Key initiatives since 2019 include implementing a carbon price, proposing Clean Fuel Regulations, and investing in the Hydrogen Strategy and Clean Fuels Fund. The government has also launched the Low-Carbon Economy Fund and Climate Action and Awareness Fund and joined the Global Methane Pledge. Future actions include expanding the Low Carbon Economy Fund with USD 2.2 billion, exploring measures to guarantee carbon pricing, and investing in Indigenous Climate Leadership and Regional Strategic Initiatives.

Canada has also focused on improving energy efficiency and reducing emissions in the buildings and agriculture sectors. Significant steps include the USD 2.6 billion Greener Homes Grant, the USD 1.5 billion Green and Inclusive Community Buildings program, and various initiatives supporting Indigenous housing. Future investments include USD 150 million for the Canada Green Buildings Strategy, USD 458.5 million for the Greener Homes Loan Program, and USD 200 million for deep retrofits. In agriculture, initiatives like the USD 3 billion Canadian Agricultural Partnership and the USD 165.7 million Agriculture Clean Technology Program aim to reduce emissions, with new actions including USD 470 million for the On-Farm Climate Action Fund and USD 330 million to expand the Agricultural Clean Technology program. The government will also advance a Green Agricultural Plan and explore tools to expedite technology adoption and reduce emissions.

Q: Canada and Serbia share a common desire for sustainable development. Which areas in energy transition, renewable energy, or environmental protection do you consider key for further development of our bilateral cooperation?

A: If we reflect on the previous 8 questions, Canada and Serbia not only share a commitment to sustainable development, but we can cooperate, bilaterally or multilaterally, in almost every sub-sector of sustainable development or fight against climate change, regardless of how you name it. Canada and Serbia are both signatories of the Paris Agreement, a call for global partnership in reducing emissions and achieving a global net-zero economy. Canada and Serbia can cooperate through the Paris Agreement by setting and achieving ambitious emission reduction targets, sharing advanced technologies and innovations, and building capacity for climate action, providing financial support, collaborating on adaptation strategies, and enhancing transparency and reporting mechanisms.

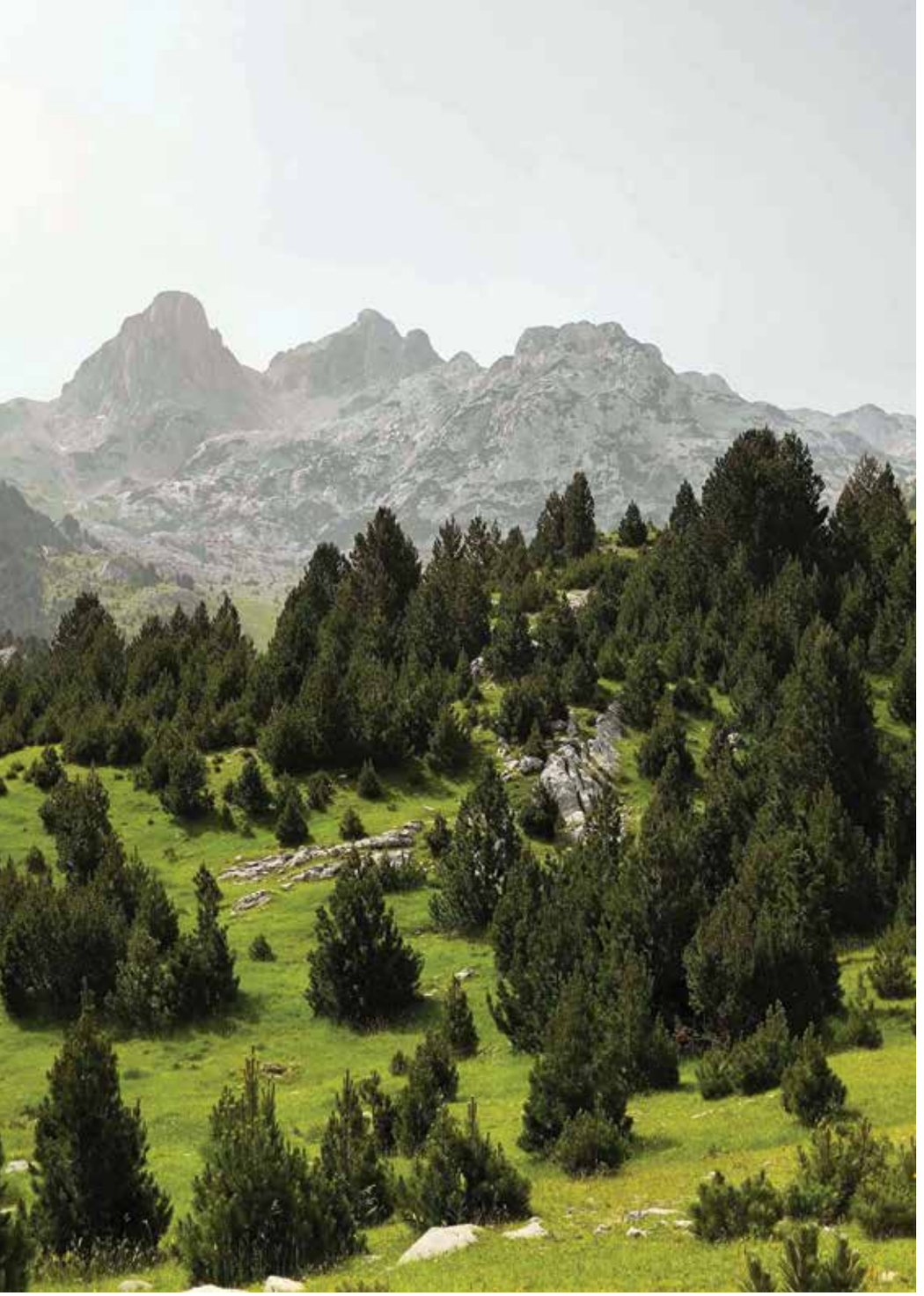
Other than cooperating through multilateral initiatives such as the Paris Agreement or the Powering Past Coal Alliance, co-established by Canada and France with the purpose of encouraging countries to phase away from fossil fuels to renewable energy sources, our countries can also directly share best practices in the industrial sector.

The inevitable source of a sustainable economy is critical minerals. Canada and Serbia are both resource-rich countries, which is a strong contributor to the security and sustainability of our economies. To maximize the benefits of our wealth of resources, the Government of Canada has developed the Strategic Innovation Fund. Established in July 2017, Canada Strategic Innovation Fund (SIF) drives economic growth and innovation across sectors like clean technology and advanced manufacturing. By leveraging critical minerals, the SIF supports the development of downstream industries such as electric vehicle (EV) and battery production, ensuring a stable supply of essential materials and reducing reliance on imports. The fund has significantly impacted job creation, generated thousands of high-quality jobs, and fostered a robust innovation ecosystem. It has also attracted major international investors, including Ford, GM Canada, Vale, Umicore, BASF, Northvolt Batteries, and Volkswagen, positioning Canada as a leader in the global transition to a low-carbon economy.

This is an excellent example of how a government can responsibly manage country resources for the benefit of our people, and we would be thrilled to share this sort of best practice with Serbia.

Interview by Milica Radičević

Photograph: Embassy of Canada



TOURISM CONFIRMS THAT POSITIVE CHANGES ARE POSSIBLE

Bosnia and Herzegovina, as a country in energy transition, faces numerous challenges in environmental protection. The problem of illegal landfills, inadequate waste management, and highly polluted air, which ranks among the worst in the world, are just some of the environmental issues requiring urgent attention. We spoke with Nasiha Pozder, the Federal Minister of Environment and Tourism, about the current problems, made progress, and future plans.

Q: What would you highlight as the most significant achievements of the past year?

A: The primary function and task of the ministry is to develop strategic frameworks and laws, which need to be supported by the Government and passed by both houses of the Federal Parliament. It may sound very bureaucratic, perhaps even uninteresting. Still, it is actually a dynamic process that involves analyzing needs and conditions and consulting experts, industry, citizens, and decision-makers at all levels. In the end, I am satisfied because, in the past year, we managed to achieve meaningful, planned goals.

Amendments to the Law on Nature Protection and the Law on Waste Management have come into force. We have also adopted a new Air Law, launched the development of the Waste Management Plan for the Federation of Bosnia and Herzegovina (FBiH), and just recently adopted the Regulation on Strategic Assessment.

What I am particularly proud of is that all the mentioned legislative solutions were adopted almost unanimously, with strong support from both ruling and opposition representatives in Parliament. I am convinced that this resulted from thorough preparation and continuous dialogue with cantons and other levels of government.

Photograph: Federal Ministry of Environment and Tourism

Citizens must not lose hope that positive changes are possible. I genuinely believe they are, and perhaps the best example of this is tourism and its development. Last year, we achieved the best results since we started keeping statistical records.

When we compare the total number of tourists for the period January–December 2024 with the same period in 2023, the number of arrivals and overnight stays increased by 12.97 percent. Compared to 2022, the increase was 34.80 percent, and compared to 2019, 17.62 percent.

In 2024, the total number of domestic tourists was 1,057,782, while the number of foreign tourists reached 3,184,520.

These numbers are encouraging and serve as a guiding light for our future efforts. Last year, we had current and capital transfers for tourism development amounting to four million KM. I believe that the projects that received public funds also contributed to the record-breaking tourist season.

We also initiated the process of protecting Mount Prenj and Mokra Megara and contributed to the designation of the first protected areas in Posavina, including Starača Marsh and Tišina. Additionally, we carried out numerous activities in the field of waste management, making 2024 a highly successful year from our perspective.

Q: What are the main current issues in your sector?

A: There are many challenges. I don't like to refer to jurisdictions, but in the complex administrative framework in which we operate, this often takes up time and energy. For this reason, I regularly organize meetings with cantonal ministers responsible for tourism and the environment. We find ways to resolve many challenges, and as I have already mentioned, this has helped us adopt several important legislative solutions in the first half of our mandate.

The last coordination meeting with tourism ministers was held at the end of the year, where we also discussed the new Law on Tourism in the Federation of Bosnia and Herzegovina (FBiH).

We have a clear plan and a timeline of activities related to this legislative solution, and I hope that by 2025, we will have a new Law on Tourism.

Numerous challenges exist in environmental protection, where illegal landfills represent significant issues, along with unresolved property-legal, administrative, technical, and other challenges. Additionally, when issuing environmental permits, it is crucial to adhere to legal regulations strictly, considering the interests of both local residents and investors.

NASIHA POZDER graduated from the Faculty of Architecture at the University of Sarajevo in 2003 and earned her PhD in Architecture and Urbanism in 2013. Since 2004, she has been employed at the Faculty of Architecture, University of Sarajevo, in the Department of Urbanism and Spatial Planning, where she was appointed as an assistant professor in 2018. Since 2009, she has also been engaged at the Institute for Architecture, Urbanism, and Spatial Planning, where she contributes to the development of spatial planning documents for cities across Bosnia and Herzegovina. She is the author of numerous scientific papers, studies, and publications.

Q: What do the amendments to the Law on Waste Management in FBiH entail?

A: The amendments to the Law on Waste Management in FBiH address two key issues: waste disposal sites in municipalities and cities and the operational activities of inspections in the field. They include criminal provisions for specific waste categories, such as tires, oils, and similar materials.

Photographs: (bottom) Pixabay/Kerim Sarıgül; (Pozder) Federal Ministry of Environment and Tourism

We successfully harmonized the text in both houses of Parliament. Under this legislative solution, waste management can now be carried out by appropriate municipal, inter-municipal, city, inter-city, cantonal, inter-cantonal, and regional centers, which was not previously the case.

Additionally, legal prerequisites have been created for the proper and complete implementation of the Law on Waste Management in practice, aligning it with EU legislation. The issue of waste disposal sites is now being more precisely regulated, and further details will be defined in an implementing act that is currently under development.

Furthermore, the amendments define the amounts of financial penalties based on the severity of the offense for specific waste categories, something that was previously not covered by the law.

We are currently working on a completely new, comprehensive, and, I would say, boldly structured law aimed at reassessing current waste management practices. The draft of this law is expected to be available for public review by the end of this month, and we look forward to receiving constructive proposals and valuable suggestions.

Q: Where does Bosnia and Herzegovina stand on the path to responsible waste management?

A: I dedicate a significant portion of my working time to this issue. We are trying to push things forward across the entire Federation. We have adopted the Environmental Protection Strategy of the Federation of Bosnia and Herzegovina (FBiH), which clearly highlights this issue as one that requires systematic and long-term efforts.

We must learn to manage waste properly rather than simply disposing of it in unregulated landfills, where it becomes a problem. In developed countries, waste is considered a valuable raw material, an energy source, and even a sector that creates jobs. Unfortunately, in our country, this issue still represents a burden—primarily on human health but also on the state of the environment and public budgets.

The Waste Management Plan for FBiH will provide us with a roadmap for solving waste management issues, and we expect its adoption in the fall of this year. We have been without a plan or strategy for the past seven years, which means we have been addressing waste management issues sporadically and ad hoc rather than systematically.

Q: When will the first effects of the air protection law be seen?

A: The previous law was last amended and supplemented in 2010. Unfortunately, we are witnessing a deterioration in air quality, particularly in urban industrial areas. Analyses indicate that household heating is the largest single source of air pollution, followed by urban traffic and, of course, industry in areas where it is developed.

The new law establishes a stronger institutional framework for air quality management and monitoring. Most importantly, it opens up opportunities for reactive measures, project implementation, and initiatives, such as the World Bank's project for air quality improvement, for which the International Bank for Reconstruction and Development (IBRD) has approved a 50 million US dollar loan.

Specifically, 31.5 million dollars will be allocated to reduce household heating emissions by providing grants for investments in cleaner heating solutions and energy efficiency. Additionally, 10 million dollars will be invested in low-emission transportation in the Canton of Sarajevo, including the development of cycling infrastructure, the procurement of new low-emission public transport

Photographs: (top) Federal Ministry of Environment and Tourism; (bottom) Pixabay/Petar Ubiparip

vehicles, and the provision of technical assistance for implementing comprehensive low-emission measures.

Time and significantly greater financial resources are needed to reduce air pollution for citizens. The Environmental Protection Strategy estimates that 3.3 billion KM will be required over the next 10 years to address air quality issues, with 10 percent of this amount needing to be secured from the budget.

In 2024, through three ministries responsible for air quality issues and the Environmental Protection Fund, we have secured almost 50 million KM, which is 50 percent more than the Strategy defined as the minimum necessary. However, the readiness of projects to absorb these funds remains questionable, and we must work on this issue with lower levels of government and citizens.

Although this law cannot be strictly assessed in terms of economic justification, in the long run, it is highly economically justified because its primary objectives are to prevent, avoid, or reduce harmful effects on human health, quality of life, and the environment as a whole. It is high time this became our priority.

Q: What does the adoption of amendments to the Law on Nature Protection specifically mean, and how many potentially protected areas does Bosnia and Herzegovina have?

A: Data shows that in the Federation of Bosnia and Herzegovina (FBiH), only around 4 percent of the territory is designated as protected areas. This is significantly below the 17 percent we were obligated to protect by 2020 and almost unattainable compared to the 30 percent we have committed to protecting by 2030.

The amendments to the Law on Nature Protection now allow local communities to declare protected areas with the approval of the competent ministry. We have considered the initiatives of cantonal ministries and representatives of the non-governmental sector, who pointed out that by simplifying administrative procedures, our natural resources could be protected more adequately and efficiently.

Additionally, the implementation of activities arising from conventions and international agreements signed by Bosnia and Herzegovina is now facilitated. A new provision has been introduced regarding the content of management plans for protected areas, aligning with the Green Agenda and the Sofia Declaration. This means that management plans for protected areas must now also consider the impact of climate change on biodiversity within these areas.

Furthermore, the amendments and additions to the law better define the work of the supervisory service, increase penalties, and clarify the responsibilities of inspections. They also introduce the mandatory inclusion of environmental measures in concession contracts.

We have also included the protection of tufa (sedra), as in all neighboring countries, tufa and its tufa barriers are considered strictly protected natural assets. This could also help us in the nomination of significant natural treasures, such as the Martin Brod waterfalls on the Una River, for inclusion on the UNESCO World Heritage List.

Q: Which smaller towns or regions would you highlight as having great potential?

A: I love this country. I have traveled extensively abroad, but when you go, for example, into the heart of Prenj, in Tisovica, it is something that brings you back to the purest beauty of nature. As our Herzegovinians say—there is nothing like it anywhere in the world.

Of course, I love Sarajevo and its urban charm, Mostar and its magnificence, as well as the Una River and other rivers, but I also love to visit Mount Konjuh in Tuzla Canton, where I grew up, Blidinje, or Trebinje, which is a true gem with a Mediterranean allure that captivates anyone who visits.

My favorite travel writer, Zuko Džumhur, who traveled the world, once wrote: "Only images are remembered for a long time, while words change their order the very next day."

The images you can experience in Bosnia and Herzegovina are unforgettable. That is why I invite all our people to explore Bosnia and Herzegovina as much as possible because every new image you see is a new experience, a new value, and a new insight into ourselves.

Interview by Jasna Dragojević

Photograph: Federal Ministry of Environment and Tourism

WASTE AS A RESOURCE – THE PATH TO SUSTAINABLE ENERGY IN SERBIA

Establishing a sustainable future requires a comprehensive and coordinated approach to addressing environmental challenges. Inadequate waste management harms the environment and contributes to the emission of harmful gases from unsanitary landfills and illegal dumpsites.

Modern lifestyles are accompanied by a constant increase in waste generation, which represents a serious problem. However, the issue becomes even more alarming when considering that most of this waste undergoes no treatment and ends up in landfills or natural environments. At the same time, changes in consumption habits have led to an increased demand for energy. Since the majority of energy in Serbia is still generated from fossil fuels, primarily coal, this process further contributes to pollution, worsens the environmental situation, and endangers human health and ecosystems.

This cause-and-effect relationship is particularly important when examining the link between waste and energy. Energy recovery from waste plays a crucial role in achieving the goals of circular economy and recycling, which are becoming increasingly ambitious in Serbia and the European Union. To meet these goals, more types of waste must undergo pre-treatment, including lower-quality materials that were previously unsuitable for recycling.

Photograph: Unsplash/Ljubomir Žarković

The sorting process generates residues with significant calorific value, which should be utilized before disposal. This is where energy recovery from waste comes into play, serving two key purposes – reducing waste volume and its negative impact while creating opportunities for energy generation.

One significant challenge in using waste as an alternative energy source in Serbia is the inadequate preparation of municipal waste for use in cement plants and incinerators

White Paper on Energy Recovery from Waste

The White Paper on Energy Recovery from Waste in Serbia is a publication providing a comprehensive overview of all regulatory and technical aspects of energy recovery from waste, specifically incineration, which are crucial for the functioning of this technology and related facilities in Serbia and beyond. The authors of the White Paper include numerous experts from Serbia and Austria, while the publisher is the Association of Environmental Protection Engineers. The following text will highlight key considerations from the publication. At the same time, our interviewee, Nebojša Vraneš, an advisor at the Center for Circular Economy of the Chamber of Commerce and Industry of Serbia, will present his insights and views on the topic.

According to this publication, one significant challenge in using waste as an alternative energy source in Serbia is the inadequate preparation of municipal waste for use in cement plants and incinerators. Addressing this issue is essential for increasing the efficiency and sustainability of the waste treatment process.

The importance of using fuel derived from waste lies in several key benefits. These include reducing fossil fuel consumption while simultaneously minimizing the negative consequences of combustion, such as greenhouse gas emissions, sulfur oxide emissions, and ash production. Additionally, this process allows for better utilization of municipal and industrial waste, reducing the amount of waste that ends up in landfills.

The White Paper identifies two types of waste-derived fuel products based on their refinement level, which are generated in mechanical

The first waste-to-energy facility in the country and the region was built in Vinča as part of a public-private partnership for waste management in Belgrade

or mechanical-biological waste treatment plants. The first is Solid Recovered Fuel (SRF), a solid renewable fuel obtained from non-hazardous waste that has been processed and improved to a quality suitable for trading and use in combustion and co-combustion facilities. To be classified as SRF, the fuel must meet the requirements established by the EN 15359 standard, including limits on calorific value and chlorine and mercury content. The second type is Refuse Derived Fuel (RDF), a shredded fraction of non-hazardous waste that may include residues from municipal and industrial waste and sludge from wastewater treatment plants. RDF has a high calorific value and is often used as an alternative fuel in the cement industry. While RDF does not have to meet the strict standards required for SRF, its classification as non-hazardous waste allows it to be used in various industries.

Today, more than 500 technologically advanced waste-to-energy facilities across Europe process over 100 million tons of waste annually. This industrial sector operates in compliance with the strictest legal regulations and the highest environmental protection standards.

In Central Europe, Italy, and the United Kingdom, the production of waste-derived fuel is well developed but applied in different ways. In Germany and Austria, Solid Recovered Fuel (SRF) is produced for use in local thermal power plants, waste-to-energy plants, and cement factories. On the other hand, SRF produced in Italy and the United Kingdom is exported chiefly due to a

The Use of Waste-Derived Fuel Reduces CO_2 Emissions

Using alternative fuels does not increase CO_2 emissions, as it helps reduce emissions from landfills. In landfills, approximately 0.27 tons of CO_2 are released per ton of waste. Ten tons of waste are required to produce four tons of RDF, meaning that using one ton of RDF prevents the emission of 0.675 tons of CO_2, which would have been released if the waste had ended up in a landfill.

Photograph: Unsplash/Anja van de Gronde

lack of domestic capacity for its utilization.

The Basel Convention regulates the process of export, transboundary trade, and transportation for the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

Legislative Framework in Serbia

Speaking about Serbia, the first waste-to-energy facility in the country and the region was built in Vinča as part of a public-private partnership for waste management in Belgrade. It is expected to process 340,000 tons of waste annually, supplying five percent of Belgrade households with electricity and more than ten percent with thermal energy for heating.

"Following the construction of the new waste-to-energy facility in Vinča, after the cement plants in Beočin and Popovac, we are facing significant new experiences in this field. So far, our greatest theoretical knowledge has come from the WtERT Institute at Columbia University," emphasizes Vraneš.

The Waste Management Program of the Republic of Serbia for the period 2022–2031 envisions the development of infrastructure for the production of refuse-derived fuel (RDF) in regions with large settlements. Three facilities are planned, each with an average capacity of approximately 75,000 tons annually. This initiative aims to address the issue of insufficient municipal waste preparation for energy recovery.

Regarding regulations in Serbia, the legal framework for waste incineration is based on various national laws, regulations, and by-laws. Several new documents have been adopted in recent years, with expectations of further by-laws being introduced, and our interviewee highlighted some of the most significant. The primary legal framework governing waste management, including its energy recovery, is the Waste Management Act, which is designed to align with the EU Waste Framework Directive (WFD). The Energy Act provides the legal framework for producing energy from alternative sources, including waste. Furthermore, the Waste Management Program of the Republic of Serbia for the period 2022–2031 foresees the development of RDF production infrastructure in larger settlements. Serbia has also adopted the SRPS EN 15359:2012 standard, which pertains to solid recovered fuels (SRF). Finally, there are international regulations, such as the aforementioned Basel Convention.

Photograph: Unsplash/Collab Media

Vraneš notes that the legislative framework has several key shortcomings. One of them is that waste collection fees are charged based on square meters of property area rather than the actual amount of waste generated. Additionally, the landfill tax is below minimum requirements, while secondary regulations for specific aspects of energy recovery from waste are not sufficiently developed. There is also a limited capacity for sorting and preparing waste for energy recovery. Moreover, incentives and subsidies for the private sector are lacking, making investments in waste-to-energy facilities more difficult. Lastly, there is a lack of clear regulations regarding the categorization and treatment of RDF and SRF fuels within the domestic legal framework.

"If regulatory improvements, infrastructure expansion, and the elimination of existing shortcomings occur, Serbia could significantly increase energy recovery from waste, reduce its dependence on fossil fuels, and simultaneously address the issue of inadequate waste management," concludes our interviewee.

Prepared by Katarina Vuinac

INNOVATIONS FOR ENERGY EFFICIENCY AND ENVIRONMENTAL SUSTAINABILITY

Nestled in the north-western part of Bosnia and Herzegovina, with a rich history and strategic location, Gradiška is an important regional trade, transport, and culture hub. The town stretches along the Sava River, which gives it a natural potential for agriculture and tourism. By investing in various projects, the city contributes to global sustainable development goals and environmental protection and ensures a better quality of life for both present and future generations. Zoran Adžić, the Mayor of Gradiška, spoke to the Energy Portal Magazine about energy-saving methods in public spaces and the most significant projects, including an innovative solution for securing the city's water supply.

Q: What would you highlight as the most important achievements in ecology, energy independence, or sustainable development?

A: The transition of the entire public lighting system to smart LED lights has brought about a range of positive effects, significantly improving the quality, efficiency, and sustainability of the lighting. By 2023, the City of Gradiška had a public lighting system using high-pressure sodium (HPS) lamps, which, compared to currently available technologies in this field, had several significant drawbacks, including high energy consumption, shorter lifespan, poor light quality, longer warm-up time, high heat production, negative ecological impact, limited lighting control options, and a higher failure rate.

The identified problem with the existing public lighting system prompted the city to include a project in its plans to transition to more modern and efficient lighting technologies, which can improve energy efficiency, reduce costs, and enhance light quality. In 2023, the city completed the transition of public lighting from high-pressure sodium lamps to smart LED lighting, during which it established its own LoRaWAN network, enabling the widespread use of IoT (Internet of Things) technologies in managing urban resources. This modernization and technology not only increase energy efficiency and reduce costs but also allow for advanced management and control of public resources.

The City of Gradiška has one of the best-organized municipal systems,

Photograph: Predrag Zec

not only in the Republic of Srpska but also in the region, with particular emphasis on its water supply system. Due to several limiting factors for the water supply system, the city initiated a project to build a 1 MW solar power plant at the Žeravica water source. Implementing this project ensures increased energy independence, an ecologically sustainable and economically viable solution for the city's entire water supply system, providing stability and sustainability for the system in the future. Through this project, the city affirms its commitment to innovation and sustainable development, demonstrating its capacity to use natural resources sustainably.

Installing a 1 MW solar power plant at the Žeravica water source represents an innovative solution for securing the city's entire water supply. This solution provides a stable and sustainable source of electricity for the operation of the water supply system. By installing solar panels at the water source, Gradiška ensures energy independence and reduces energy costs and CO_2 emissions, contributing to a more ecologically sustainable future. This solution brings long-term economic and ecological benefits to the city and promotes sustainable development.

The complete energy reconstruction of the Gradiška Music School and the Gradiška Grammar School has been completed. This project is unique because it concerns a protected cultural heritage building, which required a special approach to renovation. The external appearance of the building had to remain unchanged. This project has improved the comfort of students and teachers while achieving significant energy savings.

Parallel to this, the complete energy refurbishment of the Gradiška Grammar School building is in its initial phase. This project aims to address long-standing issues with energy efficiency. The building suffered significant energy losses for years due to an outdated façade, worn-out windows and doors, and an obsolete heating system. These shortcomings led to high energy costs and uneven temperatures in classrooms. Completing this project will bring significant benefits, including reduced energy consumption, stable indoor temperatures throughout the year, and improved working conditions for students and staff. At the same time, the project will contribute to environmental protection by reducing greenhouse gas emissions.

ZORAN ADŽIĆ was born on 30 December 1963 in Nova Gradiška. He graduated from the Faculty of Electrical Engineering, specializing in energy, in Belgrade in 1988. Throughout his career, he worked at ZP Elektrokrajina a.d. Banja Luka – Elektrodistribucija Gradiška Operating Unit, where he spent most of his time as the head of this unit. From November 2016, Mr Adžić served as the Mayor of the Municipality of Gradiška, and since December 2020, he has been holding the position of Mayor of the City of Gradiška.

These projects are outstanding examples of how investments in educational infrastructure can significantly improve working conditions while also supporting the sustainable development of the local community.

Q: What does the Local Sustainable Development Leader Award mean to you, and which activities or projects led to this recognition?

A: The City of Gradiška won the Local Sustainable Development Leader Award in the thematic area of Smart

Photographs: (bottom) Predrag Zec; (Adžić) City of Gradiška

Growth thanks to innovative projects that have significantly contributed to reducing greenhouse gas emissions and protecting the environment. The project involving the transition from traditional to LED lighting is a response to air pollution and CO2 emissions, which have become serious issues in our community and many urban areas worldwide.

This award was presented as part of the program "A Framework for the Implementation of Sustainable Development Goals as a Foundation for Sustainable and Inclusive Growth in Bosnia and Herzegovina (SDG2BiH)", supported by the Kingdom of Sweden and UNDP, in partnership with UNICEF and UN Women. By introducing innovative digital solutions, the City of Gradiška has effectively reduced emissions, optimized energy consumption, and improved resource management. As part of this project, the city established a LoRaWAN network, enabling efficient monitoring and management of current and future urban digital systems, including air quality, public lighting, smart agriculture, smart parking, smart water management, smart waste management, and more.

Q: What activities is the City of Gradiška undertaking to implement the ESG agenda?

A: ESG has become a key parameter in assessing the success of organizations, but its importance is particularly pronounced at the local level, where direct effects on the environment and society are created. For cities and local communities, implementing ESG principles means introducing policies and initiatives that promote environmentally sustainable development, empower citizens by improving their quality of life, and foster transparency and inclusiveness in governance.

The City of Gradiška has recognized the importance of ESG standards as a fundamental guide for sustainable development. The city's activities are focused on integrating these principles into public policies, investment projects, and daily services provided to citizens. This approach enhances local economic and social development and positions Gradiška as a leading regional community that actively contributes to global sustainability goals.

One of the key examples of Gradiška's environmental efforts is the construction of a 1 MW solar power plant for the city's entire water supply system. This project is not just a step towards energy efficiency but also a significant contribution to reducing carbon dioxide emissions. At the same time, a feasibility study is underway for a waste-to-energy plant with cogeneration, which will enable the production of heat and electricity with minimal environmental impact.

On the social front, Gradiška is dedicated to improving the lives of its citizens through support for entrepreneurship, culture, and sports. A particularly notable project is "Develop Your Idea" and "Start Your Business", which enables young people to launch their own businesses, fostering employment and economic growth.

Resource and project management in Gradiška are based on the principles of transparency and efficiency. The digitalization of the City Administration allows citizens more straightforward access to services and increases trust in public administration. The introduction of e-government brings significant advantages for citizens, businesses, and public administration alike.

For citizens, e-government provides faster, easier, and more transparent access to public services, reducing administrative barriers and speeding up procedures.

For businesses, it simplifies company registration, improves access to information, and accelerates communication with the public sector.

For public administration, digitalization reduces operational costs and improves efficiency. Ultimately, e-government strengthens citizens'

Photograph: Predrag Zec

trust in institutions, promotes transparency, and enhances the quality of life in local communities.

This comprehensive approach, which combines environmental responsibility, social inclusion, and good governance, positions Gradiška as an example of a local community that actively contributes to sustainable development goals while ensuring a better quality of life for current and future generations.

Q: How much is being invested in improving the energy efficiency of residential and public buildings?

A: In the past three years, three projects have been implemented for the energy refurbishment of multi-storey residential buildings. These projects were carried out in cooperation with homeowners' associations, with a total investment of approximately €198,220 (BAM 387,707.34).

Investments in the construction and reconstruction of community centres have so far amounted to around €1,715,580 (BAM 3,354,744.64), with all energy efficiency measures being followed. Additionally, about €1,868,740 (BAM 3,651,489.09) has been invested in constructing and refurbishing kindergarten facilities, again ensuring compliance with all energy efficiency standards.

The sports centre Arena stands out among public facilities, with an investment of approximately €4,638,788 (BAM 9,066,304.65). The Branko Smiljanić Music School was also energy refurbished, with an investment of approximately €598,296 (BAM 1,169,055.96) in cooperation with the Republic of Srpska.

Q: What are the plans for improving air quality, and what are the most significant pollutants?

A: Air quality measurements in the City of Gradiška are conducted by the Regulation on Air Quality Monitoring Conditions (Official Gazette of the Republic of Srpska, No. 124/12). Fixed air pollution measurements are carried out to protect human health, vegetation, and natural ecosystems in Gradiška. Representative measuring points are selected to ensure a detailed overview of air pollution levels.

Air sample measurements are conducted continuously, 24 hours a day, at the current location, the City Centre – Cultural Centre building. Monitoring of air pollution parameters in Gradiška has been carried out since 2020.

The measured concentrations of pollutants do not exceed the permissible values defined by the Regulation on Air Quality Values (Official Gazette of the Republic of Srpska, No. 124/12), except for an increase in PM10 particulate matter concentrations, which exceed the limit of 50 µg/m³ several times a year during the winter period due to lower temperatures and high humidity.

Q: How is the transition to renewable energy progressing, and how many such facilities are being built?

A: Solar energy is undoubtedly one of the most significant potentials when it comes to renewable energy sources in our area. So far, in the City of Gradiška, 31 occupancy permits have been issued, along with 89 construction permits, 78 location conditions, and 27 requests for location conditions for small solar power plants that are currently in process. Additionally, there are three solar power plants in the city for which the Ministry of Spatial Planning, Construction, and Ecology has issued construction permits.

The total installed capacity of small solar power plants that have been built or are under construction in the territory of the City of Gradiška exceeds 42 megawatts. In recent years, the City of Gradiška has implemented the SOLAR CET project in cooperation with UNDP. As part of this project, solar installations for self-supply were installed on nine individual buildings, with a total installed capacity of approximately 42 kilowatts.

Interview by Jasna Dragojević

MODERN TECHNOLOGIES IN WASTE MANAGEMENT

The production of solid municipal waste, which amounted to 2.3 billion tons in 2023, is projected to increase to 3.8 billion tons by 2050. In 2020, the global direct costs of waste management were estimated at 252 billion dollars. Still, when considering the hidden costs of pollution, poor health, and climate change due to improper waste disposal, the total cost rose to 361 billion dollars. Without urgent action, by 2050, this cost could nearly double to 640.3 billion dollars. These concerning figures come from the United Nations Environment Programme (UNEP) report titled Global Waste Management Outlook 2024.

Modeling in the report suggests that bringing waste under control through prevention and waste management measures could limit net annual costs by 2050 to 270.2 billion dollars, thereby avoiding further economic and environmental damage.

As part of global efforts to achieve the Zero Waste concept, also known as WasteZero, the primary goal is to reduce waste generation itself. Although reuse and recycling

Photographs: (top) Pixabay/Metalwork Company; (bottom) Unsplash/Jennifer Uppendahl

significantly contribute to sustainability and pollution reduction, these processes still require additional resources, such as energy and water. Since completely eliminating waste production remains an unattainable goal for now, it is essential to focus on developing new technologies and improving existing waste management methods, including recycling and reuse.

The modern world faces numerous challenges, but simultaneously, it opens the door to innovations that make waste management more efficient and sustainable. Technological advancements such as artificial intelligence, robotics, and bio-innovations are making the waste industry more effective and environmentally friendly, laying the foundation for better resource management and a reduced ecological footprint.

Innovations Around the World

Below are several inspiring examples from different parts of the world, demonstrating that implementing a circular economy and sustainable waste management is an entirely achievable goal through innovation and the development of advanced technologies.

At the beginning of every waste management process is waste sorting, which is crucial for achieving high recycling rates and reducing landfill waste. In this regard, technological innovations, such as automated systems based on artificial intelligence and robotics, play a key role in optimizing this process. Given the complexity and diversity of waste content, modern technologies enable faster, more precise, and more environmentally friendly waste sorting solutions.

Artificial intelligence and digitalization are gradually being integrated into these processes, recognizing materials and optimizing sorting without human intervention. One sorting technology also being implemented is LiDAR, which uses light pulses to precisely identify and classify materials, providing essential information for subsequent sorting steps.

One example of waste sorting innovation comes from Finland. Developed by the Finnish company ZenRobotics, this technology combines AI and robotics in recycling plants to extract high-purity valuable materials from different types of waste, such as construction and municipal waste. The robots recognize and sort waste based on shape, weight, and size. In addition to improving recycling efficiency and reducing costs, this innovation also increases worker safety, as robots take over heavy and hazardous tasks. The high-purity materials obtained through this process can be reused and transformed into new, high-quality secondary raw materials.

Technological advancements such as artificial intelligence, robotics, and bio-innovations are making the waste industry more effective and environmentally friendly, laying the foundation for better resource management and a reduced ecological footprint

Photographs: (middle) Pixabay/recyclind; (middle below) Pixabay/Džoko Stach

The modern world faces numerous challenges, but at the same time, it opens the door to innovations that make waste management more efficient and sustainable

Although large sorting and recycling facilities are essential for effective waste management, there are also ways to contribute from our homes. Bio-waste is one type of waste that can be managed at the household level through specialized composting bins. These small technological innovations allow kitchen waste to be processed into valuable organic fertilizer.

One company that has taken this a step further is HomeBiogas from Israel. They have developed a technology that converts organic waste into biogas. Their system, designed for households with backyards, uses anaerobic digestion, a process in which organic materials break down in the absence of oxygen, producing biogas that can be used for cooking.

Our next destination is the United States, home to another successful bio-waste innovation. The company MycoCycle has developed an innovative approach that uses fungi to break down synthetic materials, including plastics, turning them into natural compost with a low carbon footprint. Waste is processed through biosorption, bioconversion, and

Photographs: (left) Pixabay/Mostafa Meraji; (bottom) Pixabay/M. W.

biodegradation processes, reducing its toxicity and transforming it into eco-friendly raw materials.

Belgium offers an innovative approach to adequately managing hazardous waste materials. The Umicore company specializes in metal recycling with a focus on electronic waste. Its advanced recycling processes combine pyrometallurgy and hydrometallurgy. Pyrometallurgy uses high temperatures to extract metals, while hydrometallurgy relies on chemical solutions in aqueous phases. These processes allow more than 20 key metals to be recovered from complex waste streams, reducing environmental impact and supporting the circular economy.

Umicore mainly focuses on recycling metals from batteries and electronics, reintegrating these valuable materials into new products.

We conclude our journey in Canada, home to a company that has developed advanced technology for recycling PET plastic, one of the most widely used materials in the packaging industry. Loop Industries has developed an innovative plastic recycling process, enabling non-conventionally recyclable PET plastic and polyester fibers to be transformed into high-quality materials.

This technology allows infinite plastic recycling without losing quality, significantly reducing plastic waste that would otherwise end up in landfills and oceans.

The process begins with depolymerization, where plastic is broken down into its fundamental building blocks—monomers. These monomers are then reassembled into long-chain molecules through polymerization, resulting in new PET plastic and polyester.

This method produces high-quality, food-safe, and durable plastic and fibers, which can be recycled indefinitely without degrading quality. This process reduces the demand for new raw materials while supporting a sustainable circular economy and minimizing the ecological footprint of the plastics industry.

Modern waste management technologies open up new possibilities for reducing the environmental footprint and achieving circular economy goals. Innovations such as automated waste sorting systems, biogas technologies, and plastic recycling advancements allow for more efficient resource management and a reduction in plastic pollution.

Although completely eliminating waste remains an unattainable goal, these technologies play a crucial role in sustainable development, resource conservation, and environmental protection for future generations.

Prepared by Katarina Vuinac

Photographs: (top) Unsplash/John Cameron; (middle) Pixabay/Maurice Angres

CIRCULAR ECONOMY – AN INVESTMENT IN THE FUTURE

The circular economy is becoming an increasingly important concept in global efforts towards sustainable development, and its implementation in Serbia could bring numerous economic, environmental, and social benefits. To explore how the circular economy can enhance the competitiveness of the domestic economy, what its key challenges are, and how it can be successfully implemented, we spoke with Siniša Mitrović, head of the Centre for Circular Economy at the Serbian Chamber of Commerce.

Q: What is the essence of the circular economy, and what are its advantages compared to the linear model?

A: The topic of the circular economy is being discussed more and more each day. There are many definitions and interpretations of what it entails and how far its scope extends. Many people view the circular economy primarily through the lens of waste management, but that is only one aspect of circularity. The linear economy, which we have been living in for so long, has distanced us from nature and put us in conflict with it. Each new generation has taken more natural resources and depleted living spaces. Unfortunately, we may have started waking up too late – forced by climate change, which is altering our lives through extreme weather events affecting the Western Balkans as well. In 2024, for the first time, the Earth's temperature exceeded 1.5 degrees Celsius above the pre-industrial average on an annual basis, putting the fulfillment of the Paris Agreement's climate goals in jeopardy.

The circular economy is not some 'new religion' created by the European political elite; rather, it arises from the European industry's struggle to survive without critical materials and remain competitive against the challenges posed by the US, China, and the BRICS economies. The EU must urgently address the long-standing obstacles and structural weaknesses holding it back. For over two decades, Europe has failed to keep pace with other major economies due to a persistent productivity growth gap, lagging particularly in innovation. The European industry is under pressure today due

Photograph: Pixabay/TyliJura

to high energy prices and complex regulatory frameworks.

Interestingly, the circular economy existed in this region two hundred years ago. Our ancestors lived sustainably, producing zero waste, protecting water sources and streams from pollution, and practicing regenerative agriculture. However, then came socialism, industrialization, a command economy, and eventually liberal capitalism, leading to the emergence of a consumer society. Today, Serbia depletes its natural resources by mid-year, and beyond that point, we overexploit nature, which 'invoices' us through droughts, floods, erosion, supercell storms, and other hazards. Ultimately, the easiest way to define these economic models is that the linear economy follows a produce–use–discard model, while the circular economy follows a produce–use–reproduce model.

Q: How do you assess the current implementation of the circular economy in Serbia, and what are the biggest challenges in this process?

A: The circular economy in Serbia is not far behind the EU; in fact, some of our companies are already highly circular, not due to populism but because they have made sound business decisions prioritizing community progress over profit alone. The challenge these companies face is that the state lacks mechanisms to reward them, such as tax reductions on profits or exemptions from environmental levies. To be fair, the EU has not fully resolved this issue either, but it is actively working on it.

Circular products are generally more expensive, making them uncompetitive against similar non-circular products. Currently, significant efforts are being made to develop a system for measuring circularity so that each product will eventually have something akin to a passport, recording details such as energy consumption and type, raw materials used, whether recycled materials were incorporated, and how recyclable the final product is. This passport will contain additional data, but ultimately, consumers will have much more information at their disposal.

At the Serbian Chamber of Commerce, our primary mission is knowledge transfer to companies, particularly in the area of business decarbonization. We must encourage companies to think ahead and transform their business models. Otherwise, competitiveness will increasingly depend on how green production processes become. Serbia has strategic documents on circular economy policy, but implementing the proposed measures is the most significant and challenging step. Green transformation in Serbia could enable GDP growth of one percent annually. However, from mid-2024 onwards, the green agenda seems to be losing momentum, as small and medium-sized enterprises are not seeing the benefits of green regulations – only increased bureaucracy and rising production costs.

Siniša Mitrović

Head of the Centre for Circular Economy at the Serbian Chamber of Commerce

Criticism of the European Green Deal is mounting, and there is growing pressure to delay taxonomy measures, particularly the carbon tax. In Serbia today, the most expensive word is business predictability. Many risk factors are at play – trade tariffs, sanctions against NIS, decarbonization of the energy sector, resource prices, supply chain disruptions, and the broader influence of shifting global politics, including Trumpism. All of this pushes us to develop strategic policies that will steer Serbia towards a more advanced economic future and integration into international economic blocs.

Q: How does implementing the circular economy contribute to reducing industrial waste and improving the recycling system in Serbia?

A: When we have five billion euros in foreign direct investment and an annual economic growth of four percent, the industry must have ready-made solutions for the waste it

Photographs: Pexels/Artempodrez; (Mitrović) courtesy of Siniša Mitrović

generates. Serbia currently has the most expensive industrial waste management solutions in Europe, poor infrastructure for collection and treatment, insufficient knowledge and best practices, and, of course, a lack of financial resources to organize everything.

In addition, there is public resistance, which is justified if negotiations with citizens and the civil sector about the best environmental solutions are not conducted in time. We must be brave, especially at the local level, transparent, and confident that investments in industrial waste infrastructure (storage and treatment) are much better solutions than dumping waste in nature, watercourses, or burying it.

Industrial waste can become a resource for other industries, which is why we at the Serbian Chamber of Commerce advocate for industrial symbiosis—where waste from one industry becomes raw material for small and medium-sized enterprises, particularly in cases involving plastic, used tires, ferrous and non-ferrous metals, cables, and other materials.

Q: How much impact does the circular economy have on environmental protection?

A: The circular economy is the leading tool for improving environmental quality. Every aspect of circular economy principles aims for a cleaner environment. Energy efficiency, waste reduction, and waste reuse start with product design, ensuring that goods and services have a minimal negative environmental impact.

These are interconnected processes—sustainable production requires sustainable consumption, reducing consumerism, and changing habits. Our future depends on us. I believe Generation Z, which now dominates the population, will have the answers for the future. Only by changing our habits—how we build, consume, travel, and produce—can we move towards sustainability. Otherwise, rising average temperatures will majorly challenge the national economy, public health, and population safety.

Q: How does the Serbian Chamber of Commerce help entrepreneurs recognize and implement circular practices in their business models?

A: Knowledge transfer to small and medium-sized enterprises (SMEs) is our most important task. Since the pandemic, we have developed a comprehensive range of services to help companies identify business risks in time, particularly in the areas of green policies and environmental regulations in Serbia. Laws, regulations, and directives introduced by the relevant ministry affect business operations and organizational culture. They require new knowledge and the emergence of sustainability managers, as the pace of change is in-

Photograph: Pexels/Greta Hoffman

tense and will accelerate further once Chapter 27 of the EU accession process is opened and the rapid implementation of EU directives begins.

Serbia is expected to fully implement European environmental regulations by 2026, adopting around 113 laws as part of the Growth Agenda and Reform Agenda. Achieving this requires shared responsibility, knowledge, commitment, and showcasing advanced technical and economic expertise. The Serbian Ministry of Economy and international organizations such as UNDP and GIZ support us in building a communication platform to accelerate changes in business practices.

To unlock the widespread adoption of green technologies, we need education, new profiles of managers and engineers, complete process digitalization, artificial intelligence integration, and new workforce competencies.

Q: Tell us more about the Serbian Chamber of Commerce's digital platform for the circular economy. Do you have feedback from entrepreneurs on how much they use it and how helpful it is for business development?

A: The Circular Economy Serbia platform (circulareconomy-serbia.com) is constantly improving and is open to all companies, startups, and innovators. Since its launch, it has recorded 150,000 visits, with an average monthly growth of 10 percent. The platform has attracted around 100,000 unique users, indicating broad interest in circular economy topics.

Most visitors come from Serbia (70 percent), while the remaining 30 percent come from the region and other countries, demonstrating international interest in the site's content.

This year, we are enhancing the platform by integrating data from the Environmental Protection Agency, introducing artificial intelligence for data analysis and content personalization based on user needs, and increasing the number of users by an additional 30 percent through intensified marketing campaigns and targeted outreach.

The platform will also be expanded to include other regional countries through content localization and the formation of regional partnerships.

Q: How does the circular economy contribute to sustainable development in Serbia, and what long-term economic, environmental, and social benefits do you expect?

A: Climate change is the greatest future threat to our economy. Over the past 20 years, the direct damage caused by climate-related destruction has cost Serbia's public finances eight billion euros, and this figure will only continue to rise. New public policies are needed in transport, agriculture, construction, e-mobility, and healthcare.

Our circularity indicators are highly problematic, especially in managing municipal waste, wastewater treatment, air pollution, soil degradation, excessive deforestation, high energy consumption, nuclear energy use, food production, rising cancer rates, premature deaths due to pollution, and biodiversity loss. So, what should we do?

We need a new dialogue. We must negotiate the future with citizens and bravely open discussions on all problematic issues, including green mining, access to drinking water, underground water resources, air quality, and energy. More and more, I find myself questioning whether the green transition is a free cheese in a mousetrap for our economy or an opportunity that must not be missed. In recent weeks, EU policies have been reset, casting doubt on the goal of climate neutrality by 2050. Climate efforts are being pushed into the background while competitiveness takes center stage, where anything goes.

However, the most important factor in this transition is people. They must understand, support, and endure these changes, which will be our economy's biggest challenge. The future is unpredictable, but financially very predictable – life will become more expensive and full of surprises.

After all, ask ChatGPT. It knows everything – but don't trust it. Take your life into your own hands.

Interview by Milena Maglovski

Photographs: (middle) Pixabay/geraltl; (bottom) Unsplash/Jan Kopřiva

SOLAR PROJECT ON THE TAMIŠ RIVERBANK

The construction of a solar power plant as an infrastructural undertaking requires thorough planning, design, and precise execution of works to ensure the efficiency and longevity of the system. Near the river Tamiš, one such project is nearing completion by the company MT-KOMEX, which is known for the realization of over 250 solar power plants on the ground and rooftops. About 30 kilometers east of Zrenjanin, in the settlement of Sutjeska, located in the municipality of Sečanj, the power plant is situated, and its construction went without major disturbances. The project is in the final phase, more precisely, in the phase of connection to the power grid.

This site houses 5,400 solar panels, each with a capacity of 580 Wp, manufactured by the German company Luxor Solar. The panels are placed vertically at an angle of 25 degrees, optimizing their efficiency in collecting solar energy. The collected electrical energy is transmitted to the inverter via DC cables. The inverters, manufactured by Huawei, then play a crucial role in converting direct current (DC) from the panels into alternating current (AC).

As for the other components, the ground-mounted solar power plant has a total active power connection of 2.4 MW, with the entire energy transmission to the distribution system. It has 24 installed inverters, each with a capacity of 100 kW, which

Photographs: MT-KOMEX

With an installed capacity of 3.1 MW from solar panels, this power plant will save approximately 4,500 tons of CO_2 annually

enables efficient management of the generated energy. The electricity is then distributed via cables to local transformer stations, which increase the voltage to 20 kV to ensure efficient transmission to the central distribution facility.

The safety and stability of the system are of great importance. Grounding the solar power plant and lightning protection are indispensable parts of the project to ensure that the equipment and infrastructure are protected from possible electrical discharges and lightning strikes. Additionally, adequate lighting has been installed inside the entire power plant for safe maintenance and operation.

The company MT-KOMEX, which is behind the realization of the power plant project in Sutjeska, once again applied the turnkey principle, meaning that they take full responsibility—from the project documentation and obtaining all the necessary permits to the final technical acceptance and commissioning of the facility. This is already a well-established practice in the company's operation.

– We did not encounter any problems during the project's implementation. Everything generally went according to plan. The only change compared to the original conceptual design was related to the area of the power plant construction. Due to a canal flowing through the planned area, which covered three plots, it was necessary to modify the initial solution. Consequently, the solar power plant was constructed only on one side of the canal – explained Filip Stojović, an engineer at MT-KOMEX, who was entrusted with managing the project.

With an installed capacity of 3.1 MW from solar panels, this power plant will save approximately 4,500 tons of CO_2 annually. Considering the average consumption, the energy produced can meet the needs of over 600 households. In an ecological context, to better understand the significance of this reduction in carbon dioxide emissions, we can compare it to the absorption of CO_2 by trees. Namely, the annual CO_2 savings realized by the solar power plant in Sutjeska corresponds to the amount that would be absorbed by between 170,000 and 220,000 trees, assuming that an average tree absorbs between 20 and 25 kilograms of CO_2 per year.

When considering all the projects MT-KOMEX has worked on, as well as the total amount of carbon dioxide saved thanks to the installed panels, the environmental impact the company achieves becomes highly significant.

Prepared by Milica Vučković

UŽICE LEADS THE WAY IN ENERGY EFFICIENCY

For many local governments in Serbia, air pollution is one of the biggest challenges, requiring significant investments and active participation from all sectors of society. However, Užice proves that progress in environmental protection and energy efficiency is possible. This city has been at the forefront of implementing concrete measures for years, and the results are becoming increasingly visible.

To learn more about the projects carried out, the results achieved so far, and future plans, we spoke with Svetlana Drakul, Head of the Department for Environmental Protection and Sustainable Development of the City of Užice.

Pioneering Steps Toward Sustainability

While most local governments in Serbia have only recently joined the Project of Clean Energy and Energy Efficiency for Citizens, implemented by the Ministry of Mining and Energy, Užice initiated energy renovation projects as early as 2015, using its own funds.

– We started co-financing energy renovation measures nine years ago, initially with four million dinars. Year by year, we increased that amount, and so far, we have implemented 3,566 contracts, investing over 317 million dinars – Drakul stated.

The high level of citizen interest confirms the project's success—in 2023 alone, 619 applications were submitted, 527 of which received renovation funding. In 2024, the number of applications was slightly lower, but out of 265 requests, 224 subsidies were approved.

– We usually start with smaller amounts, and when we see the level of interest, we increase the funds through contract annexes. This year, with the ministry's support, we secured an additional 34 million dinars, allowing all citizens who meet the criteria to receive subsidies – Drakul explained.

Beyond improving energy efficiency, this project has significantly boosted the local economy. More than 50 percent of the contractors involved in the work are from Užice,

Photograph: Pexels/Miljan Rašević

and the most in-demand renovation measures are window replacement and the installation of new boilers.

– The highest demand is for window replacement because it is a quick investment to implement, and many companies are capable of carrying out the work– Drakul added.

Cleaner Air Through Modern Boilers

For years, Užice has struggled with severe air pollution. However, replacing outdated boilers with modern solutions is already producing results. Over the past ten years, the city has replaced 1,590 gas-powered boilers and 141 pellet-fired boilers.

– Although gas is not a completely ecological energy source, its emissions are significantly lower compared to coal and improperly used wood – Drakul explained.

The results speak for themselves—while in 2018, the average annual concentration of PM10 particles was 45.5 µg/m³, by 2023, it had decreased to 32.7 µg/m³. The data for 2024 is expected to show even further improvement. Additionally, the number of days exceeding pollution limits has significantly decreased, proving the effectiveness of the measures implemented.

Užice has no plans to stop here—the next goal is to encourage citizens to use renewable energy sources. The city has already awarded 10 subsidies for heat pumps, and 18 for solar panels, and interest in these technologies is expected to grow in the coming years.

Photograph: Wikipedia/Peđa Šupurović

However, there is a challenge—a shortage of contractors for thermal insulation projects.

– This is one of the most important measures because it provides the most significant energy savings. Unfortunately, we don't have any registered contractors for it, which poses a serious problem. Major construction projects on Zlatibor are drawing labor away, while on the other hand, contractors complain that the administrative procedures are too complicated – Drakul pointed out.

Energy Advisory Center Opens in Užice

To provide citizens with relevant information and support in the energy renovation process, Užice has established an Energy Advisory Center.

– The center operates within the Enhancing the Use of Sustainable Energy in the Zlatibor Region project, implemented by the Regional Development Agency in collaboration with GIZ and the City of Užice. It is open for consultations on Tuesdays and Thursdays from 10 AM to 1 PM, where citizens can receive advice on the best measures for their property and how to prepare for public calls – Drakul stated.

The awareness of energy efficiency among citizens is now significantly higher than in previous years, with residents increasingly prioritizing measures that allow them to use energy resources more efficiently.

– Even those who own private forests are now more frequently opting for heat pumps, preserving their trees for future generations – our interviewee concluded.

Through these efforts, Užice continues to set standards in energy efficiency and environmental protection, proving that local governments can play a crucial role in combating climate change and improving the quality of life for their citizens.

Prepared by Milena Maglovski

NALED ADVOCATES FOR MORE EFFICIENT MUNICIPAL WASTE MANAGEMENT IN 2025

Serbia has planned 26 regional landfills to serve as storage centers for municipal waste, but currently, only ten are in operation. The biggest issue is the disposal of municipal waste in locations that lack proper infrastructure and are not designated for this purpose. If municipal waste is stored in unsanitary and uncontrolled landfills, it can further contaminate groundwater and surrounding water sources.

The good news is that, as part of the Ministry of Environmental Protection's activities, work is underway on the construction of six new regional landfills, which could somewhat improve the situation. Waste that ends up in nature, unsanitary landfills, or illegal dumpsites poses a serious risk to human life and health. Due to the lack of primary waste separation, various other waste components are often found in municipal waste, including metals, construction debris, and medical and pharmaceutical waste.

This is why it is crucial to work on developing a primary waste separation system, which involves collecting and sorting waste at the source. Serbia is aligned with EU regulations regarding municipal waste management laws, but the problem lies in their implementation.

The situation on the ground does not match what is prescribed by law. The main issues are insufficient infrastructure and a lack of public awareness. Additionally, local

NALED is also promoting the use of new digital solutions, including applications that will enable a modern packaging waste management system in Serbia

Photograph: Pixabay

If municipal waste is stored in unsanitary and uncontrolled landfills, it can further contaminate groundwater and surrounding water sources

Slobodan Krstović
Director of Sustainable Development at NALED

governments often lack the capacity to implement their responsibilities effectively with the resources and funding available. This is why pilot projects and EU funds can serve as a significant boost, especially for smaller municipalities.

A successful example is the cross-border cooperation project BEST Cooperation in Waste Management – Towards a Sustainable Environment, funded by the European Union and implemented by NALED in collaboration with the Center for Ecotoxicological Research. Participants in the project included the City of Novi Pazar and the Municipality of Tutin in Serbia, as well as the municipalities of Mojkovac, Bijelo Polje, and Kolašin in Montenegro.

These municipalities have gained tangible benefits, including guidelines and infrastructure improvements that enable them to manage municipal waste more effectively. Novi Pazar received 1,500 waste bins and a waste collection vehicle, while Mojkovac received 500 bins and a waste baling press. Field results indicate that residents in these areas are developing greater environmental awareness and taking better care of their surroundings. Some former problematic landfills have now become examples of good waste management. Additionally, certain waste management centers operate according to the highest standards, using the best available technologies. For instance, the Vinča landfill has significantly improved municipal waste collection in Belgrade, and the next step should be utilizing municipal waste as an energy source.

Another critical measure is the improvement of the deposit return system for collecting packaging waste, which NALED has been advocating for years. There are announcements that this system will be implemented by 2027. Initially, the deposit system will focus on plastic bottles and aluminum cans. This is a return system, meaning that once products are consumed, the packaging will no longer end up in municipal landfills but will be returned to the production cycle.

NALED is also promoting the use of new digital solutions, including applications that will enable a modern packaging waste management system in Serbia.

The European Union co-financed this project under the Instrument for Pre-Accession Assistance (IPA II) through the Serbia-Montenegro Cross-Border Cooperation Program 2014-2020. The funding agreement with the European Union was signed with the Ministry of Finance of the Republic of Serbia—Sector for Contracting and Financing Programs from EU Funds.

Slobodan Krstović

Photographs: NALED; (Krstović) courtesy of Slobodan Krstović

BiH ON THE PATH TO A CIRCULAR ECONOMY

By implementing the circular model, society gains numerous benefits, fosters innovation, creates new jobs, and establishes long-term economic stability. Additionally, the circular economy promotes responsible consumption behavior, increasing awareness about preserving natural resources and reducing pollution. Business operations in developed countries have long been aligned with the circular economy principles. We talked with Professor Dušica Pešević, PhD, whose work focuses on environmental protection, and who is the author of the first scientific monograph in Bosnia and Herzegovina (BiH) on the topic of circular economy and its significance for environmental protection and where Bosnia and Herzegovina stand on this path.

Q: How much is the circular economy as a topic represented in BiH?

A: The idea of the circular economy is still new and underdeveloped in Bosnia and Herzegovina. In recent years, the circular economy has been increasingly recognized as a concept and practice, but still to a limited extent. The economy in BiH is primarily based on a model of linear, extractive economy, the depletion of natural resources, an additional increase in waste production, and leaving a high carbon footprint in the country, all of which negatively affect the environment and the health of citizens, as well as the community as a whole. By adopting the Green Agenda for the Western Balkans in 2020, the countries of the Western Balkans accepted the European Green Deal (or its key elements), where they committed to implementing and respecting measures in five areas, one of which is the circular economy. The first priority of the Green Agenda for the Western Balkans is "material value preserved as much as possible, and waste generation minimized."

Q: What is the potential for applying circular economy in BiH?

A: As a resource-intensive economy, BiH has the potential to achieve significant economic benefits by applying the circular economy model. Increasing resource productivity in the economy, with better utilization of raw materials extracted from domestic territory, is one of the conditions for the transition to a circular economy. Resources should be kept in the economy for as long as possible, maximizing their value and minimi-

Photograph: Pixabay/Orlando

zing waste. This includes good product design, efficient use of materials and energy, long product life cycle, well-designed circular industrial plants, new business models, and effective recycling to obtain high-quality secondary raw materials when a product finally becomes waste.

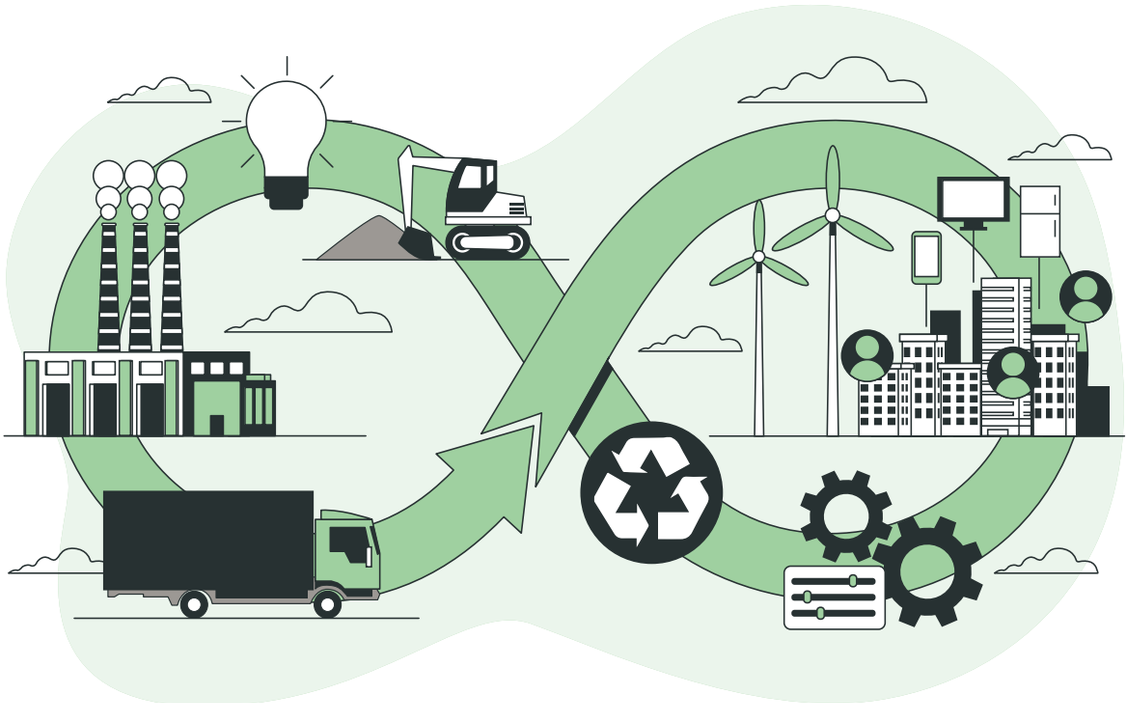
Q: How would you assess the representation of the circular economy in BiH now and in the region?

A: BiH has not yet adopted the Roadmap for Circular Economy as a

necessary framework for a fast transition to a circular economy, while neighboring countries accepted this document years ago as a guideline for transitioning to the circular economy model, which, alongside profit, focuses on environmental protection and resource conservation. This initial document will start a dialogue between decision-makers, industry representatives, the academic sector, and civil society, with the goal of defining future transitional steps and timelines using digital tools. Only recently has this concept appeared in BiH's strategies and plans, mainly in the field of environmental protection. In recent years, BiH has reformed its waste management legislation as part of efforts to transpose the European Union's legal framework. New terms such as product reuse, green islands, extended producer responsibility, recycling yard, and waste management center have been integrated into waste management laws. Specific duties, responsibilities, and obligations regarding industrial product manufacturers and waste carriers have been defined. Manufacturers of industrial products are required to use technology and develop production to ensure the rational use of natural resources, encourage the reuse and recycling of products, and promote the environmentally sustainable management of natural resources. All these changes are in line with the principles of the circular economy. However, it cannot be claimed that all these legal provisions are consistently implemented in practice. State and entity authorities are required to transpose annexes and new articles of related EU directives into local laws and policies. The representation of the circular economy in the region has reached its highest level in Slovenia. As early as 2016, Slovenia began its strategic and systemic circular transformation immediately after the publication of the Circular Economy Package, which the European Commission adopted in 2015. The Roadmap for Circular Economy in Slovenia set the path to becoming the leader of the circular economy in the region. One of the first and most necessary steps was the establishment of recycling centers and a separate waste collection system, which in just a few years helped reduce the amount of landfill waste, bringing Slovenia to the European top in recycling rates. Since 2018, this country has had a mandatory green public procurement system.

DUŠICA PEŠEVIĆ, PhD, graduated and obtained her Master's degree at the Faculty of Natural Sciences and Mathematics at the University of Banja Luka. She earned her PhD in 2010 at the Faculty of Geography, University of Belgrade, obtaining the academic title of Doctor of Geography in Environmental Science. She began her academic career at the Faculty of Natural Sciences and Mathematics at the University of Banja Luka immediately after completing her undergraduate studies. Her scientific research focuses on environmental protection, emphasizing various forms of environmental threats and protection, waste management, and circular economy. PhD Pešević has published five books and around fifty scientific papers in domestic and international journals and has participated in numerous scientific conferences. She represents Bosnia and Herzegovina in developing the Global Environmental Outlook (GEO7) as part of the United Nations Environment Program (UNEP).

Photograph: Pixabay/geralt; (Pešević) courtesy of Dušica Pešević



Compliance with environmental protection aspects in public procurement procedures is compulsory for electricity, food, textile products, office paper, televisions, refrigerators, and building construction, roads, lighting, tires, traffic signs, etc. Large export-oriented companies were the first to recognize the benefits of the circular economy in Slovenia.

Q: What is the main obstacle in the process of transitioning to a circular economy?

A: The key areas for creating conditions for the transition to a circular economy include the development and adoption of the Roadmap and Action Plan for the introduction of circular economy at the entity level (aligned with the Roadmap at the BiH level), removing legal barriers, and introducing incentive instruments for green business practices, promoting the application of green public procurement in public institutions and the private sector, developing regulations for eco-design of products, and ensuring financial support for strengthening voluntary instruments for green business practices. It should be kept in mind that the transformation of resource-intensive industries to a green and circular economy is not an easy task. Brown industries in BiH have a long tradition, employ a significant part of the workforce, and have developed value chains and market infrastructure. Considering good practices in the EU and the specifics of the Bosnian economy, to encourage the development of a circular economy in BiH, it is necessary to create a set of incentives aimed at creating value, reducing risks, and improving the competitiveness of circular economy supply chains.

Q: In which areas are good practices in support of circular economy principles represented?

A: Although there is no systemic approach to circular economy in BiH, there has been a noticeable increase in initiatives to promote it recently, including creating a strategic-regulatory framework. The waste management goals are outlined in the waste management strategies of various entities in BiH. One of the initiatives related to the circular economy is including the region in EU industrial supply chains and developing a regional agreement to prevent plastic pollution. In addition, the countries of the region have committed to a series of concrete actions, including the introduction of a carbon dioxide emission tax and market models to encourage renewable energy sources, as well as the gradual elimination of subsidies for coal.

In Bosnia and Herzegovina, the importance of the sharing economy has been growing in recent years, although it has not experienced the same level of expansion as in developed countries. Recently, private companies have shown increased interest in investing in circular economy activities and developing organized electricity markets in the region, particularly those companies expecting financial aid from various European funds.

Q: In which sectors is the transition to circular economy crucial for BiH?

A: The circular economy model, in which resources are kept in the economy for as long as possible and minimizes waste generation, reduces pressure on natural resources while simultaneously promoting sustainable growth and creating new jobs. It can make a decisive contribution to the decarbonization of the economy. This requires a complete shift in thinking and the concept of managing material resources for production, including primary and auxiliary resources, water, and energy. To introduce

Illustration: Freepik

a circular economy, it is necessary to improve the legal and strategic framework in the field of waste management in line with EU principles, as well as to introduce economic and financial instruments and mechanisms that will influence the reduction of waste quantity and the increase in the utilization rate of all waste categories.

BiH requires significantly more engagement in waste prevention, increasing sorting and recycling capacities, and substantially increasing recycling rates. Although the circular economy is much more than just recycling, as it is based on establishing an industrial system for creating from waste through repair, reuse, and remanufacturing of existing products, recycling has been a significant part of sustainable practices for many years. It is of fundamental importance to a circular economy. By increasing waste separation at the point of origin, which requires engagement from institutions and utility companies and raising public awareness, businesses will be able to receive more significant quantities of waste that require less effort to process. This will enable sufficient quantities of recyclable materials for sustainable production in various sectors (industry, agriculture, etc.) and efficient use of resources. The introduction of extended producer responsibility for packaging and packaging waste and electronic and electrical waste represents the first step towards transitioning to the circular economy in BiH. Extended producer responsibility is a principle that implies the producer is responsible for the entire life cycle of the product and packaging they place on the market. In practice, this principle works because the producer incorporates environmental protection costs into the product price, charges them to the end consumer, and then invests these funds in environmentally-friendly waste management of the product's use.

Q: Which countries, in your opinion, have a good representation of the circular economy, and how have they achieved success?

A: China and the European Union have made the fastest progress in transitioning to a circular economy. China was the first major Asian economic player to formally introduce circular economy policy at the national level as a concept for cleaner production. The Chinese government officially adopted the circular economy concept as part of its new development strategy in 2002. It approved the first law on promoting the circular economy in 2009, thereby creating legal and political foundations and initiating activities aimed at promoting the concept of circular economy. In Europe, Germany played a leading role in integrating the circular economy into national legislation, which it did as early as 1996 with the enactment of the Closed Substance Cycle and Waste Management Act. In 2021, the highest circularity rate was recorded in the Netherlands (34 percent), far exceeding the EU's target for 2030, followed by Belgium (21 percent) and France (20 percent). The lowest rate was recorded in Romania (1 percent), followed by Finland and Ireland (both at 2 percent). Belgium has made significant efforts to establish advanced waste sorting systems, develop innovative recycling technologies, and promote citizen awareness of the importance of proper waste management. The circular economy concept is primarily applied to waste management in the United Kingdom, Denmark, Switzerland, and Portugal. However, there are also business models that apply concepts of circular use (or reuse) of materials. A document called "The Manifesto for a Resource-Efficient Europe," published by the European Commission in 2017, clearly states that "in a world of increasing pressure on natural resources and the environment, the European Union has no choice but to embark on the path of transitioning to a resource-efficient and ultimately regenerative model of circular economy." The European Union's economy depends on raw materials from the rest of the world, and this dependence leads to vulnerability. Transitioning to a circular economy could, by reducing the EU's demand for primary resources and energy, increase resilience, reduce dependence on imports of energy and materials, and contribute to the shift to clean energy. Additionally, the circular economy contributes to climate neutrality and the preservation of biodiversity and ecosystems; it creates local green jobs and encourages innovation.

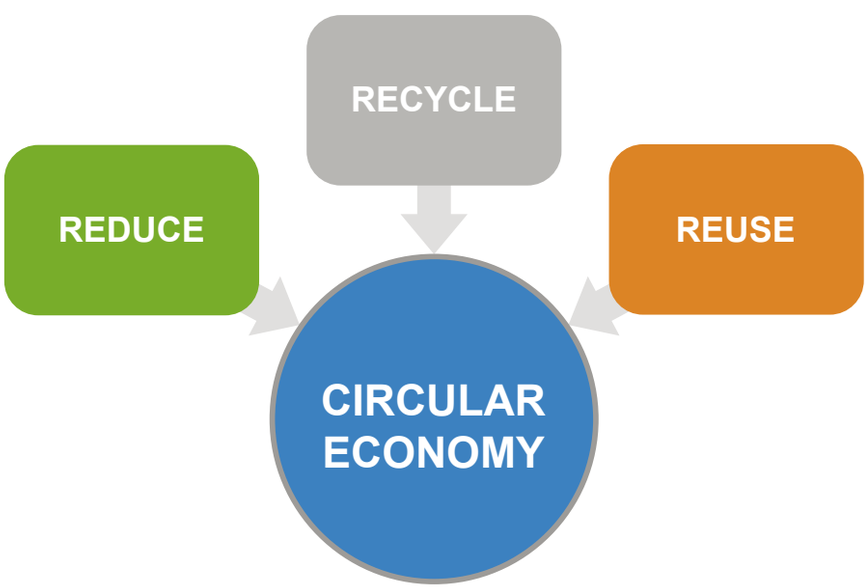


Illustration: courtesy of Dušica Pešević

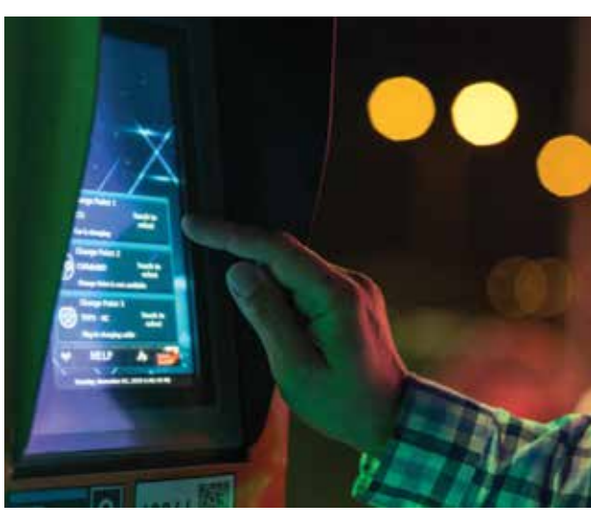
Interview by Jasna Dragojević

FIRST DC CHARGERS IN CITIES ACROSS SERBIA

Drivers in Serbia often face dilemmas when it comes to choosing electric vehicles. This ambiguity usually stems from the perception that adequate infrastructure is lacking, leading many to conclude that electric cars still pose too much risk despite their considerable benefits. It is also common for electric vehicle users who are in transit or visiting the country for business purposes to doubt the availability and efficiency of the domestic charging network.

The readiness of our charging infrastructure depends on many stakeholders, including companies that provide specific services in developing the charging network. Their initiative and operation can significantly influence perceptions about the risks and practicality of electric vehicles.

One of the key players in the development of infrastructure is the



Photographs: Charge&GO

company Charge&GO, which is starting this year with a lot of good news and important plans.

DC Chargers – from Kikinda to Prokuplje

Charge&GO recently launched two new chargers and then announced the installation of DC chargers in several cities across Serbia that previously did not have such equipment.

Talking about two new and active DC chargers, Charge&GO has installed one charger in the northern part of the country and the other in the south. An ultra-fast DC charger with a power of 150 kW with two CCS connectors was installed at the Super Vero parking lot in Novi Sad. The second installed charger, with a power of 60 kW with CCS connectors, is located within the Penta Park in Prokuplje and is the first DC charger in this city.

As for the plans for other cities, the company intends to install one DC charger in the following locations before the summer, i.e., during the first half of the year: Kragujevac, Loznica, Užice, Kraljevo, Jagodina, Kikinda, and Belgrade—on the Zrenjanin-Belgrade road. Up to two DC chargers are planned to be installed in some locations in the coming months, with one of the guaranteed locations being Zrenjanin.

It is very important to highlight that Kikinda, Loznica, Užice, and Jagodina are getting their first DC charger within the network, which will significantly contribute to the further development of infrastructure in the North Banat, Mačva, Zlatibor, and Pomoravlje District. Unlike Belgrade, which already has a solid number of chargers and developed supporting infrastructure, e-mobility has yet to become a part of everyday life in other cities. That is why every location is equally important in connecting all parts of Serbia, ensuring more equal access to modern traffic solutions.

Charging your vehicle should be a simple and routine process, which Charge&GO is continually working to improve

When considering the charging process for electric cars, the key factor for most users is the speed at which the vehicle's battery can be charged. Much like water through a garden hose requiring higher pressure for faster flow – a higher voltage allows the car to charge faster. Essentially, the efficiency of a charging station depends on its ability to quickly and efficiently transfer electricity to the vehicle's battery. Therefore, the chargers that Charge&GO will install in the next series will provide users with fast and efficient service in the eight mentioned cities of Serbia, as they are DC chargers. We should not forget the fact that the amount of power the vehicle will draw depends on the battery in the vehicle. That is, the battery has control over the charging process itself.

Improved Version of the Application

The application offered by the company is improving every day. It is used by more than 5,500 people, enabling easy management of the charging process. Registered users enjoy unique benefits and lower recharge prices. The application features a map showing charger locations, availability, connector type, and prices. Payment is automatically processed from the user's account after adding a payment card. For those who prefer a one-time payment, there is also an option for unregistered users. Charge&GO customer support is available 24/7 for any inquiries and problems. Additionally, a new advanced version of the Charge&GO application for iOS and Android devices is expected soon, with numerous new functions and tools for even faster and easier starting of charging sessions and worry-free planning of daily routes and trips.

Charging your vehicle should be a simple and routine process, which Charge&GO is continually working to improve. The charging station map will soon include several new locations across the country, allowing hesitant drivers to witness the development of electric vehicle infrastructure personally.

Prepared by Milica Vučković

WHERE DOES OUR WASTE GO, AND WHAT COMES IN?

The transboundary movement of waste is one of the indicators used to monitor progress in achieving sustainable waste management. The latest State of the Environment Report for the Republic of Serbia, published by the Environmental Protection Agency (SEPA), presents data for 2023, providing a detailed overview of the quantities of exported and imported waste, their types, and the countries to which they were transported.

Waste Export from Serbia

In 2023, a total of 300,003 tons of waste was exported from Serbia. Of this, 15,704 tons consisted of hazardous waste, while 284,299 tons were non-hazardous. The most considerable portion of this waste consisted of metals, primarily scrap iron, and steel. Additionally, significant amounts of exported waste included paper and cardboard packaging, wastepaper and cardboard, waste glass and glass packaging, waste edible oils and fats, and slag from the thermal metallurgy of aluminum.

Most of the waste was exported to Bulgaria and Croatia, where both hazardous and non-hazardous waste types were transported. Hungary, Slovenia, and Italy followed these countries, although only non-hazardous waste was exported there. Regarding dangerous waste, the most considerable quantities were transported to Bulgaria, Saudi Arabia, and Germany.

Among the exported hazardous waste types, the most prominent were waste generated from gas treatment in the iron and steel industry, non-chlorinated mineral motor oils, lead batteries, and hazardous components removed from discarded electrical and electronic equipment. However, large amounts of waste that could be processed domestically continue to be exported, indicating the potential for improving local recycling and waste processing systems.

In 2023, Serbia imported a total of 320,419 tons of waste. Of this, 6,734 tons were classified as hazardous, while 313,685 were non-hazardous. The majority of the imported waste consisted of paper and cardboard packaging, wastepaper, and cardboard, which together accounted for 55 percent of the total imported waste. Additionally, waste metals, plastics, rubber, and combustible waste from waste treatment facilities were also significantly present.

The largest quantities of waste were imported from Croatia, Hungary, Romania, and Bosnia and Herzegovina. Regarding hazardous

Photograph: Pixabay/Bakhrom Tursunov

One of the key challenges remains illegal waste trafficking, which can lead to environmental problems and pose risks to public health

waste, the majority originated from Bosnia and Herzegovina, with additional imports from Montenegro and North Macedonia. The most prevalent type of imported hazardous waste was lead batteries.

Trends in the transboundary waste movement show that Serbia continues to export and import the same types of waste, such as wastepaper and metals. While waste export can help address domestic waste surpluses, the simultaneous import of similar waste types suggests a need to optimize waste management within the country.

According to the Environmental Protection Agency, despite the increase in cross-border waste transfers, large quantities of waste, including hazardous waste, remain stored in Serbia. This highlights the need for further infrastructure development for proper waste disposal and recycling. The strategic goal remains waste prevention and reduction, along with improvements in domestic waste processing to reduce reliance on both waste exports and imports.

Regulation and Challenges

The management of transboundary waste transport largely depends on compliance with international regulations, primarily the Basel Convention, which governs the export, import, and transit of hazardous waste. Additionally, as a candidate country for European Union membership, Serbia is gradually aligning its legislation with EU regulations, which includes stricter standards for waste transport and processing.

One of the key challenges remains illegal waste trafficking, which can lead to environmental problems and pose risks to public health. Cases from previous years have shown that waste from certain EU countries has been illegally disposed of in Serbia, highlighting the need to strengthen inspection oversight and control mechanisms.

Opportunities for Improving the Waste Management System

Serbia has significant potential for developing its recycling industry, which could help reduce the export of raw materials that could be processed domestically. Investments in modern recycling technologies, as well as incentives for businesses to use recycled materials, could contribute to the economic sustainability of the waste management system.

Furthermore, informing the public and businesses about the importance of proper waste separation and treatment can lead to long-term positive effects. Adopting a circular economy and minimizing the use of primary raw materials through reuse and recycling are crucial steps toward more sustainable waste management in Serbia.

Prepared by Milena Maglovski

CHALLENGES AND OPPORTUNITIES FOR MONTENEGRO ON THE PATH TO A CIRCULAR ECONOMY

Countries in the region are making significant strides in implementing a circular economy (CE), which is vital for reducing dependence on primary resources, boosting competitiveness, and protecting the environment. We spoke with Milena Rmuš, Secretary of the Coordinating Committee for Energy Efficiency and Environmental Protection at the Chamber of Commerce of Montenegro, about how the country gradually embraces circular principles, tackles specific challenges, and develops key strategies and initiatives to achieve sustainable development.

Q: How would you describe Montenegro's progress in transitioning to a circular economy? What are the key challenges, and what has been the most significant achievement so far? What are the focus areas?

A: Montenegro has made some progress in transitioning to a circular economy, but it still faces a series of structural challenges that slow down its implementation. Aligning with European regulations provides a framework for further reforms, but the fundamental transformation of the economic system and business models is happening gradually.

The main obstacles include underdeveloped waste management and recycling infrastructure, while the capacity for processing secondary raw materials is limited. This makes closing material loops difficult and increases dependence on imported primary resources. Additionally, Montenegro generates a significant amount of municipal waste, most of which ends up in landfills, with recycling rates remaining below the European average.

Financial constraints, particularly for small and medium-sized enterprises, hinder the adoption of

Photograph: Pixabay/pixelRaw

circular business models. Incentive mechanisms and access to green financing are at a very low level. Furthermore, awareness among businesses and citizens about the benefits of circular transition is still unsatisfactory. A lack of education, limited access to information, and weak promotion of CE contribute to this issue. Targeting campaigns and integrating CE principles into educational programmes are essential to overcome this challenge.

Despite these challenges, Montenegro has made progress by improving the legislative framework in waste management, energy efficiency, and emissions reduction, laying the foundation for further CE development. Additionally, active regional cooperation within the Green Agenda for the Western Balkans has enabled knowledge and experience exchange.

The key focus areas for CE in Montenegro include sectors with high potential for circular practices, as well as horizontal policies that support the efficient integration of circular principles into economic flows. Given the specific characteristics of the national economy, particular attention and action are required in the agriculture, tourism, and construction sectors.

Tourism contributes significantly to GDP but generates large amounts of waste, resource consumption, and CO_2 emissions. In recent years, sustainability initiatives have improved the reputation of tourist destinations and attracted more visitors, while hotels have obtained prestigious Green Key certifications. The tourism sector has become an essential driver of the circular economy by introducing innovative technologies for resource monitoring and optimization and using renewable energy sources.

The key focus areas for CE in Montenegro include sectors with high potential for circular practices, as well as horizontal policies that support the efficient integration of circular principles into economic flows

Milena Rmuš

Secretary of the Coordinating Committee for Energy Efficiency and Environmental Protection at the Chamber of Commerce of Montenegro

Furthermore, the agri-food sector holds excellent potential for circular solutions, especially given Montenegro's high dependence on imported food products and raw materials. The focus is on producing organic, local, and healthy food using environmentally friendly practices and valorising bio-waste.

The construction sector in Montenegro faces challenges related to high CO_2 emissions, low energy efficiency of buildings, and unstructured management of construction waste. This makes further efforts necessary for the implementation of sustainable construction practices.

Q: How would you assess the importance of Montenegro's 2022 Circular Economy Roadmap and the National Circular Economy Strategy until 2030?
A: Montenegro's Circular Economy Roadmap from 2022 is the first docu-

Photograph: Pixabay/Tania_pl; (Rmuš) courtesy of Milena Rmuš

ment to create a framework for integrating circular principles into economic, regulatory, and institutional processes and aligning them with EU policies. Its implementation helps reduce reliance on imported raw materials, develop the secondary raw materials market, create an enabling regulatory environment, and strengthen economic competitiveness.

The document provides guidelines for priority sectors and outlines further steps, emphasizing public policies and business models. Sector-specific and local roadmaps that precisely identify challenges and opportunities within specific industries and regions are essential to enhancing CE implementation.

Based on the recommendations from the Roadmap, the Government of Montenegro in 2022 adopted the National Circular Economy Strategy until 2030, together with the Action Plan for 2023-2024. This comprehensive framework integrates CE into national development policies, redefines resource policy, industrial production, and waste management, and aims to create a resilient, competitive, and economically sustainable system. The action plans define concrete measures and resource allocation to ensure the transition is measurable, adaptable, and aligned with market and regulatory changes. The strategy identifies key sectors for the application of circular principles, including the agri-food, forestry, construction, and tourism sectors, while strengthening horizontal policies in the areas of education, innovation, and energy efficiency.

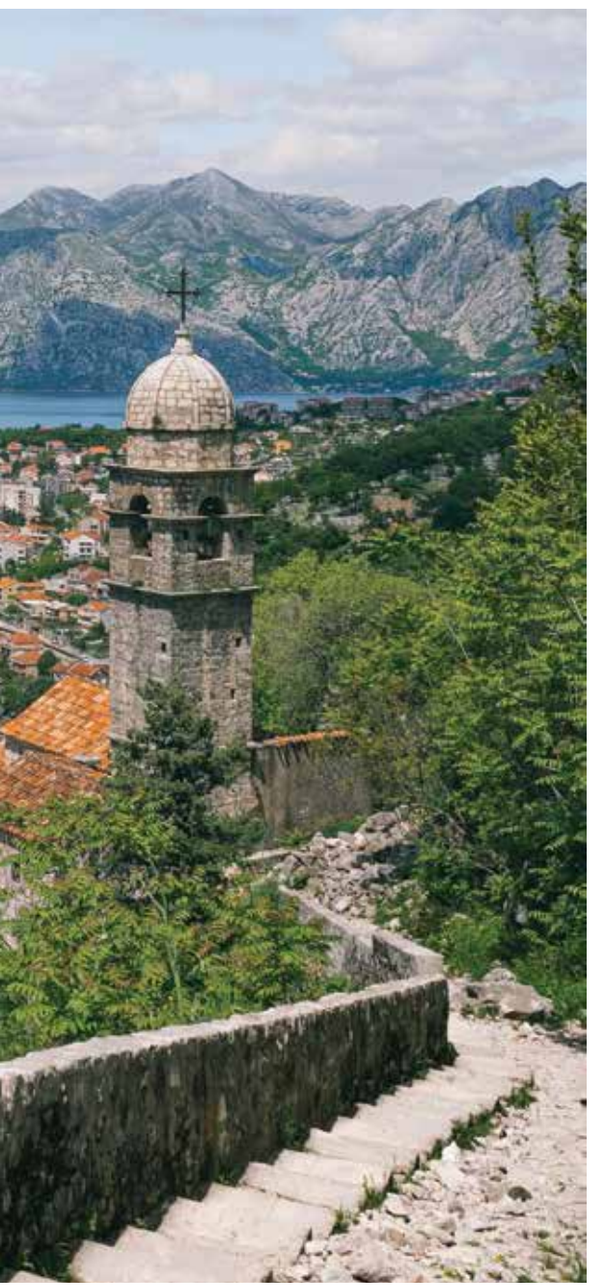
Q: The Chamber of Commerce of Montenegro has established the Circular Economy HUB. Can you tell us more about what this initiative represents, its goals, and who it is intended for?

A: The Circular Economy HUB within the Chamber of Commerce of Montenegro has been established as a central platform for coordinating and promoting CE principles. Its goal is to build a dynamic ecosystem that encourages innovation, accelerates the adoption of circular norms, and strengthens the competitiveness of Montenegro's economy. The HUB connects key stakeholders – businesses, state institutions, the academic community, non-governmental organisations, and international partners – to drive transformation in strategic economic sectors. The HUB strengthens the business sector's capacities through education, information on financial instruments, and encouragement of innovation in sustainable production. Direct communication with businesses supports the development of sustainable business models aligned with CE principles. It participates in the implementation of legal solutions in the areas of waste management and resource efficiency. As an educational and consultative platform, it enables knowledge exchange and networking, contributing to an accelerated transition to a sustainable and competitive economy.

In its initial phases, the HUB focused on sectors with the most

Photograph: Unsplash/Joachim Lesne

significant potential for integrating circular principles, primarily tourism and agriculture. Additionally, through horizontal measures, special emphasis has been placed on education and raising awareness within the business community. The HUB, as part of the activities of the Chamber of Commerce of Montenegro, participates in projects financed by the European Union, aimed at promoting CE at the regional and broader European level, fostering partnerships and the exchange of best practices. Additionally, the HUB organises professional conferences and gatherings at the national and regional levels.



The importance of local communities

Local communities play a key role in circular transformation because they are responsible for spatial planning, municipal services, and support for small businesses. Implementing the circular economy in Montenegro is most prevalent in financially more stable municipalities. Podgorica leads in infrastructure solutions for recycling, while southern municipalities are working on sustainable waste management and reducing the environmental footprint of tourism. Local authorities help preserve marine ecosystems through the blue economy, as most marine waste originates from land. However, northern Montenegro faces economic decline and a high rate of depopulation.

In the coming period, the HUB will direct its activities towards implementing solutions defined by the new waste management law, the overarching regulatory framework for further circular transition. Special attention will be given to establishing an efficient model of extended producer responsibility and developing activities for implementing ESG principles in business operations and ESG reporting. Although Montenegrin small and medium-sized enterprises (SMEs) do not yet have a formal obligation to report according to these criteria, their gradual implementation is becoming critical for access to international markets, investments, and supply chains.

Q: What are the key initiatives or projects related to the circular economy planned for 2025, and what is considered the most crucial step toward further improving this model in the country?

A: Given Montenegro's aspirations to join the EU by 2028, the accelerated integration of circular models will be key to aligning with European standards and strengthening the economy's competitiveness. Priorities include establishing an efficient secondary raw materials market, modernising recycling and waste processing infrastructure, and developing specialised financial mechanisms for circular investments.

For the acceleration of the transition to CE, it is necessary to establish a stable, supportive, and predictable regulatory framework that will enable economic incentives for businesses while gradually eliminating market distortions that favour the linear economy. In this context, the introduction of green public procurement is needed to stimulate demand for circular products, motivating companies to offer sustainable solutions. Furthermore, the development of circular infrastructure includes constructing and modernizing facilities for sorting, recycling, and waste valorisation. Establishing digital tracking systems that enable transparent monitoring of material flows is particularly important.

The financial sector should focus on green financing through favourable credit lines, guarantee schemes, and venture capital funds for circular investments. At the same time, it is necessary to strengthen cooperation with funds to mobilise additional sources of financing, while financial institutions should also provide advisory support and education to entrepreneurs on ESG standards. Finally, further development of horizontal areas of education and innovation is crucial. Educational programmes and training must be continuously aligned with the dynamic needs of the labour market, with a special emphasis on developing professional competencies and green skills.

Interview by Katarina Vuinac

FOUR SOLAR POWER PLANTS IN PRNJAVOR FOR NEW GREEN KILOWATTS

Soon, new kilowatts of green energy will begin to be produced in the town of Prnjavor, where preparatory works are underway for the construction of four solar power plants on the ground. The winter months were used to carry out earthworks – marking the terrain, digging and laying cables, and the progress of the works is going according to plan.

Power plants Prosjek 1, Prosjek 2, Prosjek 3, and Prosjek 4 each have a capacity of 149.26 kWp and will occupy a total area of around 13,500 square meters. They are being constructed in the town of Prnjavor in Bosnia and Herzegovina, and the investor is Solo Verde.

The locations of the power plants are easily accessible via the local access road, and the well-developed power infrastructure in this area enables efficient connection to the grid. The new plants are planned to be connected to the medium-voltage grid via a dedicated transformer station, ensuring a stable supply and maximum utilization of solar energy.

Solar panels from AIKO Solar and inverter systems from Huawei will be used for the construction of

Photographs: MT-KOMEX BH

A new step towards a greener future

Thanks to its favorable geographical location and large number of sunny days per year, Bosnia and Herzegovina has enormous potential for the development of solar energy. By utilizing this renewable energy source, the country reduces dependence on fossil fuels, enhances energy security, and contributes to environmental protection. Solar projects stimulate economic growth, create new jobs, and enable a cleaner and more sustainable future for future generations.

solar power plants, and other equipment will come from world-famous brands that guarantee long-term use and stable electricity production. The panels will be placed on an aluminum and steel structure oriented towards the south at a tilt angle of 28 degrees. The project envisages a basic primary steel structure driven into the ground.

Each of the power plants consists of 234 panels with a power of 640 Wp and three inverters with a power of 50 kW. The construction of Prosjek 1, Prosjek 2, Prosjek 3, and Prosjek 4 solar power plants was entrusted to the company MT-KOMEX BH, a renowned leader in renewable energy sources. With years of experience, the company's team of skilled engineers and installers applies state-of-the-art technical solutions to ensure maximum efficiency and long-term reliability of the system.

MT-KOMEX BH enabled the investor to optimally use the potential of this location with top-notch implementation of all project segments

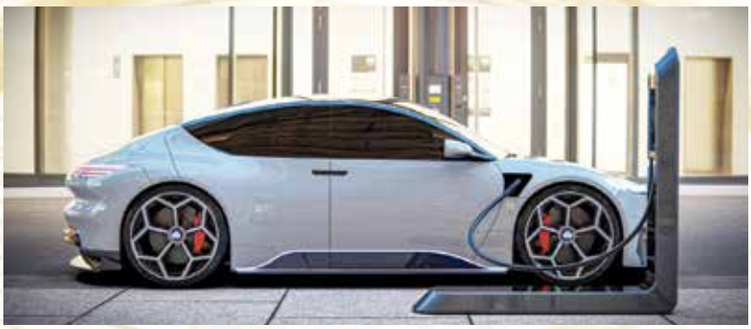
– The terrain where the solar power plants are being built is challenging as it is inclined towards the north, which is not ideal for the installation of solar panels. However, after a detailed analysis, the optimal panel tilt angle and the distance between the rows were determined so that they would not be shaded, which can cause reduced production. Based on the above, the layout of the solar power plants was designed to ensure the best utilization of the plot – said Bojan Lazić, the project engineer.

Thanks to the expertise and dedication of MT-KOMEX BH, the investor has been able to optimally use the potential of this location with top-notch implementation of all project segments – from design and preparatory works to final installation and grid connection.

According to the data, the average annual electricity production per solar power plant, accounting for losses, is 211,897 kWh. The estimated annual production of solar power plants was obtained using software packages.

With the completion of these projects, Bosnia and Herzegovina will receive new kilowatts of green energy. Energy from renewable sources enables economic growth, improves the quality of life, and contributes to the fight against climate change. One of the main advantages of solar power plants is their ability to reduce the emission of harmful gases because they do not use fossil fuels to operate. The installation of solar panels is becoming increasingly affordable, and their performance continues to improve, contributing to global efforts to reduce dependence on conventional energy sources.

Prepared by Jasna Dragojević



Canada

In 2023 alone, **more than 320,000 new electric vehicles** were registered across Canada.

Serbia

The Waste Management Program of the Republic of Serbia (2022–2031) envisages **three plants for producing fuel from waste (RDF)** in large settlements, with a capacity of about 75,000 tons annually.

Program PRO

Local management for people and nature is focused on the economic empowerment of **informal waste collectors**, providing them not only with more stable sources of income but also better access to rights and services.

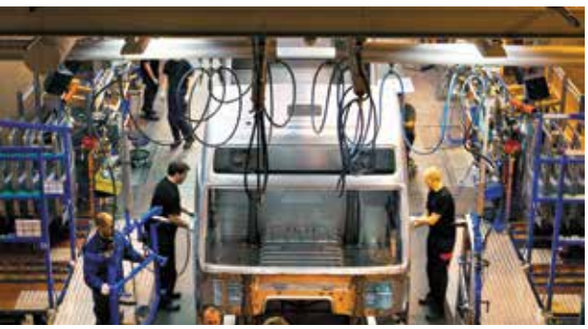
Ceefor

The CEEFOR company, with many years of experience in designing solar power plants, **efficiently manages construction waste**, ensuring that materials suitable for recycling or reuse are not mixed with other types of waste and do not end up in landfills.

MT-KOMEX D.O.O.
ENERGY SOLUTIONS

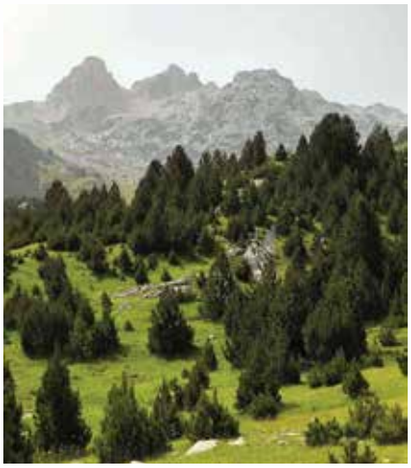
The MT-KOMEX company is successfully completing a project in the Banat area – a solar power plant that will save **4.500 tons of CO_2** annually.

Photographs: (top) Pixabay/Lee Rosario; (middle top) PRO – Local Governance for People and Nature; (middle left) Unsplash/Ljubomir Žarković; (middle right) CEEFOR; (bottom) MT-KOMEX



VOLVO

Volvo Trucks will begin incorporating **low CO_2 emission steel into commercial production** on a larger scale starting in 2025. This represents a significant step forward towards its goal of achieving a net-zero emission supply chain by 2040.



BiH

In Bosnia and Herzegovina, the **number of tourists significantly increased from January to December 2024.** Compared to the same period in 2023, it increased by 12.97 percent, compared to 2022 by 34.80 percent, and compared to 2019 by 17.62 percent.

MT-KOMEX BH ENERGY SOLUTIONS D.O.O.

The company MT-KOMEX BH has been entrusted with the construction of **four solar power plants** on the territory of the city of Prnjavor, with a **total power of 597,04 kWp**. These power plants will significantly contribute to greening the energy portfolio of Bosnia and Herzegovina and improving the quality of life for citizens.

The City of Užice

In Užice, the concentration of **PM10 particles** in 2018 was 45.5 μg/m³, and by 2023, it decreased to **32,7 μg/m³**. Additionally, the number of days with exceeded pollution levels has significantly decreased, confirming the success of the energy rehabilitation measures of buildings.

charge&GO

Kikinda, Loznica, Užice, and Jagodina are getting their first DC charger within the network, which will significantly contribute to the further development of infrastructure in the districts of North Banat, Mačvan, Zlatibor, and Pomoravlje.

Photographs: (top) VOLVO; (middle left) *Nasiha Pozder;* (middle) MT-KOMEX BH; (middle right) Wikipedia/Peđa Šupurović; (bottom) Charge&GO

HUMAN HEALTH IS DIRECTLY DEPENDENT ON THE HEALTH OF NATURE

Atypical cancers, endocrine disorders, neurological impairments, allergies, and vector-borne diseases are a common denominator, whether we are talking about climate change or excessive plastic pollution as their cause. The ability of the system to function is repeatedly proven when a crisis occurs, yet what is missing is mitigation and adaptation to climate change, along with a systematic approach to prevention and treatment once the crisis has passed. These were the key conclusions of the second WWF Environmental Policy Forum, Impact on People and Health.

– There is ample evidence that climate disruptions have led to an increase in diseases that were previously considered atypical for our region. A concrete example is West Nile fever or allergies, which nearly 50 percent of the population now reports experiencing symptoms of. We feel these effects every day. The range of causes extends from heat waves (which are responsible for the immediate deaths of 70,000 people), through droughts and floods, to the emergence of viruses we are encountering for the first time – stated Dunja Macoko Drvar, Director of the Nature Conservation Program at WWF Adria.

Large quantities of plastic are present in 63 percent of everyday products

Milanko Šekler, scientific advisor at the Veterinary Specialist Institute in Kraljevo, explained that viruses primarily spread through insects and birds, their most frequent targets. He emphasized that any climate deviation of even +0.1 degrees Celsius results in an expansion of insect populations by approximately 150 kilometers north and south of the measurement point.

Maja Vučković Krčmar from the Delegation of the European Union followed up with data from the World Health Organization (WHO), highlighting the alarming increase in lung cancer cases among non-smokers (with as many as 200,000 cases recorded), as well as a 15 percent rise in cardiovascular diseases in 2023.

Photographs: WWF

– Through our actions or inaction, humans will push themselves to the brink of survival, while nature will endure – emphasized Vučković Krčmar.

To Sustain Healthcare Systems, Investments, and Workforce Retention Are Crucial

To ensure the survival of healthcare systems, we must invest more in healthcare, work on motivating healthcare professionals to remain in the country and follow the recommendations of recognized experts.

According to Igor Jezdimirović from the Association of Environmental Protection Engineers, of the 1.25 kg of waste we produce daily, 0.2 kg is plastic, which ends up in sanitary or non-sanitary landfills. The lack of deposit and recycling systems, as well as the unwillingness to enforce existing regulations, has led to a general reluctance to address the issue of waste management.

Once plastic breaks down into micro and nanoparticles, it primarily ends up in the water, from where it enters the bodies of humans, plants, and animals. Senior Research Associate Maja Raković noted that the Institute for Biological Research Siniša Stanković maintains a relational database on river pollution in the Danube basin, which is updated daily with precise data. This database could serve as a foundation for further research on the impact of microplastics on aquatic ecosystems and human health.

Large quantities of plastic are present in 63 percent of everyday products, with its proportion ranging from 15 percent to 50 percent.

– The most common way humans are exposed to harmful plastic substances is through skin contact (via clothing, cosmetics, and hygiene products containing these particles). Long-term exposure, even at low intensity, is key to understanding how these substances accumulate in the human body – warned Branislava Matić from the Institute of Public Health of Serbia Dr Milan Jovanović Batut.

Another major water-related issue caused by climate change is water blooming, which leads to the proliferation of cyanobacteria. Without first acknowledging that nearly all surface waters are affected by this issue, followed by proper and continuous monitoring and ultimately timely interventions by public water treatment companies, disruptions in water supply systems become inevitable.

The most recent incident occurred in Užice, but this case also demonstrated how a crisis led to the redefinition of operational processes to prevent similar situations in the future. Marija Simić Savić from the association Ekomar emphasized that it is crucial to encourage all authorities responsible for water management to conduct regular and proper monitoring to ensure an uninterrupted water supply and prevent potential crises.

– Environmental issues are the greatest generational battle. I urge all actors, both institutional and non-institutional, not to lose enthusiasm and to continue upholding the principles of networking, to which forums like this significantly contribute – stated Mihailo Vesović, Director of the Sector for Strategic Analysis, Services, and Internationalization at the Chamber of Commerce and Industry of Serbia, during the opening of the Forum.

The WWF Environmental Policy Forum was organized at the Chamber of Commerce and Industry of Serbia and implemented as part of the Safe Nature and Climate project, which was financially supported by the European Commission. The project's goal is to strengthen the capacity of civil society organizations in Serbia that focus on environmental protection and climate change.

WWF

GLOBAL AI AND ENERGY MONITORING CENTER: IEA ANNOUNCES INNOVATIONS AS INDIA BUILDS THE WORLD'S LARGEST DATA CENTER

The International Energy Agency (IEA) has announced the launch of a Global AI and Energy Monitoring Center this spring to track the growing impact of data center construction on electricity consumption. During the "AI Action Summit" in Paris, IEA Executive Director highlighted that the rapid growth of artificial intelligence and digital technologies requires urgent coordination between energy companies, government institutions, and the technology sector to ensure a stable and sustainable energy infrastructure.

According to IEA data, electricity demand from data centers currently accounts for 1.4 percent of global consumption, with projections suggesting it could reach as high as three percent by 2030. An AI data center can consume as much electricity as 100,000 households on average. IEA Director Birol warned that without proper planning and the construction of new energy infrastructure, many AI projects risk being delayed or halted.

In addition to increasing energy demands, artificial intelligence offers significant potential to transform how we produce, consume, and distribute energy. AI can improve weather forecasting and efficiency in developing new technologies, including nuclear energy (such as small modular reactors) and geothermal solutions, while also optimizing the operation of electric grids.

In December last year, the IEA organized the first global conference on energy and artificial intelligence, where experts from various sectors discussed how AI can facilitate the green transition and enhance energy system efficiency. Ahead of the release of its new Special Report on Energy and Artificial Intelligence on April 10, Dr. Birol confirmed that the "Energy, AI, and Data Center Observatory" will also be launched on the same day, providing the most detailed publicly available data on the global energy needs of AI technologies.

India is currently constructing the world's largest data center, designed to offer massive storage, processing, and analytics capacities to support the development of artificial intelligence and other advanced digital technologies. The data center is being built near Mumbai, one of India's key business and technology hubs, and during the summit, the IEA director praised the Indian Prime Minister for this ambitious initiative.

The primary goal of the project is to ensure a reliable IT infrastructure that supports the exponential growth of AI applications while giving India a strategic advantage in the global race for technological innovation, attracting international investments, and creating new jobs in the rapidly growing IT sector.

The new observatory that the IEA plans to launch will serve as a centralized, comprehensive system for monitoring energy consumption in data centers and the impact of artificial intelligence on energy infrastructure. This means the IEA will collect and analyze detailed data on how much electricity data centers worldwide consume, how the rising demand for AI technologies is affecting global electricity needs, and which models of collaboration and innovation prove most effective after the project goes live this spring.

Energy Portal

Photograph: Pixabay/Elchinator

NEW GENERATION OF SOLAR CELLS – FULLY RECYCLABLE AND ENVIRONMENTALLY FRIENDLY

Researchers from Linköping University in Sweden have developed a revolutionary method for recycling next-generation solar cells, enabling their reuse without harmful chemicals. This innovation, published in the journal Nature, could solve the problem of electronic waste and advance the sustainable energy transition.

Unlike traditional silicon panels, which end up in landfills after their lifespan expires, the new perovskite solar cells can be fully recycled using only ordinary water as a solvent. Even more impressively, recycled cells retain the same efficiency as the original ones – converting up to 25 percent of solar energy into electricity.

What Are Perovskite Solar Cells and Why Are They Superior?

Perovskite solar cells are a type of photovoltaic cell made from perovskite materials, which have a unique crystal structure suitable for high-efficiency solar energy conversion. These cells are lightweight, flexible, and transparent, meaning they can be used on various surfaces – from traditional solar panels to windows and even textiles.

Unlike silicon solar cells, which require high temperatures and complex manufacturing processes, perovskite cells can be produced more cheaply and with lower energy consumption. Additionally, they have the potential to be more efficient in low-light conditions, making them ideal for various climates.

Revolutionary Recycling Method – Without Harmful Chemicals

Current methods for recycling perovskite cells use toxic solvents such as dimethylformamide, which are harmful to the environment and human health. However, researchers from Linköping have developed an innovative approach that uses water as the only solvent.

Their method allows careful decomposition of solar cells in water, enabling all key materials – glass layers, electrodes, perovskite layers, and charge transport layers – to be reused in new cells without any loss of performance. This process not only reduces waste but also significantly lowers the environmental footprint of solar panel production.

Milena Maglovski

THE WORLD'S LARGEST AIRCRAFT WILL TRANSPORT WIND TURBINE BLADES LONGER THAN A FOOTBALL FIELD

Wind energy holds untapped potential that requires further infrastructure development to be fully harnessed. Roads used for transporting wind turbine blades are often unsuitable due to limited width, especially in areas with tunnels, bridges, and sharp curves. Currently, the maximum blade length that can be transported by road is no more than 70 meters.

The efficiency of wind energy production also depends on the length of the blades. Increasing the efficiency of wind turbines means extending the length of their blades. To enable future blades to reach lengths of over 100 meters, a new method of transportation must be found.

One potential solution comes in the form of innovative technology such as the WindRunner – the world's largest aircraft designed to transport these massive blades. This aircraft will be capable of transporting blades up to 105 meters long – longer than a standard football field, for comparison.

The WindRunner will be able to land on semi-prepared dirt runways as short as 1,800 meters, significantly shorter than standard runways. Thanks to this design, wind turbine blades can be delivered almost directly to their installation sites.

The largest aircraft ever built was the Antonov An-225, designed for cargo transport, with a cargo volume of approximately 1,160 cubic meters. However, once completed, the WindRunner will push the boundaries of possibility with an astonishing 8,200 cubic meters of cargo volume, as announced on the official website of Radia, the company developing this revolutionary aircraft.

Katarina Vuinac

Photographs: (left) Unsplash/Jadon Kelly; (right) Pixabay/Enrique

DR CONGO PLANS TO PROTECT 550,000 SQUARE KILOMETERS OF THE WORLD'S LARGEST REMAINING TROPICAL FOREST

The Democratic Republic of the Congo has recently unveiled an ambitious plan to protect and preserve the world's largest remaining tropical rainforest. President Félix Tshisekedi emphasized that the project will involve the creation of the world's largest tropical forest reserve along the Congo River Basin, spanning more than 550,000 square kilometers of forest.

This initiative represents a crucial step in safeguarding forest ecosystems within the Congo Basin, whose forests constitute a significant portion of the world's natural resources. By establishing a green corridor that will connect the Kivu region with the capital, Kinshasa, DR Congo aims not only to preserve the rainforest but also to stimulate economic development and improve the living conditions of millions in the region. The planned expansion of the corridor to over 2,400 kilometers will be a major step toward sustainable development, biodiversity conservation, and mitigating the effects of climate change.

According to international media reports, President Tshisekedi underscored that this project extends beyond mere forest conservation, as it will also have a profound impact on local communities. Estimates suggest that the implementation of the green corridor could generate approximately 500,000 new jobs and secure one million tons of food annually for Kinshasa, Africa's largest city.

The project has received support from the European Union, which has mobilized 1 billion euros for this purpose. Additionally, the EU has allocated more than 40 million euros in grant funding to promote sustainable agriculture, the use of renewable energy sources, and biodiversity conservation.

Data shared by the World Economic Forum (WEF) indicate that the Congo River Basin serves as the world's largest tropical forest carbon sink, absorbing 1.5 billion tons of CO_2 annually.

Energy Portal

FINLAND DEVELOPS THE MOST ADVANCED RADIOACTIVE WASTE DISPOSAL SYSTEM

Finland has recently completed a trial run at its nuclear waste encapsulation facility, marking a significant step toward achieving a safer and more long-term solution for disposing of highly radioactive materials. This approach aims to ensure that the radioactivity decreases to a safe level over the course of several decades. Recognized as one of the most advanced nuclear waste management solutions, this project could serve as a model for other countries facing similar challenges.

What Is Encapsulation and Why Is It Important?

Encapsulation is a technological process in which highly radioactive waste, such as spent fuel rods from nuclear reactors, is hermetically sealed in specially designed containers resistant to corrosion and mechanical damage. These containers are then transported and stored in deep geological repositories, located within stable rock formations at great depths. The objective of this process is to isolate radioactive materials for thousands of years—until radiation levels decrease to a safe threshold.

Finland's encapsulation facility is part of a broader complex dedicated to the final disposal of nuclear waste. Once the final disposal process begins, spent nuclear fuel will be transported from interim storage to this facility, where it will be securely packed into canisters before being transferred to underground repository tunnels, at depths ranging from 400 to 450 meters. The canisters will then be placed in specially designated deposition holes lined with bentonite clay, which provides additional protection against potential radioactive leakage, as explained by World Nuclear News (WNN).

Completion of the Trial Phase

The Finnish company responsible for this project has recently concluded the trial run of the final disposal process (Trial Run of Final Disposal – TRFD) at the encapsulation facility. The final canister used in this test phase—initiated in August last year—was successfully encapsulated, underwent structural inspection, and was transported to the underground repository at a depth of 430 meters, according to WNN.

Energy Portal

Photographs: (left) Pixabay/Kudra Abdulaziz; (right) Pixabay/minka2507

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IS GREEN STEEL THE NEXT STEP TOWARD A CLIMATE-NEUTRAL TRUCK?

Steel makes up 47 percent of a typical diesel-powered truck, the so-called heavy truck, and is responsible for about 44 percent of the CO_2 emissions generated during its production. But what if all this steel could be replaced with a low-CO_2 emission alternative?

In 2025, Volvo Trucks will begin massively incorporating low-CO_2 emission steel into its commercial production. This marks a significant step forward toward its goal of achieving a net-zero emissions supply chain by 2040.

The new low-CO_2 emission steel is produced using recycled materials and renewable energy, which reduces emissions by about 80 percent compared to standard steel.

Starting next year, this new low-CO_2 steel will be used for rail frames in approximately 12,000 Volvo FH and Volvo FM trucks, which is expected to reduce CO_2 emissions by

Photographs: Volvo

around 6,600 tons. That is equivalent to the annual CO_2 emissions produced by 910 European residents.

Why Low-CO_2 Emission Steel Is a Key Factor in Producing Net-Zero Emission Trucks

If Volvo Trucks aims to fulfill its environmental ambitions, including a net-zero emissions supply chain, it is crucial to use an alternative to standard steel with low CO_2 emissions.

involves hydrogen instead of coal in the iron reduction process, effectively eliminating all CO_2 emissions. However, this technology is still developing and is not yet commercially available in large quantities. In the meantime, Volvo Trucks is exploring ways to use recycled steel to reduce the carbon footprint of its trucks today.

Now that low-CO_2 steel is better understood, the next step is to replace steel in different parts of the truck—and that plan is already underway.

The new low-CO_2 emission steel is produced using recycled materials and renewable energy, which reduces emissions by about 80 percent compared to standard steel

durability and surface treatment tests and that its characteristics were equal to those of conventional steel. Only then did we decide to start using it in production, explains Harsha A.R., Chief Engineer at Volvo Trucks.

As this is a recently developed product, the available quantities of new steel are still relatively small. However, as the supplier ramps up production for all steel grades, Volvo Trucks hopes to increase its use to replace standard steel consumption.

– Our strategy was to start with one type of steel of a specific thickness in a pilot project, but the plan has always been to expand this practice if the outcome is successful. Now that we have a better understanding of this steel and have tested it, the next step is to apply it to different steel grades and thicknesses and replace steel in various truck sections. That plan is already in preparation, says Harsha.

– Since steel is the largest structural material in a truck and its production has the most significant environmental impact, the ability to use a low-CO_2 alternative in mass production is genuinely essential for meeting our environmental ambitions, says Håkan Björklund, Product Architect at Volvo Trucks.

In 2022, Volvo Trucks became the first truck manufacturer in the world to use fossil-free steel. This steel is produced using a new technology that

How Low-CO_2 Emission Steel Could Shape the Future of Truck Transport

Before it could incorporate new low-CO_2 steel into production, Volvo Trucks had to test and verify its quality.

– From a technological perspective, we need to understand steel better. Due to its recycled content, there are some differences in its properties. That's why we had to ensure that it could pass all our internal

The successful adoption of low-CO_2 emission steel eliminates one of the biggest obstacles to producing net-zero emission heavy trucks. By integrating this innovative material, Volvo Trucks is making a significant step forward in achieving its environmental goals.

Volvo Trucks

TREBINJE BECOMES THE ENERGY HUB OF THE REGION

The Energy Summit SET Trebinje is opening its doors to visitors for the sixth time. From March 19 to 21, Trebinje will become the regional energy hub, bringing together over 900 participants from around ten countries in the region. This event provides an opportunity to discuss new projects, investments, and upcoming developments in the energy sector in the years ahead. Aleksandar Branković, director of SET Trebinje, shared insights on what to expect at the forthcoming summit.

Q: Preparations are underway for the 6th Trebinje Energy Summit, which will be held under the slogan Just Energy Transition in the Western Balkans. What sets this year's summit apart from previous editions?

A: The Trebinje Energy Summit is an opportunity to showcase all the ideas and projects implemented in recent years across the region. It will also provide insight into new business models that will need to be adopted in Bosnia and Herzegovina starting next year with the introduction of the CBAM tax. The event will bring together experts, scientists, and investors to discuss the projects they have undertaken and exchange experiences. The upcoming SET Trebinje will not undergo significant changes compared to previous editions because, based on attendance in recent years, we have realized that we are on the right track regarding event organization and alignment of topics with the current energy landscape in the region.

Q: During the three-day program,

Photograph: SET Trebinje

multiple panel discussions are expected. Which of them should conference attendees not miss?

A: This year's SET Trebinje will feature one plenary session and six separate panel discussions. The plenary session and the summit will begin with a discussion on climate change, specifically its impact on electricity production from renewable energy sources. Four distinguished professors from prestigious universities in the region will present climate models predicted for this region over the next 10 to 20 years. They will discuss the state of water resources, not just water—wind and solar energy as well—analyzing how these factors will affect electricity generation from renewables.

A particularly important topic at this year's summit is the energy transition of the Western Balkans, specifically, the implementation of conditions and the Green Plan adopted under the Sofia Declaration and the Paris Agreement, as well as the introduction of the CBAM tax on electricity production from fossil fuels, which will take effect on January 1, 2026.

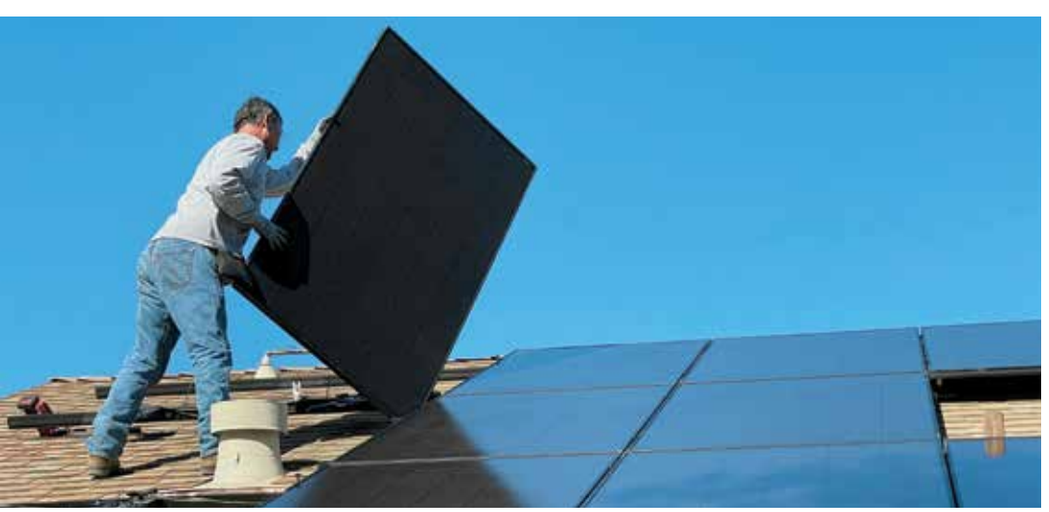
Of course, we cannot overlook electricity trading, one of the most critical topics for all investors who have invested in renewable energy sources, including solar power plants and wind farms, and expect returns on their investments.

The Trebinje Energy Summit is an opportunity to showcase all the ideas and projects implemented in recent years in this region

We will also discuss investments in renewable energy sources, emerging technologies in renewable energy development, the state of the transmission network, and the need to expand its capacity.

Q: SET Trebinje is the first scientific event of its kind in the region. Given the growing interest in the future of energy, the number of similar conferences has also been increasing. What makes SET Trebinje stand out?

A: It is true that in 2019, when we first came up with the idea of organizing the Energy Summit and chose Trebinje as the destination for this regional conference, there were not many similar events. Before the Trebinje Energy Summit, there was the Energy Summit in Neum, which had a completely different concept compared to our event. After the COVID-19 pandemic in 2021, similar conferences suddenly started appearing across the region, particularly in Belgrade, Podgorica, Banja Luka, Zagreb, Sarajevo, and other cities. However, regarding concept, organization, and the broad scope of topics covered, SET Trebinje remains the leading conference of its kind in the entire region. This is evident from the number of participants and sponsors who continue to support the event.



Aleksandar Branković
Director of SET Trebinje

As hosts, we strive to ensure that every participant leaves Herzegovina with great memories, that the program maintains high quality, and that the conclusions drawn at the summit are presented to the broader professional community and government institutions.

Regarding the event's organization, we are the only conference directly organized by a company that dedicates an entire year to planning every detail. For this reason, the organization is at an exceptionally high level, which our attendees recognize—leading them to return year after year.

Interview by Jasna Dragojević

Photographs: (bottom) Unsplash/Bill Mead; (Branković) courtesy of Aleksandar Branković

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CIRCULAR ECONOMY – A GOAL OR A MEANS OF WASTE MANAGEMENT?

The last two centuries have been characterized by intensive exploitation of natural resources, resulting in significant changes in both natural and anthropogenic material flows. The need for developing and implementing a circular economy has arisen due to the excessive consumption of material goods in modern societies, coupled with waste generation, climate change, and detrimental environmental emissions. The circular economy (CE), serving as a foundation for the economy of the future, promotes responsible behavior towards secondary resources, advocating for environmental preservation while still maintaining the benefits of modern civilization. While these ideas and principles sound inspiring, the question remains: Is it genuinely possible to achieve such a balance, and under what conditions?

August Wilhelm von Hofmann, the first president of the Royal Society of Chemistry and a pioneer of the circular economy, stated in 1848: "In an ideal chemical factory, there is no waste—only products. The better a factory utilizes its waste, the closer it is to its goal—greater profit." Today, even though the circular economy is recognized as the foundation of sustainable development, we remain far from Hofmann's ideal. Furthermore, our task is even more complex, as we must optimize individual industrial processes and the entire anthropogenic metabolism, incorporating all economic and industrial sectors, consumers, and households.

A declarative commitment to the principles of the circular economy has become highly attractive—not only for the economy and industry but also for environmental protection. The Circular Economy Development Program of the Republic of Serbia for the period 2022–2024 establishes a legal framework aimed at creating an environment in which resources are used efficiently,

Photograph: Pixabay/Gregor Mima

As a necessary step for the proper development and implementation of the circular economy, it is crucial that we, as a society, understand and accept the fact that the circular economy is not the ultimate goal but merely a tool for achieving sustainability objectives, which are complementary to waste management goals

environmental pressure is reduced, and economic development continues. The document Roadmap for Circular Economy in Serbia describes the circular economy as an industrial model focused on resource regeneration and waste reduction. The core idea of this approach is that waste does not exist—every waste material has the potential for reuse and must be fully utilized.

Although this concept encourages a positive transformation of production processes, the question remains: How feasible is this approach in modern societies facing overconsumption (the very foundation of economic growth), increasing product complexity, waste challenges, and infrastructure limitations? It is essential to highlight that reducing environmental pressure while fostering economic development simultaneously remains one of the most significant challenges of contemporary societies!

This very challenge necessitates the definition and positioning of the role of waste management in the modern economy. Although in recent years, waste management goals have not been given much significance

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Photographs: Pixabay/Benjamin C, courtesy of Nemanja Stanisavljević

or discussed within professional and academic circles in Serbia, they have already been elaborated on in the public sphere. The anthroposphere consumes large quantities of materials, accumulates part of these materials in infrastructure over long periods, and generates significant amounts of waste daily. Efficient waste management is crucial for adequately addressing all outputs of the anthroposphere. These outputs, which may have been produced 10 or even 100 years ago, may contain legacy substances that are either currently unusable or banned due to toxicity or hazardous characteristics, such as mercury, lead, asbestos, cadmium, or brominated flame retardants (BFRs). These substances must be managed to prevent contamination of the circular economy. For this reason, the problem of waste and its management, treatment, disposal, and reuse as a secondary resource cannot and must not be viewed solely in terms of mass; instead, its chemical composition and hazardous substance content must also be considered. In the circular economy, waste containing hazardous substances must be purified (detoxified) before recycling, which is sometimes impossible or extremely costly. Moreover, new consumer products with complex chemical compositions appear every year, some of which may contain newly identified hazardous substances. These substances, together with legacy contaminants, pose a challenge to waste management systems and circular economy concepts.

Efficient management of non-reusable outputs of the modern economy through waste management systems while simultaneously striving toward sustainability goals, such as the protection of human health and the environment, is a fundamental challenge and objective for the circular economy. Current circular economy concepts focus exclusively on recyclable or reusable waste materials, while waste containing contaminants (hazardous substances) is entirely marginalized. With the development of the circular economy, an increase in the number of implemented projects is expected, eventually leading to the evolution of quality standards for secondary materials. Due to new criteria for secondary raw materials, significant amounts of non-recyclable and hazardous materials/substances will be generated, requiring adequate management and safe disposal. Due to this fact, treatment facilities and/or landfills that serve as safe disposal sites must become integral to all circular economy projects and concepts.

Once again, the waste management system emerges as a key sustainability process in today's economy. As a filter between the anthroposphere and the environment and as a process of purifying solid outputs (waste), which produces secondary resources needed for the circular economy, it remains the only system capable of handling non-recyclable waste through its existing and/or required infrastructure. Therefore, the role of waste management is not only to provide resources from waste but also to properly handle non-reusable and hazardous substances by directing non-recyclable waste into safe, final disposal sites and/or treatment processes. This requires appropriate waste treatment technologies that produce three types of products: clean, recyclable materials that can replace primary resources, inert residues for safe disposal, and acceptable levels of emissions into the environment (air, water, and soil). In an ideal scenario of a sustainable circular economy, only non-toxic (uncontaminated) materials would be used, eliminating the need for safe disposal sites for hazardous substances. However, in today's economy, we face large amounts of

Photographs: (top) Unsplash/Jas Min; (middle) Pixabay/Franz W

hazardous materials and substances that require safe management, making strategies and concepts for their disposal essential.

As a necessary step for the proper development and implementation of the circular economy, it is crucial that we, as a society, understand and accept the fact that the circular economy is not the ultimate goal but merely an instrument for achieving sustainability objectives, which are complementary to waste management goals. The current focus of the circular economy, which is exclusively directed toward increasing recycling rates and utilizing resources from waste, must be shifted toward fulfilling waste management objectives. The circular economy cannot and should not replace waste management; instead, it is a strategic tool for achieving waste management goals, not a goal in itself. Just like the waste management hierarchy and all available waste treatment technologies, the circular economy is a means that contributes to achieving the fundamental objectives of waste management—protecting human health and the environment, preserving resources, and ensuring the sustainability of waste management. Therefore, it is of fundamental importance that circular economy concepts also encompass the disposal of waste that cannot and must not be recycled. Only then can we begin discussing future green development.

In both the professional community and the general public, sufficient knowledge exists about the main obstacles and the need to develop waste management in line with circular economy principles. We now have enough human resources who understand the issues, possess knowledge, and have a vision. However, we lack human resources capable of implementing these concepts and managing the system effectively. We must continue working on capacity building for education in waste management and circular economy at our universities, investing in and conducting research that will provide us with new, Serbia-specific information—information that is not merely a trend imported from developed countries. We must gain insights into regional, national, and local material flows (resources and waste) so that circular economy projects can have real meaning. Any attempt to develop or implement a circular economy without such information is essentially worthless to society and merely declarative. Moreover, we will need to allocate more funds for waste management and environmental protection at all levels, eliminate unnecessary administrative barriers, facilitate project planning and execution, and seriously address the instruments required for implementation.

As a society, we must also reach a consensus on the relationship between waste management and the circular economy. We must replace the circular economy's current goal of maximizing recycling rates with the fundamental objectives of protecting human health and the environment. We must understand and accept the circular economy as a tool (not as a goal) and use all the opportunities it offers to improve the waste management system. We must acknowledge that regional landfills and thermal treatments (incinerators, cement kilns) are essential for the circular economy because there will always be portions of waste that cannot be reused or recycled—some for economic and technological reasons. For such waste, we need safe disposal sites if we want to prevent its uncontrolled dispersion into the environment. While we continue developing the waste management system, building the remaining regional disposal centers, and treating waste, we must also consider the quality of our waste management and the standards for the treatments we have and must implement on the agenda. Recycling strategies must focus not only on the quantity of recycled waste but also on the quality of recycled materials. We must also consider the quality (not just the quantity) of the outputs from our current and future treatment processes and where the final disposal sites are for waste that cannot and must not be recycled. Only then can we discuss modern waste management and a clean circular economy!

RESPONSIBLE WASTE MANAGEMENT: KEY TO SUSTAINABLE SOLAR ENERGY

The management of construction waste in Serbia is regulated by a series of laws and by-laws, with an emphasis on the Law on Waste Management and the Regulation on the Manner and Procedure for Construction and Demolition Waste Management. These documents provide basic criteria and guidelines for the responsible handling of waste generated during construction projects, including the construction of solar power plants, whether they are ground-mounted or rooftop installations.

Although solar power plants generate clean megawatts, waste at construction sites is unavoidable. However, CEEFOR, a company with many years of experience in designing solar power plants, also has expertise in developing waste management plans. These plans are created specifically based on the aforementioned regulations to forecast the types, amounts, and waste disposal methods at an early stage.

One of the recent projects undertaken by CEEFOR involved the construction of a 4.1 MW photovoltaic power plant on the ground, with the total energy output being fed into the distribution system. This project required the installation of more than 7,300 solar panels with an individual power of 650 Wp. The company has developed a waste management plan for this project, which requires implementing the measures outlined in the Regulation. These measures primarily focus on the separate collection of different types of waste, classification into categories (hazardous and non-hazardous), determining appropriate spaces for their temporary storage,

and regulating the final treatment or disposal through cooperation with licensed operators.

During construction, the most significant part of the waste will consist of wooden pallets, reels, and accompanying wood materials used

Photographs: CEEFOR

for transporting, storing, and installing solar panels, inverters, and cables. Estimates for this project predicted about four tons of wood waste. In comparison, the other sources of waste will be plastic materials, about 0.005 tons (five kilograms), packaging films, protective covers, and other various elements.

A waste management plan was drawn up on the construction site, ensuring that wooden waste is stored in metal containers with a capacity of

10 m³. In comparison, plastic waste is disposed of in separate containers with a capacity of 1.1 m³. Thanks to such a system, materials suitable for recycling or reuse are not mixed with other types of waste or referred to landfills.

In practice, wooden pallets that remain intact are returned to manufacturers or distributed to suppliers for subsequent transport processes. In contrast, damaged ones are usually forwarded to recycling centers, where the wood mass is ground and prepared for secondary use in chipboards, boards, or biofuel. When it comes to plastic, it is treated by washing, sorting, and granulation, after which it becomes suitable for producing new products, which achieves multiple benefits for the economy and the environment. The authorized operator further monitors the dynamics of container filling, the time of removal, and the location where further treatment is performed.

Roof-mounted Power Plant Example

Another project that was taken as an example of the waste management strategy concerns the construction of a solar power plant on the roof of the building with a total power of 120 kW. Although the capacity and scope of work are smaller than in the previous example, the basic principles of responsible waste management that the CEEFOR company adhered to remain the same. The power plant consists of 312 solar panels with an individual power of 410 Wp. In this case, recording types of waste, determination of space for temporary storage, labeling, and safe transportation are also applied.

The specificity of this project lies in the fact that the roof did not provide a large manipulation area. As a result, waste is collected in smaller containers, which, when filled, are transported to a separate location within the warehouse. The types of waste generated by this solar power plant project include approximately 0.8 tons of wooden pallets and reels, about one kilogram of plastic waste, around 0.5 kilograms of copper, bronze, and brass, five kilograms of aluminum, 0.5 kilograms of mixed metals, and one kilogram of cables.

Due to the relatively small quantities of certain materials, metal waste, and cables are most often collected in one container designated for mixed metals, with clear markings to ensure proper selection. Plastic is disposed of separately in its container, while wood waste is placed on a surface protected from precipitation, as in the previous example.

After the installation is complete, the operator takes the waste and transports it to the facilities, where recycling, energy recovery, or, in the worst case, disposed of if some materials are not suitable for reuse.

Regardless of the type and capacity of solar power plants, both CEEFOR projects share a common feature: the critical importance of planning and implementing efficient waste management strategies from the outset of construction. This approach ensures that waste is disposed of responsibly, preventing uncontrolled disposal that could result in illegal landfills and significant environmental damage.

CEEFOR adheres to the principles of sustainable development and continuously improves its practices and expertise in the areas where it achieves the best results.

Prepared by Milica Vučković

REVERSE VENDING MACHINES – A SMART SOLUTION FOR A CLEAN FUTURE

Plastic waste is one of today's biggest environmental challenges. Every year, around 500 billion plastic bottles are consumed worldwide, with a significant number ending up in nature instead of being recycled. It is estimated that as much as eight million tons of plastic enter the oceans annually, leading to an alarming forecast – by 2050, there will be more plastic than fish in the seas, measured by weight.

This is why society must recognize the importance of recycling and the circular economy in reducing waste and preserving valuable resources. Recycling saves energy that would otherwise be spent on extracting and processing raw materials, thereby contributing to reducing carbon dioxide emissions.

How Important is Recycling?

Some materials decompose extremely slowly or almost never. For example, it takes about 500 years for an aluminum can to decompose, but recycling saves up to 90–95 percent of the energy compared to producing aluminum from primary raw materials. PET plastic takes around 100 years to break down, with the most significant problem arising when

Call for Collaboration

To help companies better prepare for the introduction of the deposit system, TOMRA Collection organizes pilot projects that allow businesses to test the technology in real-world conditions. All interested businesses can visit the showroom in Belgrade and test TOMRA technology to find the optimal solution for their operations. For more information and to schedule a visit, contact TOMRA Collection Serbia via email: post.serbia@tomra.com.

Photographs: Tomra

it ends up in rivers, lakes, and seas. Glass does not decompose in nature. Still, it is fully recyclable and can be reused indefinitely.

It is essential to understand that packaging waste is not useless—it is a valuable resource that can be returned to the system and reused. Instead of ending up in landfills or, even worse, in nature, packaging waste can be recycled and used to produce new products. This reduces the need to exploit natural resources, contributing to environmental protection and the conservation of raw materials for future generations.

Recycling packaging waste also brings significant economic benefits. Materials such as plastic, glass, and aluminum can be reprocessed and used in manufacturing, reducing production costs and energy consumption. The recycling industry also creates new jobs and stimulates the development of a sustainable economy.

It takes about 500 years for an aluminum can to decompose, but recycling saves up to 90–95 percent of the energy compared to producing aluminum from primary raw materials

TOMRA Collection – Innovator in the Circular Economy

The TOMRA Collection company leads innovation in recycling through the Clean Loop Recycling model, which enables an efficient system for collecting and recycling packaging waste. The goal is to encourage society to adopt responsible behavior and use resources more efficiently.

TOMRA currently operates over 85,000 reverse vending machines in more than 60 countries, collecting over 46 billion used bottles and cans annually. Their advanced technology allows for simple and quick return of packaging, encouraging consumers to participate in the recycling process.

The deposit system is a proven method that collects more than 95 percent of the packaging on the market, making it one of the most powerful tools in the fight against pollution.

– The common goal of the entire industry should be to eliminate waste from nature, which is one of the main reasons for introducing the deposit system, a proven method that enables the collection of more than 95 percent of packaging on the market – said Bojana Milašinović, General Manager of TOMRA Collection Serbia and Montenegro.

TOMRA Collection is highly active in Serbia and Montenegro. Their reverse vending machines are installed in retail stores but are also present at major events, including summer festivals, fairs, conferences, water parks, banks, and high schools.

In the previous year, TOMRA Collection Serbia and Montenegro collected around 1,300,000 units of empty packaging, laying the foundation for a future deposit system in the region.

TOMRA Collection Serbia and Montenegro

FROM WASTE TO FASHION SHOW

Every year, tens of millions of tons of textiles are produced worldwide. The textile industry, which has become highly dynamic in the 21st century, impacts the environment like never before. Textile production is among the major polluters responsible for an enormous amount of water consumption, with used water being significantly contaminated by chemicals from the dyeing and fabric treatment processes. The fashion industry contributes to carbon dioxide emissions through its production processes and global logistics while simultaneously generating vast amounts of textile waste that ends up decomposing instead of being recycled or reused. Moreover, the business model known as fast fashion encourages excessive consumerism, as trends change rapidly, making clothing outdated in no time, leading to an accumulation of waste. The focus is placed on quantity rather than the durability of products, and this consumption pattern is also significantly affecting our region. However, there is another way – sustainable fashion.

Humana Nova was established as a response to social and environmental challenges identified at the beginning of 2011 in Međimurje County, in the far north of Croatia. A group of dedicated individuals, inspired by study trips across the European Union and examples of good practice in social integration, recognized the high unemployment rate among people with disabilities, members of the Roma minority, and middle-aged and older seamstresses who had lost their jobs due to the collapse of the textile industry. Aware that textiles were a major pollutant and were not being systematically collected then, the team decided to launch a project

Photographs: Humana Nova

that would simultaneously address social and environmental issues.

From the very foundation of the Humana Nova Social Cooperative, the emphasis has been on integrating individuals from marginalized groups and developing a circular economy model. Establishing a sewing workshop and a textile sorting facility proved to be an effective solution. A key decision was also to register the organization first as a social enterprise and later as a non-profit company, which required reinvesting the first 70 percent and 100 percent of the generated profit into further business development.

A Sustainable Future Through Textile Recycling and Repurposing

This social cooperative operates in two facilities: a sorting center and a sewing workshop. The textile sorting center first receives clothing donated by citizens at the site or collected through partnerships with private companies and in collaboration with municipal enterprises and initiatives organized in schools and kindergartens. Afterward, a team of workers sorts the clothing and fabrics based on their quality and potential for further use. Usable and well-preserved items end up in a second-hand shop, where they are sold at affordable prices. At the same time, some materials from the sorting facility are set aside for redesign and the production of new items. Unique clothing pieces purchased from the shop can be returned to the sorting center after use. Donating textiles to organizations such as the Red Cross, social work centers, or dog shelters is also an option.

Additionally, there is another form of textile repurposing. After further processing, some materials are used for industrial cloth production or sent for further recycling, where they are transformed into felt, one of the oldest types of fabric known to humankind. Currently, secondary gas production is also in development, in cooperation with partner companies.

In the sewing workshop, employees work daily to produce various clothing and other items made from recycled and eco-friendly materials. The creative team also organizes workshops where children and adults can learn how textiles can be repurposed into new products. In this way, Humana Nova directly reduces pollution and raises community awareness about the importance of responsible resource management.

Work Integration – The Heart of Humana Nova

– Instead of people adapting to processes, processes adapt to their abilities – say representatives of this organization.

Equality among all groups of people, which is fully applied in this cooperative, significantly boosts employees' confidence, as they have the opportunity to contribute to the local community and learn new skills. At the same time, by selling products and services on the market, Humana Nova manages to maintain economic stability even though business conditions for this type of enterprise are often more demanding than for other companies.

Among many successes, key achievements include the continuous growth in the number of employees, the amount of collected textiles, revenue, and creative ventures such as sustainable fashion shows. This helps the wider community become familiar with the concept of upcycled products and realize that the world is already flooded with clothing items that could serve several generations to come.

Humana Nova advises having a clearly defined mission, persistence, and ongoing community education for those looking to launch a similar project. Fashion has always been a part of life, particularly for women, serving as a form of self-expression and even a true art. However, today, fashion is transforming into something more dangerous – an overly fast, fleeting, and often low-quality hobby that loses its essence in a consumer-driven world. By maintaining transparency with partners and customers and staying true to core values, further growth is possible, even in the era of fast fashion. Moreover, they emphasize that sustainability and quality are not passing trends but long-term investments in the future.

Humana Nova is a cooperative—the members are the owners and have the right to decide on essential matters. With a bit of goodwill, plenty of patience, good organization, and a clear vision, they have built a 21st-century enterprise—responsible, sustainable, and socially conscious.

Prepared by Milica Vučković

SCIENTISTS FROM VINČA DESIGNING A MULTIFUNCTIONAL FILTER FOR WASTEWATER PURIFICATION AND HYDROGEN PRODUCTION

Imagine a piece of paper floating on wastewater containing harmless and natural particles. The sun activates these particles, and beneath the film, a miracle occurs. Bacteria are eliminated, pesticides, dyes, and other pollutants in the water are degraded, and as a result, hydrogen is produced, which can be used as fuel. This innovative idea is at the core of research within the HYDIS project, funded by the Science Fund of the Republic of Serbia.

The project brings together scientists from the Vinča Institute of Nuclear Sciences, the Institute of Chemistry, Technology, and Metallurgy, the Innovation Center of the Faculty of Technology and Metallurgy, and the Faculty of Technology and Metallurgy. The pollution issue in Serbia is highly relevant, and the HYDIS project is designed to contribute to solving this problem. The goal is to improve the quality of life by reducing pollution and utilizing

Photographs: Private archive

environmentally friendly approach to combating pollution.

The HYDIS project focuses on developing nanomaterials based on metal oxides and natural organic compounds. Materials such as titanium dioxide and zinc oxide, known for their role in protecting the skin from UV radiation in sunscreens, are activated by sunlight in this research to be used for wastewater purification, even during winter months. Within the project, these metal oxides are combined with natural compounds isolated from plants, creating a material that, under the influence of sunlight, destroys pathogenic microorganisms, breaks down organic pollutants, and produces hydrogen—the fuel of the future.

The project's ultimate goal is to develop an industrially applicable filter that will enable wastewater purification and disinfection simply by exposure to sunlight. The scientific team plans to patent this filter and offer it for industrial use. By placing the filter in wastewater pools, purification, and disinfection occur solely through sunlight. Additionally, this process generates hydrogen, which can be used as fuel.

The project lasts for three years, and the first results after one year of work show that the newly synthesized powdered materials exhibit good antimicrobial activity and produce a satisfactory amount of hydrogen. Testing has demonstrated significant elimination of pathogenic microorganisms within just one hour of contact, while at the same time, a notable production of hydrogen was achieved.

Simultaneously, polymers/films have been synthesized that could serve as carriers for these particles, with the challenge of ensuring they float on the water's surface. In the next phase, the integration of particles into polymers is planned, along with further examination of their properties.

In addition to fundamental research, the project aims to apply acquired knowledge and technologies in industry. This can potentially improve the quality of life and contribute to solving environmental problems. The developed filter is expected to find its place in the industry and contribute to improvements in everyday life.

The HYDIS project focuses on developing nanomaterials based on metal oxides and natural organic compounds

alternative energy sources, such as hydrogen. At the same time, the problem of infections and the resistance of many bacterial strains to common antimicrobial agents necessitates new solutions. Using innovative materials activated by sunlight represents a significant step toward a healthier life for citizens and a more

Project team HYDIS

HOW TO ACHIEVE MORE EFFICIENT WASTEWATER MANAGEMENT IN SERBIA

Wastewater management in Serbia still lags behind European standards, and the number of treatment facilities remains far below the necessary level. Accelerating and significantly improving this process is essential to reaching acceptable standards for protecting watercourses and aligning with European Union directives. However, implementing wastewater treatment plant projects faces numerous obstacles, including a lack of transparency, complex bureaucratic procedures, and unclear criteria for fund allocation and technology selection.

These issues are thoroughly analyzed in a publication by the Regulatory Institute for Renewable Energy and the Environment (RERI) titled "Black Book: Murky Waters." The publication summarizes months of research and tracking investment flows in wastewater treatment plants.

According to Jovan Rajić, founder and head of RERI's legal team, the research team initiated administrative procedures in seven cities to gather information on implementing wastewater treatment plant projects. However, despite requests for access to public information, city administrations refused to disclose the data, citing the confidentiality clause of the contract between the Government of Serbia and the German Development Bank (KfW).

Photograph: Unsplash/Ivan Bandura

"The 'Black Book' offers concrete evidence and documentation illustrating the consequences when key information is inaccessible from the relevant authorities, despite their legal obligation to share it with the public," explains Rajić.

The decision-making system regarding where treatment plants will be built is also unclear. On paper, priority is given to municipalities that have made the most progress in project preparation, but these criteria are often vague and open to subjective interpretation. Additionally, no clearly defined public procurement process would enable the selection of the most efficient and cost-effective technology.

Lack of Transparency and a Prearranged Economy

Our interviewee emphasizes that their months-long attempts to obtain relevant information have been unsuccessful as responsibility has been shifted from one institution to another. He also highlights the issue of the state allowing private companies to independently decide where they will collect and analyze data, which, in practice, leads to delays in project implementation.

"The main issue is the lack of transparency, from the selection of municipalities that will receive treatment plants to the conditions under which loans are obtained and from whom. It is also unacceptable for contracts to be classified as state secrets, given that these are investments of public importance," says Rajić.

He adds that these capital investments are crucial for the long-term efficiency of the water treatment system, yet the domestic market has already been divided among certain companies.

"There is no healthy market competition, public procurement is being neglected, and nobody will analyze and select the most suitable technology for the coming decades. Everything happens behind closed doors, with no public insight into how funds allocated for this sector are being spent," concludes Rajić.

There is no clearly defined public procurement process that would enable the selection of the most efficient and cost-effective technology

The Need for Reform and a Coordinating Body

Serbia currently has around 40 wastewater treatment plants, but only one-third operate at full capacity. The country needs to build as many as 359 facilities to meet European standards. However, the centralized management system and the lack of a unified coordinating body represent significant obstacles in this process.

The current wastewater management model relies on public utility companies, which are accountable to local governments. However, municipalities lack sufficient funds and depend on central institutions, further complicating the decision-making process.

Experts suggest a regional approach to wastewater management, while infrastructure should remain local and decentralized. Such an organizational model would facilitate better information sharing, expertise exchange, and project coordination, ultimately leading to more efficient implementation. Establishing a single coordinating body, as foreseen by the Water Law, could contribute to more effective and transparent sector management and accelerate the construction of necessary infrastructure.

Wastewater management in Serbia requires urgent reforms and greater transparency. The decision-making process and fund allocation must be public and transparent, and contracts should not be classified as confidential when dealing with projects of vital importance to citizens and the environment. Additionally, experts from RERI emphasize that better coordination between local governments and central authorities is crucial to ensuring the continuity and long-term sustainability of investments.

Systemic changes are necessary to enable more efficient wastewater management if Serbia aims to meet European standards and ensure a cleaner environment.

Prepared by Milena Maglovski

Photograph: Unsplash/Martin Martz

TRANSFORMATION FROM WASTE TO NEW PRODUCTS

Paper is often presented as an environmentally friendly alternative to plastic, especially when it comes to packaging. However, even paper waste, if not properly managed, remains a source of pollution in its own way. Printing houses, as a sector that works with large amounts of paper daily, are most familiar with the challenges of managing this type of waste.

Miodrag Ristić has been in the printing business for many years and knows exactly how much paper waste remains at the end of a working day. Paper is often perceived as a more eco-friendly material due to its easier recyclability, but our interviewee does not share this view and believes that this process is not the most efficient choice. As he explains, the greatest pollution in the paper industry occurs during the recycling process, which is also highly energy-intensive, leading to greenhouse gas emissions.

In addition to the environmental impact, the financial aspect of paper waste should also be considered. The compensation for purchased waste paper has been decreasing over the years, and if this trend continues, printing houses will soon have to pay for its disposal.

"Sometimes, we deal with expensive types of paper or cardboard that go through all stages of production, only for a significant percentage of that valuable material to end up in the recycling bin. The usual question people ask themselves when they notice this anomaly is – if this has been happening for centuries, in almost every printing house worldwide, why hasn't someone already solved it?" says Ristić.

He cites this inertia as the first and most significant obstacle to any innovation. However, the family-owned printing house Deto recognized different possibilities and dared to introduce waste paper into

Photographs: courtesy of Miodrag Ristić

Kutijice.com

The online platform Kutijice.com was developed alongside the idea of producing small boxes. Although it may appear to be a typical web store at first glance, a deeper look reveals a variety of content, including the Ristić family's experiences in working with small cardboard packaging, as well as tools that individuals can use if they wish to create their own products.

an alternative process instead of sending it for recycling.

Officially founded in March 1992, the company carries on a tradition spanning more than a century, as many family members have been engaged in printing, bookbinding, publishing, journalism, and graphic design over the years.

"You could say printing ink runs in our veins, and that's probably not just a metaphor, since for the past twenty years, the Ristić family has literally lived and worked under the same roof," our interviewee jokingly adds.

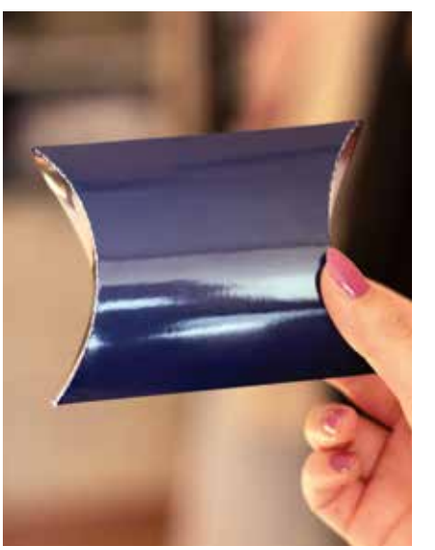
Throughout its existence, the printing house has undergone several phases of development, but as Miodrag notes, they have always been unique. They started collaborating with marketing agencies very early, developing their own products, and incorporating digital tools into their processes.

The inspiration for their idea stemmed from frustration over the environmental and financial challenges related to paper waste. Recognizing the issue of waste generated in the production process, they decided to experiment—how could they turn a narrow strip of waste cardboard into a box? The result surprised and delighted them, prompting them to share a photo of the box on Pinterest.

They modestly state that, thanks to fortunate circumstances, the image achieved great success and inspired them to consider further applications of this idea. Today, decorative and promotional boxes made from surplus technological paper are one of their most sought-after products.

The significance of this idea and the creation of new boxes is best illustrated by the fact that they produce between 10 and 20 tons of such waste annually. As Miodrag emphasizes, they have entered a race where the goal is to reclaim as much material as possible from this waste and turn it back into a useful product.

Beyond the environmental benefit of reducing potential pollution, there is also economic viability. An interesting fact is that a handful of salvaged material is worth more on the market than a full container of waste paper for recycling.



Miodrag Ristić

Printing house **Deto**

"The concepts of reduce and reuse, on which our project is based, are superior to recycle in economic, technical, and environmental terms, and they complement each other. The effects depend on the project's success, the scale of production, and our ability to engage other printing houses. So far, we are very pleased with the pace of development," he adds.

Throughout its years of existence, this printing house has strived to be innovative and different. This is why they see the future in personalization through their Edit Me application, which allows users to quickly and easily brand packaging, business cards, or labels, streamlining the process.

Their vision also includes building a creative community around the platform Kutijice.com and expanding the concept of green design. At the same time, they are developing entirely new ideas, such as a zero-waste printing house, which, as Miodrag says, "objectively still belongs in the realm of science fiction, but that only makes the challenge more enticing."

Written by Katarina Vuinac

FROM SOOT TO INK – HOW POLLUTION BECOMES A TOOL FOR ART

Air pollution often resembles dense fog covering cities, and artists frequently use it as inspiration for powerful, mystical photographs. While it may appear abstract and mesmerizing in images, the reality is far more serious—air pollution is responsible for the highest number of premature deaths worldwide.

Asia, the most populous continent on Earth, is home to one of the fastest-growing economies in the world—India. This rapid economic growth has positioned India among the countries with the most polluted air. Data shows that its capital, New Delhi, has the worst air quality among all global capitals. The primary sources of this pollution include vehicle emissions, cooking, power plants, heating, and industrial facilities.

Fine particles, known as PM 2.5, are among the most widespread pollutants, particularly in urban areas. These tiny particles measure only up to 2.5 micromillimeters, allowing them to quickly enter the lungs and bloodstream, leading to serious health problems, such as respiratory and cardiovascular diseases. PM 2.5 particles encompass a wide range of substances, and one of their primary components is soot. Soot forms as a result of burning fossil fuels, biomass, and chemicals containing tiny particles of unburned carbon.

Although India experiences high soot concentrations, this issue has inspired groundbreaking innovation. The MIT Media Lab, a research center at the Massachusetts Institute of Technology (MIT) in Cambridge, developed KAALINK technology designed

Photograph: Unsplash/Ricardo Gomez Angel

to capture soot from the air. This small device is installed in the exhaust pipes of vehicles or generators and can capture up to 95 percent of soot particles. Thanks to this innovation, the startup Graviky Labs has created an entirely new product—an eco-friendly ink called AIR-INK.

AIR-INK repurposes soot emissions generated in industrial and transportation processes instead of relying on fossil fuels, as with traditional inks. This process not only reduces dependence on fossil resources but also improves air quality by capturing particles that would otherwise remain in the atmosphere.

The KAALINK technology can collect enough emissions in just 45 minutes of operation to produce approximately 30 milliliters of ink. So far, the startup has developed two products: a marker with tip sizes ranging from 2 to 50 millimeters and printing ink. The 30-milliliter ink supply is sufficient to fill one marker or one small bottle of printing ink.

Once the soot is collected, it undergoes a purification process to remove harmful substances, such as heavy metals and carcinogenic materials, ensuring the final product is safe for use.

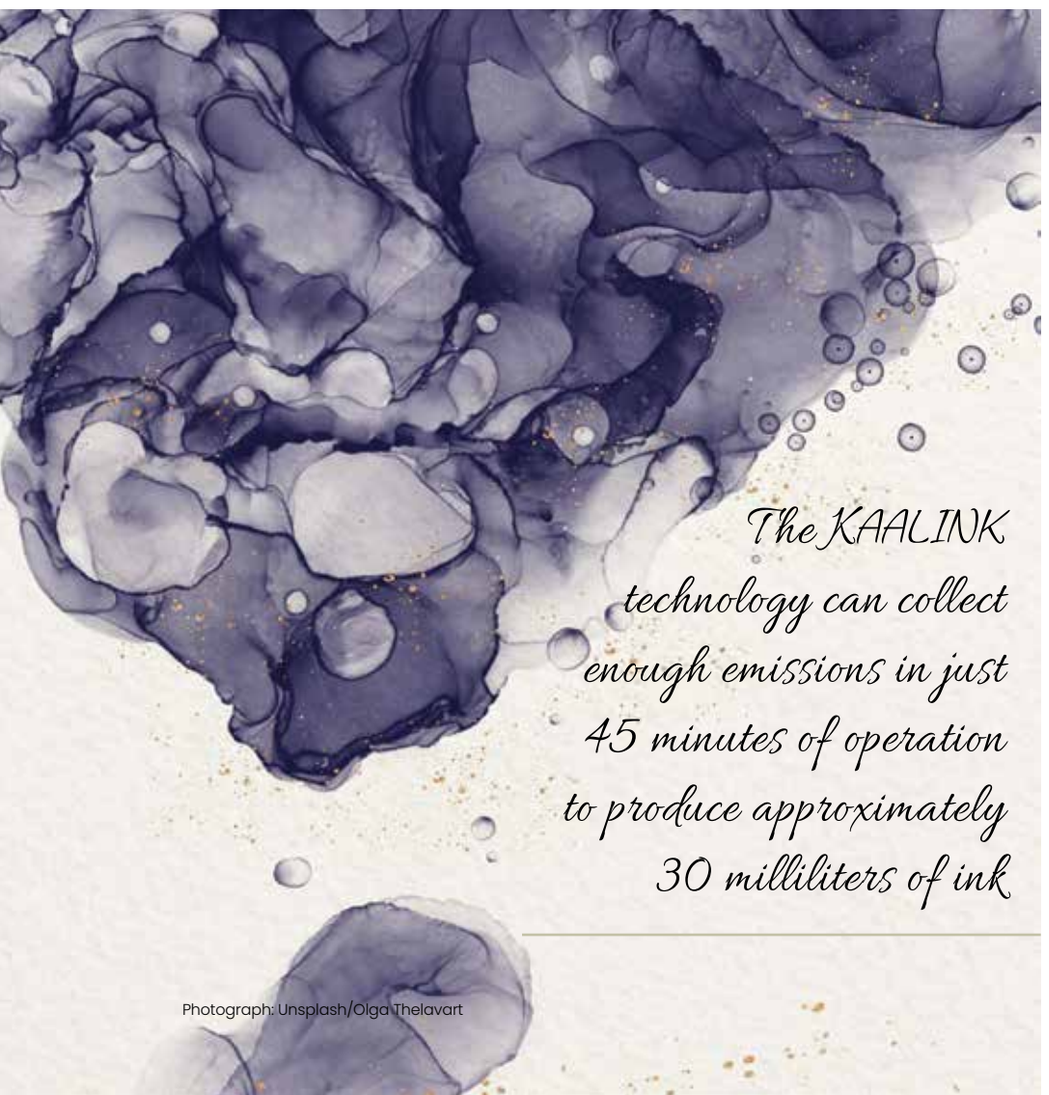
This article began with an artistic note, and it will end the same way. While soot in the air has long inspired artists to create surreal and mystical photographs, its fusion with environmental awareness introduces an entirely new dimension to the world of art. AIR-INK allows soot, once a harmful byproduct of industry and transportation, to become a valuable material for artistic creations. What was once a symbol of pollution is now transformed into a tool for sustainable innovation.

The Graviky Labs startup plans to expand its product line, including oil-based paints, textile dyes, and other creative applications. This step not only increases the potential for using eco-friendly materials but also opens doors for new art forms that utilize waste and pollution as resources for creative expression.

The startup actively promotes its product and raises awareness about pollution in various ways. For example, AIR-INK has been used to create murals depicting environmental themes. Another approach involved launching a Kickstarter campaign aimed at raising funds to scale up production and expand the distribution of KAALINK devices. The campaign has achieved significant success, reaching nearly 50 percent of its target amount with several weeks still remaining before its conclusion, thereby enabling further development and market expansion.

This success also demonstrates that the public is increasingly recognizing and understanding the importance of such environmental projects.

Prepared by Katarina Vuinac



The KAALINK technology can collect enough emissions in just 45 minutes of operation to produce approximately 30 milliliters of ink

Photograph: Unsplash/Olga Thelavart

A PROGRAMME THAT CHANGES LIVES

The programme's success is not measured solely by the number of beneficiaries but by fundamental changes in their lives – more stable incomes, better access to social services, and increased social inclusion

When the first initiatives within the PRO – Local Governance for People and Nature programme were launched two years ago, it was clear that its impact would be far-reaching. This ambitious programme, jointly implemented by United Nations agencies – UNOPS, UNFPA, UNICEF, and UNEP – in partnership with the Government of Serbia and with the support of the Swiss government, has become a key driver of change in 110 cities and municipalities across the country. Aiming to improve local governance, enhance social inclusion, and strengthen environmental protection, the programme delivers concrete results in the lives of citizens, especially those who have been on the margins of society for years.

One of the most important activities of the PRO programme is focused on the economic empowerment of informal waste collectors – people whose work contributes the most to the recycling industry in the country, yet who face precarious living and working conditions. Through a combined support strategy, PRO – Local Governance for People and Nature provides them not only with more stable sources of income but also better access to rights and services.

Better Conditions for Informal Waste Collectors

For many collectors, the closure of landfills as part of the Solid Waste Programme implemented by the Ministry of Environmental Protection posed a threat to their only source of income. However, a solution was found through the synergy of this programme and the PRO programme. Informal waste collectors are given the opportunity to integrate into formal

Photographs: PRO – Local Governance for People and Nature

employment streams, either through retraining and employment in other sectors or by establishing recycling cooperatives and social enterprises.

– In line with Environmental Protection and Social Policies, we have identified families directly affected by these changes and created a support plan for them. Our mission is not to leave them without a source of income but to provide them with a sustainable economic future – says Ana Nedeljković Belja, PRO Programme Manager.

Beyond economic support, the programme also addresses broader aspects of social inclusion. In ten local self-governments, Local Coordination Mechanisms have been established – working bodies that bring together social welfare centers, health centers, schools, municipal enterprises, and civil society organizations to ensure better access to education, healthcare, and social services for waste collectors. Additionally, each family involved in the programme is assigned a family assistant – a person who guides them through the process of formalization and social integration.

– We do not just want to provide short-term assistance but to establish systemic foundations for their long-term economic stability and social inclusion. Only in this way can we talk about sustainable change – adds Belja.

Measurable Impact for a Sustainable Future

The PRO programme delivers tangible and measurable results by systematically monitoring changes in the living conditions of beneficiaries. Each family in the priority group undergoes a detailed assessment, including an analysis of income, sources of livelihood, and key challenges. Based on these findings, Individual Family Support Plans are developed with clearly defined measures and goals.

The progress of beneficiaries is tracked through data comparison, measuring income growth, economic opportunities, and access to social protection, education, and healthcare. Additionally, access to public services is analyzed, focusing on integrating families into the social protection system, school enrolment of children, and access to healthcare for waste collectors. Finally, progress is monitored through labor market integration, recording the number of individuals who have undergone training and secured sustainable sources of income.

The programme's success is not measured solely by the number of beneficiaries but by fundamental changes in their lives – more stable incomes, better access to social services, and increased social inclusion. PRO does not merely provide immediate assistance but lays sustainable foundations for a better future for vulnerable groups in Serbia.

Plans for Programme Expansion

The PRO programme was designed from the outset to address the needs of the most vulnerable social groups, with social inclusion as one of its key pillars. It already includes people with disabilities, the Roma community, and other at-risk categories defined by the Law on Social Protection. The example of support for informal waste collectors demonstrates how the programme flexibly responds to new challenges, recognizing the specific needs of marginalized groups. With this expansion, not only have the economic and social issues of waste collectors been addressed, but a support model has been established that could, in the future, be applied to other communities across Serbia.

The unique PRO programme serves as an example of a systemic approach to reducing poverty and social exclusion. Continuous monitoring and adaptation of measures ensure long-term support for beneficiaries, while the programme's flexibility allows it to expand to new vulnerable groups. In this way, PRO transforms individual lives and contributes to building a more inclusive society.

Prepared by Milena Maglovski

ART BLOOMS – THE MOST BEAUTIFUL FRONT OF THE ENVIRONMENTAL FIGHT

Art has become a powerful ally in raising awareness about nature conservation in a world increasingly facing environmental challenges. Valentina Talijan, a visual artist from Smederevska Palanka, has found a way to merge creativity and activism, creating a unique concept that draws attention to endangered plant and animal species in Serbia. Her initiative, which began as an environmentally conscious brand, has evolved into a true non-profit artistic platform dedicated to nature conservation.

Valentina was deeply engaged with recycled materials during her studies, and her undergraduate and master's projects carried a strong environmental message. Although she did not directly speak about environmental protection at the time, she consistently chose sustainable materials in her work. After graduating, she wanted to start an eco-business, but the path to achieving this was not easy.

In 2020, she launched the Instagram page – Umetnost cveta (Art Blooms), initially designed as a brand that promotes endangered plant species in Serbia through illustrations. However, the platform carried a broader symbolism. Besides highlighting the importance of preserving nature, it also emphasized the position of artists in society, often drawing parallels between their struggles and those of endangered plant species.

Through this page, Valentina brought together artists who illustrated rare and endangered plants, turning their works into prints, greeting cards, and other products. A portion of the proceeds went to charitable causes, primarily organizations dedicated to animal protection. After three years of work, Valentina decided to stop profiting from promoting endangered species. Still, she did not shut down the page – on the contrary, Umetnost cveta became a creative platform dedicated to raising awareness about environmental issues.

Illustration: Valentina Talijan

Endangered Species of Serbia: How to Protect Them

Serbia is home to a diverse range of plant and animal species, but many are on the verge of extinction due to urbanization, pollution, and climate change. Among the most endangered plants are the Pančić spruce, Ramonda serbica, and gentian, while steppe falcons, imperial eagles, griffon vultures, and black salamanders are some of the most threatened animal species.

The leading causes of these species' decline include habitat destruction, uncontrolled exploitation of natural resources, and poaching. Key measures for their protection include declaring protected areas, afforestation, hunting bans, and public education.

Preserving biodiversity is not just a matter of nature—it is essential for the survival of future generations. Everyone can contribute to conservation through responsible behavior in nature, supporting environmental initiatives, and spreading awareness about the importance of protecting endangered species.

Valentina Talijan
Visual artist from Smederevska Palanka

An Urgent Call for Nature Conservation

Serbia is home to rich flora and fauna, but many species are on the brink of extinction due to urbanization, pollution, and climate change. According to the Institute for Nature Conservation of Serbia, there are 1,783 strictly protected wild species in the country. In comparison, an additional 860 species of wild animals, fungi, lichens, and plants fall under the protected category.

Valentina launched a unique ecological challenge concept on social media to raise awareness about the importance of protecting plant and animal species. Every week, artists receive a task to illustrate a specific endangered species, bringing public attention to often-overlooked environmental problems. Visual art serves as a gateway to further exploration, and this approach helps people absorb messages about nature conservation more easily.

A special focus has been placed on endangered species in Western Serbia, but Valentina emphasizes that this does not diminish the importance of other species in the country. Almost every part of Serbia contains biodiversity hotspots that are under serious threat, further highlighting the urgency of protecting natural ecosystems.

In addition to contributing to nature conservation, Umetnost cveta provides opportunities for young artists to gain recognition. Illustrators, painters, and designers participating in these challenges get the chance to present their work to an audience of over 7,000 people, which can support their professional development.

– Many talented artists lack opportunities to showcase their work to a broader audience. This platform allows them to both promote their talent and participate in a critical mission to protect nature, says Valentina. Currently, around ten artists actively respond to the challenges, and interest in this initiative continues to grow.

Valentina hopes to organize an exhibition in Belgrade by the end of the year, showcasing the most beautiful works created within Umetnost cveta. The goal of this exhibition is not just to promote artists but also to raise awareness about the urgent need to protect nature in Serbia.

Although art cannot directly stop deforestation or water pollution, it can help shift public consciousness and inspire action. Through her work, Valentina Talijan demonstrates that art plays a significant role in protecting nature – it inspires, educates, and motivates people to take action.

Umetnost cveta is not just a gallery of illustrations but a movement that merges creativity and activism. This project proves that even a single drawing can be the first step toward significant changes. When art blooms, so does hope for a better future for our planet.

Prepared by Milena Maglovski

Illustration: Dejan Živković • Photograph: Jelena Mitrović

MEET CORK – THE MATERIAL OF THE 21ST CENTURY

The planet is rapidly changing, facing challenges such as climate change and the depletion of natural resources. We need solutions that balance economic growth and environmental protection. In the search for better alternatives, the outer bark of the cork oak tree stands out as a versatile material that benefits both nature and industry—known as cork.

Unlike most trees, where the trunk must be cut down to obtain the desired material, the cork oak provides cork without permanent damage. The first harvest is possible only when the tree reaches about 25 years of age, and the highest-quality cork is obtained after the third harvest when the tree is over 40 years old. This cycle is repeated approximately every nine years, and throughout a 200-year lifespan, the tree can undergo about 17 harvests. The process of removing the bark is carried out by skilled professionals who carefully extract it without harming the tree's vital structure. Over time, the bark regenerates, returning to almost its original state or even improving in quality.

Beyond its ability to regenerate and extend its own lifespan, the cork oak plays a crucial role in combating climate change. Estimates show that cork oak forests worldwide can absorb up to 14 million tons of CO_2 annually, helping to reduce the greenhouse effect. Portugal, the country with the largest area of cork oak forests, covering one-third of the world's total cork oak population, leverages these benefits both

Photograph: Pixabay/Paul Edney

Estimates show that cork oak forests worldwide can absorb up to 14 million tons of CO_2 annually, reducing the greenhouse effect

economically and environmentally. Portugal is responsible for more than half of global cork production and is the leading cork producer. Over 700 companies in Portugal are directly dependent on this industry, providing thousands of jobs.

For this reason, at the end of 2011, the cork oak was officially declared Portugal's national tree, even though it has been legally protected since the 13th century.

Structure and Properties of Cork

The microscopic air chambers within the structure of cork give it exceptional lightness and elasticity. In just one cubic centimeter, millions of tiny cells can be filled with air or gases of similar composition, providing cork with thermal and sound insulation properties, moisture resistance, and the ability to slow down the spread of fire. Thanks to these characteri-

Photographs: (rop right) Pixabay/Jörg; (bottom right) Pixabay/Ben Kerckx

stics, cork is an almost ideal material for various industries—from construction and interior design to technologically advanced sectors such as the automotive and aerospace industries. Cork is even one of the key components in spacecraft precisely because of its outstanding thermal insulation properties, as rockets experience extremely high temperatures during launch.

In recent decades, eco-friendly construction has increasingly recognized cork as a material of the future. Due to its insulating properties, cork boards and tiles are used for flooring, wall coverings, and even in humid environments such as kitchens and bathrooms. While many believe cork is delicate and prone to damage, its elasticity and self-restoring structure often prevent permanent dents. If significant damage does occur, only the damaged segment can be replaced, significantly extending the lifespan of the surface. Additionally, the surface layer of cork hardly retains dust or mites, making it an excellent choice for people prone to allergies and asthma.

For decades, cork has been widely known as the material used for bottle stoppers, but its applications have expanded significantly. In the home appliance industry, cork serves as an excellent thermal and sound insulator. At the same time, properties such as buoyancy and elasticity in marine applications make it ideal for buoys, pontoons, and boat components, where lightweight and water-resistant materials are required.

Cork has been widely known as the material used for bottle stoppers, but its applications have expanded significantly

Cork in E-Mobility

Amorim Cork Solutions is one of the best examples of cork's successful application in modern technologies. Their innovations combine the elasticity and durability of cork with thermoplastic properties, resulting in a wide range of products for industries such as sports, packaging, footwear, and the automotive sector.

However, groundbreaking research for the new era lies in developing solutions for electric vehicles, where cork enhances battery performance.

The company has provided insight into one of its latest projects—using cork to produce thermal pads that are placed between battery cells. These pads act as insulators, maintaining optimal battery temperature and preventing overheating, which can lead to capacity loss or safety risks. Cork is also used as a spacer between cells, ensuring proper pressure distribution and absorbing shocks during driving. This enhances safety, extends battery lifespan, and utilizes a renewable and recyclable material.

It seems that cork is no longer just a symbol of wine stoppers—it is becoming a material of the future, making its way into industries that previously overlooked its sustainable potential. All signs point to cork becoming a key material of the 21st century.

Prepared by Milica Vučković

Photographs: (top) Pixabay/David Ramon; (middle) Pixabay/Mari Carmen

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