

LOCAL CIRCULAR BIOECONOMY ACTION PLAN

KOŠICE REGION

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1. INTRODUCTION

The CITYCIRCLE project

The CITYCRICLE project aims to bring innovation and sustainable economic growth to peripheral regions of the European Union through implementation of circular economy practices.

This Local Circular Bioeconomy Action Plan for the Košice region draws on the guidance contained in the *Circular Bioeconomy Value-chains: Harnessing Opportunities report,* and *Innovation Agenda* already developed through the CITYCIRCLE project. Together with other city action plans, this document makes up part of the final CITYCIRCLE project Transnational Circular Economy Strategy.

This action plan elaborates on how the Košice region can build on our current assets and focus on the possibilities of developing the world's leading circular bioeconomy in our region, in key developing cities as well as in the countryside.

A fully circular economy requires a systemic and transformative approach to production and consumption that effectively designs out waste and keeps materials and resulting products in use for as long as possible. It represents a fundamental shift in the relationship between production and consumption and natural resources.

The circular economy is closely linked to the bioeconomy. Many bio-based materials are renewable, biodegradable and compostable and can become the basis for important circularity in an economy. The circular economy, however, also encompasses the application of circular economy principles to non-biological resources, including manufacturing and consumption of goods and services.

Overview of Košice region Context

The territory of the Slovak Republic is divided into 8 regions. According to the urban-rural typology statistics of Eurostat (2021), the Košice region is intermediate region. On the territory of the Košice Region, several branches are decisive, in which the potential of the region is evaluated from the point of view of human resources and material and raw material base (wood, minerals, building materials, traditional production). These are mainly sectors - engineering, woodworking, metallurgical and energy industry, chemistry industry, geology and mining, construction, agriculture, fertiliser industry, tourism and services. From the point of view of the industrial structure, the most important sectors in the region are the metallurgical, engineering, chemical and ICT and automotive engineering industries. Undoubtedly, metallurgy dominates, accounting for 60% of the region's industrial production and 50% of its exports. The largest company in the region U.S. Steel Košice is also active in this sector. The ICT industry is gaining more and more economic importance, as well as in terms of employment.

Agricultural land in the Košice Region occupies 3,346.9 km2 and the region accounts for 14.0% of the agricultural land in the Slovak Republic. The agricultural production of the region in the total agricultural production of the Slovak Republic in 2013 accounted for only 8.9%.

The local circular bioeconomy action plan presents steps, ways, possibilities to achieve the goals set in the circular economy strategy with a priority focus on the field of the bioeconomy.

The Circular economy strategy for the Košice Region is designed to adopt an interactive and integrative approach by actively involving a stakeholder group in two specialized workshops, as described in the "D.T1.2.11 CE Strategy Workshops". The workshops were designed to share knowledge and ideas, create synergies between key stakeholders and apply a bottom-up approach during the strategy building process. The aim was also to ensure the commitment and acceptance of the relevant stakeholders with regard to the long-term sustainability of the strategy.

The strategy is ruled by the provisions set forth in the Manifest signed by relevant stakeholders. The Manifest is an agreement signed by regional stakeholders which identify the joint objectives and the next activities foreseen to boost circular economy initiatives within CITYCIRCLE in the Košice Region”. As part of the project implementation, the partners established CircleHub Košice, - ( [www.circlehub.sk](http://www.circlehub.sk)). Partner organizations- stakeholders:

• Technical University of Košice

• EZUS Via Carpatia

• Košice self-governing region

• Institute of Circular Economics

For the The Joint Center for Circular Economy in 2021 (www.circlehub.sk) to support the transformation of the Košice region into a circular economy. Achieving circulation requires the systematic involvement of all stakeholders on a regional, national as well as international level. Given global megatrends, we do not have enough time to invest in what has already been discovered and implemented. We need to ensure the exchange of current knowledge, experience and proven solutions so that we can use our resources in a smarter and more sustainable way to create an environment for new business models. With its local partners, Košice self-governing region wants to contribute to a sustainable and greener future with its activities and support the transformation within one generation to become a full-blooded circulating region of the country.

Mission Context in Košice region

In the Slovak Republic, the responsibilities at regional level include regional roads and public transport, education, health, territorial planning, regional economic development and culture, whereby the responsibilities at municipal level include local roads and public transport, education, social welfare, tourism, local planning and development as well as environmental protection (OECD, 2016).

Although there is no national bioeconomy strategy in Slovakia, there are various regulations, rules and legislation regarding the protection of environment and boosting the bioeconomy development. The environmental laws are related to the pollution prevention, nature and land protection, reduction of greenhouse gas emissions from fuels and also effective waste management. The laws were adopted in order to ensure sustainable development and environmental protection, to shift the economy to become more green and resource-efficient and also to emphasize the use of renewable energy sources.

Therefore, it is essential not only to maintain, but also to strengthen the dialogue among policy makers and other stakeholders relevant for the area of bioeconomy. Although the bioeconomy is included in the domain Healthy Food and Environment (within Research and Innovation Strategy for Smart Specialisation of the Slovak Republic), **there is no comprehensive bioeconomy strategy developed at national level nor regional level.** In Slovakia, the concept of bioeconomy and the concept of circular economy have so far been understood rather individually. Nevertheless, the need for synergies between two concepts arises from several strategic documents of the Slovak Republic.

Therefore, one of the tools how to further improve the policy dialogue that may lead to the development of business activities in rural areas, creation of new value chains within the circular bioeconomy, strengthening cross-sectoral links with relevant sectors for the bioeconomy. The capacity building and implementation of systematic multi-level participative governance cooperation have potential to bring actors in a targeted way together for the enhancement of the socioeconomic status of the regions, contribution to environmental, climate and resource protection as well as for fostering the development of rural areas.

At the regional level, there are some initiatives related to climate, environment, regional innovation, e.g., “Low carbon Development Strategy of the Košice Self-Governing Region, the Waste Management Program of the Košice Region for 2016 - 2020 and Regional Innovation Strategy of Košice Self-governing Region. The Košice region would like to develop an effective framework to support the circular economy in its territory through JOINT CIRCULAR ECONOMY STRATEGY.

The transition to a circular economy requires the adoption of comprehensive institutional, organizational, procedural and material measures leading to the necessary structural changes in individual sectors of the economy and in the level of education among its inhabitants.

The Joint Circular Economy Center CircleHub Košice was established in 2021 to support the transformation of our company into a circular economy within the activities of project CITYCIRCLE, supported by the Interreg Central Europe program. The main goal of creating this center was the effort of the Faculty of Economics of the Technical University in Košice, the EGTC Via Carpatia and the Košice self-governing region to support the circulation transformation within the Košice region in terms of process and knowledge. We draw on knowledge and experience from abroad, where such interdisciplinary and innovation centers, with their educational and advisory mission, play a key role in the transition to a circular economy.

In the Košice Region, The Innovation Center of the Košice Region (IC) was established also in 2021 as an interest association of legal entities between the Košice Self-Governing Region, the City of Košice, Pavel Jozef Šafárik University, the Technical University in Košice and the University of Veterinary Medicine and Pharmacy. The main goal of this cooperation is to support the development of an innovation ecosystem, increase innovation potential, create sustainable conditions for the growth and development of new businesses, slow down or completely stop the brain drain and connect individual innovation actors. The issue of bioeconomy is part of the IC. IC Košice is defined as a center of scientific and technological excellence in Košice in the fields of biomedicine, biotechnology, information technologies and advanced materials. The main mission of IC Košice is the establishment of a high-quality European center of capitalizable research and applications with an efficient and supporting environment for business activities in the high-tech industry. Green and cleantech is pervasive across various sectors, e.g., manufacturing, construction, agri-food, smart cities, transport etc. It has a cross cutting impact within the economy driven by the international agenda to reduce climate change and by customer preference for more eco-friendly choices.

CitycircleHub will cooperate with The Innovation Center of the Košice Region. It will help (provide knowledge, consultations, evaluate) to fulfil the goals of The Innovation Center of the Košice Region in the areas of circulation, bioeconomics

Our common regional role is to take steps to:

1. Creating opportunities to share best practices, knowledge and tools;

2. Sharing knowledge initiatives and supporting the interconnection of companies in the regions;

3. Coordinating efforts in organizing circular events;

4. Support for cross-sectoral but also international cooperation in the topics of the circular bioeconomy.

5. To create suitable conditions for the creation of innovations in the field of circular bioeconomy.

The general objective is to mitigate and reverse the negative demographic processes in the region. Another objective is to develop the economy based on local conditions, to increase the added value and to increase the level of processing in the industry. The objectives include the sharing of competitive knowledge with local economic actors. The synthesis of theoretical knowledge and practical experience helps to realize the local economic development aspirations. The project focuses on the ecological approach, sustainable farming and the processing of raw materials from the green economy.

1. Bioeconomy Opportunities

Bioeconomics can be used in many areas that are part of the circular economy - converting bio-waste into compost, applying compost to soil, improving soil quality and land management, reducing food waste, innovation, new materials. In the context of the circular economy, the bioeconomy is understood in different ways - but these are concepts that aim to promote the sustainable management of natural resources in practice and have their place in both current international political discourse and academic research. The interconnectedness of the bioeconomy and the circular economy is still low in the Slovak Republic, Košice region while the bioeconomy should play a more important role in the implementation of the circular economy in the Slovak Republic and Košice region.

Green and cleantech is pervasive across various sectors, e.g. manufacturing, construction, agri-food, smart cities, transport etc. It has a cross cutting impact within the economy driven by the international agenda to reduce climate change and by customer preference for more eco-friendly choices.

On the territory of the Košice Region, several branches are decisive, in which the potential of the region is evaluated from the point of view of human resources and material and raw material base (wood, minerals, building materials, traditional production). These are mainly sectors - engineering, woodworking, metallurgical and electrical industry, chemical industry, geology and mining, construction, agriculture, tourism and services. From the point of view of the industrial structure, the most important sectors in the region are the metallurgical, engineering, chemical and ICT and electrical engineering industries. Undoubtedly, metallurgy dominates, accounting for 60% of the region's industrial production and 50% of its exports. The largest company in the region U.S. Steel Košice is also active in this sector. The ICT industry is gaining more and more economic importance, as well as in terms of employment.

Košice Region has historically long tradition in agriculture. The key driver is the primary biomass sector, mainly due to its long tradition and rich natural resources in the region. However, the application of the principles of circularity and the creation of added value related to the biomass production is very low. In addition, technological solutions in the area of bioeconomy require intensive application of innovations, whereby overall, in the degree of innovation, Slovakia ranks only among moderate innovators. Nevertheless, the research infrastructure is in good state, as there are many Centers of Excellence and considerable amount of research institutions, such as Agrobiotech, Slovak Academy of Sciences, Water Research Institute or Food Research Institute. In relation to the interaction between science and industry, the dialogue among stakeholders is ensured through various types of platforms (National Platform AgroBioFood Nitra, Platform for Bioeconomy, Rural Platform, Rural Parliament in Slovakia), associations (Association of Young Farmers, Association of Agricultural Cooperatives and Business Entities in Slovakia), clusters (Bioeconomy Cluster, Hemp Cluster), chambers (Slovak Agriculture and Food Chamber, Food Chamber of Slovakia, Agrarian Chamber of Slovakia), expert working groups of the Ministry of Agriculture, etc. The main aim is to strengthen the collaboration among all stakeholders in the bioeconomy/circular economy sector and in the value chain, to represent their interests, to involve them in the decision-making process at national level, and also to improve the overall conditions in the sector.

The development of the chemicals and materials subsystem of the bioeconomy will require innovation across biomass production through biorefining to the usage of bio-based intermediaries by industries engaged in chemical and materials production. Industrial activities can be expected in the industrial park in Strážske, a 2nd generation biorefinery is planned for the processing of biomass by a biotechnological process for the production of 2nd generation biofuels with combined high-efficiency production of electricity and heat.

On the biomass production side, the range of value chains identified above point to agriculture and waste streams as among the most promising biomass sources in Slovakia. The crucial linchpin will be the development of biorefining technologies for processing of this biomass. A range of technologies are currently being pursued globally using a diverse range of biomass sources. As outlined above, a number of biorefinery projects are currently underway in Slovakia.

In all countries, the chemicals and materials sub-system of the bioeconomy is currently still under construction and the crucial central technology (biorefineries) is still at developmental stage. The development of the new bioeconomy in Slovakia is therefore likely to initially follow a gradual development pattern where many innovations – in technology, value chains, regulation and governance - will need to be aligned.

Great potential can also be seen in composite materials. At present, new materials are coming to the fore, which, unlike the traditional ones, often combine two or more components with different properties. An example of such a material is a wood-plastic composite - a combination of wood (in the form of wood fibers or fine wood dust) and polymer with various additives. Potential for such composite production comes from rich natural resources in the region (wood, minerals tec.) Composites that combine wood and plastics have been known since the early 20th century. Wood flour is made from sawdust, dust and wood chips produced during wood processing. Waste material of hard and soft woods and material from MDF (Medium Density Fiberboard, medium-density wood fiber boards produced by the dry method) are used for its production. Other sources of cellulose can also be used, such as straw, flax, rice husks and peanut husks, coconuts, jute, bamboo dust, kenaf. Use of wood-plastic composites could be in construction – window and door frames, exterior cladding (horizontal, vertical), ceiling structures, shingles (roof tiles), etc., when furnishing interiors - interior tiling, decorative profiles, office furniture, kitchen cabinets, shelves, table surfaces, blinds, shutters, plinths, railings…, for the production of garden furniture and exterior fittings, in industrial buildings, in shipbuilding, trains, etc

Local Food System Assets

Slovakia,as well as Košice Region, has historically long tradition in agriculture. Agricultural land in the Košice Region occupies 3,346.9 km2 and the region accounts for 14.0% of the agricultural land in the Slovak Republic. At the level of districts, the largest district in terms of area is Košice – okolie with an area of 153,460.7 ha (22.7% of the total area of the Košice Region). The smallest districts are the districts of the city of Košice, which together occupy only 3.6% of the region's area. In terms of land use, the highest share of agricultural land is in the districts of Trebišov (73.4%) and Michalovce (71.1%), of which an average of 70% is occupied by arable land. The share of non-agricultural land is the highest in the Gelnica district (80.6% of the total area of the district), of which up to 93% is occupied by forest land.

The agricultural production of the region in the total agricultural production of the Slovak Republic in 2013 accounted for only 8.9%. One of the biggest advantages of Slovakia is that 1/3 of the soil is fertile black soil. Nowadays, agriculture is still an important sector of the national economy, but its role is changing. In the past, this sector accounted for a substantial part of Slovakia's GDP and employment. With current economic developments, the share of agriculture in production and employment is decreasing, but social importance of this sector remains high. Agriculture is a key sector of rural development and it is one of few job providers in rural areas. In terms of domestic production, the largest share of Slovak GDP is constituted by services sector, industry and agriculture – therefore, these sectors have important role in the process of economy transition (from fossil to circular).

Agrifood is important for the Košice Self-governing Region in terms of the number of companies and the food services sector is one of the larger employers. The agricultural sector is characterized by large agricultural cooperatives, whereby Slovakia ranks among the countries with the largest average size of farms. New alternative methods in agriculture are coming with new opportunities for increasing the added value not only for farmers and the agricultural sector, but also for the country’s economy and sustainable development. One of the methods is the system of ecological farming or the system of smart and innovative precision farming.

The agri-food, forestry system is inherently complex because it comprises a large variety of heterogeneous products, production processes and supply-chains. It encompasses everything from primary agriculture to food and beverage production, to fish processing to forestry and forestry outputs. The agri-food system is typically characterised by long, often global, supply-chains with numerous actors. The construction of the value chain and the business model that supports the value chain varies considerably between sub-areas.

Agricultural products are processed and packaged within the processing or manufacturing sub-system. Food processors are important actors in many chains (e.g., butchers and meat dealers in food chain, milk processors in the dairy chain, and mills for processing feed). The food processing sector in Slovakia is made up mainly of SMEs which primarily serve the domestic market.

The below table shows the most important actors in the Košice region who are involved in agricultural production, processing, sales, support of local organic cultivation and sale of organically grown products.



**EXAMPLES OF GOOD PRACTICE IN THE Košice Region**

Ecology Zone – Agrokruh - New concept of a small 100% organic vegetable farm is built on innovative circular technologies (including cyber solutions) and processes of entire soil management (minimum tillage) including precision irrigation. The holistic concept provides guidelines how to build your own “Ecology Zone” including farm technology, innovative crop rotation system, soil management, consumer community development including social and environmental aspects of such farming. In addition, innovative Pater-Noster type greenhouse technology and eco-housing is available.

The importance of agriculture in relation to the country’s economy is irreplaceable. Food and beverages are the sector that usually contributes the most to the generation of commercial waste, and kitchen waste is generally considered to be a significant problem which, if addressed proactively, can bring economic benefits (waste prevention). The key point is that waste prevention usually brings benefits not only in terms of waste management costs, but more importantly, in preventing raw material costs (which are usually about 20 times higher for the sector.

Circular economy regarding the food system implies reducing the amount of waste generated in the food system, re-use of food, utilization of by-products and food waste, nutrient recycling, and changes in consumer food practices and diet. Within the food production system, the major area of focus is prevention of food surplus. Where food surplus does occur, the emphasis is on re-use of surplus food for human consumption for people affected by food poverty, through redistribution networks. Unavoidable food waste can be recycled into animal feed and composting. Unavoidable food waste is also increasingly viewed as a resource to be recovered, through technologies like Anaerobic Digestion (AD), into high-value energy, fuel, and natural nutrients as outlined in Bioenergy and Biofuels, and Biochemicals and Biomaterials sections above.

Greatest Local Bioeconomy Assets

Integrated Bio-Industry Assets

The use of renewable energy sources from land and water for food, materials, and energy is defined as bioeconomy. Furthermore, the bioeconomy model promotes the recycling and reuse of diverse materials in order to achieve a circular economy. In addition to industry and transportation, intensive agriculture, as the primary energy consumer, is highlighted by high yields, extensive chemical usage, high water demand, and soil depletion. Sustainable agriculture encourages the use and use of natural fertilizers in order to reduce the usage of chemicals and fertilizers.

The Košice region has a lot of potential for using agricultural biomass and waste from agricultural production as a result of the development of agriculture. Biogas is created by digesting agricultural biomass and trash. Biogas is a renewable form of energy that can be used instead of fossil fuels. This method of maximizing the potential of a single biomass source allows for the creation of higher-value goods, which is essential for the bioeconomy's formation and growth. In the Košice region there are several major types of biomass resources that can be converted into a range of products such as electricity, heat, chemicals and transport fuels. Among these bio-energy resources are: -woody biomass, wood residue and agricultural crops, converted into heat and electricity through either combustion, or through gasification via the Fischer-Tropsch process for transport fuels agricultural residues, such as manure, converted through anaerobic digestion into biogas for either electricity and heat, or transport fuels food processing wastes, such as tallow or whey, converted by processes such as transesterification into bio fuels.

The forestry sector is directly affected by climate change, competitive conditions, increasing demand and complexity of productions processes. Despite given factors, a huge opportunity is the increasing use of biomass resources in comparison to the use of fossil resources, whose role is decreasing. Therefore, the forestry sector is important part of the bioeconomy and represents perspective direction based on the biotechnologies. The food, forestry will play a foundational role in the bioeconomy as a producer of the biomass that will underpin the other components of the bioeconomy. The challenges for actors in these sectors in this regard lies in the need to recognise biomass as an additional potential revenue stream, and for primary producers to become part of bioeconomy value chains.

There are currently 96 biogas plants (BP) in operation in Slovakia. Most were built as part of agricultural cooperatives for the processing and recovery of agricultural materials. All BPs received a purchase price of electricity from the Office for the Regulation of Network Industries for 15 years and BPS built after 2011 are obliged to use 50% of the heat, otherwise they will lose 30% of the stated price. However, they mostly process cultivated biomass, which turns the fields into monocultures. According to available information, only 3 biogas plants are currently able to process kitchen waste. Mixed household waste contains 45% of the bio-components that could replace biomass. It is in this type of waste that great potential is hidden. In addition to composting plants, they can also use biogas plants, which produce electricity from it, it can also be used to drive buses or other machines, but it can also be used to store energy and transfer it to another location.

In the Košice Region, 297,727 tons of municipal waste was produced in 2020, 363 kg per capita. 18,463.44 tonnes consisted of biodegradable waste, biodegradable kitchen and restaurant waste accounted for 124.55 tonnes, edible oils and fats 24.24 tonnes. If we focus on the way in which municipal waste was recovered, then 78,853.5 tons were recovered in material, 79,657.2 tons recovered in energy, 35,581.1 tons were recovered by recovery of organic matter, of which 19,648.8 tons were recovered by composting, 96,634.8 tonnes disposed of in landfills. The rate of recovery of municipal waste by composting is 6.6%, energy recovery is at the level of 26.8%, material recovery is 26.5% and 32.5% is the rate of disposal by landfill.

Composting was the most recovered municipal waste in the district of Košice I-IV (5558.3 tons) and in the district of Spišská Nová Ves (5055 tons). The lowest rate of recovery by composting was in the districts of Košice-okolie (615.33 tons) and the district of Sobrance (10.92 tons). The composting rate also reflects the current situation and the state of terminal facilities for the processing of biodegradable waste in the Košice region. Cities and municipalities that collect biodegradable waste, including kitchen waste, have problems processing it. There are still few terminal facilities, both in the Košice region and in the whole of Slovakia. And even those that exist often do not produce compost suitable for agricultural use.

Waste disposal to the nearest biogas plant, which also processes kitchen waste:

- currently this option is available in Bošany (Alternative Energy), Budča Biogas, BPS Kokšov Bakša, BPS Horovce, BPS Veľké Bierovce. Thus, there is only 1 biogas plant in the Košice Region authorized to process kitchen waste in Košice-Kokšov Bakša (capacity 30,000 tons of waste / year). However, other biogas plants are also opening up opportunities to process kitchen waste, and their network will gradually thicken. An up-to-date list of them should be available on the website of the State Veterinary and Food Administration.

- According to available information, there are only 2 industrial composting plants in the Košice Region that have the authorization and technologies for the processing of kitchen waste (Composting Plant in Veľký Ruskov and the Regional Center for Biodegradable Waste Recovery (Spišská Nová Ves-Kúdelník)). The construction of industrial composting plant in Trebišov City is now running.

SUPPORTING INSTITUTIONS FOR BIO-INDUSTRY DEVELOPMENT in Košice region

Entrepreneurs must be educated on the need of investing in innovative technology and services in order to develop a circular economy system. To that end, it's critical to arm entrepreneurs with all the information they need about the European Union's funding options for innovative, green technology purchases. In addition to the aforementioned, it is critical to educate entrepreneurs on how to apply new technologies that are largely focused on energy conservation and waste reduction (reuse, recovery, recycling).

The table shows the most important actors in the Košice region who are active in the field of education, training, research, development in the field of bioeconomic, bio and green technologies, as well as actors from the local government, tertiary sector who play an important role in developing the region. and shaping the development of the region.

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| --- | --- | --- | --- |
| **Name** | **Website** | **Main field of competence** | **Address** |
| Brantner Nova, s.r.o. | <http://www.brantnernova.sk/-kontakt> | Waste management | Sadová 13, 052 01 Spišská Nová Ves |
| Circular Economy Institute | <https://www.incien.sk/> | Waste, Design, Sustainable business models | Búdková cesta 22, Bratislava 81104 |
| Ecocentrum SOSNA | http://www. sosna.sk/kontakt | Environmental protection | Okružná 413/17, 044 31 Družstevná pri Hornáde |
| Ekotrend Slovakia - Zväz ekologického poľnohospodárstva | [www.ecotrend.sk](http://www.ecotrend.sk/) | Bio-based agriculture | Michala Hlaváčka 21, 054 01 Levoča. |
| Chemko, a. s. Slovakia, Strážske | <https://www.chemko.sk/sk>  | Chemistry | Chemko, a. s. SlovakiaPriemyselná 720072 22 Strážske |
| Inovačné centrum BIOINFORMATIKA | <https://www.uvptechnicom.sk/pracoviska/clinical-trials-services-bioinformatika/> | Bioinformatics | Němcovej 5, 04001 Košice |
| JRK Waste Management s.r.o. | <https://www.menejodpadu.sk/kontakt/> | Waste | Gallayova 11 841 02 Bratislava |
| KOSIT a.s. | [www.kosit.sk](http://www.kosit.sk/) | Waste, Energy, Heat | Rastislavova 98 043 46 Košice |
| Ĺudía a voda o.z | <http://www.ludiaavoda.sk/> | Environmental protection | Čermeľská cesta 24, Košice |
| MAS DUŠA | <https://dusa.sk/kontakt/> | Sustainable development | Nám. A. Dubčeka 300/A,Strážske |
| MAS KRAS | <http://www.maskras.sk/> | Sustainable development | Čsl. Armády 478, Plešivec |
| Na kôpke s.r.o. | [www.nakopke.sk/](http://www.nakopke.sk/) | Sustainable business models | Park Angelinum 13, 040 01 Košice |
| Národná recyklačná agentúra Slovensko | <http://www.narask.sk/index.html#kontakty> | Waste management | Lučenecká cesta 6, 96001 Zvolen |
| Priatelia zeme o.z. | <http://www.priateliazeme.sk/spz/titulka> | Education and awareness | Alžbetina 53, Košice |
| Regionálna veterinárna a potravinová správa Košice - mesto | <https://www.svps.sk/zakladne_info/rvps30.asp> | Food Security | Hlinkova 1/c, 040 01 Košice, Slovakia |
| Slovenská agentúra životného prostredia | <https://www.sazp.sk/> | Waste management, Environmental protection | Tajovského 28, 975 90 Banská Bystrica, |
| SYRÁREŇ BEL Slovakia | <https://bel-slovakia.sk/en/about-us/company-syraren-bel-slovensko/>  | Food production | Lastomírska 1,071 01 Michalovce  |
| Technical University of Košice, Faculty of Economics | [www.ekf.tuke.sk](http://www.ekf.tuke.sk/) | Business models | Němcovej 32 040 01 Košice |
| Technical Univesity of Košice, Faculty of Materials, Metallurgy and Recycling | [www.fmmr.tuke.sk](http://www.fmmr.tuke.sk/) | Waste | Letná 9, 04200 Košice |
| Technical Unversity Košice - Faculty of Mining, Ecology, Process Control and Geotechnologies | <https://fberg.tuke.sk/en/contact/> | Regenerative resources, Environmental protection | Letna 9, blok A, 2nd floor 042 00 Kosice |
| University Science Park TECHNICOM | <https://uvptechnicom.sk/en/>  |  | Technical University of Košice, Nemcovej 5042 00 Kosice |
| The Innovation Center of the Košice Region (IC)  | ww.ickk.sk | Sustainable development, business models | Strojárenská 1065/3, 042 66, Košice Slovenská Republika |
| Technologil an Inovation Park UPJŠ | https://www.upjs.sk/pracoviska/tip/tip-upjs/ | biomedicine, biotechnology, information technology and advanced materials | Pavol Jozef Šafárik University in KošiceŠrobárova 2, 041 80 KošiceSlovak Republic |

EXAMPLES OF GOOD PRACTICE IN THE Košice Region

City of Trebišov- The current heating system in Trebišov City has undergone a complete reconstruction. The original system was broken down into several separate circuits, which were dependent on the use of natural gas. These separate circuits were combined into one circuit, the obsolete four-pipe system was replaced by a two-pipe system and heat production was transferred to the outskirts of the city, where a new central heat source was built. Natural gas has been largely replaced by biomass - especially straw and wood chips. The wood biomass that is fed consists of bark, wood chips, sawdust, shavings, wood chips, etc. It is exclusively a chemically uncontaminated wood energy raw material. The average calorific value of wood biomass is in the range of 7-10 MJ / kg. It depends mainly on the humidity (water content) of the fuel. Straw is used pressed in square bales. It is a very promising fuel, because straw grows in the fields every year. So, it renews quickly as a source of energy. After the decline in livestock production in agriculture, a large volume of straw was released for use in other sectors, including energy. The Trebišov City obtains straw from agricultural enterprises in the vicinity of Trebišov. The surroundings of Trebišov have excellent climatic conditions for growing cereals and therefore the production of straw only in the district of Trebišov significantly exceeds our annual consumption. This makes straw a promising and affordable fuel. The use of straw in energy is more demanding on quality assurance. Unlike wood biomass, it is necessary to keep the very low relative humidity of the straw used. The system of collecting, pressing and storing straw for energy purposes is therefore more demanding than with wood biomass. The average calorific value of straw is in the range of 12-14 MJ / kg.

Bio-Energy Systems Assets

Considering that biodegradable waste is one of the sources of biomass in the Košice Region, the development of the bioenergy system can significantly aid in the improvement and expansion of existing plants as well as the construction of new biogas plants for biodegradable waste streams from separately collected waste.

The ratio of targeted biomass to bio-waste in the production of "green" electricity is a ratio of 70 to 30 in favour of bio-waste. 100-200 kWh of electricity plus heat can be produced from 1 tonne of bio-waste. At 30,000 tons of such bio-waste, the volume of electricity produced by this technology can cover the annual consumption of approximately 10,500 households. The current situation in the field of biowaste recovery in the Slovak Republic is at a low level compared to other EU Member States. The waste management infrastructure for bio-waste management is mostly based on aerobic technologies - composting plants, which are able to recover only selected types of biodegradable waste, while the sale of composts as a result of the recovery of plant waste biomass is very limited.

Thanks to the possibility of processing a significant amount of waste from agricultural production, the food industry, restaurants and the municipal sector, the biogas plant helps waste generators to comply with the waste management hierarchy and fulfil the obligations imposed on them by the Waste Act. A significant benefit of the biogas plant is the recovery of kitchen waste from households, restaurants and canteens.

In addition to biowaste, the biogas plants also treat manure, which presents difficulties to farmers due to the legally prescribed method of disposal (in accordance with the Nitrates Directive of the European Union). The construction of biogas plants is one of the best examples of a system for closing the production and processing agricultural processes, because it enables the production of heat and electricity as well as to ensure quality fertilizer. The produced electricity is transferred to the network, while the produced heat is used for the needs of processing raw materials for biogas production.

Future development in electricity supply in the Slovak Republic as well as in Košice region will be influenced mainly by: development of electricity consumption, decommissioning and launch of new sources of electricity, availability and development of raw material prices for electricity production, electricity price on the market, higher costs associated with greenhouse gas and pollutant emissions, prices new production technologies, developments in the field of RES and methods of electricity production, as well as developments in the field of legislation. In particular, the current situation in the world will push for electricity and gas (biogas) from alternative sources, as there is a sharp rise in gas prices, fuels, which are transformed into higher prices for electricity, food, all commodities for the production of which electricity is needed. or gas.

The replacement of fossil fuels with bioenergy and biofuels rests on a diverse range of innovations. These include, for example, the usage of crops as biomass that does not require extensive inputs and can grow on marginal land that is unsuitable for other uses. This would simultaneously reduce emissions and reduce the burden that energy crops create for the food supply. Other innovations needed are the development of new sources of potential bioenergy, particularly in the area of waste. The major innovations needed are in establishing supply chains, infrastructures and consumer demand, rather than technological innovation.

The systems linking biomass inputs from production to consumption are still in the early stages of development. Significant innovation and technology development will be required in fostering sustainable biomass supply, building new supply chains, optimising efficient processing and piloting, and demonstrating the efficiency and economic viability of large-scale demonstration biorefineries. It will also require the development of markets for bio-based products.

Such systems will be complex due to the variety of biomass inputs and the wide range of bio-based products involved. The balance between local value chains, where biomass is sourced and processed locally, and global value chains, where biomass production and consumption are internationally distributed, is yet to be determined. What is clear is that biorefineries will perform the crucial processing step between biomass production and bio-based product manufacture and will therefore play a critical role within the development of this component of the bioeconomy.

However, demand for biomass in a fully developed bioeconomy is likely to far exceed supply unless the overall bioeconomy system is managed according to circular economy principles so as to restore and regenerate natural resources. Due to sustainability concerns, utilising waste streams as a significant input to biorefining processing is an early consideration for the development of a sustainable bioeconomy. The Slovak agricultural and food sector generates a number of organic wastes that require management, are currently underutilised, and could underpin the early development of the Slovak bioeconomy. There is also significant potential to examine the bio-refinement of wastewater and municipal solid waste.

One challenge in the development of the bioeconomy will be the attitude of consumers towards new biomass-based products and regulation to allow waste streams to be utilised. As outputs of biorefineries are typically intermediate products that form inputs to the manufacture of a range.

Current Local Bioeconomy System Mapping

Biomass energy covers a range of technologies that in essence process organic matter, in solid, liquid or gaseous form, to derive energy. The basis of the process is most commonly combustion – e.g., the burning of plants, or energy crops, grown specifically for the purpose. The heat generated is then used to produce electricity as in conventional coal and gas-fired power stations. Other types of processing are starting to emerge, including gasification, where the organic material is converted to a gas by heating in the absence of oxygen. The gas, (principally hydrogen, carbon dioxide and methane) is then burned, or used in a spark conversion engine to drive a crankshaft attached to a generator, to produce electricity. Gasification is more efficient than conventional combustion – more electricity is produced per unit weight of biomass. A related technology is pyrolysis, which involves the production of oil and/or gas from a biomass source by thermal degradation (again without oxygen). A range of products can be produced by this technology, including liquid bio fuels and biogas to generate electricity. Anaerobic Digestion involves the generation of biogas (methane) from organic wastes such as farm slurry or food waste, and burning this in a boiler or gas turbine to produce heat and/or electricity. Sewage gas production is a particular instance of this. Biomass fuels include energy crops (primarily willow, coppiced in short rotation), residues and wastes from agriculture (e.g., poultry litter, slurry), food processing and forestry (e.g., tree cuttings), other waste woods (often pelletized), and other waste streams (e.g., sewage gas). From this, it can be inferred that biomass excludes the mass-burn incineration of general municipal wastes, which may contain non-biodegradable materials and plastics, which are derived from oil and are hence non-renewable. The transportation of the crops to the power station is a major consideration in the development of biomass produced electricity. Beyond a certain range (within 40km even for the biggest schemes), it becomes uneconomical to transport domestically-produced fuel to the biomass power station, and clearly as the distance transported increases, so do associated vehicle emissions. Smaller scale and local applications using biomass from on-site processes are increasingly popular. It is important to bear in mind that the environmental sustainability of biomass also depends on its supply chain. Long distance transport of bulky biomass materials such as food by-products or wood can erode or negate the carbon emissions savings of its use. Also, the value of the resource being burned needs to be taken into account. Wood and energy crops supplies need to come from sustainable sources where effective replanting regimes are in place, and local biodiversity is not sacrificed. It is important to ensure that other biomass products are not diverting much needed soil conditioning, or raw material resources from vulnerable communities. Another way to use this discarded wood resource is to manufacture wood pellets. Wood pellets have a number of advantages as they are a cleaner burning, more efficient fuel which helps to reduce air quality problems experienced in some parts of the region. Wood pellets are also more easily transported from the site of production (predominantly rural areas) to the place of consumption (primarily urban areas The wood pellets are more usable by domestic consumers as the work has been taken out of chopping the wood, and the efficiency of home heating is greatly improved by the fact that the fuel is properly dry.

Local Bioeconomy Priorities

The bioeconomy can contribute to many areas that are part of the circular economy - conversion of bio-waste into compost, application of compost to the soil, improvement of soil quality and land management, reduction of food waste, innovation, new materials. Bioeconomic provides a number of important ecosystem services, e.g., in the form of increasing water retention in the country or reducing the cost of water treatment, because it does not burden the environment with agrochemicals. In the Slovak Republic, the interconnectedness of the bioeconomy and the circular economy in the Slovak Republic is still low, while the bioeconomy should play a more important role in the implementation of the circular economy in the Slovak Republic. The Slovak Republic is struggling with deteriorating soil structure, a decrease in organic matter content, a high degree of compaction and acidification. All of these factors increase the risk of erosion. It is necessary to focus on increasing the application of quality compost from biowaste on the soil.

The following specific areas were identified, within which the Košice self-governing region and TUKE with their partners can ensure the transition to a low-carbon and circular bioeconomy.

1. CHANGE OF PUBLIC OPINION ON THE CIRCULATING AND LOW CARBON ECONOMY, WITH AN EMPHASIS ON ATTITUDES TOWARDS A GLOBAL ACCESS TO THE BIOECONOMY, CIRCULATING ECONOMY AND ITS OPPORTUNITIES
2. STRENGTHENING THE ROLE OF THE KOŠICE REGION WITH REGARD TO EFFECTIVE WASTE REDUCTION AND PROMOTION OF CIRCULATION IN PUBLIC ADMINISTRATION ORGANIZATIONS
3. CREATION AND DEVELOPMENT OF ECOSYSTEM PREPARED FOR THE UPCOMING CIRCULAR AND LOW CARBON ECONOMY.

Other identified goals:

1. Facilitate the use of renewable energy sources and the development of innovative energy-saving technologies
2. Promote and develop energy efficiency and ways energy conservation
3. To support the role of the Košice region in the field of securing a stable energy supply
4. Recognize and promote the key role of energy in the regional and national economy.

Attention should also be paid to:

**1. An increased focus on adoption and diffusion of existing technologies**

Slovakia appears to be behind comparison countries with regard to the adoption of existing technologies in both the bioeconomy and the circular economy. An increased focus on the adoption and diffusion of existing technologies and practices could accelerate the development of the bioeconomy and circular economy here.

**2. Catalysing transformative lead innovators**

Lead innovators can play a major role in transforming value chains when they adopt new technologies and practices. In doing so, they can induce suppliers and customers to innovate in ways which can have a significant impact in terms of the development of the bioeconomy and circular economy as a whole. Further research on the role of such transformative lead innovators is warranted, along with an analysis of the policies that can be adopted to encourage the emergence of a greater number of lead innovators in Slovakia.

3. Specific action needed on Circular economy

The bioeconomy is an active area of research, policy and enterprise engagement in Slovakia. The circular economy, by comparison, is still very much at a nascent stage. A strategic whole of government response is needed to facilitate the development of the circular economy here.

1. Bioeconomy Mission

Mission

The vision:

**"Improving quality of life for people in the Kosice region through affordable and energy efficient lifestyles, a reliable and renewable energy supply, by encouraging the efficient use and re-use of resources and materials, efficient infrastructure and, the development of innovative practices and processes that can improve the efficiency in agriculture and forestry production systems, informed decision making, and innovative solutions that enhance competitive advantage",**

**The mission is centered on the production, processing, and conversion of renewable and natural resources, as well as waste materials, into energy and/or value-added goods. The use of natural resources should be sustainable and in harmony with the current ecosystem, while avoiding negative environmental repercussions, according to bioeconomy principles.**

Mission Brand

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later.

Mission Propositions

The change catalyst must come from more than just energy support awareness of people through educational programs. If we want to use our renewable base locally level, we must do the whole a series of steps. Above all we must realize how we think about the energy in our regions and how we use it. As in others areas of the economy Slovakia also needs innovative leadership in the energy sector. State aid and investment must therefore to promote entrepreneurship in energy as well as development new technologies.

Mission Development Process

*At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later.*

1. Action Centre Plan

Overview

The challenges of the circular economy are numerous and necessitate significant adjustments in company practices and social behaviours. This means it will be tackled methodically, with necessary skills and knowledge, a development platform, investment, and/or commercial models in place.

Several principles will guide overall design:

• A clearly defined set of objectives based on the strategy and action plan

• Activities will be based on a thorough examination of the environment (both business and societal);

Kosice region lack large‐scale collaborations between academic entities and the renewable energy industry. Major collaborations give national and EU visibility to the research being done at these states’ institutions. Moreover, the research provides significant opportunities for commercialization and job creation. Such collaborations are critical to develop new clean energy technology and to defray the burden of the large capital investment needed to provide the equipment to participate in the renewable energy industry. Use of bio & renewable energy sources and reducing energy consumption respectively also the development of efficient energy technologies requires the continued cooperation of a number of companies, institutions with different expertise, business models and experiences - collaborative platform is an effective tool for sharing knowledge, information, enables companies to identify technological and business trends, form of a requirement for applied research and follow the latest industry direction in the world, allow to direct material and financial resources on key areas of applied research. “

Leadership/Governance and Organisation Model

Leadership/Governance Model

The Circrlehub covers several activities - from raising awareness and networking supporters and disseminators of ideas and promoters of circular economy principles, through conducting capacity building programs and sharing good examples from abroad, to support the establishment of innovation partnerships in the field of low-carbon and circular economy in the region.

The existence of a CircleHub with competencies and resources (financial and human) for the promotion and support of potential projects will greatly facilitate the transformation of society and industry and the use of OE resource potential in Eastern Slovakia. The CircleHub should focus in particular (but not only) on reducing food waste and promoting local healthy food chains to enable the circular economy, direct links with businesses across the bioeconomy sectors, policy makers, third sectors, consumers and other relevant communities and stakeholder parties.

In general, the CircleHub should function as an effective regional innovative incentive tool to help seek opportunities and disseminate and exploit the results of applied research and development in the circular economy, better understand and reconfigure the whole raw material, waste and waste flow system and change business practices, supply chains and market business structures.

Use of bio & renewable energy sources and reducing energy consumption respectively also the development of efficient energy technologies requires the continued cooperation of a number of companies, institutions with different expertise, business models and experiences - collaborative platform is an effective tool for sharing knowledge, information, enables companies to identify technological and business trends, form of a requirement for applied research and follow the latest industry direction in the world, allow to direct material and financial resources on key areas of applied research.

Mission Contracts

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Organisation Model

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Core Team

Core Team Model

OUR OPERATING MODEL

I. GOVERNANCE

• Association of member companies

• Single stable leadership team selected by each hub member

• Joint decision-making on projects

II. FUNDING MECHANISMS

• EU funding

• Direct investment by members

• Many EU funded grants/programs require consortiums

III. SERVICES/ACTIVITIES

• Managing large innovation projects, reporting and steering

• Advising and managing finances and investment

• Legal support

• Coaching and mentoring, accelerating existing innovation ideas

• Encouraging live business pilots and implementation- create and build synergy with other business organizations in the region to promote the region’s mutual interest in clean energy and energy efficiency technology.

• Cooperating with universities, research centres, SMEs, research and technological parks,

* engage and support local energy Hubs and innovation partnerships

• Investigate and adopt best practices

Core Team Funding/Resourcing Plan

To ensure mission of this HUB, to ensure the upon mentioned series of activities/ services in particular to identify its leaders and its ongoing financing is crucial. A very important part of this process is set up regional support system for innovative green clean-energy projects at the time of birth of the project proposal of products and services, promoting value chain oriented on providing services and products of clean energy bio economy and promoting networking, consulting and support services.

FUNDING MECHANISMS:

• EU funding

• Direct investment by members

• Many EU funded grants/programs require consortiums.

Building partnerships is what it takes to effectively utilize opportunities in the budgets of corporates and from EU funds- so everyone brings his or her own strengths and learns from others. Not every company has the capabilities available to successfully manage innovation projects – but a hub can always create a complete mosaic of skills and capacities.

Community allies

The network's and ecosystem's development will be largely determined by the value of the projects and efforts undertaken. In this regard, the initial core team and future core team staff must perform a thorough research of the regional CE ecosystem and determine two things:

 • Which business models are appropriate for the region.

• What are the benefits of applying best practices to various stakeholders?

The number of organizations, specialists, and community members will continue to grow as a result of this approach, giving the effort greater importance. For steering the HUB as a whole and particular activities/project, a governance model and framework would be critical.

Capacity Development Plan

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later.

1. Enablers

The basic problem of the transition to a circular economy is the low knowledge of the public, including the business community, about the topicality and opportunities associated with the transition to a low-carbon and carbon economy. For this reason, it is appropriate to introduce communication channels and campaigns in order to change society's attitudes in this area - e.g., through the Information and Consultation Point for the circular economy, awareness-raising and networking of supporters and disseminators of ideas and promoters of the principles of the circular economy (from citizens, municipalities, the corporate sector, education and research organizations, but also the non-profit sector). It is also necessary to build capacity and share good examples from abroad, and last but not least, to ensure the availability of experts for the establishment of innovative partnerships in the field of low-carbon and circular economy in the region.

As previously said, we can see that the region needs certain fundamental waste management infrastructure and facilities. From an infrastructural standpoint, these facilities are critical for establishing a functional circular economy plan. The lack of funding for constructing this fundamental infrastructure and processing facilities is one of the region's challenges. As a result, we can draw two conclusions:

1. There is a general lack of understanding of environmental issues and how they affect or will effect people's quality of life.

2. No suitable business model has been built to ensure the long-term viability of the infrastructure required to build a circular economy practice in the region, making adequate financing difficult to come by.

Activities to be implemented:

a) Analysis of the nature of the economic environment and the possibility of applying technological and non-technological innovations of the circular economy in key sectors of the Košice Region. Identification of suitable sectors for the transition to a circular economy.

b) Co-creation process with regional stakeholders to identify the suitable operational plan for ecosystem, the strategic actions to be taken and the list of project proposals (pool of ideas, pilots, scale-up) to increase the quality of life in the Košice Region.

c) Search for funding (internal/external) for operation of ecosystem, implementation of identified strategic actions and project proposals

d) Formulation of recommendations for national support schemes and active participation in the creation of schemes for the next programming period in order to support the financing of identified project intentions.

Collaborative Communities

Community Communication

In general, there are not enough understanding of the environmental issues we are currently facing and what we will face in the future. These challenges will translate into many direct economic and environmental issues which will incur additional costs. These costs would need to cover by taxpayers’ money. Circular economy is one of the most important tools to lower that cost, but it will require large upfront investment.

This message needs to be conveyed to all community members in a clear way with a proposition of several practical solutions with which community members can relate to.

Activities to be implemented:

a) Preparation of the organizational unit providing information point and channel services

b) Preparation and implementation of the program and channels of educational activities

c) Preparation and implementation of the capacity building program and channels (trainings)

d) Preparation and implementation of a program and channels for sharing good examples from abroad

e) Preparation and launch of an innovation platform and database of domestic experts and R&D workplaces and offices dedicated to the field of waste / low carbon / circular economy

The activities will be complemented by a dedicated digital platform to ensure awareness-raising campaigns, dissemination of knowledge, inspiration for actors to adopt good practice and networking between partners to support the emergence of application and innovation partnerships.

Citizen Co-creation

Strengthening the localization and wider use of regional renewable energy potential and savings energy resources can be done only by their clean-tech technology localization in local companies, in cities and municipalities Kosice regions. This requires close cooperation between universities and research institutes including consulting, engineering organization and investment firms with domestic SME in identifying opportunities and threats associated with their long-term competitiveness of products and services including the possibility of financing from EU funds. Specifically, since it is a new generation of clean energy industrial and information technology and services with which is not much experience is necessary to gain the trust of the management companies that start to apply. This can be solved through the search and evaluation of best practice of implemented projects or demonstration RES micro-technology projects deployed on a larger scale in the municipal sector.

Measure: Assist local companies and entrepreneurs in acquiring locally developed clean-tech technologies by connecting them with regional university and research lab tech transfer offices, with support from regional economic development agency and technology innovation start-up centres.

Measure: Proactively encourage companies and entrepreneurs using locally developed clean tech technologies and RES micro-technologies (solar, advanced bio-fuels, geothermal, waste-to-energy, battery storage, fuel cells, co-generation, and smart grid) to locate in the KSR- by working with university and research lab, tech transfer offices in the early stages of a company’s due diligence process.

Measure: Connect entrepreneurs with investors, local financial incentives, and economic development programs.

Collective Management Structures

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

Enabling Economies

Business Models

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

Transformative Investment

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

Economic Structures

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

Smarter Systems

Data Commons

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Interoperability

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

Smart Applications

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Municipal Momentum

Procurement

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

Policy

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

Organisational Readiness

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

1. Process and Portfolio Management

Mission Proposition extrapolation

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

Systems Analysis

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

Near-term Portfolio

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later

Strategic Actions & Experiments

Strategic Portfolio Overview

|  |  |
| --- | --- |
| **Action/Experiment Name** | **Brief Description (max 50 words)** |
| Košice cluster of new industry | The project of the Košice Cluster of New Industry (CNIC) is the first significant project of the Innovation Center of the Košice Region, the aim of which is to support the creation and development of new technologies in the East Slovakian region. CNIC focuses on materials and biomedical technologies, green and digital technologies and quantum technologies. It also emphasizes social areas, including the care of an aging population and a healthy lifestyle for the working age population. ICKK actively cooperates with the CNIC and coordinates its activities so that they are in direct compliance with the Regional Innovation Strategy. In addition, the ICKK will support the commercialization of CNIC science and research results and create new partnerships that will benefit the entire region |
| Agrokruhy - creation of small organic farms within the Košice region | An ecologically and economically sustainable way of growing vegetables for young growers. The farm model is easily reproducible and is based on the principle of supporting community agriculture. The system of this crop cultivation is beneficial for humans as well as for the soil. This is a small "revolution" in vegetable growing. Unlike heavy machinery, the agro-circle does not damage the soil and healthy food from domestic production gets on the table. During the year, under suitable climatic conditions, it is possible to grow 52 types of vegetables, various types of herbs or flowers in the fields. |
| Construction of a composting plant in Trebišov | Construction of industrial composting plant in Trebišov equipped with a sanitary CSC container resp. aerobic fermenter and kitchen waste shredder. |
| Modernization of existing composting plants over 100 tons of waste | Equip existing composting plants with a CSC hygiene container, aerobic converter and kitchen waste shredder |
| Construction of biorefinery in Strážske | In the industrial park in Strážske, a 2nd generation biorefinery is planned for the processing of biomass by a biotechnological process for the production of 2nd generation biofuels with combined high-efficiency production of electricity and heat. |

Action/Experiment 1

***Košický klaster nového priemyslu - Cassovia New Industry Cluster (CNIC)***

The main goal of the CNIC project is to create a new modern industry in the region of Eastern Slovakia through close cooperation between universities, SAS institutes and private industry with strong support from regional authorities. Emphasis is placed on the formation and development of a modern and creative environment for creation innovative high-tech companies in the region of eastern Slovakia, expanding to other regions, including abroad, and in connection with the development of social areas including the care of an aging population and a healthy lifestyle.

 *The focus of the CNIC project on biomedical research, new materials, quantum and information technologies, the environment and green energy is in line with research European Research Area (ERA) programs and initiatives enshrined in Horizon 2020 / Horizon Europe. This project is closely linked to everyone the three pillars of ERA - excellent science, industry leadership and societal challenges. The CNIC project goes beyond the "technological focus" and adds innovative social activities to its portfolio of activities. This important element in the activities of the CNIC consortium is based on today 's generally accepted findings that advances in technology are it does not have to automatically improve people's quality of life.*

The total required investment of the project is 320 mil. EUR (excluding VAT). This the project will be financed from EU funds, domestic private sources, financial resources from scientific activities and technology transfer and from the economic activity of the CNIC.

Action/Experiment 2

***Agrokruhy - creation of small organic farms within the Košice region***

We want to inspire farmers to embark on the path of sustainable agriculture and make it easier for them with our years of revolutionary technology, as well as agronomic and business know-how. Let's turn the dilapidated land together into fertile agro-circles! No work!

Unlike conventional tillage, the agro-ring system completely eliminates the use of heavy machinery, which causes soil compaction and the formation of a so-called floor, which prevents air or water erosion. No fertilizers or biocides are used in the cultivation. Undesirable species are removed mechanically, and their residues remain in the soil, thus enriching it as a very important organic component. The Agrokruh system does not use either plowing or tillage, thus supporting a rich soil life at the microbiological and macrobiological level, as confirmed by the Research Institute of Soil Fertility.

The optimal area of ​​a small farm is 2 hectares, on which it is possible to ensure the production of healthy crops for the whole family. The model farm consists of four arms, which cultivate twelve circular fields. Among them are stabilization areas to support biodiversity. Such cultivation is exceptional in that, thanks to the set system, the farmer is able to grow various crops on a small area.

The Agrokruh system is already in operation on a model school farm, which the Košice self-governing region launched at the allocated workplace of the Secondary Vocational School of Agrotechnical and Gastronomic Services in Pribeník. Pupils learn to grow ecologically and in organic quality directly in the fields and not only theoretically. The project also aims to motivate young people to learn and work in agriculture and food production. The inventor of the Agrokruh system is Ján Šlinký. This tillage system can be found in three places in Slovakia, but only in Pribeník it is the first official version of a functional prototype.

Action/Experiment 3

***Construction of industrial composting plant in Trebišov***

A construction plant is starting to be built in the former military warehouses in Trebišov - start of work: 3/2022. The end of construction is planned for January 2023. The total budget of the Biodegradable Municipal Waste Recovery project is more than 3.1 million euros. The construction is designed in the area of former military warehouses in the locality of Nový Koronč on an area of approximately 13,000 square meters. The contractor of the construction is the company 3 Energy.

The municipality received more than three million euros for the project through the Ministry of the Environment of the Slovak Republic and the Operational Program Environmental Quality, the city of Trebišov participates in the amount of approximately 158,000 euros. The investment includes construction work, which will include the construction of a composting plant with aeration technology, as well as the technical equipment of the composting plant and the procurement of containers for waste collection and treatment. The composting plant will make it possible to turn waste into compost - a product that citizens will be able to do in their gardens, but also when growing flowers and ornamental plants on balconies or apartment buildings. The city plans to use the compost produced, for example, in public spaces and flower beds.

Action/Experiment 4

**Modernization of existing composting plants over 100 tons of waste**

**Kitchen waste must go through a more complex process, it must be crushed to a 12mm fraction and sanitized at** 70C for 1 hour. The aim of this process is to eliminate pathogens and prevent the spread of diseases such as swine and bird flu, BSE, which is a very current topic. Kitchen waste treated in this way can be mixed with green bio-waste and composted further. This will make it possible to avoid the high costs of transporting the waste and the system can start operating very quickly. According to available sources, the acquisition costs for the hygienic CSC container are at the level of approx. EUR 90,000-100,000 with VAT, and the aerobic convent-fermenter at the level of approx. EUR, kitchen waste shredder approx. 135 thous. EUR. According to available sources, 70 tonnes of compost can be produced from 100 tonnes of bio-waste. The amount of total costs depends on the size of the existing industrial composting plant in larger cities, current equipment, operation. The total cost must be determined individually for each composting plant involved. However, this must be preceded by a thorough analysis of the condition and technological equipment of existing industrial composting plants in the Košice region**.**

Action/Experiment 5

***Construction of biorefinery in Strážske***

A locality on the border of the Prešov and Košice regions was chosen for the construction of the biorefinery, for it agricultural nature, but also because it has been strongly concentrated in this area in the past the chemical industry, which has trained professionals for many years. There is a presumption that there will also be enough well-founded workers to employ in the refinery. At the same time support job creation in a region with high unemployment.

Implementation of an investment project for the construction of a 2nd generation biorefinery for the processing of biomass by a biotechnological process for the production of 2nd generation biofuels with combined high-efficiency production of electricity and heat.

Lignocellulosic biomass will be processed in successive steps with ethanol production and subsequent conversion into biochemicals, which can be used in various industries, together with the processing of by-products for heat and electricity. The annual production capacity of second generation biofuels is planned at the level of 30 mil. Liters.

Funding is provided from private and public sources and the project will require an investment of more than EUR 100 million.

1. Collective Learning Plan

Learning Labs

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later.

Progress and Outcome Evaluation

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later.

1. Appendices

Appendix 1 - Mission Propositions

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later.

Appendix 2 – Action Centre Leadership/Governance Agreement

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later.

Appendix 3 – Mission Contracts / Partnership Agreements

At this stage in the preparation of the action plan, this area is not developed and specified. We will deal with its development later.